

AIRS/AMSU/HSB Version 5 Data Disclaimer

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Please read this before reporting problems with data or data availability. The following factors may have affected the data products you have ordered.

AIRS Data Product Version Numbers

The version numbers that appear in the V5 AIRS Product Files are slightly different, depending upon the product due to a staged delivery of processing code to the GES DISC. They are:

- **All Level 1B Products:** v5.0.0.0 (with one exception)
- **Level 1B Calibration Subset Product:** v5.0.16.0
- **All Level 2 Products:** v5.0.14.0
- **All Level 3 Products:** v5.0.14.0

Differences between Version 4 and Version 5

The basic retrieval methodology has not changed between V4 and V5, but many details have changed as we have acquired more experience with the data. These changes, from Level 1 processing onward, mean that all output parameters will be slightly different in V5 when compared to previous versions.

Please consult the document:

V5_Changes from V4.pdf

for a discussion of the changes.

A report on the status of V5 calibration and validation is provided in the document:

V5_CalVal_Status_Summary.pdf

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The most important difference to a user between V4 and V5 is the improved product-specific quality indicators and error estimates that are employed to set them. They are discussed in detail in the two documents:

V5_L2_Quality_Control_and_Error_Estimation.pdf

V5_L2_Standard_Product_QuickStart.pdf

Users must no longer rely on **RetQAFlag** to filter retrievals. This flag does not have a sufficient number of bits to capture the current quality control.

The quantities on which the new quality flags are based are written out in the Level 2 Support Product. We do not encourage second-guessing of the threshold values that were used to set the quality flags in the Level 2 Standard Product, but users may find these values useful if they desire to further refine their filtering of retrieved products in specific parts of the atmosphere.

The surface emissivity over ocean follows the shape of Wu and Smith ("Emissivity of rough sea surface for 8-13 μ m: modeling and verification," Appl. Opt. 36, 2609-2619 (1997)) as recomputed at higher spectral resolution by van Delst and Wu (<http://airs2.ssec.wisc.edu/~paulv/#IRsse>), with one overall adjustment parameter for wind speed of 5 meters/sec.

Over land and ice, the initial emissivity is set to a flat first guess before carrying out the first cloud clearing. The subsequent regression retrieval determines a spectral shape that is then used as an updated state for the final retrieval. This regression with shortwave variability has been greatly improved in V5. The final retrieval then adjusts the spectral shape, over land or ocean, with four degrees of freedom. Although algorithm improvements include better treatment of land surface heterogeneity and training over land, the AIRS surface emissivity product over land and ice is still being refined.

The error in calculating the total Outgoing Longwave Radiation (L2 product, **olr**) has been corrected in V5. The error did not affect the clear-sky outgoing longwave radiation (L2 product, **clolr**) in V4.

The error in calculating the vapor pressure saturation profile has been corrected in V5. In V4, the profile was not a layer quantity, and so could not be compared to the retrieved specific humidity. In V5 there are two properly layer-averaged layer quantity profiles for vapor pressure saturation. One is over liquid water and the other takes into account the change in state from liquid to ice when the temperature profile dips below the freezing point.

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Data Products

All data are released to the public, regardless of the state of their validation.

The V5 release includes two new standard data products, carbon monoxide and methane. Methane is still a research product and its retrieval is still being refined.

Averaging kernels are now calculated in V5 for H₂O, O₃, CO and CH₄ and appear in the Level 2 Support Product. The verticality and degrees of freedom for these products appear in the Level 2 Standard Product.

Invalid Values

Fields in Level 1B and Level 2 data products may contain an invalid value:

-9999 for floating-point and 16-bit and 32-bit integers

-1 or 255 for 8-bit fields.

no HSB and including HSB

The HSB instrument ceased operation on February 5, 2003 due to a mirror scan motor failure. Release V5 of AIRS Data Products provide two versions of the L2 and L3 data products up to the date of HSB failure, and a single version thereafter. The AIRS Level 2 and Level 3 data product file naming convention has been modified with release V5 to allow users to easily determine whether the data include HSB or not.

AIRS Level 2 Standard Product produced without using HSB

AIRS.2002.09.06.183.L2.RetStd.v5.0.14.0.G04283152315.hdf

AIRS Level 2 Standard Product produced using HSB

AIRS.2002.09.06.183.L2.RetStd_H.v5.0.14.0.G04283152315.hdf

AIRS Level 3 Daily Product produced without using HSB

AIRS.2002.09.06.L3.RetStd001.v5.0.14.0.G04283152315.hdf

AIRS Level 3 Daily Product produced using HSB

AIRS.2002.09.06.L3.RetStd_H001.v5.0.14.0.G04283152315.hdf

See **V5_Released_Proc_FileDesc.pdf** for a complete description of the AIRS Data Product file name and local granule ID (LGID) convention.

