AIRS
Atmospheric Infrared Sounder

AIRS Version 6.1.1 Released Processing Files Description

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

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Atmospheric Infrared Sounder

AIRS Version 6.1.1 Processing Files Description

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Document Change Log

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1 Introduction

1.1 Purpose

This document describes the released product files for the Version 6.0.7.0 (V6.0.7.0) delivery of the AIRS Science Processing System (ASPS). These products incorporate data from the AIRS, AMSU-A (AMSU-A1 + AMSU-A2) and HSB instruments.

1.2 Product Overview

Level 1B science data is calibrated instrument measurements in physical units. Data from the AIRS instrument is divided into separate products: AIRIBRAD has infrared data, while AIRVBRAD has Vis/NIR data. The corresponding AIRIBQAP and AIRVBQAP QA subset files exclude radiances and other large fields to deliver quality information in a compact format.

AIRS IR and Vis/NIR radiances are in radiance units, while MW instrument data AIRABRAD and AIRHBRAD are in brightness temperature units.

Level 1C Ir (AIRICRAD) science data has had various corrections applied in addition to calibration.

The Level 1B calibration subset product (AIRXBCAL) collects selected data from AIRS IR, Vis/NIR and AMSU-A for use in calibration.

In Level 2, atmospheric and surface quantities are estimated from the Level 1B data.

Level 2 products are cloud-cleared radiances (AIRI2CCF) and atmospheric parameters (AIRX2RET and AIRX2SUP). The standard retrieval product AIRX2RET is designed for the general user, while the support product (AIRX2SUP) contains interim and experimental portions intended for use by the AIRS team and others willing to make a significant investment of time in understanding the product.

Each Level 1B, and Level 2 science file type contains data from 6 minutes of observations in HDF-EOS Swath format.

Level 3 standard files grid data from AIRX2RET standard retrieval product in daily (AIRX3STD), eight-day (AIRX3ST8), and monthly (AIRX3STM) HDF-EOS Grid products. A more detailed set using 100-layer support profiles is included in Level-3 support products AIRX3SPD, AIRX3SP8, and AIRX3SPM. There is also a Level-3 research product for internal project use with intermediary products and quality indicators: AIRX3RED, AIRX3RE8, and AIRX3REM.

Level 3 quantized files also grid data from AIRX2RET, but, in this case, into coarser 5-day (AIRX3QP5) and monthly (AIRX3QPM) products, with information on multiple clusters within each grid cell retained.

The RaObs (AIRX2MAT) and fixed-site (AIRX2MTL) Match-Ups contain Level 1B, Level 2, and forecast data that match ground truth measurement locations in HDF-EOS Swath format.

All AIRX2, AIRI2 and AIRX3 products are produced when Level 2 is run, using AIRS and AMSU-A instruments. Variations with AIRH* are produced, using AIRS + AMSU + HSB. Variations with AIRS* are produced, using only the AIRS instrument.

AIRS products are archived at the GSFC DAAC archive. These product formats are defined in the product interface specifications, provided in Appendix A.

The basic product and QA file types are shown in Table 1.

Table 1. Product and QA File Types

ESDT Shortname	*Mnemonic Name*
AIRIBRAD	L1B_AIRS_SCIENCE
AIRIBQAP	L1B_AIRS_QA
AIRVBRAD	L1B_VIS_SCIENCE
AIRVBQAP	L1B_VIS_QA
AIRABRAD	L1B_AMSU_SCIENCE
AIRABQAP	L1B_AMSU_QASup
AIRHBRAD	L1B_HSB_SCIENCE
AIRHBQAP	L1B_HSB_QASup
AIRXBCAL	L1B_Calibration Subset
AIRICRAD	L1C_AIRS_SCIENCE
AIR*2RET	L2_Standard_atmospheric&surface_product
AIR*2CCF	L2_Standard_cloud-cleared_radiance_product
AIR*2SUP	L2_Support_atmospheric&surface_product
AIR*3STD	L3_Standard_Daily
AIR*3ST8	L3_Standard_Multiday
AIR*3STM	L3_Standard_Monthly
AIR*3SPD	L3_Support_Daily
AIR*3SP8	L3_Support_Multiday
AIR*3SPM	L3_Support_Monthly
AIR*3RED	L3_Research_Daily
AIR*3RE8	L3_Research_Multiday
AIR*3REM	L3_Research_Monthly
AIR*3QP5	L3_Quant_Pentad
AIR*3QPM	L3_Quant_Monthly

Special Note for V6.0: Level-1 products are not being updated for the v6.0 release, so the Level-1B section in Appendix A1 is unchanged from v5.0.

1.3 Applicable Documents

AIRS Version 5.0 Processing Files Description, JPL D-38428, Version 1.2, November 2007

AIRS Version 4.0 Processing Files Description, JPL D-31231, Version 1.1, August 2005

AIRS Version 3.0 Processing Files Description, JPL D-26382, June 2003

AIRS Version 2.7 Processing Files Description, JPL D-25941, March 2003

AIRS Version 2.5.1 Processing Files Description, JPL D-20001, September 2002

Interface Control Document between the Earth Science Data and Information System (ESDIS) and the AIRS Science Processing Systems (ASPS), Earth Science Data and Information System Project Number 423-42-07, JPL D-22992, February 2002

Operations Agreement (OA) between the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC) and the AIRS Team Leader Science Computing Facility (TLSCF), JPL D-23045, January 2002

AIRS Science Processing System Software Development Methodology, JPL D-18573, February 19, 2000

AIRS Product Generation System (PGS) Version 2.1 Requirements and Design Document, JPL D-19556, January 2001

AIRS Product Generation System (PGS) Version 1.5 Requirements and Design Document, JPL D-18926, January 2001

AIRS Product Generation System (PGS) Version 1 Requirements and Design Document (Preliminary), JPL D-17851, Version 1.1, July 1999

AIRS Version 2.0 System Description Document, Version 2.0, JPL D-19557, August 2000

AIRS Science Software Integration and Test Procedures and Agreement with the Goddard Distributed Active Archive Center, JPL D-16791, Version 3, Revision 2.0, June 1, 2000

AIRS Product Generation System (PGS) Prototype 8 Requirements and Design Document (Preliminary), JPL D-16451, Version 1.0, December 1998

AIRS Data Processing and Instrument Operations (DPIO) Software Requirements Document, JPL D-16785, Version 1.0, April 3, 1998

1.4 Acronymns

AIRS	Atmospheric Infrared Sounder
AMSU-A	Advanced Microwave Sounding Unit - Version A (AMSU-A1 and AMSU-A2)
APID	Application Process Identifier
ASPS	AIRS Science Processing System
AVN	Aviation (Global Forecast System Model)
BRTEMP	Brightness Temperature
DAAC	Distributed Active Archive Center
DECOM	Decommutation
DN	Data Number
DPIO	Data Processing and Instrument Operations
ECS	EOSDIS Core System
EDOS	EOS Data Operations Service
EMOS	EOS Mission Operations System
ENG	Engineering
EOS	Earth Observing System
ESDIS	Earth Science and Data Information System
ESDT	Earth Science Data Type
FOR	Field of Reguard
FOV	Field of View
GCM	General Circulation Model
GRIB	GRIdded Binary
GSFC	Goddard Space Flight Center
HSB	Humidity Sounder for Brazil
HDF	Hierarchical Data Format
ICD	Interface Control Document
IR	Infrared
L1B	Level 1B
L2	Level 2
L3	Level 3
LGID	Local Granule ID
LID	Logical ID
MW	Microwave
NCEP	National Centers for Environmental Prediction
NDVI	Normalized Differential Vegetation Index
NIR	Near Infrared
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OA	Operations Agreement
PCF	Process Control File
PDS	Product Description Section (NCEP Office Note 388 (ON388))
PGE	Product Generation Executive
PGS	Product Generation System
PSA	Product Specific Attributes

QA	Quality Assessment
SCF	Science Computing Facility
SDPS	Science and Data Processing Segment
SPS	Science Processing System
SSI&T	Science Software Integration and Test
TAI	Universal Atomic Time
TLSCF	Team Leader Science Computing Facility
UR	Universal Reference
UTC	Coordinated Universal Time
Vis	Visible
WMO	World Meteorological Organization

Appendix A1. Single-Swath Fixed-Format Product Interface Specifications

Each file contains all observations of a given type made during a period of exactly 6 minutes. For each day there are 240 granules, numbered 1-240. Over the course of 6 minutes the EOS-Aqua platform travels approximately 1500 km, and the AIRS-suite instruments scan (whisk broom) a swath approximately 1500 km wide.

Start times of granules are keyed to the start of 1958. Because of leap seconds, they do not start at the same time as days do. For data from launch through 12-31-2005, granule 1 spans 00:05:26Z - 00:11:26Z and granule 240 starts at 23:59:26Z and ends at 00:05:26Z the next day. For data 12-31-2005 through the next leap second, granule 1 spans 00:05:25Z - 00:11:25Z and granule 240 starts at 23:59:25Z and ends at 00:05:25Z the next day.

These products have exactly one swath per file. The swath name is given in the interface specification.

The names of all dimensions, geolocation fields, fields and attributes are exactly as given in the "Name" column of the appropriate table, including underscores and capitalization.

The "Explanation" information, as provided in the product interface specifications, is a guide for users of the data and is not included the product files.

The contents of the "Type" column of the attribute and field tables can either specify a standard HDF type or a special AIRS type. The standard HDF types used by AIRS are:

String of 8-bit characters (Attributes only)
8-bit integer
8-bit unsigned integer
16-bit integer
16-bit unsigned integer
32-bit integer
32-bit unsigned integer
32-bit floating-point
64-bit floating-point

For all 16-bit or longer fields the value -9999 is used to flag bad or missing data. Special AIRS types are like structures, with the fields specified in tables as discussed below.

The first table of the interface specification lists "Dimensions" which are the HDF-EOS swath dimensions. The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "GeoTrack" is understood to be the dimension along the path of the spacecraft, and "GeoXTrack" is the dimension across the spacecraft track, starting on the left looking forward along the spacecraft track. Some products also contain second across-track dimension "CalXTrack," equivalent to "GeoXTrack," except that "CalXTrack" refers to the number of calibration footprints per scanline.

"GeoTrack" is 45 for large-spot (FOR) products (AMSU-A, Level-2, cloud-cleared AIRS) and 135 for small-spot (FOV) products (AIRS, Vis/NIR, HSB).

These files contain no geolocation mappings or indexed mappings.

The second table specifies "geolocation fields." These are all 64-bit floating-point fields that give the location of the data in space and time. If the note before the table specifies that these fields appear once per scanline then they have the single dimension "GeoTrack." Otherwise, they appear once per footprint per scanline and have dimensions "GeoTrack,GeoXTrack."

The third table specifies "Attributes." These are scalar or string fields that appear only once per granule. They are attributes in the HDF-EOS Swath sense.

The fourth table specifies “Per-Granule Data Fields.” These are fields that are valid for the entire granule but that are not scalars because they have some additional dimension.

The fifth table specifies "Along-Track Data Fields." These are fields that occur once for every scanline. These fields have dimension "GeoTrack" before any "Extra Dimensions." So an "Along-Track Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack"; whereas, if the "Extra Dimensions" is "SpaceXTrack (= 4)," then it has dimensions "GeoTrack,SpaceXTrack."

The sixth table specifies "Full Swath Data Fields." These are fields that occur once for every footprint of every scanline. These have dimensions "GeoTrack,GeoXTrack" before any "Extra Dimensions." So a "Full Swath Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack,GeoXTrack"; whereas, if the "Extra Dimensions" is "Channel (= 2378)," then it has dimensions "GeoTrack,GeoXTrack,Channel."

The last section of the interface specification may contain a table for "Special AIRS Types." These special AIRS types are used as "shorthand" for groups of fields, listed in the "Attributes," "Along-Track Data Fields" and "Full Swath Data Fields" tables as single fields. If the name of a special AIRS type appears in the "Type" column of one of these tables in place of a standard type, then there are really as many fields as there are rows in the corresponding type table, each with a name made up of the "Name" from the upper table followed by a "." and the "Field Name" from the lower table.

For example, consider a field in the "Attributes" table named "apid_415_cnt" of type "AIRS Engineering Packet Counts" (See Appendix A4.). If the table for "AIRS Engineering Packet Counts" under "Special AIRS Types" lists the three fields "missing_in," "missing_ends" and "good," then the swath contains the three fields "apid_415_cnt.missing_in," "apid_415_cnt.missing_ends," and "apid_415_cnt.good."

A1-1. L1B AIRS Science Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRIBRAD"

Swath Name = "L1B_AIRS_Science"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.
MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)

Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-	Geodetic Longitude of spacecraft at end of granule (subsatellite location at

	point	midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all channels with ExcludedChans < 3. Zero means all good channels were well calibrated, for all scanlines. Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
DCR_scan	16-bit integer	Scanline number following (first) DC-Restore. 0 for no DC-Restore
input_bb_temp	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature
input_bb_temp1	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 1A (CaBbTempV1A or CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)
input_spec_temp	Limited Engineering Struct (see below)	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)

	Struct (see below)	
input_grating_temp_2	Limited Engineering Struct (see below)	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
NumRefChannels	32-bit integer	The number of channels reported in MaxRefChannel arrays
Rdiff_swindow_M1a_chan	16-bit integer	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
CF_Version	string of 8-bit characters	Cloud Filter Version Identification. Identifies the set of thresholds used in determination of spectral_clear_indicator.
NumSaturatedFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts overflowed.
NumUnderflowFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts underflowed.
NumCalFOVsOutOfBounds	16-bit unsigned integer	Number of calibration fields-of-view (out of a nominal 810) in which the downlinked counts underflowed or overflowed.
NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
spec_shift_upwell	32-bit floating-point	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)

SpectralFeaturesUpwell	32-bit integer	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_iter_upwell	16-bit integer	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_clim_select	16-bit integer	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_iter_pary	16-bit integer	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added. Zero means the channel was well calibrated for all scanlines Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better that channels with state > 2; 1 - A-side only. Probably better that channels with state > 2; 2 - B-side only. Probably better that channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines

input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets as of first spaceview of each scan
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains (radiance units / count)
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
Gain	32-bit floating-point	Channel (= 2378)	Number of radiance units per count
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays. Entries beyon NumRefChannels are set to -1.
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (cm**-1) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Dynamic estimate of frequency associated with each channel (cm**-1). Note: This is a noisy estimate because there is very limited data in a single 6-minute granule. Designed for use only in aggregation to monitor instrument status. Use nominal_freq instead when analyzing data.
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	a signed estimate of the spectral frequency uncertainty (positive means estimated frequencies are likely too high)
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_feature_contrast_stats	Limited Engineering Struct (see below)	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the upwelling features, for each of the scene footprints considered for spectral calibration
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)

ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the all channels with ExcludedChans < 3. Zero means all "good" channels were well calibrated for this scanline Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition; Bit 0: (LSB, value 1) cold scene noise
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition;

			Bit 0: (LSB, value 1) cold scene noise
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The median of the four spaceviews immediately following the Earth views in the scanline, minus the median of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. Bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; Bit 7 quicklook (expedited) flag; bits 8-11 submode Bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
EDCBOARD	16-bit unsigned integer	None	EDC A/B Powered on Indicator:; 0: Both sides off; 1: Side A; 2: Side B; 3: Invalid; 65534: No value downlinked

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 2378)	Radiances for each channel in milliWatts/m**2/cm**-1/steradian
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit	None	Mean topography in meters above reference ellipsoid

	floating-point		
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm**-1 window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm**-1) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields).; Bit 7 (MSB, value 128): scene is inhomogeneous, as determined by the Rdiff_swindow threshold. For v5.0 the test is abs(Rdiff_swindow) > 5 * sqrt(NeN(Rdiff_swindow_M1a_chan)^2 + NeN(Rdiff_swindow_M2a_chan)); Bit 6 (value 64): scene is inhomogeneous, as determined by the Rdiff_lwindow threshold. For v5.0 the test is abs(Rdiff_lwindow) > 5 * sqrt(NeN(Rdiff_lwindow_M8_chan)^2 + NeN(Rdiff_lwindow_M9_chan)); Bits 5-0: unused (reserved)
dust_flag	16-bit integer	None	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
dust_score	16-bit integer	None	Dust score. Each bit results from a different test comparing radiances. Higher scores indicate more certainty of dust present. Dust probable when score is over 380. Not valid when dust_flag is negative.
spectral_clear_indicator	16-bit integer	None	Flag telling whether scene was flagged as clear by a spectral filter. Only ocean filter is validated; 2: Ocean test applied and scene identified as clear; 1: Ocean test applied and scene not identified as clear; 0: Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule; -1: Unvalidated land test applied and scene not identified as clear; -2: Unvalidated land test applied and scene identified as clear
BT_diff_SO2	32-bit floating-point	None	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (Kelvins)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input_scene_counts" involves reading HDF-EOS Swath field "input_scene_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)

max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

A1-2. L1B AIRS QA Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRIBQAP"

Swath Name = "L1B_AIRS_QA"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.
MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)

Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-	Geodetic Longitude of spacecraft at end of granule (subsatellite location at

	point	midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all channels with ExcludedChans < 3. Zero means all good channels were well calibrated, for all scanlines. Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
DCR_scan	16-bit integer	Scanline number following (first) DC-Restore. 0 for no DC-Restore
input_bb_temp	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature
input_bb_temp1	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 1A (CaBbTempV1A or CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)
input_spec_temp	Limited Engineering Struct (see below)	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)

	Struct (see below)	
input_grating_temp_2	Limited Engineering Struct (see below)	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
NumRefChannels	32-bit integer	The number of channels reported in MaxRefChannel arrays
Rdiff_swindow_M1a_chan	16-bit integer	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
CF_Version	string of 8-bit characters	Cloud Filter Version Identification. Identifies the set of thresholds used in determination of spectral_clear_indicator.
NumSaturatedFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts overflowed.
NumUnderflowFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts underflowed.
NumCalFOVsOutOfBounds	16-bit unsigned integer	Number of calibration fields-of-view (out of a nominal 810) in which the downlinked counts underflowed or overflowed.
NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
spec_shift_upwell	32-bit floating-point	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)

SpectralFeaturesUpwell	32-bit integer	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_iter_upwell	16-bit integer	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_clim_select	16-bit integer	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_iter_pary	16-bit integer	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added. Zero means the channel was well calibrated for all scanlines Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better that channels with state > 2; 1 - A-side only. Probably better that channels with state > 2; 2 - B-side only. Probably better that channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines

input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets as of first spaceview of each scan
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains (radiance units / count)
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
Gain	32-bit floating-point	Channel (= 2378)	Number of radiance units per count
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays. Entries beyon NumRefChannels are set to -1.
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (cm**-1) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Dynamic estimate of frequency associated with each channel (cm**-1). Note: This is a noisy estimate because there is very limited data in a single 6-minute granule. Designed for use only in aggregation to monitor instrument status. Use nominal_freq instead when analyzing data.
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	a signed estimate of the spectral frequency uncertainty (positive means estimated frequencies are likely too high)
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_feature_contrast_stats	Limited Engineering Struct (see below)	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the upwelling features, for each of the scene footprints considered for spectral calibration
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)

ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the all channels with ExcludedChans < 3. Zero means all "good" channels were well calibrated for this scanline Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition; Bit 0: (LSB, value 1) cold scene noise
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition;

			Bit 0: (LSB, value 1) cold scene noise
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The median of the four spaceviews immediately following the Earth views in the scanline, minus the median of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. Bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; Bit 7 quicklook (expedited) flag; bits 8-11 submode Bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
EDCBOARD	16-bit unsigned integer	None	EDC A/B Powered on Indicator:; 0: Both sides off; 1: Side A; 2: Side B; 3: Invalid; 65534: No value downlinked

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	See Appendix D
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit	None	Error estimate for topog

	floating-point		
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm**-1 window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm**-1) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields).; Bit 7 (MSB, value 128): scene is inhomogeneous, as determined by the Rdiff_swindow threshold. For v5.0 the test is abs(Rdiff_swindow) > 5 * sqrt(NeN(Rdiff_swindow_M1a_chan)^2 + NeN(Rdiff_swindow_M2a_chan)); Bit 6 (value 64): scene is inhomogeneous, as determined by the Rdiff_lwindow threshold. For v5.0 the test is abs(Rdiff_lwindow) > 5 * sqrt(NeN(Rdiff_lwindow_M8_chan)^2 + NeN(Rdiff_lwindow_M9_chan)); Bits 5-0: unused (reserved)
dust_flag	16-bit integer	None	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
dust_score	16-bit integer	None	Dust score. Each bit results from a different test comparing radiances. Higher scores indicate more certainty of dust present. Dust probable when score is over 380. Not valid when dust_flag is negative.
spectral_clear_indicator	16-bit integer	None	Flag telling whether scene was flagged as clear by a spectral filter. Only ocean filter is validated; 2: Ocean test applied and scene identified as clear; 1: Ocean test applied and scene not identified as clear; 0: Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule; -1: Unvalidated land test applied and scene not identified as clear; -2: Unvalidated land test applied and scene identified as clear
BT_diff_SO2	32-bit floating-point	None	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (Kelvins)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input_scene_counts" involves reading HDF-EOS Swath field "input_scene_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)

max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

A1-3. L1B Visible/NIR Science Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRVBRAD"

Swath Name = "L1B_VIS_Science"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron; Ch 4: broadband)

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
VISDarkAMSUFOVCount	32-bit integer	Number of AMSU-A footprints that are uniformly dark in the level-1B VIS/NIR and are thus likely to be uniformly clear
VISBrightAMSUFOVCount	32-bit integer	Number of AMSU-A footprints that are uniformly bright in the level-1B VIS/NIR and are thus likely to be uniformly cloudy
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location atmidpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint

	point	of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	Name of AVHRR input file used as Vegetation Map
limit_vis_det_temp	Color Counts (see below)	Input limit checking on Vis sensor array temperature
input_vis_det_temp	Limited Engineering Struct (see below)	Input statistics on Vis sensor array temperature
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
align_1_2_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3
align_2_4_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)

input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the photometric calibration source (bright target)
limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count.
gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units).
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
offset	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Offset: number of counts expected for no radiance at time nadirTAI
offset_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for offset (radiance units)
NeN	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Noise-equivalent Radiance (radiance units)
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)

sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
ViSnsrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)
ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. Bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; Bit 7 quicklook (expedited) flag; bits 8-11 submode Bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 4) * SubTrack (= 9) * SubXTrack (= 8)	Radiances for each channel in Watts/m**2/micron/steradian
PrelimCldQA	8-bit integer	None	Cloud QA index (0-good or 1-bad) -1 for not calculated
PrelimCldFracVis	32-bit floating-point	None	Cloud Fraction (0.0-1.0) -9999.0 for not calculated
PrelimCldFracVisErr	32-bit floating-point	None	Cloud Fraction Error (0.0-1.0) -9999.0 for not calculated
PrelimClrFracVis	32-bit floating-point	None	Clear Fraction (0.0-1.0) -9999.0 for not calculated
PrelimClrFracVisErr	32-bit floating-point	None	Clear Fraction Error (0.0-1.0) -9999.0 for not calculated
PrelimCldMapVis	8-bit integer	SubTrack (= 9) * SubXTrack (= 8)	Cloud Map (0-clear, 1-cloudy) -1 for not calculated
PrelimNDVI	32-bit floating-point	SubTrack (= 9) * SubXTrack (= 8)	Vegetation Index (-1.0 to 1.0) -999.0 for not calculated
bright_index	16-bit integer	None	Brightness index (1...5, 5 is brightest. -1 for not calculated
inhomo_index	16-bit integer	None	Inhomgeneity index (0...64, 1st digit NDVI-Dev, 2nd digit Ch1-Dev, -9999 for not calculated
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D

satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cornerlats	32-bit floating-point	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees North (-90.0 ... 90.0)
cornerlons	32-bit floating-point	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input_scene_counts" involves reading HDF-EOS Swath field "input_scene_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule

range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits.

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning" condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.

to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

A1-4. L1B Visible/NIR QA Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRVBQAP"

Swath Name = "L1B_VIS_QA"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron; Ch 4: broadband)

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)

eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	Name of AVHRR input file used as Vegetation Map
limit_vis_det_temp	Color Counts (see below)	Input limit checking on Vis sensor array temperature
input_vis_det_temp	Limited Engineering Struct (see below)	Input statistics on Vis sensor array temperature
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
align_1_2_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3
align_2_4_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct	Channel (= 4) *	Input statistics on data numbers from the photometric

	(see below)	SubTrack (= 9)	calibration source (bright target)
limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count.
gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units).
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
ViSnsrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)

ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. Bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; Bit 7 quicklook (expedited) flag; bits 8-11 submode Bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input_scene_counts" involves reading HDF-EOS Swath field "input_scene_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)

mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits.

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning" condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to

		"yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.
to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

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A1-5. L1B AMSU Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRABRAD"

Swath Name = "L1B_AMSU"

Level = "level1B"

Footprints = 30

scanlines per scanset = 1

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	15	Dimension of channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
CalXTrack	4	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AMSU_CALIB) (Footprints are ordered: 1-2: spaceviews; 3-4: blackbody radiometric calibration source)
SpaceXTrack	2	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_SPACE)
BBXTrack	2	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_BB)
WarmPRTA11	5	Number of PRTs measuring AMSU-A1-1 warm target (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
WarmPRTA12	5	Number of PRTs measuring AMSU-A1-2 warm target (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)

WarmPRTA2	7	Number of PRTs measuring AMSU-A2 warm target (AMSU-A2 is AMSU-A channels 1 & 2)

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AMSU-A")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)

num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode_a1	32-bit integer	Number of scanlines not in Process state (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_scanlines_not_norm_mode_a2	32-bit integer	Number of scanlines not in Process state (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_missing_scanlines_a1	32-bit integer	Number of scanlines with state = missing (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_missing_scanlines_a2	32-bit integer	Number of scanlines with state = missing (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_data_gaps_a1	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_data_gaps_a2	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_instr_mode_changes_a1	32-bit integer	Number of operational instrument mode changes (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_instr_mode_changes_a2	32-bit integer	Number of operational instrument mode changes (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_rec_cal_prob_a11	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
num_scanlines_rec_cal_prob_a12	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
num_scanlines_rec_cal_prob_a2	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the AMSU-A1 space view

		plus number of scanlines in granule with the moon in the AMSU-A2 space view (0-90)
QA_bb_PRT_a11	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_bb_PRT_a12	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_bb_PRT_a2	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
QA_rec_PRT_a11	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_rec_PRT_a12	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_rec_PRT_a2	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 15)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 15)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 15)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 15)	bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 15)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 15)	Number of scanlines with non-zero qa_channel
bb_signals	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Statistics on blackbody calibration signals (data numbers with offset subtracted)
space_signals	Unlimited Engineering Struct (see below)	SpaceXTrack (= 2) * Channel (= 15)	Statistics on spaceview calibration signals (data numbers with offset subtracted)
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 15)	Statistics on gains (count/K)
NeDT	32-bit floating-point	Channel (= 15)	Instrument noise level estimated from warm count scatter (K)
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 30) * Channel (= 15)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 2) * Channel (= 15)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a0 summary QA (K)

QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between warm cal counts, DT=ABS(T1-T2)/SQRT(2)
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between cold cal counts, DT=ABS(T1-T2)/SQRT(2)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state1	32-bit integer	None	Data state for AMSU-A1: 0:Process, 1:Special, 2:Erroneous, 3:Missing
state2	32-bit integer	None	Data state for AMSU-A2: 0:Process, 1:Special, 2:Erroneous, 3:Missing (AMSU-A2 is AMSU-A channels 1 and 2)
cal_coef_a0	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a0_err	32-bit floating-	Channel (= 15)	Error estimate for cal_coef_a0 (K)

	point		
cal_coef_a1	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a1_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a2_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a2 (K/count**2)
a1_ColdCalPstion	8-bit integer	None	AMSU-A1 Cold Calibration Position 1-4 (Binary 0-3)
a2_ColdCalPstion	8-bit integer	None	AMSU-A2 Cold Calibration Position 1-4 (Binary 0-3) (AMSU-A2 is AMSU-A channels 1 and 2)
a1_PLO_Redundncy	8-bit integer	None	AMSU-A1 PLO Redundancy, 1: default (PLO 2); 0: redundant (PLO 1)
a11_mux_temp_used	8-bit integer	None	AMSU-A1-1 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
a11_receiver_temp	32-bit floating-point	None	AMSU-A1-1 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a11_mux_temp_used) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a11_target_temp	32-bit floating-point	None	AMSU-A1-1 target temperature used in calibration (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a12_mux_temp_used	8-bit integer	None	AMSU-A1-2 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
a12_receiver_temp	32-bit floating-point	None	AMSU-A1-2 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a12_mux_temp_used) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a12_target_temp	32-bit floating-point	None	AMSU-A1-2 target temperature used in calibration (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a2_diplexer_temp_used	8-bit integer	None	AMSU-A2 diplexer Temperature use flag. (1: used diplexer temperature for AMSU-A2 receiver temperature; 0: used RF shelf temperature) (AMSU-A2 is AMSU-A channels 1 and 2)
a2_receiver_temp	32-bit floating-point	None	AMSU-A2 receiver temperature used in calibration (diplexer temperature or RF shelf temperature as specified by a2_diplexer_temp_used) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
a2_target_temp	32-bit floating-point	None	AMSU-A2 target temperature used in calibration (AMSU-A2 is AMSU-A channels 1 and 2) (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for AMSU-A: Bit 0: (LSB, value 1) Sun glint in this scanline; Bit 1: (value 2) Coastal crossing in this scanline; Bit 2: (value 4) Some channels had excessive NeDT estimate; Bit 3: (value 8) Near sidelobe correction applied
qa_receiver_a11	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15): Bit 0: (LSB, value 1) Calibration was not derived, due to the instrument mode; Bit 1: (value 2) Calibration was not derived, due to bad or missing PRT values; Bit 2: (value 4) This scanline was calibrated, but the moon was in the space view; Bit 3: (value 8) This scanline was calibrated, but there was a space view scan position err; Bit 4: (value 16) This scanline was calibrated, but there was a blackbody scan position error; Bit 5: (value 32) This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: (value 64) This scanline was calibrated, but there was a data gap; Bit 7: (value 128) Some channels were not calibrated

qa_receiver_a12	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2:Same fields as defined for qa_receiver_a11
qa_receiver_a2	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2:Same fields as defined for qa_receiver_a11
qa_channel	8-bit unsigned integer	Channel (= 15)	Channel bitmap for AMSU-A: Bit 0: (LSB, value 1) All space view counts were bad for this channel and scanline; Bit 1: (value 2) Space view counts were marginal for this channel and scanline; Bit 2: (value 4) Space view counts could not be smoothed; Bit 3: (value 8) All blackbody counts were bad for this channel and scanline; Bit 4: (value 16) Blackbody counts were marginal for this channel and scanline; Bit 5: (value 32) Blackbody counts could not be smoothed; Bit 6: (value 64) Unable to calculate calibration coefficients for this scanline, most recent valid coefficients used instead; Bit 7: (value 128) Excessive NeDT estimated

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AMSU-A instrument with respect to the AMSU-A Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 15)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 15)	Antenna temperatures, with an empirically derived correction applied to compensate for scan-position dependent bias. This correction is derived from AIRS retrievals. (K)
brightness_temp_err	32-bit floating-point	Channel (= 15)	Uncertainty in empirically derived brightness_temp bias correction, excluding radiometer noise. (K)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA_bb_PRT_a11" involves reading HDF-EOS Swath field "QA_bb_PRT_a11.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

A1-6. L1B AMSU QA Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRABQAP"

Swath Name = "L1B_AMSU_QASup"

Level = "level1B"

Footprints = 30

scanlines per scanset = 1

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	15	Dimension of channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
CalXTrack	4	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AMSU_CALIB) (Footprints are ordered: 1-2: spaceviews; 3-4: blackbody radiometric calibration source)
SpaceXTrack	2	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_SPACE)
BBXTrack	2	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_BB)
WarmPRTA11	5	Number of PRTs measuring AMSU-A1-1 warm target (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
WarmPRTA12	5	Number of PRTs measuring AMSU-A1-2 warm target (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)

WarmPRTA2	7	Number of PRTs measuring AMSU-A2 warm target (AMSU-A2 is AMSU-A channels 1 & 2)

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AMSU-A")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)

num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode_a1	32-bit integer	Number of scanlines not in Process state (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_scanlines_not_norm_mode_a2	32-bit integer	Number of scanlines not in Process state (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_missing_scanlines_a1	32-bit integer	Number of scanlines with state = missing (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_missing_scanlines_a2	32-bit integer	Number of scanlines with state = missing (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_data_gaps_a1	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_data_gaps_a2	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_instr_mode_changes_a1	32-bit integer	Number of operational instrument mode changes (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_instr_mode_changes_a2	32-bit integer	Number of operational instrument mode changes (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_rec_cal_prob_a11	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
num_scanlines_rec_cal_prob_a12	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
num_scanlines_rec_cal_prob_a2	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the AMSU-A1 space view

		plus number of scanlines in granule with the moon in the AMSU-A2 space view (0-90)
QA_bb_PRT_a11	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_bb_PRT_a12	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_bb_PRT_a2	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
QA_rec_PRT_a11	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_rec_PRT_a12	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_rec_PRT_a2	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
QA_a11_warm_load_1_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a11_warm_load_2_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a11_warm_load_3_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a11_warm_load_4_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a11_warm_load_c_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a11_rf_shelf_temp	Limited Engineering Struct (see below)	Receiver temperature QA (C)
QA_a11_rf_mux_temp	Limited Engineering Struct (see below)	Backup receiver temperature QA (C)
QA_a11_ref_PRT_select	32-bit unsigned integer	Number of times backup reference PRT selected
QA_a12_warm_load_1_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a12_warm_load_2_temp	Limited	Warm target temperature QA (C)

	Engineering Struct (see below)	
QA_a12_warm_load_3_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a12_warm_load_4_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a12_warm_load_c_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a12_rf_shelf_temp	Limited Engineering Struct (see below)	Receiver temperature QA (C)
QA_a12_rf_mux_temp	Limited Engineering Struct (see below)	Backup receiver temperature QA (C)
QA_a12_ref_PRT_select	32-bit unsigned integer	Number of times backup reference PRT selected
QA_a2_warm_load_1_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_2_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_3_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_4_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_5_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_6_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_warm_load_c_temp	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_a2_rf_shelf_temp	Limited Engineering Struct (see below)	Receiver temperature QA (C)
QA_a2_rf_diplexer_temp	Limited Engineering Struct (see below)	Backup receiver temperature QA (C)
QA_a2_ref_PRT_select	32-bit unsigned integer	Number of times backup reference PRT selected
QA_a11_NFAIL_primPRT	Reference PRT counts (see	Failure counts for AMSU-A1-1 primary reference PRT

	below)	
QA_a11_NFAIL_secPRT	Reference PRT counts (see below)	Failure counts for AMSU-A1-1 secondary reference PRT
QA_a12_NFAIL_primPRT	Reference PRT counts (see below)	Failure counts for AMSU-A1-2 primary reference PRT
QA_a12_NFAIL_secPRT	Reference PRT counts (see below)	Failure counts for AMSU-A1-2 secondary reference PRT
QA_a2_NFAIL_primPRT	Reference PRT counts (see below)	Failure counts for AMSU-A2 primary reference PRT
QA_a2_NFAIL_secPRT	Reference PRT counts (see below)	Failure counts for AMSU-A2 secondary reference PRT

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 15)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 15)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 15)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 15)	bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 15)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 15)	Number of scanlines with non-zero qa_channel
bb_signals	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Statistics on blackbody calibration signals (data numbers with offset subtracted)
space_signals	Unlimited Engineering Struct (see below)	SpaceXTrack (= 2) * Channel (= 15)	Statistics on spaceview calibration signals (data numbers with offset subtracted)
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 15)	Statistics on gains (count/K)
NeDT	32-bit floating-point	Channel (= 15)	Instrument noise level estimated from warm count scatter (K)
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 30) * Channel (= 15)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 2) * Channel (= 15)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct	Channel (= 15)	Summary QA on differences between warm cal counts, DT=ABS(T1-T2)/SQRT(2)