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Data Validation States

AIRS product validation states are “**Beta**”, “**Provisional**” and “**Validated**”. The state of product validation depends upon surface type, latitude and product type

Beta -- Early release product, minimally validated and may still contain significant errors. Available to allow users to gain familiarity with data formats and parameters but not appropriate as the basis for quantitative scientific publications.

Provisional -- Product quality may not be optimal and incremental product improvements are still occurring. General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing. Users are urged to contact science team representatives prior to use of the data in publications. Provisional products may be replaced in the archive when the validated product becomes available.

Validated -- Formally validated product, although validation is still ongoing. Uncertainties are well defined, and products are ready for use in scientific publications, and by other agencies. There may be later improved versions of these products.

The validation states for Level 1B Data Products in release V5 are:

Level 1B Product	RMS Requirement	Uncertainty Estimate	Vertical Coverage	Val Status
AIRS IR Radiance	3%*	<0.2%	N/A	Val5
AIRS VIS/NIR Radiance	20%	15-20%	N/A	Prov
AMSU Radiance	0.25-1.2 K	1-3 K	N/A	Val3
HSB Radiance	1.0-1.2 K	N/A	N/A	Val1

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The validation states for Level 2 Data Products in release V5 are:

Standard Geophysical Product	RMS Req	Uncertainty Estimate	Vertical Coverage	Val Status
Cloud Cleared IR Radiance	1.0 K	Accuracy ~1 K precision 0.3-8 K	N/A	Val3
Sea Surface Temperature	0.5 K	1.0 K	N/A	Val1
Land Surface Temperature	1.0 K	2-3 K	N/A	Prov
Surface Emissivity	N/A		N/A	Beta
Temperature Profile	1 K / km	Tropo: 1-2 K/km above: 2-3 K/km	Surface to 1 hPa	Val4
Water Vapor Profile	15% /2km	low trop: 20%/2km hi trop: 20-60%/2km sensitivity thresh: ~30 ppmv	Surface to 200 hPa or tropopause	Val4
Total Precipitable Water	5%	5-20% 0.1 mm wet bias in Antarctic	N/A	Val5
Fractional Cloud Cover	5%	5-30% cloud type dependent	900 to 100 hPa	Val2
Cloud Top Height	0.5 km	0.5-2 km cloud type dependent	900 to 100 hPa	Val3
Cloud Top Temperature	1.0 K	1-2 K	900 to 100 hPa	Val1
Total Ozone Column	-	tropics: 5% poles: 5-40%	N/A	Val3
Ozone Profile	-	20%	200 to 70 hPa	Val4
Carbon Monoxide	-	10-50% at 500 mb	800-200 hPa layer	Val3
Methane	-	1.5% monthly in mid-trop (alt & lat dependent)	700-200 hPa layer	Prov

Beta = Not suitable for scientific investigations.

Prov = Provisionally validated, suitable for scientific investigations with caution.
Validated for nonpolar (|lat| ≤ 50°) night ocean only

Val1 = non-polar (|lat| ≤ 50°) day/night ocean.

Val2 = **Val1** + non-polar (|lat| ≤ 50°) night land.

Val3 = **Val2**+nonpolar day land

Val4 = **Val3**+polar night

Val5 = **Val4**+polar day

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The validation state for the Level 3 Gridded Data Product matches that of the corresponding Level 1B or Level 2 Data Product from which it is generated.

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AIRS/AMSU/HSB Instrument States and Liens

Atmospheric Infrared Sounder (AIRS)

The AIRS instrument entered 'operate' mode on 24 July 2002.

AIRS data are unavailable for the period 29 July 2002-14:14:13 to 30 August 2002-09:25:10 UTC because of instrument defrost activities and unexpected cooler shutdowns. (The shutdowns were apparently caused by ionizing radiation affecting the cooler electronics in the South Atlantic Anomaly.)

AIRS data are unavailable for the period 19 October 2002-17:03:5 to 22 October 2002-01:37:25 UTC due to a false overstroke trip by the AIRS cooler (likely caused by a radiation 'hit').

AIRS data are unavailable for the period 29 October 2003-02:00:00 to 14 November 2003-21:01:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection. The purpose was to guard against possible permanent damage caused by the expected large flux of high energy particles (including protons). The instrument was completely off except for its survival heaters. Consequently, the AIRS instrument warmed. Upon restoration of power the instrument required prolonged cool-down and subsequent full recalibration of the spectral parameters.

AIRS IR Liens

- Per-granule measurements of spectral parameters (spectral_freq, spec_shift_upwell, etc.) and noise (NeN) are not stable enough for use as single granule measurements. Either use static values from channel properties files or smooth these measurements over longer time periods

AIRS Visible/NIR Liens

- In each scanline, at the left edge of the swath (first 3 IR footprints), the first few detectors of Channel 4 (the ones furthest South in ascending granules) have anomalously low values, less than 10% of their expected value. Since Channel 4 is primarily intended for use in a research product (energy balance studies) and the swath edges are of limited value, this problem is not considered critical.