	(see below)		
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between cold cal counts, DT=ABS(T1-T2)/SQRT(2)
QA_raw_cold_count	Limited Engineering Struct (see below)	Channel (= 15)	Raw cold count summary QA
QA_raw_warm_count	Limited Engineering Struct (see below)	Channel (= 15)	Raw warm count summary QA
QA_cold_count	Unlimited Engineering Struct (see below)	Channel (= 15)	(qual and averaged) Cold count summary QA
QA_warm_count	Unlimited Engineering Struct (see below)	Channel (= 15)	(qual and averaged) Warm count summary QA
QA_smoothed_cold_count	Unlimited Engineering Struct (see below)	Channel (= 15)	Smoothed cold count summary QA
QA_smoothed_warm_count	Unlimited Engineering Struct (see below)	Channel (= 15)	Smoothed warm count summary QA
QA_raw_count	Unlimited Engineering Struct (see below)	Channel (= 15)	Science count summary QA
QA_a11_NFAIL_wPRT	Warm PRT counts (see below)	WarmPRTA11 (= 5)	Failure counts for AMSU-A1-1 warm target PRT
QA_a12_NFAIL_wPRT	Warm PRT counts (see below)	WarmPRTA12 (= 5)	Failure counts for AMSU-A1-2 warm target PRT
QA_a2_NFAIL_wPRT	Warm PRT counts (see below)	WarmPRTA2 (= 7)	Failure counts for AMSU-A2 warm target PRT
QA_NFAIL_WC_bad_val	16-bit integer	Channel (= 15)	Number of warm target input count failures per channel for bad values
QA_NFAIL_WC_lo_lim	16-bit integer	Channel (= 15)	Number of warm target input count failures per channel for Low limit violation
QA_NFAIL_WC_hi_lim	16-bit integer	Channel (= 15)	Number of warm target input count failures per channel for High limit violation
QA_NFAIL_CC_bad_val	16-bit integer	Channel (= 15)	Number of cold cal (space view) input count failures per channel for bad values
QA_NFAIL_CC_lo_lim	16-bit integer	Channel (= 15)	Number of cold cal (space view) input count failures per channel for Low limit violation
QA_NFAIL_CC_hi_lim	16-bit integer	Channel (= 15)	Number of cold cal (space view) input count failures per channel for High limit violation
QA_NFAIL_CC_moon_flag	16-bit integer	Channel (= 15)	Number of cold cal (space view) input count failures per channel for moon in field-of-view
QA_NFAIL_CAL_not_proc_state	16-bit integer	Channel (= 15)	Number of calibration failures per channel for data not in process state (missing or special calibration mode or bad)
QA_NFAIL_CAL_no_reuse_coef	16-bit integer	Channel (= 15)	Number of calibration failures per channel for lack of reusable a0, a1, & a2 coefficients
QA_NFAIL_CAL_ref_PRT	16-bit integer	Channel (= 15)	Number of calibration failures per channel for problems with the reference PRTs
QA_NFAIL_CAL_warm_temp	16-bit integer	Channel (= 15)	Number of calibration failures per channel for determination of warm target temperature
QA_NFAIL_CAL_cold_temp	16-bit integer	Channel (= 15)	Number of calibration failures per channel for determination of cold cal (space view) temperature
QA_NFAIL_CAL_wC_no_val_data	16-bit integer	Channel (= 15)	Number of calibration failures per channel for insufficient valid warm calibration data
QA_NFAIL_CAL_wC_in_scan	16-bit integer	Channel (= 15)	Number of calibration failures per channel for excessive in-scan warm count variability
QA_NFAIL_CAL_wC_smoothing	16-bit integer	Channel (= 15)	Number of calibration failures per channel for

			insufficient raw warm counts for smoothing
QA_NFAIL_CAL_cC_no_val_data	16-bit integer	Channel (= 15)	Number of calibration failures per channel for insufficient valid cold cal (space view) data
QA_NFAIL_CAL_cC_in_scan	16-bit integer	Channel (= 15)	Number of calibration failures per channel for excessive in-scan cold cal (space view) count variability
QA_NFAIL_CAL_cC_smoothing	16-bit integer	Channel (= 15)	Number of calibration failures per channel for insufficient raw cold cal (space view) counts for smoothing
QA_NFAIL_CAL_chan_missing	16-bit integer	Channel (= 15)	Number of calibration failures per channel because channel is not implemented (HSB channel #1)
QA_NFAIL_CAL_other	16-bit integer	Channel (= 15)	Number of calibration failures per channel for other reasons

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state1	32-bit integer	None	Data state for AMSU-A1: 0:Process, 1:Special, 2:Erroneous, 3:Missing
state2	32-bit	None	Data state for AMSU-A2: 0:Process, 1:Special, 2:Erroneous, 3:Missing

	integer		(AMSU-A2 is AMSU-A channels 1 and 2)
qa_a11_primPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 primary PRT: Bit 0: (LSB, value 1) Failed bad value; Bit 1: (value 2) Failed low limit test; Bit 2: (value 4) Failed high limit test; Bit 3: (value 8) Failed cross-scan test
qa_a11_secPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 secondary PRT (bits defined as for qa_11_primPRT)
qa_a12_primPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2 primary PRT (bits defined as for qa_11_primPRT)
qa_a12_secPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2 secondary PRT (bits defined as for qa_11_primPRT)
qa_a2_primPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2 primary PRT (bits defined as for qa_11_primPRT)
qa_a2_secPRT	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2 secondary PRT (bits defined as for qa_11_primPRT)
qa_a11_wPRT_bad_val	8-bit unsigned integer	None	Warm target bad values bitmap for AMSU-A1-1 PRTs: Bit 0: (LSB, value 1) problem with center PRT; Bits 1-4: problem with PRTs 1-4
qa_a11_wPRT_lo_lim	8-bit unsigned integer	None	Warm target Low limit bitmap for AMSU-A1-1 PRTs (bits defined as for qa_a11_wPRT_bad_val)
qa_a11_wPRT_hi_lim	8-bit unsigned integer	None	Warm target High limit bitmap for AMSU-A1-1 PRTs (bits defined as for qa_a11_wPRT_bad_val)
qa_a11_wPRT_in_scan	8-bit unsigned integer	None	Warm target in-scan bitmap for AMSU-A1-1 PRTs (bits defined as for qa_a11_wPRT_bad_val)
qa_a11_wPRT_x_scan	8-bit unsigned integer	None	Warm target cross-scan bitmap for AMSU-A1-1 PRTs (bits defined as for qa_a11_wPRT_bad_val)
qa_a12_wPRT_bad_val	8-bit unsigned integer	None	Warm target bad values bitmap for AMSU-A1-2 PRTs: Bit 0: (LSB, value 1) problem with center PRT; Bits 1-4: problem with PRTs 1-4
qa_a12_wPRT_lo_lim	8-bit unsigned integer	None	Warm target Low limit bitmap for AMSU-A1-2 PRTs (bits defined as for qa_a12_wPRT_bad_val)
qa_a12_wPRT_hi_lim	8-bit unsigned integer	None	Warm target High limit bitmap for AMSU-A1-2 PRTs (bits defined as for qa_a12_wPRT_bad_val)
qa_a12_wPRT_in_scan	8-bit unsigned integer	None	Warm target in-scan bitmap for AMSU-A1-2 PRTs (bits defined as for qa_a12_wPRT_bad_val)
qa_a12_wPRT_x_scan	8-bit unsigned integer	None	Warm target cross-scan bitmap for AMSU-A1-2 PRTs (bits defined as for qa_a12_wPRT_bad_val)
qa_a2_wPRT_bad_val	8-bit unsigned integer	None	Warm target bad values bitmap for AMSU-A2 PRTs: Bit 0: (LSB, value 1) problem with center PRT; Bits 1-4: problem with PRTs 1-4
qa_a2_wPRT_lo_lim	8-bit unsigned integer	None	Warm target Low limit bitmap for AMSU-A2 PRTs (bits defined as for qa_a2_wPRT_bad_val)
qa_a2_wPRT_hi_lim	8-bit unsigned integer	None	Warm target High limit bitmap for AMSU-A2 PRTs (bits defined as for qa_a2_wPRT_bad_val)
qa_a2_wPRT_in_scan	8-bit unsigned integer	None	Warm target in-scan bitmap for AMSU-A2 PRTs (bits defined as for qa_a2_wPRT_bad_val)

qa_a2_wPRT_x_scan	8-bit unsigned integer	None	Warm target cross-scan bitmap for AMSU-A2 PRTs (bits defined as for qa_a2_wPRT_bad_val)
qa_WC_bad_val	16-bit unsigned integer	BBXTrack (= 2)	Warm target input counts bad values: Bits 0 (LSB)-14: problem with channels 1-15
qa_WC_lo_lim	16-bit unsigned integer	BBXTrack (= 2)	Warm target input counts Low limit: Bits 0 (LSB)-14: problem with channels 1-15
qa_WC_hi_lim	16-bit unsigned integer	BBXTrack (= 2)	Warm target input counts High limit: Bits 0 (LSB)-14: problem with channels 1-15
qa_CC_bad_val	16-bit unsigned integer	SpaceXTrack (= 2)	Cold cal input counts bad values: Bits 0 (LSB)-14: problem with channels 1-15
qa_CC_lo_lim	16-bit unsigned integer	SpaceXTrack (= 2)	Cold cal input counts Low limit: Bits 0 (LSB)-14: problem with channels 1-15
qa_CC_hi_lim	16-bit unsigned integer	SpaceXTrack (= 2)	Cold cal input counts High limit: Bits 0 (LSB)-14: problem with channels 1-15
qa_CC_moon_flag	16-bit unsigned integer	SpaceXTrack (= 2)	Cold cal input counts moon flag: Bits 0 (LSB)-14: problem with channels 1-15
qa_calibration	16-bit unsigned integer	Channel (= 15)	Calibration QA bitmap: Bit 0: (LSB, value 1) not in process state; Bit 1: (value 2) no coef for reuse; Bit 2: (value 4) Reference PRT; Bit 3: (value 8) Warm Temp Cal; Bit 4: (value 16) Cold Temp Cal; Bit 5: (value 32) Warm Counts - no good counts; Bit 6: (value 64) Warm Counts - in-scan dev; Bit 7: (value 128) Warm Counts - smooth threshold; Bit 8: (value 256) Cold Counts - no good counts; Bit 9: (value 512) Cold Counts - in-scan dev; Bit 10: (value 1024) Cold Counts - smooth threshold; Bit 11: (value 2048) Failed - channel not implemented; Bit 12: (value 4096) Other failure
cal_coef_a0	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a0_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a0 (K)
cal_coef_a1	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a1_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a2_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a2 (K/count**2)
bb_brightness	32-bit floating-point	Channel (= 15)	Blackbody brightness temperature (Tbw) (K)
bb_brightness_err	32-bit floating-point	Channel (= 15)	Blackbody brightness temperature error (delta-Tbw) (K)
spaceview_temp	32-bit floating-point	Channel (= 15)	Spaceview brightness temperature (Tbc) (K)
spaceview_temp_err	32-bit	Channel (=	Spaceview brightness temperature error (delta-Tbc) (K)

	floating-point	15)	
cold_count	32-bit floating-point	Channel (= 15)	Qual and averaged cold cal (space view) counts for this scanline (counts)
warm_count	32-bit floating-point	Channel (= 15)	Qual and averaged warm cal (target view) counts for this scanline (counts)
smoothed_cold_count	32-bit floating-point	Channel (= 15)	Smoothed cold cal counts for this scanline (counts)
smoothed_warm_count	32-bit floating-point	Channel (= 15)	Smoothed warm cal counts for this scanline (counts)
a1_ColdCalPstion	8-bit integer	None	AMSU-A1 Cold Calibration Position 1-4 (Binary 0-3)
a2_ColdCalPstion	8-bit integer	None	AMSU-A2 Cold Calibration Position 1-4 (Binary 0-3) (AMSU-A2 is AMSU-A channels 1 and 2)
a1_PLO_Redundncy	8-bit integer	None	AMSU-A1 PLO Redundancy, 1: default (PLO 2); 0: redundant (PLO 1)
a11_mux_temp_used	8-bit integer	None	AMSU-A1-1 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
a11_receiver_temp	32-bit floating-point	None	AMSU-A1-1 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a11_mux_temp_used) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a11_target_temp	32-bit floating-point	None	AMSU-A1-1 target temperature used in calibration (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a12_mux_temp_used	8-bit integer	None	AMSU-A1-2 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
a12_receiver_temp	32-bit floating-point	None	AMSU-A1-2 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a12_mux_temp_used) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a12_target_temp	32-bit floating-point	None	AMSU-A1-2 target temperature used in calibration (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a2_diplexer_temp_used	8-bit integer	None	AMSU-A2 diplexer Temperature use flag. (1: used diplexer temperature for AMSU-A2 receiver temperature; 0: used RF shelf temperature) (AMSU-A2 is AMSU-A channels 1 and 2)
a2_receiver_temp	32-bit floating-point	None	AMSU-A2 receiver temperature used in calibration (diplexer temperature or RF shelf temperature as specified by a2_diplexer_temp_used) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
a2_target_temp	32-bit floating-point	None	AMSU-A2 target temperature used in calibration (AMSU-A2 is AMSU-A channels 1 and 2) (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for AMSU-A: Bit 0: (LSB, value 1) Sun glint in this scanline; Bit 1: (value 2) Coastal crossing in this scanline; Bit 2: (value 4) Some channels had excessive NeDT estimate; Bit 3: (value 8) Near sidelobe correction applied
qa_receiver_a11	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15): Bit 0: (LSB, value 1) Calibration was not derived, due to the instrument mode; Bit 1: (value 2) Calibration was not derived, due to bad or missing PRT values; Bit 2: (value 4) This scanline was calibrated, but the moon was in the space view; Bit 3: (value 8) This scanline was calibrated, but there was a space view scan position err; Bit 4: (value 16) This scanline was calibrated, but there was a blackbody scan position error; Bit 5: (value 32) This scanline was calibrated, but some PRT values were

			bad or marginal; Bit 6: (value 64) This scanline was calibrated, but there was a data gap; Bit 7: (value 128) Some channels were not calibrated
qa_receiver_a12	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2:Same fields as defined for qa_receiver_a11
qa_receiver_a2	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2:Same fields as defined for qa_receiver_a11
qa_channel	8-bit unsigned integer	Channel (= 15)	Channel bitmap for AMSU-A: Bit 0: (LSB, value 1) All space view counts were bad for this channel and scanline; Bit 1: (value 2) Space view counts were marginal for this channel and scanline; Bit 2: (value 4) Space view counts could not be smoothed; Bit 3: (value 8) All blackbody counts were bad for this channel and scanline; Bit 4: (value 16) Blackbody counts were marginal for this channel and scanline; Bit 5: (value 32) Blackbody counts could not be smoothed; Bit 6: (value 64) Unable to calculate calibration coefficients for this scanline, most recent valid coefficients used instead; Bit 7: (value 128) Excessive NeDT estimated

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AMSU-A instrument with respect to the AMSU-A Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 15)	Raw antenna temperature in Kelvins
brightness_temp	32-bit	Channel (=	Antenna temperatures, with an empirically derived correction applied to

	floating-point	15)	compensate for scan-position dependent bias. This correction is derived from AIRS retrievals. (K)
brightness_temp_err	32-bit floating-point	Channel (= 15)	Uncertainty in empirically derived brightness_temp bias correction, excluding radiometer noise. (K)
bt_sidelobe_corr	32-bit floating-point	Channel (= 15)	Correction to raw antenna temperature to give brightness_temp. This correction accounts for near- and far- sidelobe effects. (K)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA_bb_PRT_a11" involves reading HDF-EOS Swath field "QA_bb_PRT_a11.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Reference PRT counts: This type provides counts of rejection due to each rejection criterion for reference PRTs for MW instruments.

Field Name	Type	Explanation
bad_value	16-bit integer	Bad value
lo_lim	16-bit integer	Low limit
hi_lim	16-bit integer	High limit
x_scan	16-bit integer	Large cross-scan deviation

Warm PRT counts: This type provides counts of rejection due to each rejection criterion for warm target PRTs for MW instruments.

Field Name	Type	Explanation
bad_value	16-bit integer	Bad value
lo_lim	16-bit integer	Low limit
hi_lim	16-bit integer	High limit
in_scan	16-bit integer	Large within-scan deviation
x_scan	16-bit integer	Large cross-scan deviation

A1-7. L1B HSB Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRHBRAD"

Swath Name = "L1B_HSB"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	5	Dimension of channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
CalXTrack	8	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_HSB_CALIB) (Footprints are ordered: 1-4: spaceviews; 5-8: blackbody radiometric calibration source)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_SPACE)
BBXTrack	4	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_BB)
WarmPRT	7	Number of PRTs measuring warm target

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)

Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("HSB")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)

end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode	32-bit integer	Number of scanlines not in Process state
num_missing_scanlines	32-bit integer	Number of scanlines with state = missing
num_data_gaps	32-bit integer	Number of blocks of scanlines where State is not Process
num_instr_mode_changes	32-bit integer	Number of operational instrument mode changes
num_scanlines_rec_cal_prob	32-bit integer	Number of scanlines with non-zero qa_receiver
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the HSB space view
QA_bb_PRT	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (C)
QA_rec_PRT	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 5)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 5)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 5)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 5)	Bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 5)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 5)	Number of scanlines with non-zero

			qa_channel
bb_signals	Unlimited Engineering Struct (see below)	BBXTrack (= 4) * Channel (= 5)	Statistics on blackbody calibration signals (data numbers with offset subtracted)
space_signals	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Statistics on spaceview calibration signals (data numbers with offset subtracted)
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 5)	Statistics on gains (count/K)
NeDT	32-bit floating-point	Channel (= 5)	Instrument noise level estimated from warm count scatter (K)
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * Channel (= 5)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 4) * Channel (= 5)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between warm cal counts, DT=ABS(T1-T2)/SQRT(2)
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between cold cal counts, DT=ABS(T1-T2)/SQRT(2)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)

sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cal_coef_a0	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a0_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a0 (K)
cal_coef_a1	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a1_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a2_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a2 (K/count**2)
SpacViewSelct	8-bit integer	None	Space View Selected
mixer_17_temp_used	8-bit integer	None	Mixer 17 Temperature use flag. (1: used mixer 17 temperature for receiver temperature; 0: used mixer 18/19/20 temperature)
receiver_temp	32-bit floating-point	None	Receiver temperature used in calibration (mixer 17 temperature or mixer 18/19/20 temperature as specified by mixer_17_temp_used) (C)
target_temp	32-bit floating-point	None	HSB target temperature used in calibration (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for HSB: Bit 0: (LSB, value 1) Sun glint in this scanline; Bit 1: (value 2) Coastal crossing in this scanline; Bit 2: (value 4) Some channels had excessive NeDT estimate; Bit 3: (value 8) Near sidelobe correction applied
qa_receiver	8-bit unsigned integer	None	Receiver bitmap for HSB: Bit 0: (LSB, value 1) Calibration was not derived, due to the instrument mode; Bit 1: (value 2) Calibration was not derived, due to bad or missing PRT values; Bit 2: (value 4) This scanline was calibrated, but the moon was in the space view; Bit 3: (value 8) This scanline was calibrated, but there was a space view scan position err; Bit 4: (value 16) This scanline was calibrated, but there was a blackbody scan position error; Bit 5: (value 32) This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: (value 64) This scanline was calibrated, but there was a data gap; Bit 7: (value 128) Some channels were not calibrated
qa_channel	8-bit unsigned integer	Channel (= 5)	Channel bitmap for HSB: Bit 0: (LSB, value 1) All space view counts were bad for this channel and scanline; Bit 1: (value 2) Space view counts were marginal for this channel and scanline; Bit 2: (value 4) Space view counts could not be smoothed; Bit 3: (value 8) All blackbody counts were bad for this channel and scanline; Bit 4: (value 16) Blackbody counts were marginal for this channel and scanline; Bit 5: (value 32) Blackbody counts could not be smoothed; Bit 6: (value 64) Most recent calibration coefficients used; Bit 7: (value 128) Excessive NeDT estimated

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra	Explanation

		Dimensions	
scanang	32-bit floating-point	None	Scanning angle of HSB instrument with respect to the HSB instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 5)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 5)	Brightness temperature. Same as antenna_temp because sidelobe correction is small and ground truth is less known for water vapor. (K)
brightness_temp_err	32-bit floating-point	Channel (= 5)	Uncertainty in empirically derived brightness_temp bias correction, excluding radiometer noise. (K)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA_bb_PRT" involves reading HDF-EOS Swath field "QA_bb_PRT.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule

num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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A1-8. L1B HSB QA Interface Specification

Interface Specification Version 5.0.14.0
2007-04-11

ESDT ShortName = "AIRHBQAP"

Swath Name = "L1B_HSB_QASup"

Level = "level1B"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	5	Dimension of channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
CalXTrack	8	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_HSB_CALIB) (Footprints are ordered: 1-4: spaceviews; 5-8: blackbody radiometric calibration source)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_SPACE)
BBXTrack	4	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_BB)
WarmPRT	7	Number of PRTs measuring warm target

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)

Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("HSB")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)

end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode	32-bit integer	Number of scanlines not in Process state
num_missing_scanlines	32-bit integer	Number of scanlines with state = missing
num_data_gaps	32-bit integer	Number of blocks of scanlines where State is not Process
num_instr_mode_changes	32-bit integer	Number of operational instrument mode changes
num_scanlines_rec_cal_prob	32-bit integer	Number of scanlines with non-zero qa_receiver
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the HSB space view
QA_bb_PRT	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (C)
QA_rec_PRT	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
QA_cal_temp_1	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_cal_temp_2	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_cal_temp_3	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_cal_temp_4	Limited Engineering Struct (see below)	Warm target temperature QA (C)

QA_cal_temp_5	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_cal_temp_6	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_cal_temp_7	Limited Engineering Struct (see below)	Warm target temperature QA (C)
QA_subrefl_temp	Limited Engineering Struct (see below)	Subreflector temperature QA (C)
QA_mixer_181920_temp	Limited Engineering Struct (see below)	183 GHz mixer temp, C
QA_mixer_17_temp	Limited Engineering Struct (see below)	150 GHz mixer temp, C
QA_ref_PRT_select	32-bit unsigned integer	Number of times backup reference PRT selected
QA_NFAIL_primPRT	Reference PRT counts (see below)	Failure counts for primary reference PRT
QA_NFAIL_secPRT	Reference PRT counts (see below)	Failure counts for secondary reference PRT

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 5)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 5)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 5)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 5)	Bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 5)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 5)	Number of scanlines with non-zero qa_channel
bb_signals	Unlimited Engineering Struct (see below)	BBXTrack (= 4) * Channel (= 5)	Statistics on blackbody calibration signals (data numbers with offset subtracted)
space_signals	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Statistics on spaceview calibration signals (data numbers with offset subtracted)
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 5)	Statistics on gains (count/K)
NeDT	32-bit floating-point	Channel (= 5)	Instrument noise level estimated from warm count scatter (K)
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * Channel (= 5)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct	BBXTrack (= 4) * Channel (= 5)	Per BB footprint position raw warm count summary QA (unfiltered)

	(see below)		
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between warm cal counts, DT=ABS(T1-T2)/SQRT(2)
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between cold cal counts, DT=ABS(T1-T2)/SQRT(2)
QA_raw_cold_count	Limited Engineering Struct (see below)	Channel (= 5)	Raw cold count summary QA
QA_raw_warm_count	Limited Engineering Struct (see below)	Channel (= 5)	Raw warm count summary QA
QA_cold_count	Unlimited Engineering Struct (see below)	Channel (= 5)	(qual and averaged) Cold count summary QA
QA_warm_count	Unlimited Engineering Struct (see below)	Channel (= 5)	(qual and averaged) Warm count summary QA
QA_smoothed_cold_count	Unlimited Engineering Struct (see below)	Channel (= 5)	Smoothed cold count summary QA
QA_smoothed_warm_count	Unlimited Engineering Struct (see below)	Channel (= 5)	Smoothed warm count summary QA
QA_raw_count	Unlimited Engineering Struct (see below)	Channel (= 5)	Science count summary QA
QA_NFAIL_wPRT	Warm PRT counts (see below)	WarmPRT (= 7)	Failure counts for warm target PRT
QA_NFAIL_WC_bad_val	16-bit integer	Channel (= 5)	Number of warm target input count failures per channel for bad values
QA_NFAIL_WC_lo_lim	16-bit integer	Channel (= 5)	Number of warm target input count failures per channel for Low limit violation
QA_NFAIL_WC_hi_lim	16-bit integer	Channel (= 5)	Number of warm target input count failures per channel for High limit violation
QA_NFAIL_CC_bad_val	16-bit integer	Channel (= 5)	Number of cold cal (space view) input count failures per channel for bad values
QA_NFAIL_CC_lo_lim	16-bit integer	Channel (= 5)	Number of cold cal (space view) input count failures per channel for Low limit violation
QA_NFAIL_CC_hi_lim	16-bit integer	Channel (= 5)	Number of cold cal (space view) input count failures per channel for High limit violation
QA_NFAIL_CC_moon_flag	16-bit integer	Channel (= 5)	Number of cold cal (space view) input count failures per channel for moon in field-of-view
QA_NFAIL_CAL_not_proc_state	16-bit integer	Channel (= 5)	Number of calibration failures per channel for data not in process state (missing or special calibration mode or bad)
QA_NFAIL_CAL_no_reuse_coef	16-bit integer	Channel (= 5)	Number of calibration failures per channel for lack of reusable a0, a1, & a2 coefficients
QA_NFAIL_CAL_ref_PRT	16-bit integer	Channel (= 5)	Number of calibration failures per channel for problems with the reference PRTs

QA_NFAIL_CAL_warm_temp	16-bit integer	Channel (= 5)	Number of calibration failures per channel for determination of warm target temperature
QA_NFAIL_CAL_cold_temp	16-bit integer	Channel (= 5)	Number of calibration failures per channel for determination of cold cal (space view) temperature
QA_NFAIL_CAL_wC_no_val_data	16-bit integer	Channel (= 5)	Number of calibration failures per channel for insufficient valid warm calibration data
QA_NFAIL_CAL_wC_in_scan	16-bit integer	Channel (= 5)	Number of calibration failures per channel for excessive in-scan warm count variability
QA_NFAIL_CAL_wC_smoothing	16-bit integer	Channel (= 5)	Number of calibration failures per channel for insufficient raw warm counts for smoothing
QA_NFAIL_CAL_cC_no_val_data	16-bit integer	Channel (= 5)	Number of calibration failures per channel for insufficient valid cold cal (space view) data
QA_NFAIL_CAL_cC_in_scan	16-bit integer	Channel (= 5)	Number of calibration failures per channel for excessive in-scan cold count variability
QA_NFAIL_CAL_cC_smoothing	16-bit integer	Channel (= 5)	Number of calibration failures per channel for insufficient raw cold counts for smoothing
QA_NFAIL_CAL_chan_missing	16-bit integer	Channel (= 5)	Number of calibration failures per channel because channel is not implemented (HSB channel #1)
QA_NFAIL_CAL_other	16-bit integer	Channel (= 5)	Number of calibration failures per channel for other reasons

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.

glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
qa_primPRT	8-bit unsigned integer	None	Receiver bitmap for HSB primary PRT: Bit 0: (LSB, value 1) Failed bad value; Bit 1: (value 2) Failed low limit test; Bit 2: (value 4) Failed high limit test; Bit 3: (value 8) Failed cross-scan test
qa_secPRT	8-bit unsigned integer	None	Receiver bitmap for HSB secondary PRT (bits defined as for qa_primPRT)
qa_wPRT_bad_val	8-bit unsigned integer	None	Warm target bad values bitmap for HSB PRTs: Bits 0 (LSB)-6: problem with PRTs 1-7
qa_wPRT_lo_lim	8-bit unsigned integer	None	Warm target Low limit bitmap for HSB PRTs (bits defined as for qa_wPRT_bad_val)
qa_wPRT_hi_lim	8-bit unsigned integer	None	Warm target High limit bitmap for HSB PRTs (bits defined as for qa_wPRT_bad_val)
qa_wPRT_in_scan	8-bit unsigned integer	None	Warm target in-scan bitmap for HSB PRTs (bits defined as for qa_wPRT_bad_val)
qa_wPRT_x_scan	8-bit unsigned integer	None	Warm target cross-scan bitmap for HSB PRTs (bits defined as for qa_wPRT_bad_val)
qa_WC_bad_val	16-bit unsigned integer	BBXTrack (= 4)	Warm target input counts bad values: Bits 0 (LSB)-4: problem with channels 1-5
qa_WC_lo_lim	16-bit unsigned integer	BBXTrack (= 4)	Warm target input counts Low limit: Bits 0 (LSB)-4: problem with channels 1-5
qa_WC_hi_lim	16-bit unsigned integer	BBXTrack (= 4)	Warm target input counts High limit: Bits 0 (LSB)-4: problem with channels 1-5
qa_CC_bad_val	16-bit unsigned integer	SpaceXTrack (= 4)	Cold cal input counts bad values: Bits 0 (LSB)-4: problem with channels 1-5
qa_CC_lo_lim	16-bit unsigned integer	SpaceXTrack (= 4)	Cold cal input counts Low limit: Bits 0 (LSB)-4: problem with channels 1-5
qa_CC_hi_lim	16-bit unsigned integer	SpaceXTrack (= 4)	Cold cal input counts High limit: Bits 0 (LSB)-4: problem with channels 1-5
qa_CC_moon_flag	16-bit unsigned integer	SpaceXTrack (= 4)	Cold cal input counts moon flag: Bits 0 (LSB)-4: problem with channels 1-5
qa_calibration	16-bit unsigned integer	Channel (= 5)	Calibration QA bitmap: Bit 0: (LSB, value 1) not in process state; Bit 1: (value 2) no coef for reuse; Bit 2: (value 4) Reference PRT; Bit 3: (value 8) Warm Temp Cal; Bit 4: (value 16) Cold Temp Cal; Bit 5: (value 32) Warm Counts - no good counts; Bit 6: (value 64) Warm Counts - in-scan dev; Bit 7: (value 128) Warm Counts - smooth threshold; Bit 8: (value 256) Cold Counts - no good counts; Bit 9: (value 512) Cold Counts - in-scan dev; Bit 10: (value 1024) Cold Counts - smooth threshold; Bit 11: (value 2048) Failed - channel not implemented; Bit 12: (value 4096) Other failure

cal_coef_a0	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a0_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a0 (K)
cal_coef_a1	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a1_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a2_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a2 (K/count**2)
bb_brightness	32-bit floating-point	Channel (= 5)	Blackbody brightness temperature (Tbw) (K)
bb_brightness_err	32-bit floating-point	Channel (= 5)	Blackbody brightness temperature error (delta-Tbw) (K)
spaceview_temp	32-bit floating-point	Channel (= 5)	Spaceview brightness temperature (Tbc) (K)
spaceview_temp_err	32-bit floating-point	Channel (= 5)	Spaceview brightness temperature error (delta-Tbc) (K)
cold_count	32-bit floating-point	Channel (= 5)	Qual and averaged cold cal (space view) counts for this scanline (counts)
warm_count	32-bit floating-point	Channel (= 5)	Qual and averaged warm cal (target view) counts for this scanline (counts)
smoothed_cold_count	32-bit floating-point	Channel (= 5)	Smoothed cold cal counts for this scanline (counts)
smoothed_warm_count	32-bit floating-point	Channel (= 5)	Smoothed warm cal counts for this scanline (counts)
SpacViewSelct	8-bit integer	None	Space View Selected
mixer_17_temp_used	8-bit integer	None	Mixer 17 Temperature use flag. (1: used mixer 17 temperature for receiver temperature; 0: used mixer 18/19/20 temperature)
receiver_temp	32-bit floating-point	None	Receiver temperature used in calibration (mixer 17 temperature or mixer 18/19/20 temperature as specified by mixer_17_temp_used) (C)
target_temp	32-bit floating-point	None	HSB target temperature used in calibration (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for HSB: Bit 0: (LSB, value 1) Sun glint in this scanline; Bit 1: (value 2) Coastal crossing in this scanline; Bit 2: (value 4) Some channels had excessive NeDT estimate; Bit 3: (value 8) Near sidelobe correction applied
qa_receiver	8-bit unsigned integer	None	Receiver bitmap for HSB: Bit 0: (LSB, value 1) Calibration was not derived, due to the instrument mode; Bit 1: (value 2) Calibration was not derived, due to bad or missing PRT values; Bit 2: (value 4) This scanline was calibrated, but the moon was in the space view; Bit 3: (value 8) This scanline was calibrated, but there was a space view scan position err;

			Bit 4: (value 16) This scanline was calibrated, but there was a blackbody scan position error; Bit 5: (value 32) This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: (value 64) This scanline was calibrated, but there was a data gap; Bit 7: (value 128) Some channels were not calibrated
qa_channel	8-bit unsigned integer	Channel (= 5)	Channel bitmap for HSB: Bit 0: (LSB, value 1) All space view counts were bad for this channel and scanline; Bit 1: (value 2) Space view counts were marginal for this channel and scanline; Bit 2: (value 4) Space view counts could not be smoothed; Bit 3: (value 8) All blackbody counts were bad for this channel and scanline; Bit 4: (value 16) Blackbody counts were marginal for this channel and scanline; Bit 5: (value 32) Blackbody counts could not be smoothed; Bit 6: (value 64) Most recent calibration coefficients used; Bit 7: (value 128) Excessive NeDT estimated

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of HSB instrument with respect to the HSB instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 5)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 5)	Brightness temperature. Same as antenna_temp because sidelobe correction is small and ground truth is less known for water vapor. (K)
brightness_temp_err	32-bit floating-point	Channel (= 5)	Uncertainty in empirically derived brightness_temp bias correction, excluding radiometer noise. (K)
bt_sidelobe_corr	32-bit floating-point	Channel (= 5)	Correction to raw antenna temperature to give brightness_temp. This correction accounts for near- and far- sidelobe effects. (K)

Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA_bb_PRT" involves reading HDF-EOS Swath field "QA_bb_PRT.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits.

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occassions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Reference PRT counts: This type provides counts of rejection due to each rejection criterion for reference PRTs for MW instruments.

Field Name	Type	Explanation
bad_value	16-bit integer	Bad value
lo_lim	16-bit integer	Low limit
hi_lim	16-bit integer	High limit
x_scan	16-bit integer	Large cross-scan deviation

Warm PRT counts: This type provides counts of rejection due to each rejection criterion for warm target PRTs for MW instruments.

Field Name	Type	Explanation
bad_value	16-bit integer	Bad value
lo_lim	16-bit integer	Low limit
hi_lim	16-bit integer	High limit
in_scan	16-bit integer	Large within-scan deviation
x_scan	16-bit integer	Large cross-scan deviation

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A1-9. L2 Standard Atmospheric/Surface Product Interface Specification

Interface Specification Version 6.0.7.0
2012-08-28

ESDT ShortNames = "AIRX2RET", “AIRS2RET”, “AIRH2RET”’

DOIs = “10.5067/AQUA/AIRS/DATA201”, “10.5067/AQUA/AIRS/DATA202”, “10.5067/AQUA/AIRS/DATA203”

Swath Name = "L2_Standard_atmospheric&surface_product"

Level = "Level2"

Footprints = 30

scanlines per scanset = 1

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up).
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes to the top of the atmosphere).
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time

Cloud	2	Cloud layer dimension in order of increasing pressure. Only first nCld or numCloud elements are valid
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.31 GHz respectively.Values are also found in field MWHingeSurfFreqGHz.
H2OFunc	11	Functions on which water vapor retrieval is calculated
O3Func	9	Functions on which ozone retrieval is calculated
COFunc	9	Functions on which carbon monoxide retrieval is calculated
CH4Func	10	Functions on which methane retrieval is calculated
HingeSurf	100	Maximum number of frequency hinge points in IR surface emissivity
H2OPressureLev	15	Number of water vapor pressure altitude levels (from bottom of the atmosphere up).
H2OPressureLay	14	Number of standard pressure altitude layers (Always one less than H2OPressureLev).

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("Level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints

NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit	Geodetic Latitude of spacecraft at start of granule (subsatellite

	floating-point	location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_fpe	16-bit integer	Number of floating point errors
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
CO_first_guess	string of 8-bit	Name of CO First Guess source.

	characters	
CH4_first_guess	string of 8-bit characters	Name of CH4 First Guess source.
NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
pressStd	32-bit floating-point	StdPressureLev (= 28)	Standard pressures in hPa (bottom of the atmosphere first)
pressH2O	32-bit floating-point	H2OPressureLev (= 15)	Water vapor pressures in hPa (bottom of the atmosphere first)
MWHingeSurfFreqGHz	32-bit floating-point	MWHingeSurf (= 7)	Frequencies in GHz for MW surface parameters (SfcTbMWStd, EmisMWStd,...)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)

glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
Geolocation			
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)

solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
Surface ancillary information from geolocation			
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
PSurfStd	32-bit floating-point	None	Surface pressure first guess in hPa, interpolated from forecast
PSurfStd_QC	16-bit unsigned integer	None	Quality flag for surface pressure guess input.; 0: Highest Quality -- from timely forecast; 1: Good Quality -- from climatology; 2: Do Not Use
nSurfStd	32-bit integer	None	Index in pressStd array of first pressure level above mean surface (1 ... 15)
Quality Indicator Pressure Boundaries			
PBest	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 (hPa)
PGood	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 or 1 (hPa)
nBestStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for

			which Quality = 0. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
nGoodStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
Surface Property Retrievals			
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfStd_QC	16-bit unsigned integer	None	Quality flag for TSurfStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfStdErr	32-bit floating-point	None	Error estimate for TSurfStd
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd_QC	16-bit unsigned integer	HingeSurf (= 100)	Quality Control for emisIRStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
Air Temperature Retrievals			
TAirStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature at StdPressLev in Kelvins.
TAirStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for TAirStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirStd
TSurfAir	32-bit floating-	None	Surface air temperature in Kelvins

	point		
TSurfAir_QC	16-bit unsigned integer	None	Quality Control for TSurfAir.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfAirErr	32-bit floating-point	None	Error estimate for TSurfAir
Temp_dof	32-bit floating-point	None	Measure of the amount of information in temperature profile retrieval (deg of freedom).
Water Vapor Saturation Quantities Derived from Temperature			
H2OMMRSat	32-bit floating-point	H2OPressureLay (= 14)	Layer Water vapor saturation mass mixing ratio (gm / kg dry air) over equilibrium phase (set to -9999. when saturation pressure exceeds 1% of ambient pressure.)
H2OMMRSat_QC	16-bit unsigned integer	H2OPressureLay (= 14)	Quality Control for H2OMMRSat.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatLevStd	32-bit floating-point	H2OPressureLev (= 15)	Level Water vapor saturation mass mixing ratio (gm / kg dry air) over equilibrium phase (set to -9999. when saturation pressure exceeds 1% of ambient pressure.)
H2OMMRSatLevStd_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality Control for H2OMMRSatLevStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatSurf	32-bit floating-point	None	Water Vapor saturation Mass Mixing Ratio at the surface (gm / kg dry air) over equilibrium phase
H2OMMRSatSurf_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSatSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSat_liquid	32-bit floating-point	H2OPressureLay (= 14)	Layer Water vapor saturation mass mixing ratio (gm / kg dry air) over liquid phase (set to -9999. when saturation pressure exceeds 1% of ambient pressure.)
H2OMMRSat_liquid_QC	16-bit unsigned integer	H2OPressureLay (= 14)	Quality Control for H2OMMRSat_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatLevStd_liquid	32-bit	H2OPressureLev	Level Water vapor saturation mass

	floating-point	(= 15)	mixing ratio (gm / kg dry air) over liquid phase (set to -9999. when saturation pressure exceeds 1% of ambient pressure.)
H2OMMRSatLevStd_liquid_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality Control for H2OMMRSatLevStd_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatSurf_liquid	32-bit floating-point	None	Water Vapor saturation Mass Mixing Ratio at the surface (gm / kg dry air) over liquid phase
H2OMMRSatSurf_liquid_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSatSurf_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Tropopause Derived from Temperature			
PTropopause	32-bit floating-point	None	Tropopause height (hPa)
PTropopause_QC	16-bit unsigned integer	None	Quality Control for PTropopause.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
T_Tropopause	32-bit floating-point	None	Tropopause temperature (K)
T_Tropopause_QC	16-bit unsigned integer	None	Quality Control for T_Tropopause.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Water Vapor Retrievals			
totH2OStd	32-bit floating-point	None	Total precipitable water vapor (kg / m**2)
totH2OStd_QC	16-bit unsigned integer	None	Quality Control for totH2OStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totH2OStdErr	32-bit floating-point	None	Error estimate for totH2OStd
H2OMMRStd	32-bit floating-point	H2OPressureLay (= 14)	Water Vapor Mass Mixing Ratio (gm / kg dry air)
H2OMMRStd_QC	16-bit unsigned integer	H2OPressureLay (= 14)	Quality Control for H2OMMRStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use

H2OMMRStdErr	32-bit floating-point	H2OPressureLay (= 14)	Error estimate for H2OMMRStd
H2OMMRLevStd	32-bit floating-point	H2OPressureLev (= 15)	Water Vapor Mass Mixing Ratio (gm / kg dry air)
H2OMMRLevStd_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality Control for H2OMMRLevStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRLevStdErr	32-bit floating-point	H2OPressureLev (= 15)	Error estimate for H2OMMRLevStd
H2OMMRSurf	32-bit floating-point	None	Water Vapor Mass Mixing Ratio at the surface (gm / kg dry air)
H2OMMRSurf_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSurfErr	32-bit floating-point	None	Error estimate for H2OMMRSurf
num_H2O_Func	16-bit integer	None	Number of valid entries in each dimension of H2O_ave_kern.
H2O_verticality	32-bit floating-point	H2OFunc (= 11)	Sum of the rows of H2O_ave_kern.
H2O_dof	32-bit floating-point	None	Measure of the amount of information in H2O retrieval (deg of freedom).
Relative Humidity Derived from Temperature and Water Vapor			
RelHum	32-bit floating-point	H2OPressureLev (= 15)	Relative humidity over equilibrium phase (%)
RelHum_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality control for RelHum.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHumSurf	32-bit floating-point	None	Relative humidity at the surface over equilibrium phase (%)
RelHumSurf_QC	16-bit unsigned integer	None	Quality Control for RelHumSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHum_liquid	32-bit floating-	H2OPressureLev (= 15)	Relative humidity over liquid phase (%)

	point		
RelHum_liquid_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality control for RelHum_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHumSurf_liquid	32-bit floating-point	None	Relative humidity at the surface over liquid phase (%)
RelHumSurf_liquid_QC	16-bit unsigned integer	None	Quality Control for RelHumSurf_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Geopotential Height Derived from Temperature and Water Vapor			
GP_Tropopause	32-bit floating-point	None	Geopotential height at tropopause (m above mean sea level)
GP_Tropopause_QC	16-bit unsigned integer	None	Quality Control for GP_Tropopause.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_Height	32-bit floating-point	StdPressureLev (= 28)	Geopotential Heights at StdPressureLev (m above mean sea level)
GP_Height_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for GP_Height.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_Surface	32-bit floating-point	None	Geopotential Height of surface (m above mean sea level)
GP_Surface_QC	16-bit unsigned integer	None	Quality Control for GP_Surface.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Cloud Formation Retrievals on 3 by 3 AIRS Fields of View			
CldFrcTot	32-bit floating-point	None	Total cloud fraction over all cloud layers and all 9 spots (0.0 ... 1.0) assuming unit cloud top emissivity.
CldFrcTot_QC	16-bit unsigned integer	None	Quality Control for CldFrcTot.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming unit cloud top emissivity (in order of increasing pressure. Only first nCld elements are valid) Caution: For CldFrcStd = 1, only the average cloud fraction over the

			nine spots is reported (duplicated nine times) for each level.
CldFrcStd_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for CldFrcStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
PCldTop	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud top pressure in hPa. (in order of increasing pressure. Only first nCld elements are valid)
PCldTop_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for PCldTop.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
PCldTopErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for PCldTop.
TCldTop	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first nCld elements are valid)
TCldTop_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for TCldTop.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TCldTopErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for TCldTop.
nCld	32-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Number of cloud layers in each of the 9 spots
Ozone Retrievals			
totO3Std	32-bit floating-point	None	Total ozone burden (Dobson units)
totO3Std_QC	16-bit unsigned integer	None	Quality Control for totO3Std.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totO3StdErr	32-bit floating-point	None	Error estimate for totO3Std
O3VMRStd	32-bit floating-point	StdPressureLay (= 28)	Ozone Volume Mixing Ratio on standard layers (ppv)
O3VMRStd_QC	16-bit unsigned integer	StdPressureLay (= 28)	Quality Control for O3VMRStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use

O3VMRStdErr	32-bit floating-point	StdPressureLay (= 28)	Error estimate for O3VMRStd
O3VMRLevStd	32-bit floating-point	StdPressureLev (= 28)	Ozone Volume Mixing Ratio at standard levels (ppv)
O3VMRLevStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for O3VMRLevStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
O3VMRLevStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for O3VMRLevStd
num_O3_Func	16-bit integer	None	Number of valid entries in each dimension of O3_ave_kern.
O3_verticality	32-bit floating-point	O3Func (= 9)	Sum of the rows of O3_ave_kern.
O3_dof	32-bit floating-point	None	Measure of the amount of information in O3 retrieval (deg of freedom).
Carbon Monoxide Retrievals			
CO_total_column	32-bit floating-point	None	Retrieved total column CO (molecules/cm2).
CO_total_column_QC	16-bit unsigned integer	None	Quality Control for CO_total_column.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
COVMRLevStd	32-bit floating-point	StdPressureLev (= 28)	CO Volume Mixing Ratio at standard levels (ppv)
COVMRLevStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for COVMRLevStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
COVMRLevStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for COVMRLevStd
num_CO_Func	16-bit integer	None	Number of valid entries in each dimension of CO_ave_kern.
CO_verticality	32-bit floating-point	COFunc (= 9)	Sum of the rows of CO_ave_kern.
CO_dof	32-bit floating-	None	Measure of the amount of information in CO retrieval (deg of

	point		freedom).
Methane Retrievals			
CH4_total_column	32-bit floating-point	None	Retrieved total column CH4 (molecules/cm2).
CH4_total_column_QC	16-bit unsigned integer	None	Quality Control for CH4_total_column.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4VMRLevStd	32-bit floating-point	StdPressureLev (= 28)	CH4 Volume Mixing Ratio at standard levels (ppv)
CH4VMRLevStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for CH4VMRLevStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4VMRLevStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for CH4VMRLevStd
num_CH4_Func	16-bit integer	None	Number of valid entries in each dimension of CH4_ave_kern.
CH4_verticality_10func	32-bit floating-point	CH4Func (= 10)	Sum of the rows of CH4_ave_kern.
CH4_dof	32-bit floating-point	None	Measure of the amount of information in CH4 retrieval (deg of freedom).
Outgoing Longwave Radiation Retrievals			
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
olr_QC	16-bit unsigned integer	None	Quality Control for olr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
olr3x3	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (per 15 km AIRS FOV) (Watts/m**2)
olr3x3_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality Control for olr3x3.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
olr_err	32-bit floating-point	None	Error estimate for olr (Watts/m**2)
clrolr	32-bit	None	Clear-sky Outgoing Longwave

	floating-point		Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
clrolr_QC	16-bit unsigned integer	None	Quality Control for clrolr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
clrolr_err	32-bit floating-point	None	Error estimate for clrolr (Watts/m**2)
Geolocation QA			
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
Miscellaneous			
dust_flag	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
retrieval_type	8-bit integer	None	Deprecated -- use Xxx_QC flags. Retrieval type:; 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded,

			initial + final cloud-clearing failed; 100 for no retrieval;
SurfClass	8-bit integer	None	Surface class used in physical retrieval, from microwave (MW) and/or infrared (IR). Identical to MWSurfClass when MW is used:; 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (Indicates high MW emissivity when MW information is used); 4 for sea ice (Indicates low MW emissivity. This value is only produced when MW information is used.); 5 for snow (Indicates higher-frequency MW scattering when MW information is used); 6 for glacier/snow (Indicates very low-frequency MW scattering. This value is only produced when MW information is used.); 7 for snow (Indicates lower-frequency MW scattering. This value is only produced when MW information is used.); -1 for unknown
Microwave Dependent			
TAirMWOnlyStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature retrieved using only MW information (no IR) at StdPressLev in Kelvins.
TAirMWOnlyStd_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for TAirMWOnlyStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
MWSurfClass	8-bit integer	None	Surface class from microwave (MW) information:; 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (High MW emissivity); 4 for sea ice (Low MW emissivity); 5 for snow (Higher-frequency MW scattering);

			6 for glacier/snow (Very low-frequency MW scattering); 7 for snow (Lower-frequency MW scattering); -1 for unknown (not attempted)
sfcTbMWStd	32-bit floating-point	MWHingeSurf (= 7)	Microwave surface brightness (Kelvins) (Emitted radiance only, reflected radiance not included. Product of MW only algorithm)
sfcTbMWStd_QC	16-bit unsigned integer	MWHingeSurf (= 7)	Quality Control for sfcTbMWStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
EmisMWStd	32-bit floating-point	MWHingeSurf (= 7)	Spectral MW emissivity at the 7 MW frequencies listed for dimension MWHingeSurf (Product of MW only algorithm)
EmisMWStd_QC	16-bit unsigned integer	MWHingeSurf (= 7)	Quality Control for EmisMWStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
EmisMWStdErr	32-bit floating-point	MWHingeSurf (= 7)	Error estimate for EmisMWStd
totH2OMWOnlyStd	32-bit floating-point	None	Total precipitable water vapor from MW-only retrieval (no IR information used) (kg / m**2)
totH2OMWOnlyStd_QC	16-bit unsigned integer	None	Quality Control for totH2OMWOnlyStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_Height_MWOnly	32-bit floating-point	StdPressureLev (= 28)	Geopotential Heights from MW-Only retrieval (No IR information used) at StdPressureLev (m above mean sea level)
GP_Height_MWOnly_QC	16-bit unsigned integer	StdPressureLev (= 28)	Quality Control for GP_Height_MWOnly.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
MW_ret_used	8-bit integer	None	MW-only final retrieval used
totCldH2OStd	32-bit floating-point	None	Total cloud liquid water in kg/m**2
totCldH2OStd_QC	16-bit unsigned integer	None	Quality Control for totCldH2OStd; 0: Highest Quality; 1: Good Quality; 2: Do Not Use

totCldH2OStdErr	32-bit floating-point	None	Error estimate for totCldH2OStd

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A1-10. L2 Standard Cloud-Cleared Radiance Product Interface Specification

Interface Specification Version 6.0.7.0
2012-08-28

ESDT ShortNames = "AIRI2CCF"", “AIRS2CCF”, “AIRH2CCF”

DOIs = “10.5067/AQUA/AIRS/DATA204”, “10.5067/AQUA/AIRS/DATA205”, “10.5067/AQUA/AIRS/DATA206”

Swath Name = "L2_Standard_cloud-cleared_radiance_product"

Level = "Level2"

Footprints = 30

scanlines per scanset = 1

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time
Module	17	Number of modules on the focal plane in which airs channels are

		grouped. The order is M-01a, M-02a, M-01b, M-02b, M-04d, M-04c, M-03, M-04b, M-04a, M-05, M-06, M-07, M-08, M-09, M-10, M-11, M-12.

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("Level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-	Zero-terminated character string denoting whether granule

	bit characters	is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees

	point	East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_fpe	16-bit integer	Number of floating point errors
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all channels with ExcludedChans < 3.; Zero means all these channels were well calibrated, for all scanlines.; Bit 7: (MSB, value 128) scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected with no offset anomaly; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
DCR_scan	16-bit integer	Level-1B scanline number following (first) DC-Restore. 0 for no DC-Restore. DCR_scan refers to Level-1 8/3-second scans, not Level-2 8-second scansets. DCR_scan = 1 refers to an event before the first scan of the first scanset.

		DCR_scan = 2 or 3 refer to events within the first scanset, DCR_scan = 4 to events between the first and second scansets.
granules_present_L1B	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing during Level-1B calibration processing. ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm**-1) of each channel
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added.; Zero means the channel was well calibrated for all scanlines; Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected with no offset anomaly; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing.; 0 - A weight = B weight. Probably better that channels with state > 2; 1 - A-side only. Probably better that channels with state > 2; 2 - B-side only. Probably better that channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - Has anomalous gain performance. Probably not usable.
NeN_L1B	32-bit floating-point	Channel (= 2378)	Level-1B Noise-equivalent Radiance (radiance units) for an assumed 250K scene. Note that effective noise on cloud-cleared radiances will be modified.

NeN_L1B_Static	32-bit floating-point	Channel (= 2378)	Expected Noise-equivalent Radiance (radiance units) for an assumed 250K scene. This static estimate comes from a channel properties file and reflects nominal conditions for an epoch of months. It is a more stable value than NeN_L1B but does not reflect recent or transient changes to noise levels.

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.

satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for calibration the current scanset.; Zero means the channel was well calibrated, for this scanset.; Bit 7: (MSB, value 128) scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition; Bit 0: (LSB, value 1) cold scene noise
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans).; Zero means all "good" channels were well calibrated for this scanset; Bit 7: (MSB, value 128) scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) DCR Occurred; Bit 2: (value 4) Moon in View; Bit 1: (value 2) telemetry out of limit condition; Bit 0: (LSB, value 1) cold_scene noise
orbit_phase_deg	32-bit floating-point	None	Orbit phase in degrees. 0.0 is nighttime equator crossing. 90.0 is near the south pole. 180.0 is near the daytime equator crossing. 270.0 is near the north pole. [0.0, 360.0]
shift_y0	32-bit floating-point	Module (= 17)	Focal plane shift in the y (spectral dispersion) direction relative to prelaunch nominal. (microns)
scan_freq	32-bit floating-point	Channel (= 2378)	Dynamic frequencies (in cm**-1) of each channel for each scan

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit	Channel (=	Cloud-cleared radiances for each

	floating-point	2378)	channel in milliWatts/m**2/cm**-1/steradian
radiances_QC	16-bit unsigned integer	Channel (= 2378)	Quality Control for radiances.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
radiance_err	32-bit floating-point	Channel (= 2378)	Error estimate for radiances (milliWatts/m**2/cm**-1/steradian)
CldClearParam	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Cloud clearing parameter Eta. Positive values are cloudier than average for the FOR, negative values are clearer.
scanang	32-bit floating-point	None	Scanning angle of the central AIRS instrument field-of-view with respect to the spacecraft (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-	None	Error estimate for landFrac

	point		
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
Doppler_shift_ppm	32-bit floating-point	None	Doppler shift for this footprint in parts per million.
dust_flag	16-bit integer	None	Flag telling whether dust was detected in any of the 9 Level-1B IR fields of view that make up this scene; 1: Dust detected in at least one contributing FOV; 0: Dust test valid in at least one contributing IR FOV but dust not detected in any of the valid contributing IR FOVs; -1: Dust test not valid for any contributing IR FOV (land, poles, cloud, problem with inputs)
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit floating-point	None	Equivalent of CC_noise_eff_amp_factor but from the first attempt at cloud clearing
CC1_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the first cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
TotCld_4_CCfinal	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimated before final cloud clearing (as seen from above), dimensionless between zero and one
CCfinal_Noise_Amp	32-bit	None	Internal retrieval quality indicator -- noise

	floating-point		amplification factor from cloud clearing because of extrapolation, dimensionless. Note: the name is misleading: this is the value after the second cloud clearing iteration, not the last.
invalid	8-bit integer	None	Profile is not valid
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
MW_ret_used	8-bit integer	None	MW-only final retrieval used
bad_clouds	8-bit integer	None	invalid cloud parameters
retrieval_type	8-bit integer	None	Deprecated -- use Xxx_QC flags. Retrieval type:; 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;

A1-11. L2 Support Atmospheric/Surface Product Interface Specification

Interface Specification Version 6.0.7.0
2012-08-28

ESDT ShortNames = "AIRX2SUP", “AIRS2SUP”, “AIRH2SUP”

DOIs = “10.5067/AQUA/AIRS/DATA207”, “10.5067/AQUA/AIRS/DATA208”, “10.5067/AQUA/AIRS/DATA209”

Swath Name = "L2_Support_atmospheric&surface_product"

Level = "Level2"

Footprints = 30

scanlines per scanset = 1

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up).
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's

		path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first nCld or numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array; Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz; (f0 = 57290.344 MHz; df = 322.4 MHz)
ChanHSB	5	Dimension of HSB Channel array; Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz; (f0 = 183.31 GHz)
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.31 GHz respectively.Values are also found in field MWHingeSurfFreqGHz.
H2OFunc	11	Functions on which water vapor retrieval is calculated
O3Func	9	Functions on which ozone retrieval is calculated
COFunc	9	Functions on which carbon monoxide retrieval is calculated
CH4Func	10	Functions on which methane retrieval is calculated
HingeSurf	100	Maximum number of frequency hinge points in IR surface emissivity
H2OPressureLev	15	Number of water vapor pressure altitude levels (from bottom of the atmosphere up).
XtraPressureLev	100	Number of pressure altitude layers in high vertical resolution support products (from top of the atmosphere down). nSurfSup is the 1-based index of the last valid level for a given profile. Any levels beyond this are below the surface. Since the actual surface will not be be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
XtraPressureLay	100	Number of pressure altitude layers in high vertical resolution support products (Always equal to XtraressureLev: first layer goes from the top of the atmosphere to level 1). nSurfSup is the 1-based index of the last valid layer for a given profile. Any

		layers beyond this are below the surface. Since the actual surface will not be be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
HingeCloud	7	Frequency hinge points in cloud emissivity in order of increasing frequency. Only first numHingeCloud elements are valid
HingeSurfInit	50	Maximum number of frequency hinge points in IR surface emissivity from initial regression
ScoresBand	10	The number of IR frequency bands for which Initial_CC_subscores are calculated. Band limits are (in cm^-1): 645., 704., 800., 1000., 1200., 2200., 2304., 2382., 2390., 2400., 2600.
MODISEmisBand	6	MODIS bands for IR emissivity first guess: 833.33, 909.09, 1169.6, 2469.1, 2531.6, and 2666.7 cm**-1.
MODISEmis10Hinge	10	MODIS hinge points for IR emissivity first guess: 699.30, 826.45, 925.93, 1075.27, 1204.82, 1315.79, 1724.14, 2000.0, 2325.58, and 2777.78 cm**-1.

MODISEmisQualLevels	4	MODIS emissivity quality levels:;
		average emissivity error <= 0.01;
		average emissivity error <= 0.02;
		average emissivity error <= 0.04;
		average emissivity error > 0.04

MODISLSTQualLevels	4	MODIS land surface temperature quality levels:;
		average LST error <= 1 K;
		average LST error <= 2 K;
		average LST error <= 3 K;
		average LST error > 3 K

TempFunc	23	Functions on which temperature retrieval is calculated
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
Module	17	Number of modules on the focal plane in which airs channels are grouped. The order is M-01a, M-02a, M-01b, M-02b, M-04d, M-04c, M-03, M-04b, M-04a, M-05, M-06, M-07, M-08, M-09, M-10, M-11, M-12.
OLRBand	16	Spectral bands used in OLR (cm-1):; 1 10 - 350; 2 350 - 500; 3 500 - 630; 4 630 - 700; 5 700 - 820; 6 820 - 980; 7 980 - 1080; 8 1080 - 1180; 9 1180 - 1390; 10 1390 - 1480;

		11 1480 - 1800; 12 1800 - 2080; 13 2080 - 2250; 14 2250 - 2380; 15 2380 - 2600; 16 2600 - 3250
SccnnBtCorr	2	Channels reported for the brightness temperature correction in cloud clearing in SCCNN

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("Level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)

NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)

end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_fpe	16-bit integer	Number of floating point errors
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.
CO_first_guess	string of 8-bit characters	Name of CO First Guess source.
CH4_first_guess	string of 8-bit characters	Name of CH4 First Guess source.
numHingeSurfInit	32-bit	Number of IR hinge points for surface emissivity and

	integer	reflectivity from initial regression (not used in retrieval)
nFOV_big_ang_adj	16-bit integer	The number of FOVs with nchan_big_ang_adj over 5
num_retrieval_type_000	16-bit integer	The number of retrievals with retrieval_type equal to 0
num_retrieval_type_010	16-bit integer	The number of retrievals with retrieval_type equal to 10
num_retrieval_type_020	16-bit integer	The number of retrievals with retrieval_type equal to 20
num_retrieval_type_030	16-bit integer	The number of retrievals with retrieval_type equal to 30
num_retrieval_type_040	16-bit integer	The number of retrievals with retrieval_type equal to 40
num_retrieval_type_050	16-bit integer	The number of retrievals with retrieval_type equal to 50
num_retrieval_type_100	16-bit integer	The number of retrievals with retrieval_type equal to 100
NumMWStratIrRetOnly	32-bit integer	Number of profiles in which the final product comes only from MW and stratospheric IR information (retrieval_types 20, 30, 40)
NumNoHSB	32-bit integer	Number of retrieval profiles for which no HSB input data is used
NumNoAMSUA	32-bit integer	Number of retrieval profiles for which no AMSU-A input data is used
NumNoAIRS	32-bit integer	Number of retrieval profiles for which no AIRS-IR input data is used
NumNoVis	32-bit integer	Number of retrieval profiles for which no AIRS-V/NIR input data is used
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in a Microwave space view (approx)

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
pressSupp	32-bit floating-point	XtraPressureLev (= 100)	Support pressures (lower boundary) in hPa.
pressStd	32-bit floating-	StdPressureLev (= 28)	Standard pressures in hPa (bottom of the atmosphere first)

	point		
H2O_trapezoid_layers	32-bit integer	H2OFunc (= 11)	Layers on which the H2O variables are defined.
O3_trapezoid_layers	32-bit integer	O3Func (= 9)	Layers on which the O3 variables are defined.
CO_trapezoid_layers	32-bit integer	COFunc (= 9)	Layers on which the CO variables are defined.
CH4_trapezoid_layers_10func	32-bit integer	CH4Func (= 10)	Layers on which the CH4 variables are defined.
MWHingeSurfFreqGHz	32-bit floating-point	MWHingeSurf (= 7)	Frequencies in GHz for MW surface parameters (SfcTbMWStd, EmisMWStd,...)
freqEmisInit	32-bit floating-point	HingeSurfInit (= 50)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
L1C_Reconst_Bias	32-bit floating-point	Channel (= 2378)	Bias between reconstructed value from cleaning andL1B values. (K)
L1C_Reconst_Dev	32-bit floating-point	Channel (= 2378)	Standard Deviation between reconstructed value from cleaning andL1B values. (K)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)

glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned integer	None	See Appendix D
orbit_phase_deg	32-bit floating-point	None	Orbit phase in degrees. 0.0 is nighttime equator crossing. 90.0 is near the south pole. 180.0 is near the daytime equator crossing. 270.0 is near the north pole. [0.0, 360.0]
shift_y0	32-bit floating-point	Module (= 17)	Focal plane shift in the y (spectral dispersion) direction relative to prelaunch nominal. (microns)
scan_freq	32-bit floating-point	Channel (= 2378)	Dynamic frequencies (in cm**-1) of each channel for each scan
L1cProc	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was unchanged in Level-1C for this scanline.; Bit 7 (MSB, value 128): unused/reserved (value 0); Bit 6: (value 64) Filled for one or more spectra on this scan line. See L1cCleanReason; Bit 5: (value 32) Shifted frequency; Bit 4: (value 16) radiometric correction applied; Bit 3: (value 8) unused/reserved (value 0); Bit 2: (value 4) unused/reserved (value 0); Bit 1: (value 2) unused/reserved (value 0); Bit 0: (LSB, value 1) unused/reserved (value 0)
L1cCleanReason	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline.; Bit 7 (MSB, value 128): Filled for all spectra because channel is in a permanent list;

			Bit 6: (value 64) Filled for one or more spectra because of bad input value; Bit 5: (value 32) Filled for all spectra because of high noise; Bit 4: (value 16) Filled for all spectra because of zero or negative noise; Bit 3: (value 8) Filled for one or more scan lines because of telemetry, gain, offset, or pop flag bit set in CalFlag; Bit 2: (value 4) Filled for one or more spectra because channel was dynamically determined to be out of expected range; Bit 1: (value 2) Filled for all spectra by command; Bit 0: (LSB, value 1) unused/reserved (value 0)

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
Geolocation			
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
Surface ancillary information from geolocation			
topog	32-bit	None	Mean topography in meters

	floating-point		above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
PSurfStd	32-bit floating-point	None	Surface pressure first guess in hPa, interpolated from forecast
PSurfStd_QC	16-bit unsigned integer	None	Quality flag for surface pressure guess input.; 0: Highest Quality -- from timely forecast; 1: Good Quality -- from climatology; 2: Do Not Use
nSurfSup	32-bit integer	None	Index of last profile pressure layer used in retrieval. (90 ... 100)
nSurfStd	32-bit integer	None	Index in pressStd array of first pressure level above mean surface (1 ... 15)
Dust, SO2, and cloud phase flags from radiances			
dust_flag	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
dust_score	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Dust score. Each bit results from a different test comparing radiances. Higher scores indicate more certainty of dust present.

			Dust probable when score is over 380. Not valid when dust_flag is negative.
BT_diff_SO2	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (Kelvins)
BT_diff_SO2_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality Control for BT_diff_SO2.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
cloud_phase_3x3	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether clouds are ice or liquid water; -9999: No cloud phase retrieval was possible; -2: Liquid water (high confidence); -1: Liquid water (low confidence); 0: Unknown; 1: Ice (low confidence); 2: Ice (higher confidence); 3: Ice (very high confidence); 4: Ice (very high confidence)
cloud_phase_bits	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Internal bit field of individual tests used in cloud phase determination; Bit 15: (MSB, 0x8000, value 32768) unused; Bit 14: (0x4000, value 16384) unused; Bit 13: (0x2000, value 8192) unused; Bit 12: (0x1000, value 4096) unused; Bit 11: (0x0800, value 2048) unused; Bit 10: (0x0400, value 1024) unused; Bit 9: (0x0200, value 512) Warm test; Bit 8: (0x0100, value 256) Liquid water test #2; Bit 7: (0x0080, value 128) Liquid water test #1; Bit 5: (0x0040, value 64) Ice test #4; Bit 4: (0x0020, value 32) Ice test #3; Bit 3: (0x0010, value 16) Ice

			test #2; Bit 2: (0x0008, value 8) Cold cloud test (ice test #1); Bit 2: (0x0004, value 4) Cloud fraction test; Bit 1: (0x0002, value 2) Desert test; Bit 0: (LSB, 0x0001, value 1) One or more tests could not be performed
Quality Indicator Pressure Boundaries			
PBest	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 (hPa)
PGood	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 or 1 (hPa)
nBestSup	16-bit integer	None	Support level index of highest pressure (i.e. lowest altitude)for which Quality = 0. A value of 0 indicates that no part of the profile passes the test. (0 ... 100)
nGoodSup	16-bit integer	None	Support level index of highest pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 0 indicates that no part of the profile passes the test. (0 ... 100)
nBestStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for which Quality = 0. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
nGoodStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
Surface Property Retrievals			
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfStd_QC	16-bit unsigned integer	None	Quality flag for TSurfStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfStdErr	32-bit floating-	None	Error estimate for TSurfStd

	point		
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd_QC	16-bit unsigned integer	HingeSurf (= 100)	Quality Control for emisIRStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
Effective_Solar_Reflectance	32-bit floating-point	HingeSurf (= 100)	Effective spectral IR bidirectional surface solar reflectance, including cloud shadow effects (in order of increasing frequency. Only first numHingeSurf elements are valid)
Effective_Solar_Reflectance_QC	16-bit unsigned integer	HingeSurf (= 100)	Quality Control for Effective_Solar_Reflectance.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Air Temperature Retrievals			
TAirSup	32-bit floating-point	XtraPressureLev (= 100)	Atmospheric Temperature at XtraPressLev in Kelvins. Value at 1-based index of nSurfSup may be an unphysical extrapolated value for a pressure level below the surface. Use TSurfAir for the surface air temperature.
TAirSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for TAirSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirSupErr	32-bit	XtraPressureLev (=	Error estimate for TAirSup

	floating-point	100)	(K)
TSurfAir	32-bit floating-point	None	Surface air temperature in Kelvins
TSurfAir_QC	16-bit unsigned integer	None	Quality Control for TSurfAir.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfAirErr	32-bit floating-point	None	Error estimate for TSurfAir
num_Temp_Func	16-bit integer	None	Number of valid entries in each dimension of Temp_ave_kern.
Temp_ave_kern	32-bit floating-point	TempFunc (= 23) * TempFunc (= 23)	Averaging kernel for temperature retrieval.
Temp_verticality	32-bit floating-point	TempFunc (= 23)	Sum of the rows of Temp_ave_kern.
Temp_dof	32-bit floating-point	None	Measure of the amount of information in temperature profile retrieval (deg of freedom).
Water Vapor Saturation Quantities Derived from Temperature			
H2OMMRSatLevSup	32-bit floating-point	XtraPressureLev (= 100)	Level Water vapor saturation mass mixing ratio (gm / kg dry air) over equilibrium phase (set to -9999. when saturation pressure exceeds 1% of ambient pressure.)
H2OMMRSatLevSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for H2OMMRSatLevSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatSurf	32-bit floating-point	None	Water Vapor saturation Mass Mixing Ratio at the surface (gm / kg dry air) over equilibrium phase
H2OMMRSatSurf_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSatSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatLevSup_liquid	32-bit floating-point	XtraPressureLev (= 100)	Level Water vapor saturation mass mixing ratio (gm / kg dry air) over liquid phase (set to -9999. when saturation

			pressure exceeds 1% of ambient pressure.)
H2OMMRSatLevSup_liquid_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for H2OMMRSatLevSup_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSatSurf_liquid	32-bit floating-point	None	Water Vapor saturation Mass Mixing Ratio at the surface (gm / kg dry air) over liquid phase
H2OMMRSatSurf_liquid_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSatSurf_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Tropopause Derived from Temperature			
PTropopause	32-bit floating-point	None	Tropopause height (hPa)
PTropopause_QC	16-bit unsigned integer	None	Quality Control for PTropopause.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
T_Tropopause	32-bit floating-point	None	Tropopause temperature (K)
T_Tropopause_QC	16-bit unsigned integer	None	Quality Control for T_Tropopause.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Water Vapor Retrievals			
totH2OStd	32-bit floating-point	None	Total precipitable water vapor (kg / m**2)
totH2OStd_QC	16-bit unsigned integer	None	Quality Control for totH2OStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totH2OStdErr	32-bit floating-point	None	Error estimate for totH2OStd
H2OCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor (molecules / cm**2)
H2OCDSup_QC	16-bit unsigne	XtraPressureLay (= 100)	Quality Control for H2OCDSup.;

	d integer		0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for H2OCDSup
H2OMMRLevSup	32-bit floating-point	XtraPressureLev (= 100)	Water Vapor Mass Mixing Ratio (gm / kg dry air)
H2OMMRLevSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for H2OMMRLevSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRLevSupErr	32-bit floating-point	XtraPressureLev (= 100)	Error estimate for H2OMMRLevSup
H2OMMRSurf	32-bit floating-point	None	Water Vapor Mass Mixing Ratio at the surface (gm / kg dry air)
H2OMMRSurf_QC	16-bit unsigned integer	None	Quality Control for H2OMMRSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OMMRSurfErr	32-bit floating-point	None	Error estimate for H2OMMRSurf
num_H2O_Func	16-bit integer	None	Number of valid entries in each dimension of H2O_ave_kern.
H2O_eff_press	32-bit floating-point	H2OFunc (= 11)	H20 effective pressure for the center of each trapezoid
H2O_VMR_eff	32-bit floating-point	H2OFunc (= 11)	Effective H2O volume mixing ratio for each trapezoid.
H2O_VMR_eff_QC	16-bit unsigned integer	H2OFunc (= 11)	Quality Control for H2O_VMR_eff.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2O_VMR_eff_err	32-bit floating-point	H2OFunc (= 11)	Error estimate for H2O_VMR_eff
H2O_verticality	32-bit floating-point	H2OFunc (= 11)	Sum of the rows of H2O_ave_kern.
H2O_dof	32-bit floating-	None	Measure of the amount of information in H2O retrieval

	point		(deg of freedom).
H2O_ave_kern	32-bit floating-point	H2OFunc (= 11) * H2OFunc (= 11)	Averaging kernel for water vapor retrieval.
Relative Humidity, Boundary Layer Top, and Geopotential Height Derived from Temperature and Water Vapor			
RelHum	32-bit floating-point	H2OPressureLev (= 15)	Relative humidity over equilibrium phase (%)
RelHum_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality control for RelHum.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHumSurf	32-bit floating-point	None	Relative humidity at the surface over equilibrium phase (%)
RelHumSurf_QC	16-bit unsigned integer	None	Quality Control for RelHumSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHum_liquid	32-bit floating-point	H2OPressureLev (= 15)	Relative humidity over liquid phase (%)
RelHum_liquid_QC	16-bit unsigned integer	H2OPressureLev (= 15)	Quality control for RelHum_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
RelHumSurf_liquid	32-bit floating-point	None	Relative humidity at the surface over liquid phase (%)
RelHumSurf_liquid_QC	16-bit unsigned integer	None	Quality Control for RelHumSurf_liquid.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
bndry_lyr_top	32-bit floating-point	None	Pressure at top of boundary layer (hPa)
bndry_lyr_top_QC	16-bit unsigned integer	None	Quality Control for bndry_lyr_top.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_Tropopause	32-bit floating-point	None	Geopotential height at tropopause (m above mean sea level)
GP_Tropopause_QC	16-bit unsigne	None	Quality Control for GP_Tropopause.;

	d integer		0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_HeightSup	32-bit floating-point	XtraPressureLev (= 100)	Geopotential Heights (m above mean sea level)
GP_HeightSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for GP_HeightSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
GP_Surface	32-bit floating-point	None	Geopotential Height of surface (m above mean sea level)
GP_Surface_QC	16-bit unsigned integer	None	Quality Control for GP_Surface.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Longwave IR Cloud Formation Retrievals on 3 by 3 AIRS Fields of View			
CldFrcTot	32-bit floating-point	None	Total cloud fraction over all cloud layers and all 9 spots (0.0 ... 1.0) assuming unit cloud top emissivity.
CldFrcTot_QC	16-bit unsigned integer	None	Quality Control for CldFrcTot.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming unit cloud top emissivity (in order of increasing pressure. Only first nCld elements are valid) Caution: For CldFrcStd = 1, only the average cloud fraction over the nine spots is reported (duplicated nine times) for each level.
CldFrcStd_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for CldFrcStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
PCldTop	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud top pressure in hPa. (in order of increasing pressure. Only first nCld elements are valid)

PCldTop_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for PCldTop.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
PCldTopErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for PCldTop.
TCldTop	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first nCld elements are valid)
TCldTop_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Quality Control for TCldTop.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TCldTopErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for TCldTop.
nCld	32-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Number of cloud layers in each of the 9 spots
Longwave IR Cloud Formation Retrievals on Single AMSU Fields of View			
PCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top pressure in hPa assuming the same two cloud formations over all 9 spots.; DEPRECATED. Newer PCldTop is a more finely resolved version.
PCldTopStd_QC	16-bit unsigned integer	Cloud (= 2)	Quality Control for PCldTopStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
PCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for PCldTopStd
TCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first numCloud elements are valid) assuming the same two cloud formations over all 9 spots.; DEPRECATED. Newer TCldTop is a more finely resolved version.
TCldTopStd_QC	16-bit unsigned integer	Cloud (= 2)	Quality Control for TCldTopStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use

TCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for TCldTopStd
numCloud	32-bit integer	None	Number of cloud layers (max over the 9 spots). Deprecated. Use only with deprecated fields PCldTopStd and TCldTopStd. Otherwise use nCld.
Cloud Spectral Properties assumed in Longwave IR Cloud Formation Retrievals			
numHingeCloud	16-bit integer	None	Number of hinge points for cloud emissivity and reflectivity
cldFreq	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Frequencies for cloud emissivity and reflectivity (in order of increasing pressure. Only first numCloud elements are valid) (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldEmis	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Ratio of cloud IR emissivity to that at 930 cm-1 (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldEmis_QC	16-bit unsigned integer	Cloud (= 2) * HingeCloud (= 7)	Quality Control for CldEmis.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use; Set to 1 to show the value is assumed, not retrieved
CldEmisErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldEmis
CldRho	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Future Cloud IR reflectivity -- DO NOT USE
CldRho_QC	16-bit unsigned integer	Cloud (= 2) * HingeCloud (= 7)	Quality Control for CldRho.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use; Set to 1 to show the value is assumed, not retrieved
CldRhoErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldRho
Cirrus Cloud Optical Properties Retrievals			
ice_cld_opt_dpth	32-bit floating-	AIRSTrack (= 3) * AIRSXTrack (= 3)	Ice cloud optical depth

	point		
ice_cld_opt_dpth_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality control for ice_cld_opt_dpth.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
ice_cld_eff_diam	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Ice cloud effective diameter (microns)
ice_cld_eff_diam_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality control for ice_cld_eff_diam.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
ice_cld_temp_eff	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Ice cloud effective cloud top temperature (K)
ice_cld_temp_eff_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality control for ice_cld_temp_eff.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
ice_cld_fit_reduced_chisq	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Normalized chi-square of the obs-calc radiance residual in the ice cloud optical properties calculation
ice_cld_opt_dpth_ave_kern	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Scalar value of averaging kernel for ice cloud optical depth
ice_cld_eff_diam_ave_kern	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Scalar value of averaging kernel for ice cloud effective diameter
ice_cld_temp_eff_ave_kern	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Scalar value of averaging kernel for ice cloud effective cloud top temperature
ice_cld_opt_dpth_err	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error estimate for ice cloud optical depth
ice_cld_eff_diam_err	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error estimate for ice cloud effective diameter
ice_cld_temp_eff_err	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error estimate for ice cloud effective cloud top temperature (K)
log_ice_cld_opt_dpth_prior_var	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	A priori variance for the logarithm of ice cloud optical depth
log_ice_cld_eff_diam_prior_var	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	A priori variance for the logarithm of ice cloud effective diameter

ice_cld_temp_eff_prior_var	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	A priori variance for ice cloud effective cloud top temperature (K)
ice_cld_opt_dpth_first_guess	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess for ice cloud optical depth
ice_cld_eff_diam_first_guess	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess for ice cloud effective diameter
ice_cld_temp_eff_first_guess	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess for ice cloud effective cloud top temperature (K)
Ozone Retrievals			
totO3Std	32-bit floating-point	None	Total ozone burden (Dobson units)
totO3Std_QC	16-bit unsigned integer	None	Quality Control for totO3Std.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totO3StdErr	32-bit floating-point	None	Error estimate for totO3Std
O3CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column ozone in molecules per cm**2
O3CDSup_QC	16-bit unsigned integer	XtraPressureLay (= 100)	Quality Control for O3CDSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
O3CDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for O3CDSupErr
O3VMRLevSup	32-bit floating-point	XtraPressureLev (= 100)	Ozone Volume Mixing Ratio on support levels (ppv)
O3VMRLevSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for O3VMRLevSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
O3VMRLevSupErr	32-bit floating-point	XtraPressureLev (= 100)	Error estimate for O3VMRLevSup
O3VMRSurf	32-bit floating-point	None	Ozone Volume Mixing Ratio at the surface (ppv)
O3VMRSurf_QC	16-bit	None	Quality Control for

	unsigned integer		O3VMRSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
O3VMRSurfErr	32-bit floating-point	None	Error estimate for O3VMRSurf
num_O3_Func	16-bit integer	None	Number of valid entries in each dimension of O3_ave_kern.
O3_eff_press	32-bit floating-point	O3Func (= 9)	O3 effective pressure for the center of each trapezoid
O3_VMR_eff	32-bit floating-point	O3Func (= 9)	Effective O3 volume mixing ratio for each trapezoid.
O3_VMR_eff_QC	16-bit unsigned integer	O3Func (= 9)	Quality Control for O3_VMR_eff.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
O3_VMR_eff_err	32-bit floating-point	O3Func (= 9)	Error estimate for O3_VMR_eff
O3_verticality	32-bit floating-point	O3Func (= 9)	Sum of the rows of O3_ave_kern.
O3_dof	32-bit floating-point	None	Measure of the amount of information in O3 retrieval (deg of freedom).
O3_ave_kern	32-bit floating-point	O3Func (= 9) * O3Func (= 9)	Averaging kernel for ozone retrieval.
	Carbon Monoxide Retrievals		
CO_total_column	32-bit floating-point	None	Retrieved total column CO (molecules/cm2).
CO_total_column_QC	16-bit unsigned integer	None	Quality Control for CO_total_column.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
COCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column carbon monoxide in molecules per cm**2 (climatology when bad_co is not 0)
COCDSup_QC	16-bit unsigned integer	XtraPressureLay (= 100)	Quality Control for COCDSup.; 0: Highest Quality; 1: Good Quality;

			2: Do Not Use
COCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for COCDSup
COVMRLevSup	32-bit floating-point	XtraPressureLev (= 100)	CO Volume Mixing Ratio at support levels (ppv)
COVMRLevSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for COVMRLevSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
COVMRLevSupErr	32-bit floating-point	XtraPressureLev (= 100)	Error estimate for COVMRLevSup
COVMRSurf	32-bit floating-point	None	CO Volume Mixing Ratio at the surface (ppv)
COVMRSurf_QC	16-bit unsigned integer	None	Quality Control for COVMRSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
COVMRSurfErr	32-bit floating-point	None	Error estimate for COVMRSurf
num_CO_Func	16-bit integer	None	Number of valid entries in each dimension of CO_ave_kern.
CO_eff_press	32-bit floating-point	COFunc (= 9)	CO effective pressure for the center of each trapezoid
CO_VMR_eff	32-bit floating-point	COFunc (= 9)	Effective CO volume mixing ratio for each trapezoid.
CO_VMR_eff_QC	16-bit unsigned integer	COFunc (= 9)	Quality Control for CO_VMR_eff.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CO_VMR_eff_err	32-bit floating-point	COFunc (= 9)	Error estimate for CO_VMR_eff
CO_verticality	32-bit floating-point	COFunc (= 9)	Sum of the rows of CO_ave_kern.
CO_dof	32-bit floating-point	None	Measure of the amount of information in CO retrieval (deg of freedom).

CO_ave_kern	32-bit floating-point	COFunc (= 9) * COFunc (= 9)	Averaging kernel for carbon monoxide retrieval.
Methane Retrievals			
CH4_total_column	32-bit floating-point	None	Retrieved total column CH4 (molecules/cm2).
CH4_total_column_QC	16-bit unsigned integer	None	Quality Control for CH4_total_column.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column methane (in molecules per cm**2)
CH4CDSup_QC	16-bit unsigned integer	XtraPressureLay (= 100)	Quality Control for CH4CDSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4CDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for CH4CDSup
CH4VMRLevSup	32-bit floating-point	XtraPressureLev (= 100)	CH4 Volume Mixing Ratio at support levels (ppv)
CH4VMRLevSup_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for CH4VMRLevSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4VMRLevSupErr	32-bit floating-point	XtraPressureLev (= 100)	Error estimate for CH4VMRLevSup
CH4VMRSurf	32-bit floating-point	None	CH4 Volume Mixing Ratio at the surface (ppv)
CH4VMRSurf_QC	16-bit unsigned integer	None	Quality Control for CH4VMRSurf.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4VMRSurfErr	32-bit floating-point	None	Error estimate for CH4VMRSurf
num_CH4_Func	16-bit integer	None	Number of valid entries in each dimension of CH4_ave_kern.
CH4_eff_press_10func	32-bit floating-	CH4Func (= 10)	CH4 effective pressure for the center of each trapezoid

	point		
CH4_VMR_eff_10func	32-bit floating-point	CH4Func (= 10)	Effective CH4 volume mixing ratio for each trapezoid.
CH4_VMR_eff_10func_QC	16-bit unsigned integer	CH4Func (= 10)	Quality Control for CH4_VMR_eff_10func.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4_VMR_eff_10func_err	32-bit floating-point	CH4Func (= 10)	Error estimate for CH4_VMR_eff
CH4_verticality_10func	32-bit floating-point	CH4Func (= 10)	Sum of the rows of CH4_ave_kern.
CH4_dof	32-bit floating-point	None	Measure of the amount of information in CH4 retrieval (deg of freedom).
CH4_ave_kern_10func	32-bit floating-point	CH4Func (= 10) * CH4Func (= 10)	Averaging kernel for methane retrieval.
Outgoing Longwave Radiation Retrievals			
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (per 45 km AMSU-A FOV) (Watts/m**2)
olr_QC	16-bit unsigned integer	None	Quality Control for olr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
spectralolr	32-bit floating-point	OLRBand (= 16)	Outgoing Longwave Radiation Flux integrated over 16 frequency bands (per 45 km AMSU-A FOV) (Watts/m**2)
spectralolr_QC	16-bit unsigned integer	OLRBand (= 16)	Quality Control for spectralolr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
olr3x3	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (per 15 km AIRS FOV) (Watts/m**2)
olr3x3_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality Control for olr3x3.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use

olr_err	32-bit floating-point	None	Error estimate for olr (Watts/m**2)
clrolr	32-bit floating-point	None	Clear-sky Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (per 45 km AMSU-A FOV) (Watts/m**2)
clrolr_QC	16-bit unsigned integer	None	Quality Control for clrolr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
clrolr_err	32-bit floating-point	None	Error estimate for clrolr (Watts/m**2)
spectralclrolr	32-bit floating-point	OLRBand (= 16)	Clear-sky Outgoing Longwave Radiation Flux integrated over 16 frequency bands (per 45 km AMSU-A FOV) (Watts/m**2)
spectralclrolr_QC	16-bit unsigned integer	OLRBand (= 16)	Quality Control for spectralclrolr.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Geolocation QA			
ftptgeoqa	32-bit unsigned integer	None	See Appendix D
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
Miscellaneous			
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
retrieval_type	8-bit integer	None	Deprecated -- use Xxx_QC flags. Retrieval type:; 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed;

			30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;
SurfClass	8-bit integer	None	Surface class used in physical retrieval, from microwave (MW) and/or infrared (IR). Identical to MWSurfClass when MW is used:; 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (Indicates high MW emissivity when MW information is used); 4 for sea ice (Indicates low MW emissivity. This value is only produced when MW information is used.); 5 for snow (Indicates higher-frequency MW scattering when MW information is used); 6 for glacier/snow (Indicates very low-frequency MW scattering. This value is only produced when MW information is used.); 7 for snow (Indicates lower-frequency MW scattering. This value is only produced when MW information is used.); -1 for unknown
IR_Precip_Est	32-bit floating-point	None	Regression-based estimate of daily precipitation based on clouds and relative humidity from Level 2 IR/MW retrieval. Analogous to and forms a continuous record when used with TOVS precipitation index. (per 45 km AMSU-A FOV) (mm/day)
IR_Precip_Est_QC	16-bit	None	Quality Control for

	unsigned integer		IR_Precip_Est.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
IR_Precip_Est3x3	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Regression-based estimate of daily precipitation based on clouds and relative humidity from Level 2 IR/MW retrieval. Analogous to and forms a continuous record when used with TOVS precipitation index. (per 15 km AIRS FOV) (mm/day)
IR_Precip_Est3x3_QC	16-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Quality Control for IR_Precip_Est3x3.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
IR_Precip_Est_Err	32-bit floating-point	None	Error estimate for IR_Precip_Est
Microwave Dependent			
TAirMWOnly	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from startup microwave-only retrieval.
TAirMWOnly_QC	16-bit unsigned integer	XtraPressureLev (= 100)	Quality Control for TAirMWOnly.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirMWOnlyErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirMWOnly (Note that error estimate only made at StdPressureLev points even though TAirMWOnly is estimated at XtraPressureLev points)
MWSurfClass	8-bit integer	None	Surface class from microwave (MW) information:; 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (High MW emissivity); 4 for sea ice (Low MW emissivity); 5 for snow (Higher-frequency MW scattering);

			6 for glacier/snow (Very low-frequency MW scattering); 7 for snow (Lower-frequency MW scattering); -1 for unknown (not attempted)
sfcTbMWStd	32-bit floating-point	MWHingeSurf (= 7)	Microwave surface brightness (Kelvins) (Emitted radiance only, reflected radiance not included. Product of MW only algorithm)
sfcTbMWStd_QC	16-bit unsigned integer	MWHingeSurf (= 7)	Quality Control for sfcTbMWStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
EmisMWStd	32-bit floating-point	MWHingeSurf (= 7)	Spectral MW emissivity at the 7 MW frequencies listed for dimension MWHingeSurf (Product of MW only algorithm)
EmisMWStd_QC	16-bit unsigned integer	MWHingeSurf (= 7)	Quality Control for EmisMWStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
EmisMWStdErr	32-bit floating-point	MWHingeSurf (= 7)	Error estimate for EmisMWStd
Emis50GHz	32-bit floating-point	None	Microwave emissivity at 50.3 GHz (This is from combined IR/MW retrieval. The shape of MW spectral emissivity stays the same as MW only algorithm.)
Emis50GHz_QC	16-bit unsigned integer	None	Quality Control for Emis50GHz.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totH2OMWOnlyStd	32-bit floating-point	None	Total precipitable water vapor from MW-only retrieval (no IR information used) (kg / m**2)
totH2OMWOnlyStd_QC	16-bit unsigned integer	None	Quality Control for totH2OMWOnlyStd.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OCDMWOnly	32-bit	XtraPressureLay (=	Layer column water vapor

	floating-point	100)	from microwave-only retrieval. (molecules / cm**2)
H2OCDMWOnly_QC	16-bit unsigned integer	XtraPressureLay (= 100)	Quality Control for H2OCDMWOnly.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totCldH2OStd	32-bit floating-point	None	Total cloud liquid water in kg/m**2
totCldH2OStd_QC	16-bit unsigned integer	None	Quality Control for totCldH2OStd; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totCldH2OStdErr	32-bit floating-point	None	Error estimate for totCldH2OStd
satzen_amsu	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (AMSU-A FOV center)
satazi_amsu	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (AMSU-A FOV center)
HSB Dependent			
PrecipAA4_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 4 (-1/255 for unknown)
PrecipAA5_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 5 (-1/255 for unknown)
PrecipAA6_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 6 (-1/255 for unknown)
PrecipAA7_50km	8-bit unsigned integer	None	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 (-1/255 for unknown)
PrecipAA8_50km	8-bit unsigne	None	Relative interference (0-2) of precipitation on AMSU-A

	d integer		channel 8 (-1/255 for unknown)
PrecipAA9_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 9 (-1/255 for unknown)
PrecipAA4_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 4 for HSB 15-km spots (-1/255 for unknown)
PrecipAA5_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 5 for HSB 15-km spots (-1/255 for unknown)
PrecipAA6_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 6 for HSB 15-km spots (-1/255 for unknown)
PrecipAA7_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 for HSB 15-km spots (-1/255 for unknown)
PrecipAA8_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 8 for HSB 15-km spots (-1/255 for unknown)
PrecipAA9_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 9 for HSB 15-km spots (-1/255 for unknown)
AMSU_A_4_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 4 for precipitation effects (Kelvins)
AMSU_A_5_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 5 for precipitation effects (Kelvins)
AMSU_A_6_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 6 for precipitation effects (Kelvins)
AMSU_A_7_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 7 for precipitation effects (Kelvins)
AMSU_A_8_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 8 for precipitation effects (Kelvins)
AMSU_A_9_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 9 for precipitation effects (Kelvins)
AMSU_A_4_Precip_Corr_15km	32-bit	AIRSTrack (= 3) *	Correction to AMSU-A

	floating-point	AIRSXTrack (= 3)	channel 4 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_5_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 5 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_6_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 6 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_7_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 7 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_8_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 8 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_9_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 9 for precipitation effects for HSB 15-km spots (Kelvins)
rain_rate_50km	32-bit floating-point	None	Rain rate (mm/hr)
rain_rate_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Rain rate for HSB 15-km spots (mm/hr)
lwCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer molecular column density (molecules / cm**2) of cloud liquid water
lwCDSup_QC	16-bit unsigned integer	XtraPressureLay (= 100)	Quality Control for lwCDSup.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
lwCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for lwCDSup
cIWSup	32-bit integer	XtraPressureLay (= 100)	Cloud Ice/Water flag (liquid = 0 / Ice = 1)
satzen_hsb	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (HSB center FOV)

satazi_hsb	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (HSB center FOV)
Forecast Quantities			
tsurf_forecast	32-bit floating-point	None	Predicted surface temperature interpolated from NOAA NCEP GFS forecast (K)
Forecast_Wind_U	32-bit floating-point	None	10 meter above surface zonal wind (+ toward east) in meters per second, interpolated from NOAA NCEP GFS forecast.
Forecast_Wind_V	32-bit floating-point	None	10 meter above surface meridional wind (+ toward north) in meters per second, interpolated from NOAA NCEP GFS forecast.
Climatology Quantities			
MODIS_emis	32-bit floating-point	MODISEmisBand (= 6)	First guess climatology emissivity from MODIS averaged over MYD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AMSU FOV or 3x3 of AIRS FOVs.
MODIS_emis_dev	32-bit floating-point	MODISEmisBand (= 6)	Standard Deviation among the MYD11C3 elements used to determine MODIS_emis
MODIS_emis_qct	16-bit integer	MODISEmisQualLevels (= 4)	Count of MODIS emissivity pixels used in each quality category
MODIS_emis_spots	32-bit floating-point	MODISEmisBand (= 6) * AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess emissivity from MODIS averaged over MYD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AIRS FOV.
MODIS_emis_spots_dev	32-bit floating-point	MODISEmisBand (= 6) * AIRSTrack (= 3) * AIRSXTrack (= 3)	Standard Deviation among the MYD11C3 elements used to determine MODIS_emis
MODIS_emis_10_hinge	32-bit floating-point	MODISEmis10Hinge (= 10)	First guess emissivity from MODIS (MODIS_emis) expanded to 10 hinge points
MODIS_LST	32-bit floating-point	None	First guess climatology land surface temperature from MODIS averaged over MYD11C3 0.05 degree (~5 km) pixels covering an area

			roughly corresponding to an AMSU FOV or 3x3 of AIRS FOVs.
MODIS_LST_dev	32-bit floating-point	None	Standard Deviation among the MYD11C3 elements used to determine MODIS_LST
MODIS_LST_qct	16-bit integer	MODISLSTQualLevels (= 4)	Count of MODIS land surface temperature pixels used in each quality category
MODIS_LST_spots	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess land surface temperature from MODIS averaged over MYD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AIRS FOV.
MODIS_LST_spots_dev	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Standard Deviation among the MYD11C3 elements used to determine MODIS_LST_spots
CO2ppmv	32-bit floating-point	None	Column averaged dry carbon dioxide volumetric mixing ratio (ppmv)
CO2ppmv_QC	16-bit unsigned integer	None	Quality Control for CO2ppmv.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use; Set to 2 because the current value is from a model instead of a retrieved value.
CO2ppmvErr	32-bit floating-point	None	Error estimate for CO2ppmv
TSurfClim	32-bit floating-point	None	Surface temperature guess from climatology in Kelvins
TSurfAirClim	32-bit floating-point	None	Surface air temperature guess from climatology in Kelvins
TAirClim	32-bit floating-point	XtraPressureLev (= 100)	Air temperature guess from climatology in Kelvins
H2OCDClim	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor guess from climatology (molecules / cm**2)
Tropo_CCI	32-bit floating-point	None	A Tropospheric Coarse Climate Indicator representing the weighted average of retrieved

			temperatures over the lower troposphere (maximum weight near 700 hPa). The weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU2R products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Tropo_CCI_QC	16-bit unsigned integer	None	Quality Control for Tropo_CCI.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Tropo_CCI_Est_Err	32-bit floating-point	None	Error estimate for Tropo_CCI
Strato_CCI	32-bit floating-point	None	A Stratospheric Coarse Climate Indicator representing the weighted average of retrieved temperatures over the lower stratosphere (maximum weight near 70 hPa). The weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU4 products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Strato_CCI_QC	16-bit unsigned integer	None	Quality Control for Strato_CCI.; 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Strato_CCI_Est_Err	32-bit floating-point	None	Error estimate for Strato_CCI
Quality Indicators for internal use in algorithm evaluation			
MoonInViewIR	16-bit integer	None	Flag if moon was in the spaceview for IR calibration. IR calibration will handle this case, but there may be a small degradation in radiance quality. (1: moon in spaceview, 0: moon not in

			spaceview, -9999: unknown)
pseudo_lapse_rate	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Pseudo lapse rate is BT diff of channels 2109 and 2108 (K). Their frequencies are 2388 and 2387 cm-1, respectively. Low values within +/-45 degrees of equator usually indicate existence of cloud. Use with caution at higher latitudes.
TAirSCCNN	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from SCCNN processing.
TAirCldyReg	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from startup cloudy regression retrieval. (not used in retrieval)
H2OCDSCCNN	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from SCCNN processing. (molecules / cm**2)
H2OCDCldyReg	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from cloudy regression retrieval. (not used in retrieval) (molecules / cm**2)
TSurfSCCNN	32-bit floating-point	None	Surface temperature from SCCNN in Kelvins
TSurf1Ret	32-bit floating-point	None	Surface temperature after regression retrieval in Kelvins (not used in retrieval)
TSurfAir1Ret	32-bit floating-point	None	Surface air temperature after regression retrieval in Kelvins (not used in retrieval)
TAir1Ret	32-bit floating-point	XtraPressureLev (= 100)	Air temperature after regression retrieval in Kelvins (not used in retrieval)
H2OCD1Ret	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor after regression retrieval (molecules / cm**2) (not used in retrieval)
O3CDInit	32-bit floating-point	XtraPressureLay (= 100)	preliminary Layer column ozone in molecules per cm**2 from initial regression step (not used in retrieval)
numHingeSurfFG	16-bit integer	None	Number of IR hinge points for first guess surface emissivity
freqEmisFG	32-bit floating-point	HingeSurf (= 100)	Frequencies for first guess surface emissivity in cm-1 (in order of increasing

			frequency. Only first numHingeSurfFG elements are valid)
emisIRFG	32-bit floating-point	HingeSurf (= 100)	First guess Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurfFG elements are valid)
emisIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Emissivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid) (not used in retrieval)
rhoIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Reflectivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid) (not used in retrieval)
FracLandPlusIce	32-bit floating-point	None	Fraction of scene assumed by physical retrieval to be covered by land or ice
CldClearParam	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Cloud clearing parameter Eta. Positive values are cloudier than average for the FOR, negative values are clearer.
CC1_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from first cloud clearing because of extrapolation, dimensionless
Tsurf_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- surface temperature used in first cloud clearing
TotCld_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimate before the first cloud clearing
CC1_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from first cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations

CC2_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from second cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
Phys_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from physical retrieval. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
TotCld_below_500mb	32-bit floating-point	None	Internal retrieval quality indicator -- estimated final cloud fraction due only to clouds below 500 hPa (as seen from above), dimensionless between zero and one
Phys_resid_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Residual for AMSU-A channels after final retrieval (K)
Phys_resid_IR_window_790	32-bit floating-point	None	Residual for IR window channel near 790 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_844	32-bit floating-point	None	Residual for IR window channel near 844 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_917	32-bit floating-point	None	Residual for IR window channel near 917 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_1231	32-bit floating-point	None	Residual for IR window channel near 1231 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)

Phys_resid_IR_window_2513	32-bit floating-point	None	Residual for IR window channel near 2513 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2616	32-bit floating-point	None	Residual for IR window channel near 2616 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
CBTmOBT1231	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	End-to-end residual for window channel 1231.3 cm-1: computed cloudy brightness temperature for the retrieved atmospheric + cloud state minus angle-corrected observed L1B brightness temperature. (K)
CBTmOBT1231s	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Variant of CBTmOBT1231 but using substitute surface properties if those were used in cloud retrieval (i.e. cases where cld_surf_fallback = 1) (K)
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit floating-point	None	Equivalent of CC_noise_eff_amp_factor but from the first attempt at cloud clearing
CC1_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the first cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K

CCfinal_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from cloud clearing because of extrapolation, dimensionless. Note: the name is misleading: this is the value after the second cloud clearing iteration, not the last.
Tdiff_IR_MW_ret	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower atmosphere between final IR temperature retrieval and the last internal MW-only temperature determination. High values suggest problems with MW or problems with cloud clearing.
Tdiff_IR_4CC1	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower atmosphere between final IR temperature retrieval and the temperature used in the first cloud clearing.
TSurfdiff_IR_4CC1	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the first cloud clearing.
TSurfdiff_IR_4CC2	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the second cloud clearing.
AMSU_Chans_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual of selected AMSU channels (currently channel 5 only) against that calculated from the final IR retrieval state, K. High values suggest lower atmosphere retrieval disagrees with MW due to problems with MW or cloud clearing.
TotCld_4_CCfinal	32-bit	None	Internal retrieval quality

	floating-point		indicator -- total cloud fraction estimated before final cloud clearing (as seen from above), dimensionless between zero and one
Surf_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of surface channels as compared to predicted uncertainty (dimensionless factor)
Temp_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of temperature channels as compared to predicted uncertainty (dimensionless factor)
Water_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of water channels as compared to predicted uncertainty (dimensionless factor)
Cloud_Resid_Ratio3x3	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Internal retrieval quality indicator -- residuals of cloud channels as compared to predicted uncertainty (dimensionless factor)
Cloud_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of cloud channels as compared to predicted uncertainty (mean of 9 values in Cloud_Resid_Ratio3x3) (dimensionless factor)
O3_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of ozone channels as compared to predicted uncertainty (dimensionless factor)
CO_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of carbon monoxide channels as compared to predicted uncertainty (dimensionless factor)
CH4_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of methane channels as compared to predicted uncertainty (dimensionless factor)

MWCheck_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of channels used in MW check as compared to predicted uncertainty (dimensionless factor)
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)
MW_ret_used	8-bit integer	None	MW-only final retrieval used
bad_clouds	8-bit integer	None	invalid cloud parameters
Start_Clim	8-bit integer	None	Source of climatology used as initial state; 0: for None; 1: for NCEP/UARS; 2: for ECMWF land only; 3: for ECMWF sea only; 4: for ECMWF land + sea; 5: for ECMWF mixed surface fallback
Startup	8-bit integer	None	Source of startup input atmospheric state used in first cloud clearing step.; 0: MW-only retrieval; 1: IR-Only cloudy regression; 2: IR+MW cloudy regression, with some info from MW-only physical retrieval; 3: Climatology; 4: Neural Network
cld_surf_fallback	8-bit integer	None	cloud retrieval used a surface state from an earlier retrieval step
nchan_big_ang_adj	16-bit integer	None	The number of good chans with an angle adjustment over 20 * noise level in at least one of the 6 angle-adjusted IR FOVs.
bad_l1b	8-bit integer	None	Level 2 process not allowed due to bad level 1b data
bad_l1b_amsu	8-bit integer	None	Bad AMSU-A level 1b data
bad_l1b_hsb	8-bit integer	None	Bad HSB level 1b data
bad_l1b_airs	8-bit integer	None	Bad AIRS level 1b data
bad_l1b_vis	8-bit integer	None	Bad VIS level 1b data
forecast	8-bit	None	Complete forecast guess

	integer		was used
no_psurf_guess	8-bit integer	None	No surface pressure was available. Topography was used for surf press
bad_temps	8-bit integer	None	invalid temp and surface skin temp
bad_h2o	8-bit integer	None	invalid water vapor profile
bad_o3	8-bit integer	None	invalid ozone profile
bad_co	8-bit integer	None	Invalid CO profile (profiles with bad_co = 1 had successful physical retrieval of CO but unsuccessful physical retrieval overall. These had climatology COCDSup. This value is no longer used. Profiles with bad_co = 2 have failed or not attempted physical CO retrieval and also have climatology in COCDSup)
no_tuning	8-bit integer	None	Standard br temp tuning NOT applied
no_ang_corr	8-bit integer	None	Standard angle correction NOT applied
no_mw	8-bit integer	None	MW only retrieval not attempted
no_initial	8-bit integer	None	First retrieval not attempted
no_final	8-bit integer	None	Final retrieval not attempted
mw_fpe	8-bit integer	None	floating-point exception in MW-Only retrieval step
cloudy_reg_fpe	8-bit integer	None	floating-point exception in cloudy regression retrieval step
initial_fpe	8-bit integer	None	floating-point exception in Initial retrieval step
final_fpe	8-bit integer	None	floating-point exception in Final retrieval step
MWPrecip	8-bit integer	None	Precipitation was detected over 0.5 mm/hr
MWsurf_T0	32-bit floating-point	None	low-frequency surface adjustment parameter -- T0
MWsurf_Tinf	32-bit floating-point	None	high-frequency surface adjustment parameter -- Tinfinity

MWsecant_ratio	32-bit floating-point	None	ratio of reflected to direct path length (only valid for mostly-water scenes)
MWseaice_conc	32-bit floating-point	None	Fraction of field-of-view with frozen covering. For predominately water areas (landFrac < 0.5, MWSurfClass = 3,4) MWseaice_conc refers to sea ice and MWseaice_conc range is [0.05 ... (1.0 - landFrac)]. For predominately land areas (landFrac >= 0.5, MWSurfClass = 5,6,7) MWseaice_conc refers to snow/glacier and MWseaice_conc range is [0.0 ... 1.0]. Frozen surface of the minority element of a coastal field-of-view is not accounted for. Other surface classes have MWseaice_conc=0.0
MWresidual_temp	32-bit floating-point	None	sum of squares of temperature residuals normalized by channel sensitivities
MWresidual_mois	32-bit floating-point	None	sum of squares of moisture residuals normalized by channel sensitivities
MWresidual_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Brightness temperature residual for each AMSU-A channel (Kelvin)
MWresidual_HSB	32-bit floating-point	ChanHSB (= 5)	brightness temperature residual for each HSB channel (Kelvin)
MWiter_temp	8-bit integer	None	# of iterations of the temperature profile
MWiter_mois	8-bit integer	None	# of iterations of the moisture profile
mw_ret_code	8-bit integer	None	Return code status of MW retrieval: values can be summed if more than one applies:; 0 All OK; 1 Moisture variables rejected by residual test; 2 Troposphere temperature profile rejected by residual test; 4 Excessive liquid water;

			8 Insufficient valid channels; 16 Numerical error; 32 Emissivity > 1 for any AMSU-A channel; 64 Stratosphere temperature profile rejected by residual test; 128/-128 MW retrieval not attempted
sccnn_ret_code	8-bit integer	None	Return code status of startup neural net retrieval:; 0 All OK; 1 Problem encountered;
cloudy_reg_ret_code	8-bit integer	None	Return code status of startup cloudy regression retrieval: values can be summed if more than one applies:; 0 All OK; 1 Problem encountered; 16 Numerical error; 128/-128 Cloudy regression not attempted
Cloudy_Reg_FOV_chan	16-bit integer	None	Channel number (1-2378) of channel used to select from among the 9 IR FOVs the one to be used in cloudy regression (-9999 for N/A)
Cloudy_Reg_FOV	16-bit integer	None	FOV number of IR FOV used in cloudy regression (1-9, -9999 for N/A)
Cloudy_Reg_FOV_BT	32-bit floating-point	None	Brightness temperature for channel Cloudy_Reg_FOV_chan at FOV Cloudy_Reg_FOV (K, -9999 for N/A)
Cloudy_Reg_Score	32-bit floating-point	None	Indicator of how well the initial cloudy radiances match radiances reconstructed from cloudy eigenvectors. (Unitless ratio. should be ~1.0. >10.0 indicates a major problem)
cloud_ice	8-bit integer	None	Scattering by cloud ice present in FOV
icc_too_cloudy	8-bit integer	None	Initial cloud clearing pass too cloudy
icc_low_contrast	8-bit integer	None	Initial cloud clearing pass contrast too low
icc_bad_rad	8-bit integer	None	Initial cloud clearing pass cloud cleared radiances do not match clear guess -

			reject the IR retrieval
icc_contrast	32-bit floating-point	None	Initial cloud clearing contrast (units?)
bad_1st	8-bit integer	None	The initial retrieval failed
bad_1st_surf	8-bit integer	None	The initial surface retrieval failed
bad_1st_cc	8-bit integer	None	The first cloud clearing failed
bad_1st_regres	8-bit integer	None	The regression guess failed
bad_1st_phys	8-bit integer	None	The first physical retrieval failed
fcc_too_cloudy	8-bit integer	None	Final cloud clearing pass too cloudy
fcc_low_contrast	8-bit integer	None	Final cloud clearing pass contrast too low
fcc_bad_rad	8-bit integer	None	Final cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
fcc_contrast1	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 1
fcc_contrast2	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 2
bad_final	8-bit integer	None	Final retrieval failed
bad_final_cc	8-bit integer	None	final cloud clearing failed
bad_final_ir	8-bit integer	None	final IR retrieval failed
bad_final_surf	8-bit integer	None	final surface ret failed
bad_final_temp	8-bit integer	None	final temp ret failed
bad_final_h2o	8-bit integer	None	final water vapor ret failed
bad_final_o3	8-bit integer	None	final ozone ret failed
bad_final_cloud	8-bit integer	None	final cloud ret failed
bad_cc_cld_ret	8-bit integer	None	Cloud clearing and cloud ret are inconsistent
MW_IR_ret_differ	8-bit	None	Microwave and IR

	integer		temperature retrieval differ too much - reject final IR retrieval
bad_MW_low_resid	8-bit integer	None	Microwave residuals in lower atmosphere too large - reject final IR retrieval
MW_low_atm_resid	32-bit floating-point	None	MW residual for lower atmosphere after final retrieval
final_AMSU_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_HSB_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_cloud_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for matrix inversion residual too large; 3 for retrieval step not attempted; 4 for singular matrix (unobservable quantity)
final_cloud_spot_ret3x3	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	0 for success; 1 for did not converge; 2 for matrix inversion residual too large; 3 for retrieval step not attempted; 4 for singular matrix (unobservable quantity)
final_surf_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_temp_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_h2o_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_o3_ret	8-bit	None	0 for success;

	integer		1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_ch4_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_co_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_co2_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
bad_vis_rad	8-bit integer	None	Vis/NIR radiance out of range
bad_vis_cal	8-bit integer	None	Vis/NIR calibration data old or invalid
bad_vis_det_temp	8-bit integer	None	Vis/NIR Detector temperature out of range
bad_scan_hd_temp	8-bit integer	None	Scan Head Assembly temperature out of range
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (Unitless ratio); 0.33 is best possible, a 3X noise reduction; <0.8 for a very good match; <3.0 for a pretty good match; >10.0 indicates a major problem
Initial_CC_subscores	32-bit floating-point	ScoresBand (= 10)	Sub-scores contributing to Initial_CC_score, by frequency band
sccnn_bt_corr	32-bit floating-point	SccnnBtCorr (= 2)	Quality indicator based on amount of cloud clearing in the internal CC of the SCCNN algorithm. Lower absolute values are better. (K)
sccnn_bt_corr_freq	32-bit floating-point	SccnnBtCorr (= 2)	Frequencies of channels used to compute sccnn_bt_corr (cm-1)
relayer_num_nonpos_coef_h2o	32-bit	None	Internal indicator from

	integer		relayering of water vapor: # of spline coefficients <= 0.0 - 1 if LSQ problem fails.
relayer_num_nonpos_coef_o3	32-bit integer	None	Internal indicator from relayering of ozone vapor: # of spline coefficients <= 0.0 - 1 if LSQ problem fails.
relayer_num_nonpos_coef_co	32-bit integer	None	Internal indicator from relayering of carbon monoxide: # of spline coeffi cients <= 0.0 -1 if LSQ problem fails.
relayer_num_nonpos_coef_ch4	32-bit integer	None	Internal indicator from relayering of methane: # of spline coefficients <= 0.0 -1 if LSQ problem fails.
relayer_num_knots	32-bit integer	None	Internal indicator from relayering of gases: # of knots in spline
relayer_degree	32-bit integer	None	Internal indicator from relayering of gases: Degree of spline. Nominally 4 for cubic.
relayer_runge_kutta_bits	32-bit integer	None	Internal indicator from relayering of gases: for temperature mass layer integrator, bit-mapped diagnostics of Runge-Kutta integrator; 0 - successful return; 2nd bit - Soft Error: This is being used inefficiently because the step size has been reduced drastically many times to get answers at many points.; 3rd bit - Soft Error: A considerable amount of work has been expended in the (primary) integration.; 4th bit - Soft Error: It appears that this problem is "stiff". ; 5th bit - Hard Error: It does not appear possible to achieve the accuracy specified by TOL and THRES; 6th bit - Hard Error: The global error assessment may not be reliable beyond the current integration point.
Num_Fill_Chan_Cloudy_Reg	16-bit integer	None	Number of channels the cloudy regression processing

			step determined to be of low quality and calculated substitute values for before proceeding.
Num_Fill_Chan_SCCNN	16-bit integer	None	Number of channels the SCCNN processing step determined to be of low quality and calculated substitute values for before proceeding.
Num_Fill_Chan_Ang_Adj	16-bit integer	None	Number of channels the local angle adjustment processing step determined to be of low quality and calculated substitute values for before proceeding.
Doppler_shift_ppm	32-bit floating-point	None	Doppler shift for this footprint in parts per million.
spectral_clear_indicator	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether scene was flagged as clear by a spectral filter. Only ocean filter is validated; 2: Ocean test applied and scene identified as clear; 1: Ocean test applied and scene not identified as clear; 0: Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule; -1: Unvalidated land test applied and scene not identified as clear; -2: Unvalidated land test applied and scene identified as clear
num_clear_spectral_indicator	16-bit integer	None	Number of 9 IR FOVs which are clear according to spectral_clear_indicator. -1 when the spectral clear indicator could not be applied to any of the spots. Note that the spectral clear indicator is not validated for land scenes.