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- In the L2 Retrieved Support Product, the following fields related to cloud height have not been validated and should be ignored:

CldHgtMapVis, CldHgtCntVis, CldHgtCntVisErr

- There appear to be low-level signals in the VIS/NIR calibration and blackbody views, where none are expected. Neither is deemed serious at this time. Specifically:
 - The last sample of the blackbody in zero-based Channel 2. This occurs day and night, and is at the fraction of a DN level.
 - The last one or two samples of the photocalibrator assembly (when the lamps are off) in zero-based Channel 1. This appears to occur during parts of every daytime granule, and has not been seen at night. It is at the 1 to 10 DN level.
- A decrease in responsivity has been observed in Visible/NIR channel 0, and to a lesser extent in Channel 1. This has been compensated for by an empirical correction, but additional data are required to validate the correction.

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Advanced Microwave Sounding Unit (AMSU)

AMSU data are unavailable for the period 29 October 2003-02:00:00 to 6 November 2003-06:00:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection. The purpose was to guard against possible permanent damage caused by the expected large flux of high energy particles (including protons). The instrument was completely off except for its survival heaters.

AMSU Liens

- On 11/16/2004 at 13:21:19 UT all of the AMSU-A2 temperature read outs except the warm load temperatures showed a sudden and simultaneous increase in noise. Subsequent analyses indicate that failure of a compensation capacitor in the reference voltage amplifier is the most probable cause. This will have a negligible effect on science products because RF shelf temperature enters into the calibration in a small second-order term. At the same time, however, the warm load temperature appeared to undergo a decrease of 0.15 K. Analysis continues to determine whether the warm load temperature offset continued. If so, the DN to EU conversion in the calibration algorithm will require modification.
- AMSU channel 7 exhibits abnormal noise levels
 - Noise level is about 5x NEdT on the average, but varies substantially
 - The added noise is not random; probable cause is spacecraft transmitter interference
 - The underlying random noise (NEdT) is within specs
 - Channel 7 should not be used until this systematic noise can be removed
- AMSU channel 6 exhibits some of the same noise characteristics as channel 7, however
 - Added noise level is a fraction of NEdT; overall level still meets specs
 - Use channel 6 with confidence
- AMSU channel 9 radiometer counts exhibit sudden, large change (~0.1%) recovering suddenly or gradually after 1-3 minutes; typically appears once or a few times per day, possibly clustered; no other channels affected
 - The phenomenon is being characterized; cause as yet unknown
 - Negligible effect in most cases; use channel 9 with confidence

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Humidity Sounder for Brazil (HSB)

HSB has not been operational since 5 February 2003-21:50 UTC due to a failure in the scan motor electronics.

HSB Liens

- HSB exhibits scan asymmetry which produces scan-dependent negative bias in scene brightness temperatures
 - A left-right asymmetry is present; the right swath edge exhibits a greater negative bias than the left edge
 - Probable cause is asymmetric space/spacecraft radiative environment
 - No scene sidelobe corrections have yet been applied
- L1B data contain fields named “**antenna_temp**” and “**brightness_temp**”. Both are well calibrated and without sidelobe correction in this release. The **brightness_temp** data field will include sidelobe correction in a future release. In this release the two fields are identical.

Aqua Spacecraft Safing Events

The Aqua spacecraft underwent two safing events. The AIRS / AMSU / HSB instrument suite did not collect data during the following periods (all times are approximate to several minutes):

27 June 2002-15:40:30 to 28 June 2002-20:36 UTC

12 September 2002-13:15:00 to 23:24 UTC.

Aqua Spacecraft Shutdown for Coronal Mass Ejection Event

AIRS data are unavailable for the period 29 October 2003-02:00:00 to 14 November 2003-21:01:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection.

AMSU data are unavailable for the period 29 October 2003-02:00:00 to 6 November 2003-06:00:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection.

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Occasional Data Outages

The AIRS / AMSU / HSB instrument suite has been shut down periodically for orbital correction maneuvers (drag makeup burns) and MODIS lunar calibration maneuvers. The two tables in the file below list all such outages to May, 2007.