A1-12. L1C AIRS Science Interface Specification

Interface Specification Version 6.1.0.0

2014-10-20

ESDT ShortName = "AIRICRAD"

DOI = “10.5067/AQUA/AIRS/DATA101”

Swath Name = "L1C_AIRS_Science"

Level = "level1C"

Footprints = 90

scanlines per scanset = 3

Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	2645	Dimension of channel array (This list of channels removes the overlaps and fills the gaps found in the 2378-channel set from the AIRS instrument.)
L1bChannel	2378	Dimension of channel array used in L1B. (In this list channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)

Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1C")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit	Number of scene footprints for which the surface is less

	integer	than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)

end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_fpe	16-bit integer	Number of floating point errors
orbitgeoqa	32-bit unsigned integer	See Appendix D
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
Rdiff_swindow_M1a_chan	16-bit integer	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
CF_Version	string of 8-	Cloud Filter Version Identification. Identifies the set of

	bit characters	thresholds used in determination of spectral_clear_indicator.
NumSaturatedFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts overflowed.
NumUnderflowFOVs	16-bit unsigned integer	Number of scene fields-of-view (out of a nominal 1350) in which the downlinked counts underflowed.
NumCalFOVsOutOfBounds	16-bit unsigned integer	Number of calibration fields-of-view (out of a nominal 810) in which the downlinked counts underflowed or overflowed.
NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
nominal_freq	32-bit floating-point	Channel (= 2645)	Nominal frequencies (cm**-1) of each channel
ChanID	16-bit unsigned integer	Channel (= 2645)	A unique identifier for each channel. For those channels which are present in Level-1B this identifier is identical to the 1-based index of the channel in Level-1B. For channels which are addidn in Level-1C to fill gaps in the Level-1B record, this is a unique identifier with value > 2378. Note: ChanID are not sequential.
ChanMapL1b	16-bit integer	L1bChannel (= 2378)	A map from the 2378-channel Level-1B channel set into the 2645-channel Level-1C set. For Level-1B channels which are used in Level-1C, this will be a number in [1,2645] giving the 1-based index in the Level-1C list for this channel. For Level-1B channels which are not used in Level-1C, this will be -1.
L1cNumSynth	32-bit unsigned integer	Channel (= 2645)	A count of how many spectra in the granule have synthesized values (cleaned or filled) for each channel. Fill channels will always have value 12150 (=90*135)

Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
satgeoqa	32-bit unsigned integer	None	See Appendix D
glintgeoqa	16-bit unsigned integer	None	See Appendix D
moongeoqa	16-bit unsigned	None	See Appendix D

	integer		

Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 2645)	Radiances for each channel in milliWatts/m**2/cm**-1/steradian
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
ftptgeoqa	32-bit unsigned	None	See Appendix D

	integer		
zengeoqa	16-bit unsigned integer	None	See Appendix D
demgeoqa	16-bit unsigned integer	None	See Appendix D
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm**-1 window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm**-1) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields).; Bit 7 (MSB, value 128): scene is inhomogeneous, as determined by the Rdiff_swindow threshold. For v5.0 the test is abs(Rdiff_swindow) > 5 * sqrt(NeN(Rdiff_swindow_M1a_chan)^2 + NeN(Rdiff_swindow_M2a_chan)); Bit 6 (value 64): scene is inhomogeneous, as determined by the Rdiff_lwindow threshold. For v5.0 the test is abs(Rdiff_lwindow) > 5 * sqrt(NeN(Rdiff_lwindow_M8_chan)^2 + NeN(Rdiff_lwindow_M9_chan)); Bits 5-0: unused (reserved)
dust_flag	16-bit integer	None	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
dust_score	16-bit integer	None	Dust score. Each bit results from a different test comparing radiances. Higher scores indicate more certainty of dust present. Dust probable when score is over 380. Not valid when dust_flag is negative.
spectral_clear_indicator	16-bit integer	None	Flag telling whether scene was flagged as clear by a spectral filter. Only ocean filter is validated;

			2: Ocean test applied and scene identified as clear; 1: Ocean test applied and scene not identified as clear; 0: Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule; -1: Unvalidated land test applied and scene not identified as clear; -2: Unvalidated land test applied and scene identified as clear
BT_diff_SO2	32-bit floating-point	None	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (Kelvins)
AB_Weight	8-bit integer	Channel (= 2645)	A/B detector weights; -1: Channel radiance is an approximate value synthesized by cleaning or filling; 0: A weight = B weight; 1: A side only; 2: B side only
L1cProc	8-bit unsigned integer	Channel (= 2645)	Bit field, by channel, for the current spectrum. Zero means the channel was unchanged in Level-1C.; Bit 7 (MSB, value 128): This is a synthesized fill channel where the AIRS instrument does not have a detector; Bit 6: (value 64) Cleaned. See L1cCleanReason for the cause; Bit 5: (value 32) Shifted frequency (not used in release 6.0); Bit 4: (value 16) radiometric correction applied (not used in release 6.0); Bit 3: (value 8) unused/reserved (value 0); Bit 2: (value 4) unused/reserved (value 0); Bit 1: (value 2) unused/reserved (value 0); Bit 0: (LSB, value 1) Output value is a dummy/filler value because data is missing or otherwise could not be processed.
L1cSynthReason	8-bit unsigned integer	Channel (= 2645)	0: value is preserved from Level-1B; 1: Filled because this channel falls in a gap between AIRS instrument modules; 2: Cleaned because this channel is known to be of low quality; 3: Cleaned because of bad (-9999.0) Level-1B radiance value; 4: Cleaned because of high Level-1B NeN noise measurement; 5: Cleaned because Level-1B reported a zero or negative value in the NeN noise measurement indicating that the channel is in too poor a state for noise level to be measured effectively; 6: Cleaned because the telemetry, gain, offset, or pop flag bits were set in Level-1B CalFlag (not

			used); 7: Cleaned because Level-1B radiance is unphysically hot; 8: Cleaned because Level-1B radiance is unphysically cold; 9: Cleaned because Level-1B radiance is hotter than expected based on the radiances of correlated channels; 10: Cleaned because Level-1B radiance is colder than expected based on the radiances of correlated channels; 11: Cleaned because Level-1B radiance is significantly increased by scene spatial inhomgeneity; 12: Cleaned because Level-1B radiance is significantly decreased by scene spatial inhomgeneity; 100: Cleaned by runtime user command (Test mode only)
NeN	32-bit floating-point	Channel (= 2645)	Noise-equivalent Radiance (radiance units) for an assumed 250 K scene. Channels which have synthesized radiances will have a flag value of 999.0.
Inhomo850	32-bit floating-point	None	Brightness temperature difference for the adjacent edges of the M-08 and M-09 detector modules. (frequency near 850 cm-1) This is a double difference using a PC reconstructed spectrum. Absolute values over ~0.84 indicate likely impact from spatial scene inhomgeneity (K)

Appendix A2. AIRS-Suite Match-Up Product Interface Specification

ESDT ShortNames=
"AIRX2MAT", "AIRX2MTL",
"AIRH2MAT", "AIRH2MTL",
"AIRS2MAT", "AIRS2MTL"

DOIs =

"10.5067/AQUA/AIRS/DATA217", "10.5067/AQUA/AIRS/DATA220",

"10.5067/AQUA/AIRS/DATA218", "10.5067/AQUA/AIRS/DATA221",

"10.5067/AQUA/AIRS/DATA219", "10.5067/AQUA/AIRS/DATA222"

This HDF-EOS Swath product can contain up to eight swaths as follows:

- L1B_AIRS_Science
- L1B_VIS_Science
- L1B_AMSU
- L1B_HSB
- L2_Standard_atmospheric&surface_product
- L2_Support_atmospheric&surface_product
- L2_Standard_cloud-cleared_radiance_product
- Matchup_Info
- GCML2
- GCMMatchup

Any number of these swaths may be missing, but, if present, all have the same size on their primary dimension (GeoTrack). There is a one-to-one correspondence between items at the same GeoTrack index in each swath.

The dimension GeoTrack has a slightly different meaning for swaths in the match-up file than for swaths in standard AIRS PGE products. For the latter files, it corresponds to the number of instrument scans that took place during the period when this data was being collected. For the match-up file, it means the total number of AIRS-suite profiles ("golfballs") contained in the file. Because this file is a collection of profiles for which truth matches happened to be found, no assumptions should be made about the geographic relations between profiles.

Appendix A2. AIRS-Suite Match-Up Product Interface Specification

Except for GCML2, GCMMatchup, and Matchup_Info, each swath follows the interface specification in the "AIRS Processing Files Description" document for the corresponding swath file with the following changes:

- All Attributes (which are once per file in the standard swath files) become fields with dimensions GeoTrack + listed Extra Dimensions.
- For "big-spot" swaths (L1B_AMSU, all L2):
    - Dimension GeoXTrack is removed.
    - Fields which were Along-Track have the same dimensions (GeoTrack + listed Extra Dimensions)
    - Fields which were Full Swath have the same dimensions, except that the second dimension (GeoXTrack) is removed. (Dimensions are now GeoTrack + listed Extra Dimensions.)
- For "small-spot" swaths (L1B_HSB, L1B_AIRS_Science, L1B_VIS_Science):
    - Dimension GeoXTrack is replaced by SubTrack3x3 and SubXTrack3x3 (both always set to 3).
    - Fields which were Along-Track have one extra dimension inserted after GeoTrack, SubTrack3x3. (Dimensions are now GeoTrack,SubTrack3x3 + listed Extra Dimensions.)
    - Fields which were Full Swath have the same dimensions except that the second dimension (GeoXTrack) is replaced by two dimensions, SubTrack3x3, SubXTrack3x3. (Dimensions are now GeoTrack,SubTrack3x3,SubXTrack3x3 + listed Extra Dimensions.)
- There are two additional 32-bit integer fields dimensioned GeoTrack.
    - start_scan_line_number contains the scan line number (1-based) of the first footprint in its original granule. (GeoTrack)
    - start_footprint_number contains the footprint number (1-based) of the first footprint in its original granule. (GeoXTrack)
- Geolocation Fields have only the dimension GeoTrack. For small-spot swaths this corresponds to the center footprint. These small-spot swaths have additional 64-bit floating-point Full Swath fields named footprint_latitude, footprint_longitude, and footprint_taitime which contain the per-footprint geolocation information.
- The fields listed below are removed because they give granule-level information that is not useful in a match-up context (When '*' is the last character then it matches all fields with that start of a name.):
    - num_*
    - processing_level
    - instrument
    - AutomaticQAFlag
    - NumTotalData
    - NumProcessData
    - NumMissingData
    - NumSpecialData
    - NumBadData
    - node_type
    - start_year

- start_month
- start_day
- start_hour
- start_minute
- start_sec
- start_Latitude
- start_Longitude
- start_Time
- end_Latitude
- end_Longitude
- end_Time
- stat_*
- QA_*
- granules_present
- gain_fit_dev
- rad_stats
- rad_scan_stats
- rad_unc_stats
- offset_unc_stats
- offset_stats
- limit_offsets
- offset_fit_dev
- input_*
- NeN_stats
- polar_stat
- limit_*
- offset_begin
- offset_end
- offset_err
- gain
- offset
- nominal_freq
- spectral_freq_prev
- DCR_*
- effective_bb_temp
- nadir_contrast
- spec_*
- gain_*
- bulb_failed
- K21
- K32
- K31
- K_factors_applied
- gamma_*
- track_err
- xtrack_err

- align_*
- cal_coef_*
- IF_offset_*
- bandwidth
- center_freq
- CalGranSummary
- CalScanSummary
- SpaceViewDelta
- spaceview_selection
- NumRefChannels
- RefChannels
- NumLandSurface
- NumOceanSurface
- start_orbit_row
- end_orbit_row
- LonGranuleCen
- LatGranuleCen
- LocTimeGranuleCen
- MoonInViewMWCount
- DCRCount
- PopCount
- VISDarkAMSUFOVCount
- VISBrightAMSUFOVCount
- primary_bulb
- secondary_bulb
- backup_bulb
- NumVisInvalid
- NumMWStratIrRetOnly
- MWHingeSurfFreqGHz
- CF_Version
- nFOV_big_ang_adj
- NumNoHSB
- NumNoAMSUA
- NumNoAIRS
- NumNoVis
- pressH2O
- pressStd
- pressSupp

The Matchup_Info swath will have the swath attributes described in Table 1:

Table 1. Matchup_Info Swath Attributes

Name	*Type*	*Explanation*
Truth_File_Type	String of 8-bit characters	Free-format text (up to 80 characters) giving match-up criteria for Truth_Type. For example, match-all, match-exact: TYP:120,match-substring:T29:11,exclude-substring:ITP:52,exclude-exact:T29:11.
Modification_History	String of 8-bit characters	Free-format text (up to 80 characters) gives the modification history of this file. For instance, it might contain "hand-modified by EMM to increase time window for ocean records." Suggested value is "N/A" for no modification.

Matchup_Info contains space for up to 5 matches for each value of GeoTrack. This reflects the possibility that more than one truth record can be within the specified time and distance window of a truth observation. If there are fewer than 5 matches, the remaining match structures will be marked invalid by having all characters of the truth_type field NUL (zero).

The HDF-EOS Matchup_Info swath will contain the dimensions in Table 2:

Table 2. HDF-EOS Matchup-Info Swath Dimensions

Name	*Value*	*Explanation*
GeoTrack	# of profiles	The total number of AIRS-suite profiles (golfballs) contained in the file (same as for all other swaths)
MaxMatch	5 (TBD)	Maximum number of truth profiles matched to one AIRS golfball
SubTrack3x3	3	Number of along-track spots per profile for small-spot swaths (L1B AIRS, VIS, HSB, GCMMatchup)
SubXTrack3x3	3	Number of across-track spots per profile for small-spot swaths (L1B AIRS, VIS, HSB, GCMMatchup)
MaxString	80	Maximum number of characters in a string
LongString	255	Maximum number of characters for Truth_File_UR and Truth_File_Name

The Matchup_Info swath will have geolocation fields Latitude, Longitude, Time with dimensions GeoTrack,MaxMatch.

For each match, the fields in Table 3 will be present. In the HDF-EOS Matchup_Info swath, each field below, except Truth_File_*, will have dimensions GeoTrack,MaxMatch (Truth_File_* have dimension GeoTrack) before the specified Extra Dimensions.

Table 3. HDF-EOS Matchup_Info Swath Fields

Name	*Type*	*Extra Dimensions*	*Explanation*
delta_sec	32-bit integer	None	Time difference (in seconds) between taking of truth data and AIRS-suite observations. Positive for AIRS data taken first. -99999999 for unknown
dist_amsu	32-bit floating point	None	Distance (km) between location of AMSU-A observations & of truth.
Truth_File_Type	String of 8-bit characters	MaxString (=80)	This item contains the type of truth file being matched. It must always exactly match one of these valids: PREPQC.ADPUPA ADP upper air radiosonde records from PREPQC. This is the only valid value under operational circumstances at GDAAC. ARM/CART ARM/CART site (TBD) Surface Marine records. NONE No truth file. OTHER Other.
Truth_File_Name	String of 8-bit characters	LongString (=255)	This item contains the filename of the file matched. When Truth_File_Type= NONE or OTHER, this field can contain the identity of the originator of this request or inforation about the purpose of this experiment. Maximum: 255 characters
Truth_File_UR	String of 8-bit characters	LongString (=255)	This is the Universal Reference (UR) for the file named in Truth_File_Name=. It is ignored when Truth_File_Type= NONE.
Truth_File_Version	String of 8-bit characters	MaxString (=80)	This is the TBD versioning information about the truth file. It is ignored when Truth_File_Type= NONE.

Name	*Type*	*Extra Dimensions*	*Explanation*
Truth_Type	String of 8-bit characters	MaxString (=80)	String uniquely identifying truth profile type. For files with Truth_File_Type PREPQC.ADPUPA, Truth_Type contains a string of the form TYP:typ,T29:t29,ITP:itp where typ, t29, and itp are replaced by the values of these Table B entries: TYP: OI/SSI REPORT TYPE T29: NMC OFFICE NOTE 29 REPORT TYPE ITP: INSTRUMENT TYPE Other values will be designated for other types of truth. All characters NUL (0) denote no match-up present at this MaxMatch index.
Profile_Id	String of 8-bit characters	MaxString (=80)	String uniquely identifying truth profile within the truth file. For PREPQC data this will be the SIDsid, where "sid" will be replaced by the SID from the PREPQC record.
Profile_Index	32-bit integer		Index uniquely identifying truth profile within the truth file. For PREPQC data this will be the SQN (TBD).
Quality_Indicator	String of 8-bit characters	MaxString (=80)	Up to 80-character string indicating the quality of a given truth record. Definitions are: PREPQC.ADPUPA Number of levels at which this profile has valid temperatures. ARM/CART TBD

The GCML2 and GCMMatchup swaths will share the dimensions in Table 4.

Table 4. GCML2 and GCMMatchup Swath Dimensions

Name	*Value*	*Explanation*
GeoTrack	# of profiles	The total number of AIRS-suite profiles (golfballs) contained in the file. (same as for all other swaths)
GCM_T_NLEV	26	The maximum number of temperature levels in GCM profile
GCM_H2O_NLEV	21	The maximum number of h2o levels in GCM profile
GCM_LW_NLEV	21	The maximum number of liquid water levels in GCM profile
GCM_OZO_NLEV	6	The maximum number of ozone levels in GCM profile
GCM_CLD_NLEV	3	The maximum number of cloud layers
GCM_NFileMax	100	The maximum number of GCM files needed to generate the swath
In addition, the GCML2 swath will contain:		
SubTrack3x3	3	Number of along-track spots per profile for small-spot swaths (L1B AIRS, VIS, HSB, GCMMatchup)
SubXTrack3x3	3	Number of across-track spots per profile for small-spot swaths (L1B AIRS, VIS, HSB, GCMMatchup)
And the GCMMatchup swath will contain:		
MaxMatch	5 (TBD)	Maximum number of truth profiles matched to one AIRS golfball

The GCML2 and GCMMatchup will have a common set of attributes, defined in Table 5.

For the following attributes: integer values are set to 0 and strings are set to '' if GCM_File_Number=0 or the index over file_number > GCM_File_Number. (file_number goes from 1 to GCM_NFileMax)

NCEP ON388 refers to NCEP Office Note 388, "GRIB, The WMO Format for the StorageProduct Information," 1998/03/10.

Table 5. GCML2 and GCMMatchup Common Attributes

Name	*Type*	*Dimension*	*Explanation*
GCM_Number_File	32-bit integer	1	The number of GCM file processes in this run, must be smaller than GCM_NfileMax
GCM_File_Name	String	***GCM_NfileMax (=100)***	The names of the GCM files
GCM_Year	32-bit integer	***GCM_NfileMax (=100)***	The year of the run of the GCM files
GCM_Month	32-bit integer	***GCM_NfileMax (=100)***	The month of the run of the GCM files
GCM_Day	32-bit integer	***GCM_NfileMax (=100)***	The day of the run of the GCM files
GCM_RunTime	16-bit integer	***GCM_NfileMax (=100)***	The hour of the run of the GCM files, e.g., 0, 6, 12, 18
GCM_Forecast_Time	16-bit integer	***GCM_NfileMax (=100)***	The forecast time in hours from the run time, e.g., 0, 3, 6, 9…
GCM_Forecast_TAI	64-bit floating-point	***GCM_NfileMax (=100)***	The forecast date and time as TAI93: floating-point seconds since start of 1993
GCM_Center	String	1	The processing center for the GCM, (see Table 0 of NCEP ON388) values will include (may be expanded): NCEP ECMWF DAO
GCM_SubCenter	16-bit integer	1	The division within the processing center, from GRIB PDS 26 (see Table C of NCEP ON388)
GCM_Process	16-bit integer	1	Generating Process or Model, from GRIB PDS B6 (see Table A, NCEP ON388), nominally 96 for AVN forecasts/analyses

Name	Type	Dimension	Explanation
GCM_GridType	16-bit integer	1	Grid ID of output (GRIB PDS B7, see Table 7, NCEP ON388), nominally 3 for global AVN forecast/analysis
P_Temp	32-bit floating-point		Pressure levels of the GCM temperature profiles (hPa)
P_H2O	32-bit floating-point		Pressure levels of the GCM water vapor profiles (hPa)
P_Ozone	32-bit floating-point		Pressure levels of the GCM ozone profiles (hPa)
P_CloudH2O	32-bit floating-point		Pressure levels of the GCM cloud water profiles (hPa)

The GCML2 swath will contain one state for each AIRS footprint, therefore it is dimensioned (GeoTrack, SubTrack3x3, SubXTrack3x3). Fields are dimensioned (GeoTrack, SubTrack3x3, SubXTrack3x3, Dim), where Dim is listed in Table 6.

The GCMMatchup swath will contain one state per matchup, dimensioned (GeoTrack, MaxMatch). Fields are dimensioned (GeoTrack, MaxMatch, Dim), where Dim is listed in Table 6 (Dimensions of 1 are ignored.).

Table 6 defines the fields in a state.

Table 6. State Fields

Name	Type	Dimension	Explanation
Location_Source	16-bit integer	1	The location type to which the GCM is interpolated: 1=AIRS, 2=V/NIR, 3=HSB, 4=AMSU, -1=N/A. Only for GCML2, not GCMMatchup
P_surf	32-bit floating-point	1	The surface pressure (hPa)
P_sealvl	32-bit floating-point	1	The sea level surface pressure (hPa)
Ice_Cover	16-bit floating-point	1	Fractional coverage of ice from spatial interpolation of ice flag
Land_Flag	16-bit floating-point	1	Fractional amount of land from spatial interpolation of land flag

Name	Type	Dimension	Explanation
T_surf	32-bit floating-point	1	The surface skin temperature (K)
H_surf	32-bit floating-point	1	The surface elevation (m)
Albedo_surf	32-bit floating-point	1	The surface visible albedo (%)
T_surf_air	32-bit floating-point	1	The surface air temperature (K)
Soil_water	32-bit floating-point	1	Volumetric fraction of soil moisture
h2o_surf_mmr	32-bit floating-point	1	The surface water mass mixing ratio
Total_Ozone	32-bit floating-point	1	Total Ozone (Dobson)
Water_burden	32-bit floating-point	1	Precipitable water (kg/m^2)
U_10	32-bit floating-point	1	The zonal wind speed 10m above surface (m/s)
V_10	32-bit floating-point	1	The meridional wind speed 10m above surface (m/s)
T_AIR	32-bit floating-point	GCM_T_NLEV (=26)	The air temperature profile (K)
H2O_mmr	32-bit floating-point	GCM_H2O_NLEV (=21)	The water vapor mass mixing ratio profile
Cloud_water	32-bit floating-point	GCM_LW_NLEV (=21)	The cloud liquid water mass mixing ratio in gm/kg, negative if cloud ice
Ozo_vmr	32-bit floating-point	GCM_OZO_NLEV (=6)	The ozone volume mixing ratio profile
CldFrac	32-bit floating-point	GCM_CLD_NLEV (=3)	The cloud fraction for each layer, 0 if clouds are absent (0-1). This is the total cloud fraction and not the viewed fraction observed by AIRS.
Pcldtop	32-bit floating-point	GCM_CLD_NLEV (=3)	The cloud top pressure (hPa)
Pcldbot	32-bit floating-point	GCM_CLD_NLEV (=3)	The cloud bottom pressure (hPa)

States are interpolated to the locations of Match-up and AIRS footprints, using linear interpolation in time, bilinear interpolation in latitude and longitude. Flags are set to one if any of the corners are 1, e.g., there might be ice or land contamination.

GCM fields for time interpolation are from the same run and do not include the analysis, i.e., we use the 3, 6 and 9 hour forecasts, but never the 0 hour forecast.

The above fields are set to Bad_Float (-9999.0) or Bad_Integer (-9999) if bounding forecasts are unavailable. Bounding forecasts are separated by 3 hours and bracket the time of the footprint, or match-up

```
Geo-Track
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    |                                                                                                       |
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    | |  AMSU | |  HSB  | |  AIRS | |  VIS  | |   L2  | |   L2  | |  L2   | | MATCH | | GCML2 | |  GCM  | |
    | |  L1B  | |  L1B  | |  L1B  | |  L1B  | |  STD  | |  SUP  | |  CC   | | swath | | swath | | MATCH | |
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Figure 1. Conceptual Layout of Match-Up File

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Geo-Track
    +-----------------------------------------------------+
    |                  AIRS  L1B Swath                    |
    |                                                     |
    |  +-----------+-----------+-----------+   ---       |
    |  |   Info    |           |           |    ^        |
    |  |    for    |           |           |    |        |
    |  |    one    |           |           |    |        |
    |  |   AIRS    |           |           |    |        |
    |  | footprint |           |           |    |        |
    |  +-----------+-----------+-----------+    |        |
    |  |           |           |           | SubTrack3x3 |
    |  |           |           |           |    = 3      |
 1  |  |           |           |           |    |        |
    |  |           |           |           |    |        |
    |  |           |           |           |    |        |
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    |  |           |           |           |    |        |
    |  |           |           |           |    |        |
    |  |           |           |           |    v        |
    |  +-----------+-----------+-----------+   ---       |
    |  |<--------SubXTrack3x3 = 3--------->|             |
    |                                                     |
    |                                                     |
    |  +-----------+-----------+-----------+             |
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    |                                                     |
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```

Figure 2. Close-up of AIRS L1B Swath, HSB L1B Swath, GCML2

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Appendix A3. AIRS-Suite Calibration Subset Product Interface Specification

The AIRS-Suite Calibration Subset file aids in verifying the calibration of AIRS, AMSU and VIS channels relative to truth on the earth's surface.

Each file covers a 24-hour period from midnight to midnight UTC, and for certain spots during that day extracts AIRS IR and VIS radiances, AMSU-A brightness temperatures, and predicted sea surface temperatures. AMSU-A data are interpolated to the location of the AIRS footprint. For the VIS data, only the mean and the standard deviation of the 8x9 pixel grid are saved.

The file contains information associated with AIRS footprints selected if they match any of three criteria:

1. A footprint is cloud-free according to a series of tests.
2. The center of a footprint lies within 30 nautical miles of a calibration site.
3. A footprint contains very high clouds and is within +/-60 degrees latitude.

In addition, isolated near-nadir footprints are selected at random in such a way that a globally balanced coverage is achieved. (Regular sampling would over-represent polar regions.)

The output file is organized in two separate pseudo-swaths called “L1B_AIRS_Cal_Subset” and “L1B_AIRS_Cal_Subset_Gran_Stats”.

“L1B_AIRS_Cal_Subset” contains the bulk of the data. It is not a true “swath” of complete scans, each containing a fixed number of footprints. Instead, individual footprints are selected, in time order, from scans covering multiple granules.

“L1B_AIRS_Cal_Subset_Gran_Stats” contains a number of statistics on a per-granule basis. It covers 241 granules - 239 full granules of the subject day, plus those portions of the preceding and following granules that lie within the subject day (between 00:00:00.000 and 23:59:59.999).

Their dimensions, attributes and geolocation and data fields are described below.

Swath L1B_AIRS_Cal_Subset

Table 1. L1B_AIRS_Cal_Subset Dimensions

Name	Value	Explanation
GeoTrack	variable	The number of CalSubset footprints contained in swath L1B_AIRS_Cal_Subset (equal to attribute "fp_count").
IR_Channel	2378	The number of AIRS IR channels. Frequencies are given in field nominal_freq.
VIS_Channel	3	The number of VIS channels. Channel 1: ~0.4 micron Channel 2: ~0.6 micron Channel 3: ~0.8 micron (The VIS/NIR instrument also has a 4th broadband channel, but that is not used here.)
AMSU_Channel	15	The number of AMSU-A channels. Channel 1: 23.8 GHz Channel 2: 31.4 GHz Channel 3: 50.3 GHz Channel 4: 52.8 GHz Channel 5: 53.596 +/- 0.115 GHz Channel 6: 54.4 GHz Channel 7: 54.94 GHz Channel 8: 55.5 GHz Channel 9: f0 Channel 10: f0 +/- 0.217 GHz; Channel 11: f0 +/- df +/- 48 MHz Channel 12: f0 +/- df +/- 22 MHz Channel 13: f0 +/- df +/- 10 MHz Channel 14: f0 +/- df +/- 4.5 MHz Channel 15: 89 GHz f0 = 57290.344 MHz df = 322.4 MHz

Table 2. L1B_AIRS_Cal_Subset Attributes

Name	Number of Occurrences or Dimensions	Data Type	Explanation
CF_Version	1	char-8	Cloud Filter Version Identification Collectively identifies the set of thresholds used for cloud filtering and the distinction between day/night and land/water. The individual thresholds values are given in Table 6.
start_year	1	int-32	Start Year (eg. 2007) This field and the date and time fields following reflect the date/time of the earliest possible footprint that may be found in the output file.
start_month	1	int-32	Start Month (1-12)
start_day	1	int-32	Start Day of the Month (1-31)
start_hour	1	int-32	Start Hour
start_minute	1	int-32	Start Minute
start_sec	1	int-32	Start Second
fp_count	1	int-32	Footprint Count Total count of footprints
Clear	1	int-32	"Clear" Footprint Count Count of footprints selected by the "cloud-free" thresholds (Selection Algorithm #1) - total for day/night and land/water
Clear_DL	1	int-32	"Clear" Footprint Count - day/land The distinction between spacecraft day and spacecraft night is based on the solar zenith angle (the angle at the center of a footprint between zenith and the sun) and a day/night threshold angle (see "th_solzen_day" in Table 6). The distinction between "land" and "water" is based on the fraction of land seen in a FOV and a threshold value (see "th_landfrac" in Table 6). The threshold values are input arguments to the Clear Match PGE.
Clear_DW	1	int-32	"Clear" Footprint Count - day/water
Clear_NL	1	int-32	"Clear" Footprint Count - night/land
Clear_NW	1	int-32	"Clear" Footprint Count - night/water
CalSite	1	int-32	Calibration Site Footprint Count Count of footprints selected from calibration sites (Selection Algorithm #2) - total for day/night and land/water
CalSite_DL	1	int-32	CalSite Footprint Count - day/land
CalSite_DW	1	int-32	CalSite Footprint Count - day/water
CalSite_NL	1	int-32	CalSite Footprint Count - night/land
CalSite_NW	1	int-32	CalSite Footprint Count - night/water
HiCloud	1	int-32	High Clouds Footprint Count Count of footprints viewing high clouds over non-polar regions (Selection Algorithm #3) - total for day/night and land/water
HiCloud_DL	1	int-32	High Clouds Count - day/land
HiCloud_DW	1	int-32	High Clouds Count - day/water

Name	Number of Occurrences or Dimensions	Data Type	Explanation
HiCloud_NL	1	int-32	High Clouds Count - night/land
HiCloud_NW	1	int-32	High Clouds Count - night/water
Random	1	int-32	Random Footprint Count Count of nadir footprints selected at random (Algorithm #4) - total for day/night and land/water (Actually only the center footprint of a 9-footprint "golfball" is selected at random. The surrounding 8 footprints are then added.)
Random_DL	1	int-32	Random Count - day/land
Random_DW	1	int-32	Random Count - day/water
Random_NL	1	int-32	Random Count - night/land
Random_NW	1	int-32	Random Count - night/water

Table 3. L1B_AIRS_Cal_Subset Geolocation Fields

These fields exist for every footprint selected.

Name	Data Type	Explanation
Latitude	float-64	Footprint Latitude in degrees North (-90.0 to 90.0)
Longitude	float-64	Footprint Longitude in degrees East (-180.0 to 180.0)
Time	float-64	Footprint Time in TAI (elapsed seconds since January 1, 1993 00:00Z UTC)

Table 4. Data Fields Appearing Once

The following data fields are produced once:

Name	Number of Occurrences or Dimensions	Data Type	Explanation
nominal_freq	IR_Channel	float-32	Nominal IR Channel "Frequencies" in cm^{-1} units

Table 5. Data Fields Associated with Every Footprint

These fields exist for every footprint selected.

Name	Number of Occurrences or Dimensions	Data Type	Explanation
granule_number	GeoTrack	int-16	The granule from which the footprint was selected (range: 0 - 240). "0'' identifies Granule 240 of the preceding day.
scan	GeoTrack	int-16	Scan number (range: 1 - 135)
footprint	GeoTrack	int-16	Footprint number (range: 1 - 90)
reason	GeoTrack	int-16	Footprint Selection Reason. Identifies the reason for the footprint's selection as follows: 1 = Clear (cloud-free) location 2 = Calibration site identified by field "site". 4 = High clouds 8 = Randomly selected location Note: Footprints may be selected for more than one reason. In that case the reason codes are combined (bitwise or'd).

site	GeoTrack	int-16	If the footprint was selected because it is near a calibration site (reason = 2), this field identifies the site as follows: 0 = footprint selection reason is not "calibration site" 1 = Egypt 1 Lat: 27.12°N, Lon: 026.10°E 2 = Simpson Desert Lat: 24.50°S, Lon: 137.00°E 3 = Dome Concordia Lat: 75.10°S, Lon: 123.40°E 4 = Mitu, Columbia Lat: 01.50°N, Lon: 069.50°W 5 = Boumba, Cameroon Lat: 03.50°N, Lon: 014.50°E 6 = Railroad Valley, NV Lat: 38.50°N, Lon: 115.70°W 7 = SPG/Arm-Cart, OK Lat: 36.60°N, Lon: 97.50°W 8 = Manus, Bismarck Archipelago Lat: 02.00°S, Lon: 147.40°E 9 = Nauru, Micronesia Lat: 00.50°S, Lon: 166.60°E 10 = North Pole Lat: 90.00°N, Lon: N/A 11 = South Pole Lat: 90.00°S, Lon: N/A 12 = Surgut, Siberian tundra Lat: 61.15°N Lon: 73.37°E 13 = Yunnan rain forest Lat: 23.90°N Lon:100.50°E 14 = Barrow, Alaska Lat: 71.32°N Lon:156.66°W 15 = Atqusuk, Alaska Lat: 70.32°N Lon:156.67°W 16 = Darwin, Australia Lat: 12.42°S Lon:130.89°E 17 = Lake Qinghai, China Lat: 36.75°N Lon:100.33°E 18 = Dunhuang, Gobi desert Lat: 40.17°N Lon: 94.33°E 19 = Lake Titicaca Lat: 15.88°S Lon: 69.33°W 20 = Lake Tahoe, CA Lat: 39.10°N Lon: 120.04°W
scan_node_type	GeoTrack	char	Node Type Consists of a single character: "A" = ascending node (day) "D" = descending node (night) "N" = north pole "S" = south pole "Z" = not available

satzen	GeoTrack	float-32	Satellite Zenith Angle Angle between satellite and zenith at footprint location in degrees [0.0, 90.0] -9999.0 means “not available”.
solzen	GeoTrack	float-32	Solar Zenith Angle Angle between sun and zenith at footprint location in degrees [0 .0, 180.0] -9999.0 means “not available”.
topog	GeoTrack	float-32	Mean elevation or “topography” at the center of the reference ellipsoid, in units of meters above mean sea level. -9999.0 means “not available”.
satheight	GeoTrack	float-32	Satellite altitude above nadir in km. -9999.0 means “not available”.
sun_glint_distance	GeoTrack	int-16	Distance, in km, from footprint center to the location of the sun glint during the sunlit portion of the orbit. “30000” indicates the spacecraft is in the earth’s shadow. -9999 means “not available”.
LandFrac	GeoTrack	float-32	Land Fraction Fraction of surface identified to be land [0.0, 1.0] -9999.0 means “not available”.
radiances	GeoTrack * IR_Channel	float-32	AIRS IR radiances for each channel for the selected footprint. Given in units of mW / m^2 / cm^{-1} / steradian -9999.0 means “not available”.
VisMean	GeoTrack * VIS_Channel	float-32	Mean Radiances - VIS Channels This is the mean of the 72 samples for VIS channels 1 - 3. Given in units of W / m^2 / μm / steradian -9999.0 means “not available”.
VisStdDev	GeoTrack * VIS_Channel	float-32	Standard Deviation - VIS Channels This is the standard deviation of the 72 samples for VIS channels 1 - 3. -9999.0 means “not available”.
avnsst	GeoTrack	float-32	Sea Surface Temperature derived from the nearest (in time) two of six 3-hour Aviation Forecasts. The forecast times are T21Z of the previous day, T03Z, T09Z, T15Z, T21Z, and T03Z of the next day. The forecasts give the temperatures for a 1-degree grid. The derived temperature (K) is interpolated 1. for latitude 2. for longitude 3. for time -9999.0 means “not available”.
cx2616	GeoTrack	float-32	Output of the spatial coherence test at 2616 cm^{-1}. For cloud-free data cx2616 < 0.7K over water and cx2616 < 2.0 K over land. -9999.0 means “not available”.

cx1231	GeoTrack	float-32	Output of the spatial coherence test at 1231 cm^{-1}. Given in K. For cloud-free data cx1231 < 10.0 K -9999.0 means "not available". See Note 1, below.
cx2395	GeoTrack	float-32	Output of the spatial coherence test at 2395 cm^{-1} Given in K. -9999.0 means "not available". See Note 1, below.
cxq2	GeoTrack	float-32	Output of the spatial coherence test for total water vapor, using the bt2616 - bt2607 proxy Given in K. For cloud-free data cxq2 < 1.0 K -9999.0 means "not available". See Note 1, below.
cxlpn	GeoTrack	float-32	Output of the spatial coherence test for the pseudo lapse rate lp, where: lp = (bt2395-bt2392) * $(\cos sza)^{0.3}$, where sza is the satellite zenith angle, Given in K. -9999.0 means "not available". See Note 1, below.
bt1231	GeoTrack	float-32	Brightness Temperature - 1231 cm^{-1} in K. -9999.0 means "not available".
sst1231r5	GeoTrack	float-32	Surface Temperature - 1231 cm^{-1} This is the surface skin temperature (day and night) for surfaces with emissivity 0.98. This is a good approximation at 1231 cm^{-1} for non-frozen water, land surfaces covered by vegetation, snow and ice. Calculated per footprint as: sst1231r5 = bt1231 + 0.28 + (1.2 * q3) + $(0.2962 * q3)^2$ + (1.0489 / cos(sza)) where: q3=bt1231-bt1227 and sza is the scan zenith angle. Given in K. -9999.0 means "not available". Validated to 0.5K over liquid water.
lp2395clim	GeoTrack	float-32	Pseudo lapse rate threshold applied in testing for cloud-free conditions.
amsu_bt	GeoTrack * AMSU_Channel	float-32	AMSU-A antenna temperatures in K. (Note: When the AMSU-A L1B data set includes side-lobe corrected antenna temperatures, as planned for Version 5, this field will reflect those corrected temperatures.) -9999.0 means "not available". Interpolated from 45 X 30 footprint AMSU-A swath to 135 X 90 footprint AIRS swath.

amsu_topog	GeoTrack	float-32	Mean elevation or "topography", in units of meters above mean sea level. -9999.0 means "not available". Interpolated from 45 X 30 footprint AMSU-A swath to 135 X 90 footprint AIRS swath.
amsu_landFrac	Geotrack	float-32	Land Fraction Fraction of surface identified to be land [0.0, 1.0] -9999.0 means "not available". Interpolated from 45 X 30 footprint AMSU-A swath to 135 X 90 footprint AIRS swath.
dust_flag	Geotrack	int16	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Invalid (due to land); -2: Invalid (due to high latitude); -3: Invalid (due to suspected cloud); -4: Invalid (due to bad input data)
BT_diff_SO2	Geotrack	float32	Brightness temperature difference BT(1361.44 cm-1) - BT(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. -9999.0 means "not available".

Note 1: Parameters cx1231, cx2395 test the spatial coherence at 1231 $cm^{-1}$and at 2395 cm^{-1}. Parameter cxq2 tests the spatial coherence of the total water (bt2616-bt2607), and parameter cxlpn tests the spatial coherence of the pseudo lapse rate (bt2395-bt2392). These test are used to identify how cloudy the special locations are which did not pass the cx2616<0.7K spatial coherence clear test.

Table 6. Threshold Values for Cloud Filter Version CF-973

Name	Explanation	Values L = over land W = over water D = at day N = at night
th_solzen_day	solzen threshold to distinguish S/C day and night	day: < 90.0 night: => 90.0
th_landfrac	landfrac threshold to distinguish between land and water	land: => .01 water: < .01
th_scor	spatial coherence threshold	L: < 2.0 W: < 0.7
th_2392	surface temperature difference threshold applied against the difference between sst1231r5 and sst2392r1	L: >-15.0 W: > -2.0
th_btq2	threshold applied against the bt2616 – bt2607 difference	> 0.1
th_cxq2	threshold applied against the most extreme among the 5-FOV bt2616 – bt2607 gradients	< 1.0
th_cx1231	threshold applied against the most extreme difference among the 5-FOV bt1231	< 10.0
th_g5n	threshold applied against the g5n quantity (glint-filtered bt2616 – bt2508 difference)	LD: < 6.0 WD: < 2.5 LN: < 1.2 WN: < 1.2
th_btg5n	minimum threshold for the g5n quantity	> 0.5

Additional thresholds for the pseudo lapse rate, based on geographical position, are obtained from ancillary files.

Swath L1B_AIRS_Cal_Subset

Table 7. L1B_AIRS_Cal_Subset_Gran_Stats Dimensions

Name	Value	Explanation
Grans_plus_1	241	The number of granules per day, plus 1.

Table 8. L1B_AIRS_Cal_Subset_Gran_Stats Data Fields

The following data fields are produced once for each granule. For the first and last granules, which start on the preceding day and end on the following day, only the portion that lies within the current day (data day) is evaluated.

The individual fields are collected from groups of individual footprints differentiated as follows:

Group 1 includes all AIRS IR footprints encountered in the input data stream that lie inside the "data day" and for which the "state" flag indicates "process".

Group 2 includes all AIRS footprints of Group 1 that also match the day/night and land/water criteria established for the majority of a granule's footprints. (See fields mean_land_flag and mean_day_flag.)

Group 2a includes all footprints of Group 2 representing "clear" FOV's

Group 2b includes all footprints of Group 2 representing "high clouds"

Some of the values below are hypothetical counts of spectra that would have been selected as "clear", had different spatial coherence thresholds been selected. The nomenclature used in the "Explanation" field below is as follows:

th is the applicable spatial coherence threshold. Its value for land and water are defined in Table 6 (see "th_scor")

tht1 is the applicable threshold, tightened by one step (whereby one step is 0.2 over water and 0.5714 over land)

thr1 is the applicable threshold, relaxed by one step

thr2 is the applicable threshold, relaxed by two steps

Name	Sel. from Grp	Data Type	Extra Dimension	Explanation
center_latitude	1	float-64	None	Latitude of granule center (-90 to 90).
center_longitude	1	float-64	None	Longitude of granule center (-180 to 180).
mean_day_flag	1	int-16	None	Indicates whether the majority of AIRS footprints in the input data stream lie on the day or night side. 0 = night

				1 = day -1 = unknown Note that this flag refers to footprints examined in the input data stream - not footprints included in the output data stream (i.e., this file).
mean_land_flag	1	int-16	None	Indicates whether the majority of AIRS footprints in the input data stream lie over land or over water. 0 = water 1 = land -1 = unknown
cnt_in	2	int-16	None	Total number of AIRS footprints in the input data stream that form the majority (i.e., match both the mean_day_flag and the mean_land_flag)
cnt_clear	2a	int-16	None	Count of input majority footprints representing clear FOV's
cnt_hi_clouds	2b	int-16	None	Count of input majority footprints representing high clouds
cnt_cx2616_th_excl	2	int-16	None	Count of input footprints which pass the test (exclusively): cx2616 < th, where th is the applicable threshold value. Only this test is made. The other tests that normally must be passed to declare a footprint as "clear" are excluded.
cnt_cx2616_q2_th_excl	2	int-16	None	Count of input footprints which pass the tests (exclusively): cx2616 < th, q2 < th where th is the applicable threshold value
cnt_cx2616_tht1_excl	2	int-16	None	Count of input footprints which pass the test (exclusively): cx2616 < tht1, where tht1 is the applicable threshold value, tightened by one step
cnt_cx2616_q2_tht1_excl	2	int-16	None	Count of input footprints which pass the tests (exclusively): cx2616 < tht1, q2 < th where th is the applicable threshold value and tht1 is the threshold value, tightened by one step
cnt_cx2616_thr1_incl	2	int-16	None	Count of input footprints which would have passed all tests (inclusively), had the test:

				cx2616 < thr1, used a threshold value relaxed by one step
cnt_cx2616_q2_thr1_incl	2	int-16	None	Count of input footprints which would have passed all tests (inclusively), had the tests: cx2616 < thr1, q2 < th used a threshold value relaxed by one step
cnt_cx2616_thr2_incl	2	int-16	None	Count of input footprints which would have passed all tests (inclusively), had the test: cx2616 < thr2, used a threshold value relaxed by two steps
cnt_cx2616_q2_thr2_incl	2	int-16	None	Count of input footprints which would have passed all tests (inclusively), had the tests: cx2616 < thr2, q2 < th used a threshold value relaxed by two steps
sst1231_gfs_mean	2a	float-32	None	Difference between the surface skin temperature calculated using bt1231 and the predicted GFS SST – Mean
sst1231_gfs_stddev	2a	float-32	None	Difference between the surface skin temperature calculated using bt1231 and the predicted GFS SST - Standard Deviation
lp_mean	2a	float-32	None	Pseudo Lapse Rate - Mean
lp_stddev	2a	float-32	None	Pseudo Lapse Rate – Standard Deviation
q3_mean	2a	float-32	None	q3 – Mean where q3 is the difference between bt1231 and bt1227
q3_stddev	2a	float-32	None	q3 – Standard Deviation
bt1231_min	2	float-32	None	bt1231 - Minimum
bt1231_max	2	float-32	None	bt1231 - Maximum
bt1231_median	2	float-32	None	bt1231 - Median
lp_min	2	float-32	None	Pseudo Lapse Rate – Minimum
lp_max	2	float-32	None	Pseudo Lapse Rate – Maximum
lp_median	2	float32	None	Pseudo Lapse Rate - Median
d_sst1231_gfs_mean	2	float-32	None	abs(sst1231 – gfssst) - mean
cnt_d_sst1231_gfs_lt_2	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) < 2 K
cnt_d_sst1231_gfs_gt_5	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 5 K
cnt_d_sst1231_gfs_gt_10	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 10 K
cnt_d_sst1231_gfs_gt_20	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 20 K
cnt_d_sst1231_gfs_gt_30	2	int-16	None	Count of footprints having

				abs(sst1231 – gfssst) > 30 K
cnt_d_sst1231_gfs_gt_40	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 40 K
cnt_d_sst1231_gfs_gt_50	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 50 K
cnt_d_sst1231_gfs_gt_60	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 60 K
cnt_d_sst1231_gfs_gt_70	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 70 K
cnt_d_sst1231_gfs_gt_80	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 80 K
cnt_d_sst1231_gfs_gt_90	2	int-16	None	Count of footprints having abs(sst1231 – gfssst) > 90 K
amsu_bt_mean	2	float-32	AMSU_ Channel (15)	mean brightness temperature [K] for each AMSU-A channel
cnt_sun_glint	2	int-16	None	Count of footprints < 200 km distant from sun glint, which are valid (state = "process") and have a maximum VIS Channel 3 radiance > 3000
CalChanSummary	1	uint-8	IR_ Channel (2378)	Summary of calibration related occurrences for each IR channel in this granule, as detailed by the following flags: Bit 7 (MSB): scene over/underflow; Bit 6: (value 64) anomaly in offset calculation; Bit 5: (value 32) anomaly in gain calculation; Bit 4: (value 16) pop detected; Bit 3: (value 8) noise out of bounds; Bit 2: (value 4) anomaly in spectral calibration; Bit 1: (value 2) Telemetry; Bit 0: (LSB, value 1) unused (reserved); If all flags are zero the channel was well calibrated for all scanlines
NeN	1	float-32	IR_ Channel (2378)	Noise-equivalent Radiances at 250K. Given in units of mW / m^2 / cm^{-1} / steradian

Appendix A4. Level 3 Standard Product Interface Specification

Interface Specification Version 6.0.8.0
2012-10-18

ESDT ShortNames=
"AIRX3STD", "AIRX3ST8", "AIRX3STM",
"AIRH3STD", "AIRH3ST8", "AIRH3STM",
"AIRS3STD", "AIRS3ST8", "AIRS3STM"

DOIs =

"10.5067/AQUA/AIRS/DATA301", "10.5067/AQUA/AIRS/DATA310",
"10.5067/AQUA/AIRS/DATA319",

"10.5067/AQUA/AIRS/DATA302", "10.5067/AQUA/AIRS/DATA311",
"10.5067/AQUA/AIRS/DATA320",

"10.5067/AQUA/AIRS/DATA303", "10.5067/AQUA/AIRS/DATA312",
"10.5067/AQUA/AIRS/DATA321"

Grid Names = "location", "ascending", "descending", "ascending_TqJoint",
"descending_TqJoint", "ascending_MW_only", "descending_MW_only"

Horizontal resolution= 1°x1° degree (360x180)

Upper Left Point= -180.0, 90.0

Lower Right Point= 180.0, -90.0

Projection= GCTP_GEO (Global image)

Temporal Characteristics of AIRS Level 3 Products

The temporal resolution of the AIRS Level 3 Standard products is daily, 8-day (half of the 16 day Aqua orbit repeat cycle) and monthly based on the needs of different user communities.

Daily Level 3 products are intended to address the needs of the Numerical Weather Prediction (NWP) and numerical modeling community. This community is interested in temperature, specific humidity, and geopotential height profiles, cloud thickness, height and fraction, surface moisture and emissivity. In addition, individual users can easily aggregate daily Level 3 products into custom multi-day global products based on their specific needs. These data are also used as input to the 8-day and monthly Level 3 products.
Level 3 products with a temporal resolution of 8-days address the needs of researchers interested in climate quasi-oscillations and assorted phenomena, such as the Madden-Julian Oscillation, annular modes, etc.

The monthly Level 3 products address the interests of those involved in climate trend analysis. They are typically interested in monthly means over long timescales and prefer data products with the lowest possible systematic errors. The characteristics of these three data types are summarized in Table 1.

Users of AIRS Level 3 products should be aware that the temporal span of Level 3 daily files is not midnight-to-midnight. The data proceeds in time from left (-180.0°) to right (180.0°) with neighboring cells of data no more than a swath of time apart. This ensures that data points in a grid box are always coincident in time, if the data were gridded using a midnight-to-midnight time scheme, the start of the day and the end of the day would be in the same grid cell, producing an artificial time discontinuity across the grid. The edges of the AIRS Level 3 cells are at the date line (the 180E/W longitude boundary). When plotted, this produces a map with 0 degrees longitude in the center of the image. This method is preferred because the left side of the grid and the right side of the grid contain data farthest apart in time. The method used is analogous to that used to create TOVS Pathfinder level 3 products.

L3 Standard Product Characteristics		
Daily	***8-Day***	***Monthly***
"Complex" data, leaves in gores between satellite tracks (missing)	"Moderate" data, no gores, and some data dropouts.	"Simple" data, no gores, complete coverage
1°x1° spatial resolution	1°x1° spatial resolution	1°x1° spatial resolution
1-day temporal resolution.	8-day temporal resolution based on Aqua 16-day repeat cycle.	Monthly (calendar)

Level-3 Standard Product Grids

The data in the Level-3 standard product is contained in 7 HDF-EOS Grids. Each grid includes datat for the entire globe in 360 x 180 grid cells each 1 x 1 degree of latitude/longitude. Most fields appear in the 4 main grids: ascending, descending, ascending_TqJoint, and descending_TqJoint. The ascending grids collect data taken while the spacecraft is in the ascending part of its orbit. This is generally daytime, except near the poles.

For the ascending and descending grids (and ascending_MW_Only and descending_MW_Ony), Level-2 quality control per field is used (*_QC) collecting all observations where quality level is 0 (best) or 1 (good). This ensures that these grids have the most complete set of data available for each field and level, but the use of different ensembles for different data fields can complicate comparisons across fields or levels, so the TqJoint fields apply a single, unified quality control criterion for all fields: TSurfAir_QC must be 0 or 1. Analyses which depend upon correlations between temperature and water vapor fields or correlations of temperature or water vapor between different pressure levels should always use TqJoint grids that contain data for a common set of observations across water vapor and temperature at all atmospheric levels.

Grid name	Tag	Description
location	None	Location information which is valid for all grids
ascending	_A	Information collected while the spacecraft is in the ascending part of its orbit. (Daytime data except near the poles.) Each field and level is individually quality controlled.
descending	_D	Information collected while the spacecraft is in the descending part of its orbit. (Nighttime data except near the poles.) Each field and level is individually quality controlled.
ascending_TqJoint	_TqJ_A	Information collected while the spacecraft is in the ascending part of its orbit. (Daytime data except near the poles.) Collective quality control is used across all fields and levels.
descending_TqJoint	_TqJ_D	Information collected while the spacecraft is in the descending part of its orbit. (Nighttime data except near the poles.) Collective quality control is used across all fields and levels.
ascending_MW_Only	_MW_A	Microwave information collected while the spacecraft is in the ascending part of its orbit. (Daytime data except near the poles.)
descending_MW_Only	_MW_D	Microwave information collected while the spacecraft is in the descending part of its orbit. (Nighttime data except near the poles.)

Geolocation Fields

These fields are within the location grid and document pertinent information for determining the location and characteristics of a given grid cell for all grids.

Name	Type	Extra Dimensions	Explanation
Latitude	32-bit floating-point	None	Array of 360 x 180 latitude values at the center of the grid box (Degrees).
Longitude	32-bit floating-point	None	Array of 360 x 180 longitude values at the center of the grid box (Degrees).
LandSeaMask	16-bit integer	None	Land sea mask. 1 = land, 0 = ocean. (Unitless). (Up through v5 this data was used to exclude land profiles from grid squares marked sean and vice versa. As of v6 this is not done, but the field is retained for user convenience.)
Topography	32-bit floating-point	None	Topography of the Earth in meters above the geoid. Original data source: PGS Toolkit

Attributes

These fields appear once per Level 3 file as HDF-EOS grid attributes in the location grid. They apply to the entire file.

The attributes with extra dimensions are provided in this format for backwards compatibility, but the same information is provided in identically named dimensions with associated dimension scales in the grids where these dimensions are used.

Name	Type	Extra Dimensions	Explanation
Year	32-bit integer	None	Year at start of nominal data period
Month	32-bit integer	None	Month at start of nominal data period [1,12]
Day	2-bit integer	None	Day of month at start of nominal data period [1,31]
NumOfDays	32-bit integer	None	Total number of days of input Level 2 data included in

			gridded maps.
AscendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mappe fields (UTC), ascending.
AscendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), ascending.
DescendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), descending.
DescendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), descending.
StdPressureLev	32-bit floating point	StdPressureLev (24)	Pressure levels of temperature profiles and geopotential height. The array order is from the surface upward, in conformance with WMO standard. Note that the Level-3 pressure levels are a subset of Level-2 pressure levels and are constrained to begin at 1000.0 mb and end at 1.0 mb.
H2OPressureLev	32-bit floating point	H2OPressureLev (12)	Pressure levels of water vapor level profiles.
H2OPressureLay	32-bit floating point	H2OPressureLay (12)	Midpoints of pressure layers of water vapor layer profiles.
EmisFreqIR	32-bit floating point	EmisFreqIR (4)	Frequencies corresponding to each of the 4 IR emissivity values reported in the AIRS Level 3 Standard Product. (832.0, 961.0, 1203.0, 2616.0 cm-1)
EmisFreqMW	32-bit floating point	EmisFreqMW (3)	Frequencies corresponding to each of the 3 microwave emissivity values reported in the AIRS Level 3

			Standard Product. (23.0, 50.3, and 89.0 GHz)
CoarseCloudLayer	32-bit floating point	CoarseCloudLayer (3)	Midlayer pressures of the 3 coarse cloud layers
FineCloudLayer	32-bit floating point	FineCloudLayer (12)	Midlayer pressures of the 12 fine cloud layers

Grid Dimensions

These dimensions appear in selected grids as needed.

Name	Grids	Size: Values	Explanation
StdPressureLev	ascending, descending, ascending_TqJoint, descending_TqJoint, ascending_MW_Only, descending_MW_Only	24: 1000, 925, 850, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 15, 10, 7, 5, 3, 2, 1.5, 1 hPa	Pressure levels of temperature and trace gas profiles and geopotential height. The array order is from the surface upward, in conformance with WMO standard. Note that the Level-3 pressure levels are a subset of the 28 Level-2 pressure levels, restricted to the range of [1.0, 1000.0] hPa.
H2OPressureLev	ascending, descending, ascending_TqJoint, descending_TqJoint	12: 1000, 925, 850, 700, 600, 500, 400, 300, 250, 200, 150, 100 hPa	Pressure levels of water vapor level profiles.
H2OPressureLay	ascending, descending, ascending_TqJoint, descending_TqJoint	12: 961.8, 886.7 771.4, 648.1, 547.7, 447.2, 346.4, 273.9, 223.6, 173.2, 122.5, 83.7 hPa	Midpoints of pressure layers of water vapor layer profiles. Layer boundaries are at StdPressureLev.
EmisFreqIR	ascending, descending, ascending_TqJoint, descending_TqJoint	4: 832, 961, 1203, 2616 cm^{-1}	Frequencies corresponding to each of the 4 IR emissivity values reported in the AIRS Level 3 Standard Product.
EmisFreqMW	ascending_MW_Only, descending_MW_Only	3: 23.0, 50.3, 89.0 GHz	Frequencies corresponding to each of the 3 microwave emissivity values reported in the AIRS Level 3 Standard Product.
CoarseCloudLayer	ascending,	3:	Midlayer pressures of the 3

	descending, ascending_TqJoint, descending_TqJoint	865., 547., 66. hPa	coarse cloud layers. Layer boundaries are at {1100., 680., 440., 10.} hPa
FineCloudLayer	ascending, descending, ascending_TqJoint, descending_TqJoint	12: 1018, 887, 771, 648, 548, 447, 346, 274, 224, 173, 122, 32 hPa	Midlayer pressures of the 24 fine cloud layers. Layer boundaries are at {1100., 925., 850., 700., 600, 500, 400, 300, 250, 200, 150, 100, 10} hPa
XDim	location, ascending, descending, ascending_TqJoint, descending_TqJoint, ascending_MW_Only, descending_MW_Only	360: -179.5, -178.5, … 178.5, 179.5	West to East dimension for all grids. Long_name "Longitude". Values are mid-cell longitude.
YDim	location, ascending, descending, ascending_TqJoint, descending_TqJoint, ascending_MW_Only, descending_MW_Only	180: -89.5, -88.5, … 88.5, 89.5	South to North dimension for all grids. Long_name "Latitude". Values are mid-cell latitude.

Grid Fields in Grids ascending, descending, ascending_TqJoint, and descending_TqJoint

These fields appear once per grid. Tags from the grid table are appended so that the final field names are unique across all the grids in each file. For example the field with the basename "Temperature" will appear as "Temperature_A" in the ascending grid and "Temperature_TqJ_D" in the descending_TqJoint grid. The value in the main field is the mean over all observations which fell in the grid cell and passed quality control. Quantities for which Level-2 provides just one retrieved value per FOR (3x3 AIRS FOVs) are recorded for each of the 9 AIRS FOV center locations.

There are also up to 5 ancillary fields for each field:

1. _ct is a 16-bit count of the number of observations used in the calculation. It can be ratioed with TotalCounts to give a yield. It is present for all floating-point fields.
2. _sdev is a 32-bit standard deviation over the observations in this grid cell. It is present for all floating-point fields.
3. _min is the 32-bit floating-point minimum of the observations in this grid cell. It is present for all floating-point fields.

4. _max is the 32-bit floating-point maximum of the observations in this grid cell. It is present for all floating-point fields.
5. _err is the 32-bit floating-point mean of the Level-2 error estimates of the observations in this grid cell. It is present for all fields where the Level-2 product provides an error estimate.

So for example in the ascending_TqJoint grid the main (mean) Temperature field is "Temperature_TqJ_A" and it has ancillary fields "Temperature_TqJ_A_ct", "Temperature_TqJ_A_sdev", "Temperature_TqJ_A_min", "Temperature_TqJ_A_max", and "Temperature_TqJ_A_err".

Basename	**Type**	**Extra Dimensions**	**Explanation**
TotalCounts	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for yield calculations.
SurfPres_Forecast	32-bit floating point	None	Surface pressure from forecast. (hPa)
SurfSkinTemp	32-bit floating point	None	Surface skin temperature. (Kelvin)
EmisIR	32-bit floating point	EmisFreqIR (4)	IR surface emissivity at frequencies {832, 961, 1203, 2616} cm^{-1}
Temperature	32-bit floating point	StdPressureLev (24)	Atmospheric temperature (Kelvin)
SurfAirTemp	32-bit floating point	None	Temperature of the atmosphere at the Earth's surface. (Kelvin)
TropPres	32-bit floating point	None	Pressure of the tropopause. (hPa)
TropTemp	32-bit floating point	None	Temperature of the tropopause. (Kelvin)
TotH2OVap	32-bit floating point	None	Total integrated column water vapor burden. (kg/m^2)
H2O_MMR_Lyr	32-bit floating point	H2OPressureLay (12)	Water vapor mass mixing ratio averaged over each of standard pressure layers (gm/kg dry air)
H2O_MMR	32-bit floating point	H2OPressureLev (12)	Water vapor mass mixing ratio at standard pressure levels (gm/kg dry air)
H2O_MMR_Surf	32-bit floating point	None	Water vapor mass mixing ratio at the surface (gm/kg dry air)
RelHum	32-bit	H2OPressureLev	Relative humidity over

	floating point	(12)	equilibrium phase (Percent)
RelHumSurf	32-bit floating point	None	Relative humidity at the surface over equilibrium phase (Percent)
RelHum_liquid	32-bit floating point	H2OPressureLev (12)	Relative humidity over liquid phase (Percent)
RelHumSurf_liquid	32-bit floating point	None	Relative humidity at the surface over liquid phase (Percent)
TropHeight	32-bit floating point	None	Height of the tropopause. (meters)
GPHeight	32-bit floating point	StdPressureLev (24)	Geopotential height. (Meters)
CloudFrc	32-bit floating point	None	Combined layer cloud fraction. (0-1). (Unitless)
CloudTopPres	32-bit floating point	None	Combined cloud top pressure (weighted by cloud fraction). (hPa)
CloudTopTemp	32-bit floating point	None	Combined cloud top temperature (weighted by cloud fraction). (Kelvin)
FineCloudFrc	32-bit floating point	FineCloudLayer (12)	Cloud fraction at fine cloud resolution (Unitless)
CoarseCloudFrc	32-bit floating point	CoarseCloudLayer (3)	Cloud fraction at coarse cloud resolution. 3 layers: low, middle, high. (Unitless)
CoarseCloudPres	32-bit floating point	CoarseCloudLayer (3)	Cloud layer pressure at coarse cloud resolution. 3 layers: low, middle, high. (hPa)
CoarseCloudTemp	32-bit floating point	CoarseCloudLayer (3)	Cloud layer cloud top temperature at coarse cloud resolution. 3 layers: low, middle, high. (Kelvin)
TotO3	32-bit floating point	None	Total integrated column ozone burden. (Dobson units)
O3_VMR	32-bit floating point	StdPressureLev (24)	Ozone volume mixing ratio (ppv)
TotCO	32-bit floating point	None	Retrieved total column CO. (molecules/cm^2)
CO_VMR	32-bit floating point	StdPressureLev (24)	CO volume mixing ratio. (ppv)
TotCH4	32-bit floating point	None	Retrieved total column CH4. (molecules/cm^2)
CH4_VMR	32-bit floating point	StdPressureLev (24)	CH4 volume mixing ratio. (ppv)
OLR	32-bit floating point	None	Outgoing long-wave radiation flux. (watts/m^2)

ClrOLR	32-bit floating point	None	Clear-sky outgoing long-wave radiation flux. (watts/m^2)

Microwave-only Ascending and Descending Grid Fields

These fields appear once per grid. Tags from the grid table are appended so that the final field names are unique across all the grids in each file. For example the field with the basename "Temperature" will appear as "Temperature_MW_A" in the ascending_MW_Only grid. The value in the main field is the mean over all observations which fell in the grid cell and passed quality control. Quantities for which Level-2 provides just one retrieved value per FOR (3x3 AIRS FOVs) are recorded for each of the 9 AIRS FOV center locations.

There are also up to 5 ancillary fields for each field:

1. _ct is a 16-bit count of the number of observations used in the calculation. It can be ratioed with TotalCounts to give a yield. It is present for all floating-point fields.
2. _sdev is a 32-bit standard deviation over the observations in this grid cell. It is present for all floating-point fields.
3. _min is the 32-bit floating-point minimum of the observations in this grid cell. It is present for all floating-point fields.
4. _max is the 32-bit floating-point maximum of the observations in this grid cell. It is present for all floating-point fields.
5. _err is the 32-bit floating-point mean of the Level-2 error estimates of the observations in this grid cell. It is present for all fields where the Level-2 product provides an error estimate.

So for example in the ascending_MW_Only grid the main (mean) Temperature field is "Temperature_MW_A" and it has ancillary fields "Temperature_MW_A_ct", "Temperature_MW_A_sdev", "Temperature_MW_A_min", "Temperature_MW_A_max", and "Temperature_MW_A_err".

Basename	Type	Extra Dimensions	Explanation
TotalCounts	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for yield calculations.
Emis	32-bit floating point	EmisFreqMW (3)	Microwave spectral emissivity at frequencies {23.8, 50.3 and 89.0} GHz.
Temperature	32-bit floating	StdPressureLev (24)	Microwave-only atmospheric temperature (Kelvin)

	point		
TotH2OVap	32-bit floating point	None	Total integrated column water vapor burden. (kg/m^2)
GPHeight	32-bit floating point	2 StdPressureLev (24)4	Microwave-only geopotential height (Meters)
TotCldLiqH2O	32-bit floating point	None	Total integrated column cloud liquid water. (kg/m^2)

Appendix A5. Level 3 Support Product Interface Specification

Interface Specification Version 6.0.8.0
2012-10-18

ESDT ShortNames=
"AIRX3SPD", "AIRX3SP8", "AIRX3SPM",
"AIRH3SPD", "AIRH3SP8", "AIRH3SPM",
"AIRS3SPD", "AIRS3SP8", "AIRS3SPM"

DOIs =

"10.5067/AQUA/AIRS/DATA304", "10.5067/AQUA/AIRS/DATA313",
"10.5067/AQUA/AIRS/DATA322",

"10.5067/AQUA/AIRS/DATA305", "10.5067/AQUA/AIRS/DATA315",
"10.5067/AQUA/AIRS/DATA323",

"10.5067/AQUA/AIRS/DATA306", "10.5067/AQUA/AIRS/DATA315",
"10.5067/AQUA/AIRS/DATA324"

Grid Names = "location", "ascending", "descending"

Horizontal resolution= 1°x1° degree (360x180)

Upper Left Point= -180.0, 90.0

Lower Right Point= 180.0, -90.0

Projection= GCTP_GEO (Global image)

The L3 support products are similar to the L3 standard products but contain fields which are not fully validated, or are inputs or intermediary values. Because no quality control information is available for some of these fields, values from failed retrievals may be included.

Temporal Characteristics of AIRS Level 3 Products

The temporal resolution of the AIRS Level 3 Support products is daily, 8-day (half of the 16 day Aqua orbit repeat cycle) and monthly based on the needs of different user communities.

Daily Level 3 products are intended to address the needs of the Numerical Weather Prediction (NWP) and numerical modeling community. This community is interested in temperature, specific humidity, and geopotential height profiles, cloud thickness, height and fraction, surface moisture and emissivity. In addition, individual users can easily aggregate daily Level 3 products into custom multi-day global products based on their specific needs. These data are also used as input to the 8-day and monthly Level 3 products.
Level 3 products with a temporal resolution of 8-days address the needs of researchers interested in climate quasi-oscillations and assorted phenomena, such as the Madden-Julian Oscillation, annular modes, etc.

The monthly Level 3 products address the interests of those involved in climate trend analysis. They are typically interested in monthly means over long timescales and prefer data products with the lowest possible systematic errors. The characteristics of these three data types are summarized in Table 1.

Users of AIRS Level 3 products should be aware that the temporal span of Level 3 daily files is not midnight-to-midnight. The data proceeds in time from left (-180.0°) to right (180.0°) with neighboring cells of data no more than a swath of time apart. This ensures that data points in a grid box are always coincident in time, if the data were gridded using a midnight-to-midnight time scheme, the start of the day and the end of the day would be in the same grid cell, producing an artificial time discontinuity across the grid. The edges of the AIRS Level 3 cells are at the date line (the 180E/W longitude boundary). When plotted, this produces a map with 0 degrees longitude in the center of the image. This method is preferred because the left side of the grid and the right side of the grid contain data farthest apart in time. The method used analogous to that used to create TOVS Pathfinder level 3 products.

L3 Product Characteristics		
Daily	***8-Day***	***Monthly***
"Complex" data, leaves in gores between satellite tracks (missing)	"Moderate" data, no gores, and some data dropouts.	"Simple" data, no gores, complete coverage
1°x1° spatial resolution	1°x1° spatial resolution	1°x1° spatial resolution
1-day temporal resolution.	8-day temporal resolution based on Aqua 16-day repeat cycle.	Monthly (calendar)

Level-3 Support Product Grids

The data in the Level-3 support product is contained in 3 HDF-EOS Grids. Each grid includes datat for the entire globe in 360 x 180 grid cells each 1 x 1 degree of latitude/longitude. Most fields appear in the 2 main grids: ascending and descending. The ascending grids collect data taken while the spacecraft is in the ascending part of its orbit. This is generally daytime, except near the poles.

Grid name	Tag	Description
location	None	Location information which is valid for all grids
ascending	_A	Information collected while the spacecraft is in the ascending part of its orbit. (Daytime data except near the poles.)
descending	_D	Information collected while the spacecraft is in the descending part of its orbit. (Nighttime data except near the poles.)

Geolocation Fields

These fields are within the location grid and document pertinent information for determining the location and characteristics of a given grid cell for all grids.

Name	Type	Extra Dimensions	Explanation
Latitude	32-bit floating-point	None	Array of 360 x 180 latitude values at the center of the grid box (Degrees).
Longitude	32-bit floating-point	None	Array of 360 x 180 longitude values at the center of the grid box (Degrees).
LandSeaMask	16-bit integer	None	Land sea mask. 1 = land, 0 = ocean. (Unitless). (Up through v5 this data was used to exclude land profiles from grid squares marked sean and vice versa. As of v6 this is not done, but the field is retained for user convenience.)
Topography	32-bit floating-point	None	Topography of the Earth in meters above the geoid. Original data source: PGS Toolkit

Attributes

These fields appear once per Level 3 file as HDF-EOS grid attributes in the location grid. They apply to the entire file.

The attributes with extra dimensions are provided in this format for backwards compatibility, but the same information is provided in identically named dimensions with associated dimension scales in the grids where these dimensions are used.

Name	Type	Extra Dimensions	Explanation
Year	32-bit integer	None	Year at start of nominal data period
Month	32-bit integer	None	Month at start of nominal data period [1,12]
Day	2-bit integer	None	Day of month at start of nominal data period [1,31]
NumOfDays	32-bit integer	None	Total number of days of input Level 2 data included in gridded maps.
AscendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), ascending.
AscendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), ascending.
DescendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), descending.
DescendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), descending.
SurfClass	32-bit integer	SurfClass (7)	Surface Classes counted in SurfClass_Count
DustTest	32-bit integer	DustTest (9)	Dust Tests counted in Dust_Score
SpectralOLR	32-bit integer	SpectralOLR (16)	Frequency bands on which spectralolr and spectralclrolr are reported
CloudPhase	32-bit integer	CloudPhase (4)	Cloud phases used in cloud_phase_3x3
SpectralClr	32-bit	SpectralClr (5)	Categories used in

	integer		Spectral_Clear_Counts
MODISEmis10Hinge	32-bit integer	MODISEmis10Hinge (10)	10 MODIS emissivity hinge points
XtraPressureLev	32-bit integer	XtraPressureLev (100)	100 pressure levels for internal temperature profiles
XtraPressureLay	32-bit integer	XtraPressureLay (100)	100 pressure layer for internal gas profiles

Grid Dimensions

These dimensions appear in selected grids as needed.

Name	Grids	Size: Values	Explanation
XtraPressureLev	ascending, descending	100	Pressure levels of internal 100-level temperature profiles. hPa.
XtraPressureLay	ascending, descending	100	Pressure layers of internal 100-layer gas profiles. hPa.
SurfClass	ascending, descending	7: "coastline (Liquid water covers 50-99% of area)", "land (Liquid water covers < 50% of area)", "ocean (Liquid water covers > 99% of area)", "sea ice (High MW emissivity)", "sea ice (Low MW emissivity)", "snow (Higher-frequency MW scattering)", "glacier/snow (Very low-frequency MW scattering)", "snow (Lower-frequency MW scattering)"	Surface Classes counted in SurfClass_Count
DustTest	ascending, descending	9:	Dust Tests counted in Dust_Score. Least significant to most significant.
MODISEmis10Hinge	ascending, descending	10: 699.30, 826.45, 925.93, 1075.27 1204.82, 1315.79, 1724.14, 2000.00, 2325.58, 2777.78	MODIS emissivity hinge points
SpectralOLR	ascending, descending	16:	Frequency bands on which spectralolr and spectralclrolr are reported

CloudPhase	ascending, descending	7: liquid (high confidence), liquid (low confidence), unknown, ice (low confidence), ice (medium confidence), ice (high confidence), ice (very high confidence)	Cloud phases used in cloud_phase_3x3
SpectralClr	ascending, descending	5: "Ocean test applied and scene identified as clear", "Ocean test applied and scene not identified as clear", "Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule", "Unvalidated land test applied and scene not identified as clear", "Unvalidated land test applied and scene identified as clear" :	Categories used in Spectral_Clear_Counts
XDim	location, ascending, descending	360: -179.5, -178.5, … 178.5, 179.5	West to East dimension for all grids. Long_name "Longitude". Values are mid-cell longitude.
YDim	location, ascending, descending	180: -89.5, -88.5, … 88.5, 89.5	South to North dimension for all grids. Long_name "Latitude". Values are mid-cell latitude.

Grid Fields in Grids ascending and descending

These fields appear once per grid. Tags from the grid table are appended so that the final field names are unique across all the grids in each file. For example the field with the basename "COCDSup" will appear as "COCDSup_A" in the ascending grid and "COCDSup_D" in the descending grid. The value in the main field is the mean over all observations which fell in the grid cell and passed quality control. Quantities for which Level-2 provides just one retrieved value per FOR (3x3 AIRS FOVs) are recorded for each of the 9 AIRS FOV center locations.

There are also up to 5 ancillary fields for each field:

6. _ct is a 16-bit count of the number of observations used in the calculation. It can be ratioed with TotalCounts to give a yield. It is present for all floating-point fields.
7. _sdev is a 32-bit standard deviation over the observations in this grid cell. It is present for all floating-point fields.
8. _min is the 32-bit floating-point minimum of the observations in this grid cell. It is present for all floating-point fields.
9. _max is the 32-bit floating-point maximum of the observations in this grid cell. It is present for all floating-point fields.
10. _err is the 32-bit floating-point mean of the Level-2 error estimates of the observations in this grid cell. It is present for all fields where the Level-2 product provides an error estimate.

So for example in the ascending grid the main (mean) COCDSup field is "COCDSup_A" and it has ancillary fields "COCDSup_A_ct", "COCDSup_A_sdev", "COCDSup_A_min", "COCDSup_A_max", and "COCDSup_A_err".

Basename	**Type**	**Extra Dimensions**	**Explanation**
TotalCounts	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for yield calculations.
Dust_Score	32-bit floating point	DustTest (9)	Fraction of obs with each dust test triggered. [0.0, 1.0]
SO2_Indicator	32-bit floating point	None	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (level-2 BT_diff_SO2) (Kelvins)
TAirSup	32-bit floating point	XtraPressureLev (100)	Atmospheric temperature (Kelvin)
Temp_dof	32-bit floating point	None	Degrees of freedom from the physical retrieval of temperature (unitless)
H2OCDSup	32-bit floating point	XtraPressureLay (100)	Water vapor layer column density (molecules/cm^2)
H2O_dof	32-bit floating point	None	Degrees of freedom from the physical retrieval of water vapor (unitless)

bndry_lyr_top	32-bit floating point	None	Pressure at top of planetary boundary layer (hPa)
cloud_phase_3x3	32-bit floating point	CloudPhase (7)	Counts of observations with each of the 7 possible cloud phase values. Use with TotalCounts to get fraction of obs with any given type.
ice_cld_opt_dpth	32-bit floating point	None	Ice cloud optical depth (unitless)
ice_cld_opt_dpth	32-bit floating point	None	Ice cloud optical depth (unitless)
ice_cld_eff_diam	32-bit floating point	None	Ice cloud effective diameter (microns)
ice_cld_temp_eff	32-bit floating point	None	Ice cloud effective cloud top temperature (Kelvin)
ice_cld_fit_reduced_chisq	32-bit floating point	None	Normalized chi-square residual of the obs-calc radiance residual in the ice cloud optical properties calculation
O3CDSup	32-bit floating point	XtraPressureLay (100)	Ozone layer column density (molecules/cm^2)
O3_VMR_Surf	32-bit floating point	None	Ozone volume mixing ratio at the surface (ppmv)
O3_dof	32-bit floating point	None	Degrees of freedom from the physical retrieval of ozone (unitless)
COCDSup	32-bit floating point	XtraPressureLay (100)	Carbon monoxide layer column density (molecules/cm^2)
CO_VMR_Surf	32-bit floating point	None	Carbon monoxide volume mixing ratio at the surface (ppmv)
CO_dof	32-bit floating point	None	Degrees of freedom from the physical retrieval of carbon monoxide (unitless)
CH4CDSup	32-bit floating point	XtraPressureLay (100)	Methane layer column density (molecules/cm^2)
CH4_VMR_Surf	32-bit floating point	None	Methane volume mixing ratio at the surface (ppmv)
CH4_dof	32-bit	None	Degrees of freedom from the

	floating point		physical retrieval of methane (unitless)
spectralolr	32-bit floating point	SpectralOLR (16)	Outgoing longwave radiation flux integrated over 16 frequancy bands (Watts/meter^2)
spectralclrolr	32-bit floating point	SpectralOLR (16)	Clear-sky Outgoing longwave radiation flux integrated over 16 frequancy bands (Watts/meter^2)
SurfClass_Count	16-bit integer	SurfClass (7)	Count of cases with each surface type.
IR_Precip_Est	32-bit floating point	None	Regression-based estimate of daily precipitation based on clouds and relative humidity from Level 2 IR/MW retrieval. Analogous to and forms a continuous record when used with TOVS precipitation index. (per 45 km AMSU-A FOV) (mm/day)
MWSST	32-bit floating point	None	Effective surface skin temperature from MW-Only retrieval step. BT / emis @ 23.8 GHz. (Kelvin)
MW_Emis_24GHz	32-bit floating point	None	MW emissivity @ 23.8 GHz (unitless)
MW_Emis_31GHz	32-bit floating point	None	MW emissivity @ 31.4 GHz (unitless)
MW_Emis_50GHz	32-bit floating point	None	MW emissivity @ 50.3 GHz (unitless)
MW_Emis_89GHz	32-bit floating point	None	MW emissivity @ 89.0 GHz (unitless)
SurfSkinTemp_Forecast	32-bit floating point	None	Predicted surface temperature interpolated from NOAA NCEP GFS forecast (K)
MODIS_LST	32-bit floating point	None	First guess climatology land surface temperature from MODIS averaged over MYD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AMSU FOV or 3x3 of AIRS FOVs.
MODIS_emis_10_hinge	32-bit	MODISEmis10Hinge (=	First guess emissivity from

	floating-point	10)	MODIS (MODIS_emis) expanded to 10 hinge points
Strato_CCI	32-bit floating-point	None	A Stratospheric Coarse Climate Indicator representing the weighted average of retrieved temperatures over the lower stratosphere (maximum weight near 70 hPa). The weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU4 products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Tropo_CCI	32-bit floating-point	None	A Tropospheric Coarse Climate Indicator representing the weighted average of retrieved temperatures over the lower troposphere (maximum weight near 700 hPa). The weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU2R products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Spectral_Clear_Counts	16-bit integer	SpectralClr (=5)	Counts of cases found for each value of spectral_clear_indicator

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Appendix A6. Level 3 Research Product Interface Specification

Interface Specification Version 6.0.8.0
2012-10-18

ESDT ShortNames=
"AIRX3RED", "AIRX3RE8", "AIRX3SREM",
"AIRH3RED", "AIRH3RE8", "AIRH3REM",
"AIRS3RED", "AIRS3RE8", "AIRS3REM"

DOIs =

"10.5067/AQUA/AIRS/DATA307", "10.5067/AQUA/AIRS/DATA316",
"10.5067/AQUA/AIRS/DATA325",

"10.5067/AQUA/AIRS/DATA308", "10.5067/AQUA/AIRS/DATA317",
"10.5067/AQUA/AIRS/DATA326",

"10.5067/AQUA/AIRS/DATA309", "10.5067/AQUA/AIRS/DATA318",
"10.5067/AQUA/AIRS/DATA327"

Grid Names = "location", "ascending", "descending"

Horizontal resolution= 1°x1° degree (360x180)

Upper Left Point= -180.0, 90.0

Lower Right Point= 180.0, -90.0

Projection= GCTP_GEO (Global image)

The L3 research products are similar to the L3 standard and support products but contain fields which are not validated, or are inputs or intermediary values. These products are not meant for public distribution. Because no quality control information is available for some of these fields, values from failed retrievals may be included.

Level-3 Research Product Grids

The data in the Level-3 research product is contained in 3 HDF-EOS Grids. Each grid includes datat for the entire globe in 360 x 180 grid cells each 1 x 1 degree of

latitude/longitude. Most fields appear in the 2 main grids: ascending and descending. The ascending grids collect data taken while the spacecraft is in the ascending part of its orbit. This is generally daytime, except near the poles.

Grid name	Tag	Description
location	None	Location information which is valid for all grids
ascending	_A	Information collected while the spacecraft is in the ascending part of its orbit. (Daytime data except near the poles.)
descending	_D	Information collected while the spacecraft is in the descending part of its orbit. (Nighttime data except near the poles.)

Geolocation Fields

These fields are within the location grid and document pertinent information for determining the location and characteristics of a given grid cell for all grids.

Name	Type	Extra Dimensions	Explanation
Latitude	32-bit floating-point	None	Array of 360 x 180 latitude values at the center of the grid box (Degrees).
Longitude	32-bit floating-point	None	Array of 360 x 180 longitude values at the center of the grid box (Degrees).
LandSeaMask	16-bit integer	None	Land sea mask. 1 = land, 0 = ocean. (Unitless). (Up through v5 this data was used to exclude land profiles from grid squares marked sean and vice versa. As of v6 this is not done, but the field is retained for user convenience.)
Topography	32-bit floating-point	None	Topography of the Earth in meters above the geoid. Original data source: PGS Toolkit

Attributes

These fields appear once per Level 3 file as HDF-EOS grid attributes in the location grid. They apply to the entire file.

The attributes with extra dimensions are provided in this format for backwards compatibility, but the same information is provided in identically named dimensions with associated dimension scales in the grids where these dimensions are used.

Name	Type	Extra Dimensions	Explanation
Year	32-bit integer	None	Year at start of nominal data period
Month	32-bit integer	None	Month at start of nominal data period [1,12]
Day	2-bit integer	None	Day of month at start of nominal data period [1,31]
NumOfDays	32-bit integer	None	Total number of days of input Level 2 data included in gridded maps.
AscendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), ascending.
AscendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), ascending.
DescendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), descending.
DescendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), descending.
SurfClass	32-bit integer	SurfClass (7)	Surface Classes counted in MWSurfClass_Count
ChanAMSU	32-bit integer	ChanAMSU (15)	AMSU-A Channels
RetType	32-bit integer	RetType (7)	Values of L2 retrieval_type counted in Retrieval_Type_Count
XtraPressureLay	32-bit integer	XtraPressureLay (100)	100 pressure layer for internal gas profiles
XtraPressureLev	32-bit	XtraPressureLev	100 pressure levels for

	integer	(100)	internal temperature profiles
StdPressureLev	32-bit integer	StdPressureLev (28)	28 pressure levels for standard profiles

Grid Dimensions

These dimensions appear in selected grids as needed.

Name	Grids	Size: Values	Explanation
XtraPressureLev	ascending, descending	100	Pressure levels of internal 100-level temperature profiles. hPa.
XtraPressureLay	ascending, descending	100	Pressure layers of internal 100-layer gas profiles. hPa.
SurfClass	ascending, descending	7: "coastline (Liquid water covers 50-99% of area)", "land (Liquid water covers < 50% of area)", "ocean (Liquid water covers > 99% of area)", "sea ice (High MW emissivity)", "sea ice (Low MW emissivity)", "snow (Higher-frequency MW scattering)", "glacier/snow (Very low-frequency MW scattering)", "snow (Lower-frequency MW scattering)"	Surface Classes counted in SurfClass_Count
ChanAMSU	ascending, descending	15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	AMSU-A Channels
RetType	ascending, descending	7: 0, 10, 20, 30, 40, 50, 100	Values of L2 retrieval_type counted in Retrieval_Type_Count
XDim	location, ascending, descending	360: -179.5, -178.5, … 178.5, 179.5	West to East dimension for all grids. Long_name “Longitude”. Values are mid-cell longitude.
YDim	location, ascending, descending	180: -89.5, -88.5, … 88.5, 89.5	South to North dimension for all grids. Long_name “Latitude”. Values are mid-cell latitude.

Grid Fields in Grids ascending and descending

These fields appear once per grid. Tags from the grid table are appended so that the final field names are unique across all the grids in each file. For example the field with the basename "TSurfClim" will appear as "TSurfClim_A" in the ascending grid and "TSurfClim_D" in the descending grid. The value in the main field is the mean over all observations which fell in the grid cell and passed quality control. Quantities for which Level-2 provides just one retrieved value per FOR (3x3 AIRS FOVs) are recorded for each of the 9 AIRS FOV center locations.

There are also up to 5 ancillary fields for each field:

1. _ct is a 16-bit count of the number of observations used in the calculation. It can be ratioed with TotalCounts to give a yield. It is present for all floating-point fields.
2. _sdev is a 32-bit standard deviation over the observations in this grid cell. It is present for all floating-point fields.
3. _min is the 32-bit floating-point minimum of the observations in this grid cell. It is present for all floating-point fields.
4. _max is the 32-bit floating-point maximum of the observations in this grid cell. It is present for all floating-point fields.
5. _err is the 32-bit floating-point mean of the Level-2 error estimates of the observations in this grid cell. It is present for all fields where the Level-2 product provides an error estimate.

So for example in the ascending grid the main (mean) TSurfClim field is "TSurfClim_A" and it has ancillary fields "TSurfClim_A_ct", "TSurfClim_A_sdev", "TSurfClim_A_min", "TSurfClim_A_max", and "TSurfClim_A_err".

Basename	Type	Extra Dimensions	Explanation
TotalCounts	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for yield calculations.
TAirMWOnly	32-bit floating point	XtraPressureLev (100)	Air temperature in Kelvins from startup microwave-only retrieval.
H2OCDMWOnly	32-bit floating point	XtraPressureLay (100)	Layer column water vapor from microwave-only retrieval. (molecules / cm**2)

MWSurfClass_Count	16-bit integer	SurfClass (7)	Counts of observations with each value of MWSurfClass
totCldH2OStd	32-bit floating point	None	Total cloud liquid water in kg/m**2
TSurfClim	32-bit floating point	None	Surface temperature guess from climatology in Kelvins
TSurfAirClim	32-bit floating point	None	Surface air temperature guess from climatology in Kelvins
TAirClim	32-bit floating point	XtraPressureLev (100)	Air temperature guess from climatology in Kelvins
H2OCDClim	32-bit floating point	XtraPressureLay (100)	Layer column water vapor guess from climatology (molecules / cm**2)
TAirSCCNN	32-bit floating point	XtraPressureLev (100)	Air temperature in Kelvins from SCCNN processing.
TAirCldyReg	32-bit floating point	XtraPressureLev (100)	Air temperature in Kelvins from startup cloudy regression retrieval. (not used in retrieval)
H2OCDSCCNN	32-bit floating point	XtraPressureLay (100)	Layer column water vapor from SCCNN processing. (molecules / cm**2)
H2OCDCldyReg	32-bit floating point	XtraPressureLay (100)	Layer column water vapor from cloudy regression retrieval. (not used in retrieval) (molecules / cm**2)
TSurfSCCNN	32-bit floating point	None	Surface temperature from SCCNN in Kelvins
TSurf1Ret	32-bit floating point	None	Surface temperature after regression retrieval in Kelvins (not used in retrieval)
TSurfAir1Ret	32-bit floating point	None	Surface air temperature after regression retrieval in Kelvins (not used in retrieval)
TAir1Ret	32-bit floating point	XtraPressureLev (100)	Air temperature after regression retrieval in Kelvins (not used in retrieval)
H2OCD1Ret	32-bit floating	XtraPressureLay (100)	Layer column water vapor after regression retrieval

	point		(molecules / cm**2) (not used in retrieval)
CldClearParam	32-bit floating point	None	Cloud clearing parameter Eta. Positive values are cloudier than average for the FOR, negative values are clearer. In Level-3 the mean CldClearParam of a grid square is always near zero, so the standard deviation in CldClearParam_sdev is more interesting.
Phys_resid_AMSUA	32-bit floating point	ChanAMSU (15)	Residual for AMSU-A channels after final retrieval (K)
Phys_resid_IR_window_790	32-bit floating point	None	Residual for IR window channel near 790 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_844	32-bit floating point	None	Residual for IR window channel near 844 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_917	32-bit floating point	None	Residual for IR window channel near 917 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_1231	32-bit floating point	None	Residual for IR window channel near 1231 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2513	32-bit floating point	None	Residual for IR window channel near 2513 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2616	32-bit floating point	None	Residual for IR window channel near 2616 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
CBTmOBT1231	32-bit floating point	None	End-to-end residual for window channel 1231.3 cm-1: computed cloudy brightness temperature for the retrieved atmospheric + cloud state

			minus angle-corrected observed L1B brightness temperature. (K)
CBTmOBT1231s	32-bit floating point	None	Variant of CBTmOBT1231 but using substitute surface properties if those were used in cloud retrieval (i.e. cases where cld_surf_fallback = 1) (K)
CC_noise_eff_amp_factor	32-bit floating point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit floating point	None	Equivalent of CC_noise_eff_amp_factor but from the first attempt at cloud clearing
CC1_Resid	32-bit floating point	None	Internal retrieval quality indicator -- residual between the first cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Resid	32-bit floating point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Noise_Amp	32-bit floating point	None	Internal retrieval quality indicator -- noise amplification factor from cloud clearing because of extrapolation, dimensionless. Note: the name is misleading: this is the value after the second cloud clearing iteration, not the last.
Tdiff_IR_MW_ret	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower

			atmosphere between final IR temperature retrieval and the last internal MW-only temperature determination. High values suggest problems with MW or problems with cloud clearing.
TSurfdiff_IR_4CC1	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the first cloud clearing.
TSurfdiff_IR_4CC2	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the second cloud clearing.
AMSU_Chans_Resid	16-bit integer	None	Internal retrieval quality indicator -- residual of selected AMSU channels (currently channel 5 only) against that calculated from the final IR retrieval state, K. High values suggest lower atmosphere retrieval disagrees with MW due to problems with MW or cloud clearing.
TotCld_4_CCfinal	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimated before final cloud clearing (as seen from above), dimensionless between zero and one
Surf_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of surface channels as compared to predicted uncertainty (dimensionless factor)
Temp_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of temperature channels as compared to predicted

			uncertainty (dimensionless factor)
Water_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of water channels as compared to predicted uncertainty (dimensionless factor)
Cloud_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of cloud channels as compared to predicted uncertainty (dimensionless factor)
O3_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of ozone channels as compared to predicted uncertainty (dimensionless factor)
CO_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of carbon monoxide channels as compared to predicted uncertainty (dimensionless factor)
CH4_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of methane channels as compared to predicted uncertainty (dimensionless factor)
MWCheck_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of channels used in MW check as compared to predicted uncertainty (dimensionless factor)
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (Unitless ratio); 0.33 is best possible, a 3X noise reduction; <0.8 for a very good match; <3.0 for a pretty good match; >10.0 indicates a major problem
Cloudy_Reg_Score	32-bit	None	Indicator of how well the

	floating-point		initial cloudy radiances match radiances reconstructed from cloudy eigenvectors. (Unitless ratio. should be ~1.0. >10.0 indicates a major problem)
Retrieval_Type_Count	16-bit integer	RetType (=7)	Counts of how many retrievals had each retrieval_type

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Appendix A7. Level 3 Quantized Product Interface Specification

Interface Specification Version 5.0.14
2007-05-01

ESDT ShortNames:
"AIRX3QP5", "AIRX3QPM",
"AIRH3QP5", "AIRH3QPM",
"AIRS3QP5", "AIRS3QPM"

DOIs =

"10.5067/AQUA/AIRS/DATA331", "10.5067/AQUA/AIRS/DATA322",

"10.5067/AQUA/AIRS/DATA332", "10.5067/AQUA/AIRS/DATA323",

"10.5067/AQUA/AIRS/DATA333", "10.5067/AQUA/AIRS/DATA324",

File Type: HDF-EOS Grid

Grid Name = "L3Quant"

Horizontal resolution= 5°x5° degree (72x36)

Upper Left Point= -180.0, 90.0

Lower Right Point= 180.0, -90.0

Projection= GCTP_GEO

Temporal Characteristics

The temporal resolution of the AIRS Level 3 Quant products is 5-day (pentad) and monthly (calendar). Pentads always start on the 1st, 6th, 11th, 16th, 21st, and 26th days of a month. The last pentad may contain as little as 3 days of data or as much as 6 days.

Dimensions		
Name	***Value***	***Description***
LonDim	72	Number of Longitude grid cells. 72 5-degree cells = 360 degrees. Cells are ordered West to East, from -180 to + 180.

LatDim	36	Number of Latitude grid cells. 36 5-degree cells = 180 degrees. Cells are ordered North to South. (???)
NumTrials	200	Number of different clustering attempts for each grid cell.
MaxNumClusters	100	Maximum number of clusters permitted in each grid cell. Actual number of clusters can be less. In this case, only the first NumClusters values are valid.
NumDimNorm	18	Dimensionality of clusters in normalized space.
NumDimPhysical	35	Dimensionality of clusters in physical space. (Need to list what the physical dims are here or refer to a table that does.)
NumPentad	6	Present in monthly files only – Number of pentads contributing to month. (6 5-day periods gives 30 days. For longer or shorter months the last pentad will be 3-6 Days. See TBD.)

Global Attributes		
Name	***Additional Dimensions***	***Description***
Start_year	None	Year at start of data set
Start_month	None	Month at start of data set
Start_day	None	Day at start of data set. Data starts at the beginning of this day.
Start_TAI	None	TAI93 at start of data set
End_year	None	Year at end of data set
End_month	None	Month at end of data set
End_day	None	Day at end of data set. Data runs through the end of this day.
End_TAI	None	TAI93 at end of data set
Means	NumDimPhysical	Means of Physical Parameters (T, q…)
Covariance Matrix	NumDimPhysical, NumDimPhysical	
Eigenvectors	NumDimPhysical, NumDimPhysical	
PhysicalValuesDescriptor	NumDimPhysical strings	An array of string values describing the contents of PhysicalValues. (e.g., "Temperature at 350 mb (K)")
Lambda	None	

Name	***Type***	***Units***	***Additional Dimensions***	***Description***
LatCenter	Float32	Degrees North	None	Center Latitude of 5x5 grid cell (-90.0, 90.0)
LonCenter	Float32	Degrees East	None	Center Longitude of 5x5 grid cell (-180.0, 180.0)
SouthLatBound	Float32	Degrees North	None	Minimum bounding latitude in a 5x5 degree grid cell. (-90.0, 90.0)
NorthLatBound	Float32	Degrees North	None	Maximum bounding latitude in a 5x5 degree grid cell. (-90.0, 90.0)
WestLonBound	Float32	Degrees East	None	Minimum bounding longitude in a 5x5 degree grid cell. (-180.0, 180.0)
EastLonBound	Float32	Degrees East	None	Maximum bounding longitude in a 5x5 degree grid cell. (-180.0, 180.0)

NumClusters	Int16	Number	None	Number of clusters in a 5x5 degree grid cell. Cannot exceed MaxNumClusters
NormalizedValues	Float32	Unitless	MaxNumClusters, NumDimNorm	Normalized observations averaged over each cluster
PhysicalValues	Float32	Various physical units	NumClusters, NumDimPhysical	Raw physical observations averaged over each cluster. PhysicalValuesDescription in Global Attributes gives mapping of contents to physical values (e.g., T, H2O…)
NumObsInCluster	Int16	Number	MaxNumClusters,	Number of Observations represented by this cluster
ClusterMeanSquaredError	Float32	Unitless	MaxNumClusters	
Entropy	Float32	Unitless	NumTrials	

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Appendix B. AIRS Filenames and Local Granule ID (LGID) Convention

AIRS filenames correspond to the "identifier" portion of the ECS
Local Granule ID (LGID) standard:

LGID:shortname:version:identifier

where:

":" is a colon that acts as a separator of the parts of the LGID
"LGID" is a literal string
"shortname" is the ECS ESDT shortname
"version" is the ECS ESDT version
"identifier" is detailed below

AIRS identifiers are:

AIRS.yyyy.mm.dd.[ggg|TttZ].[Lev].Instr_Prod[_H|_IR][ddd].vm.m.r.b.lvid.Ftttttttttttt.ext

Making the whole LGID:

LGID:shortname:version:AIRS.yyyy.mm.dd.[ggg|TttZ].[Lev].Instr_Prod[_H|_IR][ddd].

vm.m.r.b.lvid.Ftttttttttttt.ext

where:

AIRS is the literal string "AIRS" to identify this as
an AIRS-instrument-suite product.

yyyy.mm.dd is the year/month/day of the start of the granule.

Note: yyyy.mm.dd is the date of which T00Z is the start
for T00Z.L*.Match_RaObs and T00Z.Loc_RaObs files.

ggg is the granule number in day (001 - 240).

Note: Granule number is replaced by synoptic time for
Match_RaObs & Loc_RaObs files. It will always be one of
T00Z, T06Z, T12Z, T18Z.

Note: Granule number is omitted for daily products.

Note: The numbering system from 001 - 240 is closely
tied to the idea of 6-minute granules triggered at
precise intervals keyed to total elapsed time since start
of year 1958.

.

Lev is processing level:
"L1B", "L2", or "L3".

Note: special level "L1BMW" is used for Match_xxxx files
that have only L1B microwave information.

Note: no level is used for Loc_xxx files.

Instr is instrument name:
"AMSU" for AMSU-A
"HSB" for HSB
"VIS" for Vis channels of AIRS when there is a separate Vis product
"AIRS" for AIRS/IR *or* AIRS/IR + AIRS/Vis
Omitted for Daily & L2 products

Prod is descriptor of product:
For L1B:
"Rad" for science radiances (including MW instruments where radiances are in units of brightness temperature)
"QaSub" for QA subsets
"QaSup" for QA support products (Which are TLSCF-only.)
"CalSub" for Calibration subsets
For L2:
"CC" for cloud-cleared AIRS radiances
"RetStd" for standard retrieval product
"RetSup" for support retrieval product
“CO2” for internal CO2 text products
“CO2_Std” for standard CO2 HDF products
“CO2_Sup” for support CO2 HDF products
For L3:
"RetStd" for standard L3 retrieval products
"RetSup" for support L3 retrieval products
"RetRes" for research L3 retrieval products
"RetQuantMom" for quantization L3 retrieval monthly global moments products (v5.0)
"RetQuant" for quantization L3 retrieval products (v5.0)
Files that can be L1B, L1BMW, or L2:
"Match_xxxx" for Truth matchup file
where xxxx is a truth type descriptor:
"RaObs" for Radiosonde (PREPQCH)
"Dynam_yyy" for dynamic sets of locations
"Fixed_yyy" for fixed sets of locations
Files with no associated level:
"Loc_xxxx" for Truth location file
where xxxx is as for Match_xxxx
_H is appended to Level-2 and later files where data from HSB has been used in the processing. When the _H is missing the product contains data from AIRS IR, AMSU-A, and maybe AIRS V/NIR, but not HSB. The "H" is present for all files with shortname starting with "AIRH2" or "AIRH3".
_IR is appended to Level-2 and later files where no data from HSB or AMSU been used in the processing. The "_IR" is present for all files with shortname starting with "AIRS2" or "AIRS3".
ddd is used only for L3 and is the number of days covered by that L3 product. Generally 001, 008, 028, 029, 030, 031 for L3.RetStd files; 001, 005, 028, 029, 030, 031 for L3.RetQuant files.
c is a single-character source version code, present only

for Loc_xxx and Match_xxx files

vm.m.r.b is the PGEVersion uniquely identifying a configuration of source code + static ancillary files. "v" is the literal character 'v'. It is followed by four numbers separated by three "."s. These are the major & minor version numbers, a release number, and a build number. Example: "v5.0.14.0" is the official (.0) build of release 9 of version 4.0.

lvid is the LocalVersionID. This field is optional and usually absent.

Note: LocalVersionID is not usually included in the file name/LGID when the processing facility is "A" or "G".

F is processing facility ID:

"N" for NOAA NESDIS Near-Real Time (NRT) system
"R" for NASA GSFC GES DISC Near-Real Time (NRT) system
"G" for NASA GSFC GES DISC official archival system
"A" for NASA JPL AIRS TLSCF official processing
"T" for NASA JPL AIRS TLSCF system testing
"S" for NASA JPL AIRS TLSCF simulation products
"D" for any direct broadcast station
"X" for anything else

tttttttttt is AIRS run tag (00000000000 - 99999999999). This field is designed to ensure LocalGranuleIDs are unique, even when the same software is used to reprocess the same data. It is local processing time as yyyydoyhhmmss. (year, doy-of-year (julian day), hour, minute, second).

Note: this corresponds to PSA AIRSRunTag.

ext is the filetype extension:

".hdf" for all HDF products (including HDF-EOS)
".txt" for all text products

Note: when optional fields are absent only one "." appears, never two in a row. Trailing "."s are also omitted.

Here's a full set (one of each type) with shortnames.
Items in parentheses are not produced at Goddard Earth Sciences DISC.

Produced by Level-1B PGEs:

AIRS.2001.12.03.131.L1B.AMSU_Rad.v5.0.14.0.G2002123120634.hdf	AIRABRAD
(AIRS.2001.12.03.131.L1B.AMSU_QaSup.v5.0.14.0.G2002123120634.hdf	AIRABQAP)
AIRS.2001.12.03.131.L1B.HSB_Rad.v5.0.14.0.G2002123120634.hdf	AIRHBRAD
(AIRS.2001.12.03.131.L1B.HSB_QaSup.v5.0.14.0.G2002123120634.hdf	AIRHBQAP)
AIRS.2001.12.03.131.L1B.AIRS_Rad.v5.0.14.0.G2002123120634.hdf	AIRIBRAD
AIRS.2001.12.03.131.L1B.AIRS_QaSub.v5.0.14.0.G2002123120634.hdf	AIRIBQAP
AIRS.2001.12.03.131.L1B.VIS_Rad.v5.0.14.0.G2002123120634.hdf	AIRVBRAD
AIRS.2001.12.03.131.L1B.VIS_QaSub.v5.0.14.0.G2002123120634.hdf	AIRVBQAP

Produced by Level-1C PGE:

AIRS.2001.12.03.131.L1C.AIRS_Rad.v6.1.0.0.G2002123120634.hdf	AIRICRAD

Produced by Level-1B Calibration Subset PGE:

AIRS.2001.12.03.L1B.CalSub.v5.0.14.0.G2002123120634.hdf	AIRXBCAL

Produced by Level-2 Retrieval PGE:

AIRS.2001.12.03.131.L2.RetStd.v5.0.14.0.G2002123120634.hdf	AIRX2RET
AIRS.2001.12.03.131.L2.RetStd_H.v5.0.14.0.G2002123120634.hdf	AIRH2RET
AIRS.2001.12.03.131.L2.RetStd_IR.v5.0.14.0.G2002123120634.hdf	AIRS2RET
AIRS.2001.12.03.131.L2.RetSup.v5.0.14.0.G2002123120634.hdf	AIRX2SUP
AIRS.2001.12.03.131.L2.RetSup_H.v5.0.14.0.G2002123120634.hdf	AIRH2SUP
AIRS.2001.12.03.131.L2.RetSup_IR.v5.0.14.0.G2002123120634.hdf	AIRS2SUP
AIRS.2001.12.03.131.L2.CC.v5.0.14.0.G2002123120634.hdf	AIRI2CCF
AIRS.2001.12.03.131.L2.CC_H.v5.0.14.0.G2002123120634.hdf	AIRH2CCF
AIRS.2001.12.03.131.L2.CC_IR.v5.0.14.0.G2002123120634.hdf	AIRS2CCF

Produced by the Level-2 CO2 PGE:

AIRS.2002.09.06.120.L2.CO2.v6.0.8.0.PGE_Verify.T12292193121.txt	AIRX2CO2
AIRS.2002.09.06.120.L2.CO2_H.v6.0.8.0.PGE_Verify.T12292193121.txt	AIRH2CO2
AIRS.2002.09.06.120.L2.CO2._IRv6.0.8.0.PGE_Verify.T12292193121.txt	AIRS2CO2
AIRS.2002.09.06.120.L2.CO2_Sup.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRX2SPC
AIRS.2002.09.06.120.L2.CO2_Sup_H.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRH2SPC
AIRS.2002.09.06.120.L2.CO2_Sup_IR.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRS2SPC
AIRS.2002.09.06.120.L2.CO2_Std.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRX2STC
AIRS.2002.09.06.120.L2.CO2_Std_H.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRH2STC
AIRS.2002.09.06.120.L2.CO2_Std_IR.v6.0.8.0.PGE_Verify.T12292193525.hdf	AIRS2STC

Produced by L3 Daily PGEs:

AIRS.2001.12.03.L3.RetStd001.v5.0.14.0.G2002123120634.hdf	AIRX3STD
AIRS.2001.12.03.L3.RetStd_H001.v5.0.14.0.G2002123120634.hdf	AIRH3STD
AIRS.2001.12.03.L3.RetStd_IR001.v5.0.14.0.G2002123120634.hdf	AIRS3STD
AIRS.2001.12.03.L3.RetSup001.v5.0.14.0.G2002123120634.hdf	AIRX3SPD
AIRS.2001.12.03.L3.RetSup_H001.v5.0.14.0.G2002123120634.hdf	AIRH3SPD
AIRS.2001.12.03.L3.RetSup_IR001.v5.0.14.0.G2002123120634.hdf	AIRS3SPD
AIRS.2001.12.03.L3.RetRes001.v5.0.14.0.G2002123120634.hdf	AIRX3RED
AIRS.2001.12.03.L3.RetRes_H001.v5.0.14.0.G2002123120634.hdf	AIRH3RED
AIRS.2001.12.03.L3.RetRes_IR001.v5.0.14.0.G2002123120634.hdf	AIRS3RED

Produced by L3 Multiday PGEs:

AIRS.2001.12.03.L3.RetStd008.v5.0.14.0.G2002123120634.hdf	AIRX3ST8
AIRS.2001.12.03.L3.RetStd_H008.v5.0.14.0.G2002123120634.hdf	AIRH3ST8
AIRS.2001.12.03.L3.RetStd_IR008.v5.0.14.0.G2002123120634.hdf	AIRS3ST8
AIRS.2001.12.03.L3.RetSup008.v5.0.14.0.G2002123120634.hdf	AIRX3SP8
AIRS.2001.12.03.L3.RetSup_H008.v5.0.14.0.G2002123120634.hdf	AIRH3SP8
AIRS.2001.12.03.L3.RetSup_IR008.v5.0.14.0.G2002123120634.hdf	AIRS3SP8
AIRS.2001.12.03.L3.RetRes008.v5.0.14.0.G2002123120634.hdf	AIRX3RE8
AIRS.2001.12.03.L3.RetRes_H008.v5.0.14.0.G2002123120634.hdf	AIRH3RE8
AIRS.2001.12.03.L3.RetRes_IR008.v5.0.14.0.G2002123120634.hdf	AIRS3RE8
AIRS.2001.12.06.L3.RetQuant005.v5.0.14.0.G2002123120634.hdf	AIRX3QP5
AIRS.2001.12.06.L3.RetQuant_H005.v5.0.14.0.G2002123120634.hdf	AIRH3QP5
AIRS.2001.12.06.L3.RetQuant_IR005.v5.0.14.0.G2002123120634.hdf	AIRS3QP5
AIRS.2001.12.01.L3.RetQuantMom005.v5.0.14.0.G2002123120634.txt	AIRX3QM5
AIRS.2001.12.01.L3.RetQuantMom_H005.v5.0.14.0.G2002123120634.txt	AIRH3QM5
AIRS.2001.12.01.L3.RetQuantMom_IR005.v5.0.14.0.G2002123120634.txt	AIRS3QM5

Produced by L3 Monthly PGEs:

AIRS.2001.12.01.L3.RetStd031.v5.0.14.0.G2002123120634.hdf	AIRX3STM
AIRS.2001.12.01.L3.RetStd_H031.v5.0.14.0.G2002123120634.hdf	AIRH3STM

AIRS.2001.12.01.L3.RetStd_IR031.v5.0.14.0.G2002123120634.hdf AIRS3STM
AIRS.2001.12.01.L3.RetSup031.v5.0.14.0.G2002123120634.hdf AIRX3SPM
AIRS.2001.12.01.L3.RetSup_H031.v5.0.14.0.G2002123120634.hdf AIRH3SPM
AIRS.2001.12.01.L3.RetSup_IR031.v5.0.14.0.G2002123120634.hdf AIRS3SPM
AIRS.2001.12.01.L3.RetRes031.v5.0.14.0.G2002123120634.hdf AIRX3REM
AIRS.2001.12.01.L3.RetRes_H031.v5.0.14.0.G2002123120634.hdf AIRH3REM
AIRS.2001.12.01.L3.RetRes_IR031.v5.0.14.0.G2002123120634.hdf AIRS3REM
AIRS.2001.12.01.L3.RetQuant031.v5.0.14.0.G2002123120634.hdf AIRX3QPM
AIRS.2001.12.01.L3.RetQuant_H031.v5.0.14.0.G2002123120634.hdf AIRH3QPM
AIRS.2001.12.01.L3.RetQuant_IR031.v5.0.14.0.G2002123120634.hdf AIRS3QPM

Truth location files:
AIRS.2001.12.03.T12Z.Loc_RaObs.a.v5.0.14.0.G2002123120634.txt AIRX2LOC

Produced by Match Truth & Level-2 matchup Truth PGEs:
AIRS.2001.12.03.T12Z.L2.Match_RaObs.a.v5.0.14.0.G2002123120634.hdf AIRX2MAT
AIRS.2001.12.03.T12Z.L2.Match_RaObs_H.a.v5.0.14.0.G2002123120634.hdf AIRH2MAT
AIRS.2001.12.03.T12Z.L2.Match_RaObs_IR.a.v5.0.14.0.G2002123120634.hdf AIRS2MAT
AIRS.2001.12.03.T12Z.L1B.Match_RaObs.a.v5.0.14.0.G2002123120634.hdf AIRX2MAT
(AIRS.2001.12.03.T12Z.L1BMW.Match_RaObs.a.v5.0.14.0.G2002123120634.hdf AIRX2MAT)
AIRS.2001.12.03.L2.Match_Fixed_ACAR.a.v5.0.14.0.G2002123120634.hdf AIRX2MTL
AIRS.2001.12.03.L2.Match_Fixed_ACAR_H.a.v5.0.14.0.G2002123120634.hdf AIRH2MTL
AIRS.2001.12.03.L2.Match_Fixed_ACAR_IR.a.v5.0.14.0.G2002123120634.hdf AIRS2MTL

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Appendix C-1. AIRS Products

ESDT Short Names	Sample File Name (Local Granule ID)	PCF LIDs	DOI	Instrument	Usage	File Size Per Granule (MB)	Files Per Day	Daily Rate (MB per Day per stream)	Description
AIRHBRAD	AIRS.2002.09.06.001.L1B.HSB_Rad.v5.0.14.0.G02108051208.hdf	6302 6312 7212		HSB	L1B Product Output, L2, Match-up PGE Input	1.8	240	421	HSB L1B Radiances-HDF: HSB geolocated & calibrated brightness temp. in Kelvin
AIRHBQAP	AIRS.2002.09.06.001.L1B.HSB_QaSup.v5.0.14.0.G02108051208.hdf	7252		HSB	L1B Optional Product Output	2.2	240	511	HSB QA Support Product for debugging
AIRABRAD	AIRS.2002.09.06.001.L1B.AMSU_Rad.v5.0.14.0.G02108050637.hdf	6300 6310 7210		AMSU-A	L1B Product Output, L2, Match-up PGE Input	0.6	240	144	AMSU-A L1B Radiances-HDF: AMSU-A1 & AMSU-A2 combined, geolocated & calibrated brightness temp. in Kelvin
AIRABQAP	AIRS.2002.09.06.001.L1B.AMSU_QaSup.v5.0.14.0.G02108050637.hdf	7250		AMSU-A	L1B Optional Product Output	0.8	240	204	AMSU QA Support Product for debugging

AIRIBRAD	AIRS.2002.09.06.001.L1B.AIRS_Rad.v5.0.14.0.G02108054232.hdf	7211		AIRS	L1B Product Output, L2, Match-up PGE Input	60	240	13800	AIRS L1B Radiances-HDF: AIRS IR Geolocated Radiances in Watts/cm**2/micron/steradian
AIRICRAD	AIRS.2002.09.06.001.L1C.AIRS_Rad.v60.1.0.G02108054232.hdf	7511	10.5067/AQUA/AIRS/ DATA101	AIRS	L1C Product Output	60	240	13800	AIRS L1C Radiances-HDF: AIRS IR Geolocated Radiances in Watts/cm**2/micron/steradian
AIRIBQAP	AIRS.2002.09.06.001.L1B.AIRS_QaSub.v5.0.14.0.G02108054232.hdf	7251		AIRS	AIRS L1B QA Product Output	2.5	240	602	AIRS L1B QA Product Output
AIRVBRAD	AIRS.2002.09.06.001.L1B.VIS_Rad.v5.0.14.0.G02108053937.hdf	7213		AIRS	L1B Product Output, L2, match-up PGE Input	5-15	240	1900	VIS L1B Radiances-HDF: VIS Geolocated Radiances in Watts/cm**2/micron/steradian
AIRVBQAP	AIRS.2002.09.06.001.L1B.VIS_QaSub.v5.0.14.0.G02108053937.hdf	7253		AIRS	VIS L1B QA Product Output	1.1	240	275	VIS L1B QA Product Output
AIRXBCAL	AIRS.2002.09.06.L1B.Cal_Subset.v5.0.14.0.G02108055444.hdf	7401		AIRS-Suite	Cal Subset PGE Output	242	1	242	Calibration Subset of L1B AIRS, Vis, and AMSU-A
AIRX2RET AIRS2RET AIRH2RET	AIRS.2002.09.06.001.L2.RetStd.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.RetStd_IR.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.RetStd_H.v5.0.14.0.G02108055444.hdf	7300	10.5067/AQUA/AIRS/ DATA201 10.5067/AQUA/AIRS/ DATA202 10.5067/AQUA/AIRS/ DATA203	AIRS-Suite	L2 Product Output, Match-up, L3 PGE Input	3.8	240	911	AIRS L2 Standard Retrieval Product

AIRI2CCF AIRH2CCF AIRS2CCF	AIRS.2002.09.06.001.L2.CC.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CC_IR.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CC_H.v5.0.14.0.G02108055444.hdf	7301	10.5067/AQUA/AIRS/DATA204 10.5067/AQUA/AIRS/DATA205 10.5067/AQUA/AIRS/DATA206	AIRS-Suite	L2 Product Output, Match-up PGE Input	14	240	3300	AIRS L2 Cloud-Cleared Radiance Product
AIRX2SUP AIRS2SUP AIRH2SUP	AIRS.2002.09.06.001.L2.RetSup.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.RetSup_IR.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.RetSup_H.v5.0.14.0.G02108055444.hdf	7302	10.5067/AQUA/AIRS/DATA207 10.5067/AQUA/AIRS/DATA208 10.5067/AQUA/AIRS/DATA209	AIRS-Suite	L2 Product Output, Match-up PGE Input	22	240	5000	AIRS L2 Support Product
AIRX2CO2 AIRS2CO2 AIRH2CO2	AIRS.2002.09.06.001.L2.CO2.v5.0.14.0.G02108055444.txt AIRS.2002.09.06.001.L2.CO2_IR.v5.0.14.0.G02108055444.txt AIRS.2002.09.06.001.L2.CO2_H.v5.0.14.0.G02108055444.txt	7304		AIRS-Suite	L2 CO2 Product Output	0.3	240	105	AIRS L2 CO2 Product
AIRX2STC AIRS2STC AIRH2STC	AIRS.2002.09.06.001.L2.CO2_Std.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CO2_Std_IR.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CO2_Std_H.v5.0.14.0.G02108055444.hdf	7305	10.5067/AQUA/AIRS/DATA211 10.5067/AQUA/AIRS/DATA213 10.5067/AQUA/AIRS/DATA215	AIRS-Suite	L2 CO2 Product Output, L3 CO2 Input	0.3	240	105	AIRS L2 Standard CO2 Product
AIRX2SPC AIRS2SPC AIRH2SPC	AIRS.2002.09.06.001.L2.CO2_Sup.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CO2_Sup_IR.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.001.L2.CO2_Sup_H.v5.0.14.0.G02108055444.hdf	7306	10.5067/AQUA/AIRS/DATA212 10.5067/AQUA/AIRS/DATA214 10.5067/AQUA/AIRS/DATA216	AIRS-Suite	L2 CO2 Product Output, L3 CO2 Input	0.3	240	105	AIRS L2 Support CO2 Product
AIRX2LOC	AIRS.2002.09.06.T18Z.Loc_RaOb.a.v5.0.14.0.G02108055444.txt	7402		N/A	RaObs match-up PGE Temporary File	Varies	4	0.5	Truth Location File
AIRX2MAT AIRH2MAT AIRS2MAT	AIRS.2002.09.06.T18Z.L2.Match_RaOb.a.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.T18Z.L2.Match_RaOb_H.a.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.T18Z.L2.Match_RaOb_IR.a.v5.0.14.0.G02108055444.hdf	7401	10.5067/AQUA/AIRS/DATA217 10.5067/AQUA/AIRS/DATA218 10.5067/AQUA/AIRS/DATA219	AIRS-Suite	RaObs Match-up PGE Output	Varies	4	500	Match-ups of radiances, retrievals, and radiosondes - runs 4 times per day in overlapping runs

AIRX2MTL AIRH2MTL AIRS2MTL	AIRS.2002.09.06.L1B.Match_Fixed_Dobson.a.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.L1B.Match_Fixed_Dobson_H.a.v5.0.14.0.G02108055444.hdf AIRS.2002.09.06.L1B.Match_Fixed_Dobson_S.a.v5.0.14.0.G02108055444.hdf	7401	10.5067/AQUA/AIRS/DATA220 10.5067/AQUA/AIRS/DATA221 10.5067/AQUA/AIRS/DATA222	AIRS-Suite	Fixed location match-up PGE Output	Varies	7	800	Match-ups of radiances & retrievals to fixed validation sites
AIRX3STD AIRH3STD AIRS3STD	AIRS.2002.09.06.L3.RetStd001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetStd_IR001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetStd_H001.v5.0.14.0.G05031160923.hdf	7340	10.5067/AQUA/AIRS/DATA301 10.5067/AQUA/AIRS/DATA302 10.5067/AQUA/AIRS/DATA303	AIRS-Suite	Std L3 1-day PGE Output, Std L3 8-day and monthly PGE input	400	1	400	L3 Standard Daily Product
AIRX3SPD AIRH3SPD AIRS3SPD	AIRS.2002.09.06.L3.RetSup001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetSup_H001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetSup_IR001.v5.0.14.0.G05031160923.hdf	7340	10.5067/AQUA/AIRS/DATA304 10.5067/AQUA/AIRS/DATA305 10.5067/AQUA/AIRS/DATA306	AIRS-Suite	Sup L3 1-day PGE Output, Sup L3 8-day and monthly PGE input	500	1	500	L3 Support Daily Product
AIRX3RED AIRH3RED AIRS3RED	AIRS.2002.09.06.L3.RetRes001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetRes_H001.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetRes_IR001.v5.0.14.0.G05031160923.hdf	7340	10.5067/AQUA/AIRS/DATA307 10.5067/AQUA/AIRS/DATA308 10.5067/AQUA/AIRS/DATA309	AIRS-Suite	Research L3 1-day PGE Output, Research L3 8-day and monthly PGE input	800	1	800	L3 Research Daily Product
AIRX3ST8 AIRH3ST8 AIRS3ST8	AIRS.2002.09.06.L3.RetStd008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetStd_H008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetStd_IR008.v5.0.14.0.G05031160923.hdf	7341	10.5067/AQUA/AIRS/DATA310 10.5067/AQUA/AIRS/DATA311 10.5067/AQUA/AIRS/DATA312	AIRS-Suite	Std L3 8-day PGE Output	470	1/8	58	L3 Standard Multiday (8-day) Product
AIRX3SP8 AIRH3SP8 AIRS3SP8	AIRS.2002.09.06.L3.RetSup008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetSup_H008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetSup_IR008.v5.0.14.0.G05031160923.hdf	7341	10.5067/AQUA/AIRS/DATA313 10.5067/AQUA/AIRS/DATA314 10.5067/AQUA/AIRS/DATA315	AIRS-Suite	Support L3 8-day PGE Output	580	1/8	72	L3 Support Multiday (8-day) Product

AIRX3RE8 AIRS3RE8 AIRH3RE8	AIRS.2002.09.06.L3.RetRes008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetRes_H008.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetRes_IR008.v5.0.14.0.G05031160923.hdf	7341	10.5067/AQUA/AIRS/DATA316 10.5067/AQUA/AIRS/DATA317 10.5067/AQUA/AIRS/DATA318	AIRS-Suite	Research L3 8-day PGE Output	945	1/8	118	L3 Research Multiday (8-day) Product
AIRX3STM AIRH3STM AIRS3STM	AIRS.2002.09.01.L3.RetStd030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetStd_H030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetStd_IR030.v5.0.14.0.G05031160923.hdf	7343	10.5067/AQUA/AIRS/DATA319 10.5067/AQUA/AIRS/DATA320 10.5067/AQUA/AIRS/DATA321	AIRS-Suite	Std L3 monthly PGE Output	470	1/30	16	L3 Standard Monthly Product
AIRX3SPM AIRH3SPM AIRS3SPM	AIRS.2002.09.01.L3.RetSup030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetSup_H030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetSup_IR030.v5.0.14.0.G05031160923.hdf	7343	10.5067/AQUA/AIRS/DATA322 10.5067/AQUA/AIRS/DATA323 10.5067/AQUA/AIRS/DATA324	AIRS-Suite	Sup L3 monthly PGE Output	580	1/30	19	L3 Support Monthly Product
AIRX3REM AIRH3REM AIRS3REM	AIRS.2002.09.01.L3.RetRes030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetRes_H030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetRes_IR030.v5.0.14.0.G05031160923.hdf	7343	10.5067/AQUA/AIRS/DATA325 10.5067/AQUA/AIRS/DATA326 10.5067/AQUA/AIRS/DATA327	AIRS-Suite	Research L3 monthly PGE Output	945	1/30	32	L3 Research Monthly Product
AIRX3QP5 AIRH3QP5 AIRS3QP5	AIRS.2002.09.06.L3.RetQuant005.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetQuant_H005.v5.0.14.0.G05031160923.hdf AIRS.2002.09.06.L3.RetQuant_IR005.v5.0.14.0.G05031160923.hdf	7344	10.5067/AQUA/AIRS/DATA331 10.5067/AQUA/AIRS/DATA332 10.5067/AQUA/AIRS/DATA333	AIRS-Suite	L3 Quant pentad PGE Output, L3 Quant monthly PGE input	42	1/5	0.8	L3 Quantized Pentad (5-day) Product
AIRX3QM5 AIRH3QM5 AIRS3QM5	AIRS.2002.09.06.L3.RetQuantMom005.v5.0.14.0.G05031160923.txt AIRS.2002.09.06.L3.RetQuantMom_H005.v5.0.14.0.G05031160923.txt AIRS.2002.09.06.L3.RetQuantMom_IR005.v5.0.14.0.G05031160923.txt	7348	10.5067/AQUA/AIRS/DATA334 10.5067/AQUA/AIRS/DATA335 10.5067/AQUA/AIRS/DATA336	AIRS-Suite	L3 Quant pentad PGE Output	0.2	1/5	0.04	L3 Quantized Pentad (5-day) Moments

AIRX3QPM AIRH3QPM AIRS3QPM	AIRS.2002.09.01.L3.RetQuant030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetQuant_H030.v5.0.14.0.G05031160923.hdf AIRS.2002.09.01.L3.RetQuant_IR030.v5.0.14.0.G05031160923.hdf	7346	10.5067/AQUA/AIRS/DATA328 10.5067/AQUA/AIRS/DATA329 10.5067/AQUA/AIRS/DATA330	AIRS-Suite	L3 Quant monthly PGE Output	5	1/30	0.2	L3 Quantized Monthly Product

Appendix C-2. AIRS Dynamic Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	Daily Rate (MB per Day)	Description
AVI3_ANH	gblav.1998-09-12.T18Z.PGrbF03.hdf	2203, 2213, 2223, 2233 & 2243		L2 Dynamic Ancillary Input	328.	GFS forecast from model; 2203, 2213, 2223, 2233 & 2243: 3-hour forecast for 18Z-hour, 00Z-hour, 06Z-hour, 12Z-hour, 18Z-hour, respectively, cycle time on day prior to day in which granule starts
AVI6_ANH	gblav.1998-09-12.T18Z.PGrbF06.hdf	2206, 2216, 2226, 2236 & 2246		L2 Dynamic Ancillary Input	328.	GFS forecast from model; 2206, 2216, 2226, 2236 & 2246: 6-hour forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
AVI9_ANH	gblav.1998-09-12.T18Z.PGrbF09.hdf	2209, 2219, 2229, 2239 & 2249		L2 Dynamic Ancillary Input	328.	GFS forecast from model; 2209, 2219, 2229, 2239 & 2249: 9-hour forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively

AVI3_AN	gblav.1998-09-12.T18Z.PGrbF03	2253, 2263, 2273, 2283 & 2293		L2 Dynamic Ancillary Input	104.	GFS forecast from model; 2203, 2213, 2223, 2233 & 2243: 3-hour forecast for 18Z-hour, 00Z-hour, 06Z-hour, 12Z-hour, 18Z-hour, respectively, cycle time on day prior to day in which granule starts
AVI6_AN	gblav.1998-09-12.T18Z.PGrbF06	2256, 2266, 2276, 2286 & 2296		L2 Dynamic Ancillary Input	104.	GFS forecast from model; 2206, 2216, 2226, 2236 & 2246: 6-hour forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
AVI9_AN	gblav.1998-09-12.T18Z.PGrbF09	2259, 2269, 2279, 2289 & 2299		L2 Dynamic Ancillary Input	104.	GFS forecast from model; 2209, 2219, 2229, 2239 & 2249: 9-hour forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
PREPQCH	L2.gdas1.980913.T00Z.BufPREPda.anc	6400	RaObs	RaObs PGE Dynamic Ancillary Input	12.0	NOAA Radiosonde Observations

Appendix C-3. AIRS Static Ancillary Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	File Size (MB)	Description
AIRHBPAR	L1B.HSB_AncMain.v2.0.0.anc	3601	HSB	L1B Ancillary Input	0.01	HSB calibration parameters
AIRHBSLC	L1B.HSB_SLCorr.v1.0.0.anc	3602	HSB	L1B Ancillary Input	0.03	HSB sidelobe correction matrices
AIRHBSLI	L1B.HSB_SLInterp.v2.0.0.anc	3604	HSB	L1B Ancillary Input	0.01	HSB cold sidelobe interpolation arrays
AIRABPAR	L1B.AMSU_AncMain.v2.0.0.anc	3501	AMSU-A	L1B Ancillary Input	0.01	AMSU-A calibration parameters
AIRABSLC	L1B.AMSU_SLCorr.v1.0.0.anc	3502	AMSU-A	L1B Ancillary Input	0.04	AMSU-A sidelobe correction matrices
AIRABSLI	L1B.AMSU_SLInterp.v2.0.0.anc	3504	AMSU-A	L1B Ancillary Input	0.04	AMSU-A cold sidelobe interpolation arrays
AIRXBPAR	L1B.config_file1.v1.2.0.anc	3005	AIRS	L1B Ancillary Input	0.06	L1B Calibration parameters
AIRIBFRQ	L1B.airs_freq.v1.0.0.anc	3006	AIRS	L1B Ancillary Input	0.02	AIRS frequency list

Appendix C-3. AIRS Static Ancillary Inputs

AIRIBFPM	L1B.airs_focal_plane_map.v1.1.0.anc	3007	AIRS	L1B Ancillary Input	0.001	AIRS focal plane map
AIRIBSFF	L1B.spectral_feature.v1.2.0.anc	3010	AIRS	L1B Ancillary Input	0.17	AIRS spectral features
AIRIBNLC	L1B.non_linear_corr.v1.1.0.anc	3011	AIRS	L1B Ancillary Input	0.09	AIRS Non-linearity correction coefficients
AIRIBPOL	L1B.polarization_corr.v1.1.0.anc	3012	AIRS	L1B Ancillary Input	0.04	AIRS polarization correction coefficients
AIRIBQPR	L1B.airs_qa.v1.3.0.anc	3015	AIRS	L1B Ancillary Input	0.3	AIRS QA parameters
AIRVBCPR	L1B.vis_param.v1.0.0.anc	3009	AIRS	L1B Ancillary Input	0.003	VIS calibration parameters
AIRVBQPR	L1B.vis_qa.v1.1.0.anc	3016	AIRS	L1B Ancillary Input	0.01	VIS QA parameters
AIRI2TMC	L2b.trcoef.airs.v5.1.0.anc	2001	AIRS	L2 Ancillary Input	36.9	AIRS IR Channel Transmittances
AIRICREC	L1C.airs_clean_param.v2.1.0.anc	3200	AIRS	L1C, L2 Ancillary Input	0.0004	Parameters for L1C cleaning of bad channels
AIRIBFPM	L1C.airs_model_shift.2002.08.30.v1.0.1.anc	3018	AIRS	L1C, L2 Ancillary Input	0.4	Model of L1C spectral shifting

AIRICPCA	L1C.airs_pca.v2.2.0.anc	3202	AIRS	L1C, L2 Ancillary Input	19	PCA coefs
AIRICREC	L1C.airs_replace_stat.v1.0.0.anc	3201	AIRS	L1C, L2 Ancillary Input	217	Stats for replacing bad channels
AIRICRSM	L1C.airs_resample.v1.0.0.anc	3203	AIRS	L1C, L2 Ancillary Input	.08	Resampling ccoefs
AIRA2TMC	L2.trcoef.amsu.v3.0.0.anc	2002	AMSU-A	L2 Ancillary Input	0.13	AMSU-A Transmittances
AIRH2TMC	L2.trcoef.hsb.v3.0.0.anc	2003	HSB	L2 Ancillary Input	0.05	HSB Transmittances
AIRX2CLI	L2.uars_clim.v1.0.1.anc	2005	AIRS-suite	L2 Ancillary Input	1.2	Climatology to set initial guess profiles
AIRX2AAC	L2h.angle_adj_coef.v2.1.4.anc	2006	AIRS	L2 Ancillary Input	40.9	Angle Correction Coefficients
AIRX2AEI	L2.F.error_est.v1.0.0.anc	2007	AIRS-suite	L2 Ancillary Input	0.01	Ancillary error estimate inputs
AIRX2ABT	L2h.brtemp_tuning_coef.v2.0.0.anc	2008	AIRS	L2 Ancillary Input	29.4	BRTemp Tuning Coefficients
AIRI2SRD	L2.airs_solar_rad.v5.1.0.anc	2009	AIRS	L2 Ancillary Input	0.06	Solar radiances

AIRX2CAV	L2.cloud_avg.v2.0.0.anc	2010	AIRS	L2 Ancillary Input	0.24	Parameters determining channel averaging vs. extrapolation
AIRM2MEC	L2.M.ecof_705.v1.0.0.anc	2011	AMSU + HSB	L2 Ancillary Input	0.004	MW emissivity coefficients
AIRM2MCM	L2.M.cov100av.v1.0.0.anc	2012	AMSU + HSB	L2 Ancillary Input	0.22	MW temperature profile covariance matrix
AIRH2AAW	L2.M.weight.hsb.v1.0.0.anc	2013	HSB	L2 Ancillary Input	0.003	HSB ASCII Weight
AIRI2CHP	L2.I.channel_prop.v5.1.2.anc	2014	AIRS	L1B AIRS & L2 Ancillary Input	0.21	AIRS Channel properties
AIRI2OLR	L2h.F.coef_olr.v1.0.0.anc	2015	AIRS	L2 Ancillary Input	0.06	Outgoing longwave radiation coefficients
AIRX2MAS	L2.masuda.v1.0.0.anc	2016	AIRS suite	L2 Ancillary Input	0.06	Coefficients for Masuda model of ocean emissivities
AIRI2FRQ	L2.I.clr.regcoef.v1.0.1.anc	2056 & 2057	AIRS	L2 Ancillary Input	1.1	Clear sky detection regression coefficients
AIRI2FEV	L2.I.eigvec_allang.solang.nf.v2.0.0.anc	2041 & 2042	AIRS	L2 Ancillary Input	6.6	FIRST retrieval first guess matrix of eigenvectors for nighttime footprints
AIRI2FRD	L2.I.rcoef.solang.v2.0.0.anc	2043 & 2044	AIRS	L2 Ancillary Input	0.6	FIRST first guess principal component mode regression coeff daytime footprints

AIRI2IFC	L2.I.freq.eigvec.v2.0.0.anc	2045	AIRS	L2 Ancillary Input	0.02	FIRST retrieval first guess eigenvectors AIRS channels list
AIRX2ANG	L2.I.ang_pc.v2.0.0.anc	2046	AIRS	L2 Ancillary Input	7.9	Principal components for angle adjustment
AIRX2ITC	L2.I.freq.tmp.ret.v2.0.0.anc	2052	AIRS & AMSU-A	L2 Ancillary Input	0.001	FIRST retrieval temperature channel list for AIRS and AMSU-A
AIRX2IWC	L2.I.freq.h2o.ret.v2.0.0.anc	2053	AIRS & HSB	L2 Ancillary Input	0.001	FIRST retrieval water channel list for AIRS and HSB
AIRX2NLD	L2_DEFAULTS100.v2.0.4.anc	2061	AIRS-Suite	L2 Ancillary Input	0.01	Namelist giving default values for L2 parameters
AIRV2PRM	L2.vis_nir.v2.0.0.anc	2065	AIRS	L2 Ancillary Input	0.001	V/NIR parameters
AIRVBVIM	AVHRR_NDVI_Apr11to20_1993.v1.1.0.anc	2301-2312	AIRS	L2 Ancillary Input	700	Static monthly mean multiday surface visible maps, for use when no dynamic AIRVBVIM available
AIRX3LND	L3h.land_sea_mask_1x1.v1.0.0.anc	2090	AIRS-Suite	L3 ancillary input	1	Land/sea mask 1 degree square lat/lon
AIRX3STM	AIRS.2005.01.01.L3.RetStd031.v5.6.5.13.2008_All.X10258093244.hdf	2501-2512 2521-2532 2581-2592	AIRS-Suite	L2 Ancillary Input	38	Climatology (Standard levels)

AIRX3SPM	AIRS.2005.01.01.L3.RetSup031.v5.6.5.14.2008_Sea.X10258144453.hdf	2541-2552 2561-2572 2601-2612	AIRS-Suite	L2 Ancillary Input	103	Climatology (Support levels)
AIRXBLPS	L1B.airs_lapse_rate_v1.0.0_01.anc	3701-3712	AIRS	L1C, CalSub Ancillary Input	0.3	Lapse rate climatology
AIRI2TMC	L2b.CCI_coefs.v5.0.0.anc	2011	AIRS-suite	L2 ancillary input	0.2	Coarse Climate Inicator coefs
AIRA2TMC	L2b.co_clim.v4.0.0.anc	2088	AIRS-suite	L2 ancillary input	0.5	Carbon Monoxide climatology
AIRX2CPH	L2.cloud_phase.v1.0.2.txt	2020	AIRS-suite	L2 ancillary input	0.0001	Cloud phase determination params
AIRI2OLR	L2.F.coef_olr.v1.0.0.anc	2015	AIRS-suite	L2 ancillary input	0.0001	OLR RTA coefs
AIRX2AAC	L2h.sccnn_coef.v3.0.0.anc	2100	AIRS-suite	L2 ancillary input	1521	Neural net coefs
AIRX2SMC	SNDR_PEATE_smoothness_clim_v04.txt	2075	AIRS-suite	L2 ancillary input	0.0001	Smoothness climatology for vertical interpolation
AIRX2LTL	L2.Loc_Dedicated_ValSites.v5.0.0.anc	7402	AIRS-suite	Matchup ancillary input	0.03	Truth locations

AIRX3QM5	L3.Quant_Moments.v5.0.1.anc	7349	AIRS-suite	L3 Quant ancillary input	0.04	Moments file for L3 Quant

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Appendix D. Geolocation QC bit definitions

Field name	Description
orbitgeoqa	Orbit Geolocation QA:; Bit 0: (LSB, value 1) bad input value (last scanline); Bit 1: (value 2) bad input value (first scanline); Bit 2: (value 4) PGS_EPH_GetEphMet() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 3: (value 8) PGS_EPH_GetEphMet() gave PGSEPH_E_BAD_ARRAY_SIZE; Bit 4: (value 16) PGS_EPH_GetEphMet() gave PGSTD_E_TIME_FMT_ERROR; Bit 5: (value 32) PGS_EPH_GetEphMet() gave PGSTD_E_TIME_VALUE_ERROR; Bit 6: (value 64) PGS_EPH_GetEphMet() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 7: (value 128) PGS_EPH_GetEphMet() gave PGS_E_TOOLKIT; Bit 8: (value 256) PGS_TD_UTCtoTAI() gave PGSTD_E_NO_LEAP_SECS; Bit 9: (value 512) PGS_TD_UTCtoTAI() gave PGSTD_E_TIME_FMT_ERROR; Bit 10: (value 1024) PGS_TD_UTCtoTAI() gave PGSTD_E_TIME_VALUE_ERROR; Bit 11: (value 2048) PGS_TD_UTCtoTAI() gave PGS_E_TOOLKIT; Bit 12: (value 4096) PGS_CSC_DayNight() gave PGSTD_E_NO_LEAP_SECS; Bit 13: (value 8192) PGS_CSC_DayNight() gave PGSCSC_E_INVALID_LIMITTAG; Bit 14: (value 16384) PGS_CSC_DayNight() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 15: (value 32768) PGS_CSC_DayNight() gave PGSCSC_W_ERROR_IN_DAYNIGHT; Bit 16: (value 65536) PGS_CSC_DayNight() gave PGSCSC_W_BAD_TRANSFORM_VALUE; Bit 17: (value 131072) PGS_CSC_DayNight() gave PGSCSC_W_BELOW_HORIZON; Bit 18: (value 262144) PGS_CSC_DayNight() gave PGSCSC_W_PREDICTED_UT1 (This is ex except when reprocessing.); Bit 19: (value 524288) PGS_CSC_DayNight() gave PGSTD_E_NO_UT1_VALUE; Bit 20: (value 1048576) PGS_CSC_DayNight() gave PGSTD_E_BAD_INITIAL_TIME; Bit 21: (value 2097152) PGS_CSC_DayNight() gave PGSCBP_E_TIME_OUT_OF_RANGE; Bit 22: (value 4194304) PGS_CSC_DayNight() gave PGSCBP_E_UNABLE_TO_OPEN_FILE; Bit 23: (value 8388608) PGS_CSC_DayNight() gave PGSMEM_E_NO_MEMORY; Bit 24: (value 16777216) PGS_CSC_DayNight() gave PGS_E_TOOLKIT; Bit 25-31: not used
satgeoqa	Satellite Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_EPH_EphemAttit() gave PGSEPH_W_BAD_EPHEM_VALUE; Bit 4: (value 16) PGS_EPH_EphemAttit() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 5: (value 32) PGS_EPH_EphemAttit() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 6: (value 64) PGS_EPH_EphemAttit() gave PGSEPH_E_NO_DATA_REQUESTED; Bit 7: (value 128) PGS_EPH_EphemAttit() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 8: (value 256) PGS_EPH_EphemAttit() gave PGSEPH_E_BAD_ARRAY_SIZE; Bit 9: (value 512) PGS_EPH_EphemAttit() gave PGSTD_E_TIME_FMT_ERROR; Bit 10: (value 1024) PGS_EPH_EphemAttit() gave PGSTD_E_TIME_VALUE_ERROR; Bit 11: (value 2048) PGS_EPH_EphemAttit() gave PGSTD_E_NO_LEAP_SECS; Bit 12: (value 4096) PGS_EPH_EphemAttit() gave PGS_E_TOOLKIT; Bit 13: (value 8192) PGS_CSC_ECItoECR() gave PGSCSC_W_BAD_TRANSFORM_VALUE; Bit 14: (value 16384) PGS_CSC_ECItoECR() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 15: (value 32768) PGS_CSC_ECItoECR() gave PGSTD_E_NO_LEAP_SECS; Bit 16: (value 65536) PGS_CSC_ECItoECR() gave PGSTD_E_TIME_FMT_ERROR; Bit 17: (value 131072) PGS_CSC_ECItoECR() gave PGSTD_E_TIME_VALUE_ERROR; Bit 18: unused (set to zero); Bit 19: (value 524288) PGS_CSC_ECItoECR() gave PGSTD_E_NO_UT1_VALUE; Bit 20: (value 1048576) PGS_CSC_ECItoECR() gave PGS_E_TOOLKIT; Bit 21: (value 2097152) PGS_CSC_ECRtoGEO() gave PGSCSC_W_TOO_MANY_ITERS; Bit 22: (value 4194304) PGS_CSC_ECRtoGEO() gave PGSCSC_W_INVALID_ALTITUDE; Bit 23: (value 8388608) PGS_CSC_ECRtoGEO() gave PGSCSC_W_SPHERE_BODY; Bit 24: (value 16777216) PGS_CSC_ECRtoGEO() gave PGSCSC_W_LARGE_FLATTENING; Bit 25: (value 33554432) PGS_CSC_ECRtoGEO() gave PGSCSC_W_DEFAULT_EARTH_MO Bit 26: (value 67108864) PGS_CSC_ECRtoGEO() gave PGSCSC_E_BAD_EARTH_MODEL; Bit 27: (value 134217728) PGS_CSC_ECRtoGEO() gave PGS_E_TOOLKIT; Bit 28-31: not used
glintgeoqa	Glint Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) glint location in Earth's shadow (Normal for night FOVs); Bit 2: (value 4) glint calculation not converging; Bit 3: (value 8) glint location sun vs. satellite zenith mismatch; Bit 4: (value 16) glint location sun vs. satellite azimuth mismatch; Bit 5: (value 32) bad glint location; Bit 6: (value 64) PGS_CSC_ZenithAzimuth() gave any 'W' class return code;

	Bit 7: (value 128) PGS_CSC_ZenithAzimuth() gave any 'E' class return code; Bit 8: (value 256) PGS_CBP_Earth_CB_Vector() gave any 'W' class return code; Bit 9: (value 512) PGS_CBP_Earth_CB_Vector() gave any 'E' class return code; Bit 10: (value 1024) PGS_CSC_ECItoECR() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); Bit 11: (value 2048) PGS_CSC_ECItoECR() gave any 'E' class return code (for Glint); Bit 12: (value 4096) PGS_CSC_ECRtoGEO() gave any 'W' class return code (for Glint); Bit 13: (value 8192) PGS_CSC_ECRtoGEO() gave any 'E' class return code (for Glint); Bit 14: (value 16384) PGS_CSC_ECItoECR() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; Bit 15: (value 32768) PGS_CSC_ECItoECR() gave any 'E' class return code
moongeoqa	Moon Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_CBP_Sat_CB_Vector() gave PGSCSC_W_BELOW_SURFACE; Bit 4: (value 16) PGS_CBP_Sat_CB_Vector() gave PGSCBP_W_BAD_CB_VECTOR; Bit 5: (value 32) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_BAD_ARRAY_SIZE; Bit 6: (value 64) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_INVALID_CB_ID; Bit 7: (value 128) PGS_CBP_Sat_CB_Vector() gave PGSMEM_E_NO_MEMORY; Bit 8: (value 256) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_UNABLE_TO_OPEN_FILE; Bit 9: (value 512) PGS_CBP_Sat_CB_Vector() gave PGSTD_E_BAD_INITIAL_TIME; Bit 10: (value 1024) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_TIME_OUT_OF_RANGE; Bit 11: (value 2048) PGS_CBP_Sat_CB_Vector() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 12: (value 4096) PGS_CBP_Sat_CB_Vector() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 13: (value 8192) PGS_CBP_Sat_CB_Vector() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 14: (value 16384) PGS_CBP_Sat_CB_Vector() gave PGS_E_TOOLKIT; Bit 15: not used
ftptgeoqa	Footprint Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_MISS_EARTH; Bit 4: (value 16) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 5: (value 32) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_ZERO_PIXEL_VECTOR; Bit 6: (value 64) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_BAD_EPH_FOR_PIXEL; Bit 7: (value 128) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_INSTRUMENT_OFF_BOARD; Bit 8: (value 256) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_BAD_ACCURACY_FLAG; Bit 9: (value 512) PGS_CSC_GetFOV_Pixel() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 10: (value 1024) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_DEFAULT_EARTH_MODEL; Bit 11: (value 2048) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_DATA_FILE_MISSING; Bit 12: (value 4096) PGS_CSC_GetFOV_Pixel() gave PGSCSC_E_NEG_OR_ZERO_RAD; Bit 13: (value 8192) PGS_CSC_GetFOV_Pixel() gave PGSMEM_E_NO_MEMORY; Bit 14: (value 16384) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_NO_LEAP_SECS; Bit 15: (value 32768) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_TIME_FMT_ERROR; Bit 16: (value 65536) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_TIME_VALUE_ERROR; Bit 17: (value 131072) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_PREDICTED_UT1; Bit 18: (value 262144) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_NO_UT1_VALUE; Bit 19: (value 524288) PGS_CSC_GetFOV_Pixel() gave PGS_E_TOOLKIT; Bit 20: (value 1048576) PGS_CSC_GetFOV_Pixel() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 21: (value 2097152) PGS_CSC_GetFOV_Pixel() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 22-31: not used
satgeoqa	Satellite zenith Geolocation QA flags: Bit 0: (LSB, value 1) (Spacecraft) bad input value; Bit 1: (value 2) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_BELOW_HORIZON; Bit 2: (value 4) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_UNDEFINED_AZIMUTH; Bit 3: (value 8) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_NO_REFRACTION; Bit 4: (value 16) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_INVALID_VECTAG; Bit 5: (value 32) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_LOOK_PT_ALTIT_RANGE; Bit 6: (value 64) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_ZERO_INPUT_VECTOR; Bit 7: (value 128) PGS_CSC_ZenithAzimuth(S/C) gave PGS_E_TOOLKIT; Bit 8: (value 256) (Sun) bad input value; Bit 9: (value 512) (suppressed) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); Bit 10: (value 1024) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_UNDEFINED_AZIMUTH; Bit 11: (value 2048) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_NO_REFRACTION; Bit 12: (value 4096) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_INVALID_VECTAG; Bit 13: (value 8192) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_LOOK_PT_ALTIT_RANGE; Bit 14: (value 16384) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_ZERO_INPUT_VECTOR; Bit 15: (value 32768) PGS_CSC_ZenithAzimuth(Sun) gave PGS_E_TOOLKIT
demgeoqa	Digital Elevation Model (DEM) Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) Could not allocate memory; Bit 2: (value 4) Too close to North or South pole. Excluded. (This is not an error condition - a different model is used); Bit 3: (value 8) Layer resolutionincompatibility. Excluded; Bit 4: (value 16) Any DEM Routine (elev) gave PGSDEM_E_IMPROPER_TAG; Bit 5: (value 32) Any DEM Routine (elev) gave PGSDEM_E_CANNOT_ACCESS_DATA;

	Bit 6: (value 64) Any DEM Routine (land/water) gave PGSDEM_E_IMPROPER_TAG; Bit 7: (value 128) Any DEM Routine (land/water) gave PGSDEM_E_CANNOT_ACCESS_DATA; Bit 8: (value 256) Reserved for future layers; Bit 9: (value 512) Reserved for future layers; Bit 10: (value 1024) PGS_DEM_GetRegion(elev) gave PGSDEM_M_FILLVALUE_INCLUDED; Bit 11: (value 2048) PGS_DEM_GetRegion(land/water) gave PGSDEM_M_FILLVALUE_INCLUDED; Bit 12: (value 4096) Reserved for future layers; Bit 13: (value 8192) PGS_DEM_GetRegion(all) gave PGSDEM_M_MULTIPLE_RESOLUTIONS; Bit 14: (value 16384) PGS_CSC_GetFOV_Pixel() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1; Bit 15: (value 32768) PGS_CSC_GetFOV_Pixel() gave any 'E' class return code

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