AIRS Ready/Operate Times due to MODIS lunar cal roll Maneuvers					
Year/DOY	Date	Guard Test Operate	Guard Test CheckOut	Ready (UT)	Operate (UT)
2002/200	Jul 19			19:55:22	22:30:30
2002/289	Oct 16			14:05:00	14:53:00
2002/319	Nov 15			4:29:00	4:58:00
2002/348	Dec 14			21:59:00	22:20:05
2003/013	Jan 13			18:37:00	19:03:00
2003/043	Feb 12	11:25:00	11:54:00	13:48:00	14:19:00
2003/073	Mar 14	6:00:00	6:29:00	7:26:00	7:59:00
2003/112	Apr 12	19:32:00	19:58:00	20:13:00	20:43:00
2003/132	May 12	4:54:05	5:20:00	5:47:00	6:14:00
2003/161	Jun 10	10:58:00	11:26:00	12:01:30	12:31:00
2003/190	Jul 9	12:07:00	12:33:00	18:09:00	18:44:00
2003/337	Dec 3	N/A	N/A	18:34:00	18:56:00
2004/002	Jan 2	10:22:00	10:50:00	15:10:00	15:33:00
2004/001	Feb 1	11:28:00	N/A	11:56:45	12:26:40
2004/062	Mar 2	6:41:00	N/A	7:10:00	7:45:00
2004/092	Apr 1	0:16:18	0:45:00	2:33:00	3:05:00
2004/121	Apr. 30	11:19:10	11:47:00	17:04:00	17:31:00
2004/150	May 29	23:10:00	23:37:00		
2004/151	May 30			4:18:00	4:46:00
2004/180	Jun 28	11:01:00	11:28:00	12:06:00	12:40:00
2004/297	Oct 23	20:25:35	20:51:00	22:12:00	22:47:00
2004/356	Dec 21	11:00:40	11:28:00	16:41:00	17:02:00
2005/020	Jan 21	7:55:00		8:25:00	8:56:00
2005/049 & 2005/050	Feb 19	23:03:06	23:30:00	03:40:00	04:15:00
2005/079 & 2005/080	Mar 21	23:15:00	23:42:00	00:38:30	01:13:00
2005/109	Apr 19	11:05:00	11:31:00	18:24:00	18:54:00

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2005/139	May 19	11:18:00	11:45:00	12:15:00	12:43:00
2005/168 & 2005/169	Jun 17 June 18	23:08:00	23:35:00	01:02:00	01:36:00
2005/286	Oct 13	11:48:00	12:15:00	16:06:00	16:42:00
2005/315	Nov 11	19:31:00	19:58:00	20:32:00	21:01:00
2005/346	Dec 12	19:38:30	20:05:30		
2006/009	Jan 9	10:09:00	10:36:00	14:50:00	15:18:00
2006/038 & 2006/039	Feb 7 Feb 8	22:50:00	23:17:00	05:06:00	05:40:00
2006/068	Mar 9	19:45:00	20:12:00	21:07:00	21:41:00
2006/098	Apr 8	10:04:00	10:31:00	16:31:00	17:02:00
2006/128	May 8	08:38:00	09:05:00	10:22:00	10:50:00
2006/158	Jun 7	07:12:00	07:39:00	04:08:00	04:41:00
2006/187	Jul 6	10:00:00	10:27:00	13:34:00	14:18:00
2006/305	Nov 1	20:04:00	20:34:00	19:26:00	
2006/335	Dec 1	06:18:00	06:45:00	03:03:00	03:29:00
2006/364	Dec 30	09:04:00	09:31:00	07:11:00	07:37:00
2007/028	Jan 28	18:22:00	18:49:00	16:28:00	17:02:00
2007/058	Feb 27	07:07:00	07:34:00	03:31:00	04:06:00
2007/117	Apr 27	08:01:00		08:30:30	08:57:--
2007/147	May 27	07:01:00	07:28:00	02:18:00	02:49:00

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AQUA Drag MakeUp Burn Table since Launch				
Drag Burn No.	Year/DOY	Date	Drag burn Start Time	AIRS READY MODE DURATION
1	2002/192	Jul 11	15:08:00	
2	2002/234	Aug 22	15:32:00	
3	2002/259	Sep 16	14:58:00	13:02 - 16:48
4	2002/290	Oct 17	15:38:00	
5	2002/316	Nov 12	15:40:30	14:20 - 17:26
6	2002/346	Dec 12	15:40:00	14:30 - 17:26
7	2003/003	Jan 03	15:55:00	15:00 - 17:38
8	2003/030	Jan 30	21:26:00	19:22 - 23:00
9	2003/078	Mar 19	16:15:00	15:25 - 18:03
10	2003/114	Apr 24	16:29:42	15:59 - 18:38
11	2003/163	June 12	15:47:30	14:55 - 17:30
12	2003/309	Nov 5	15:00:00	13:14 - 16:45
13	2003/351	Dec 17	17:10:00	17:06 - 19:31
14	2004/021	Jan 21	16:00:00	15:00 - 17:46:33
15	2004/112	Apr 21	15:49:00	14:44 - 17:30
16	2004/174	June 22	20:46:00	19:05 - 22:31:48
17	2004/218	Aug 5	10:31:46	9:44:00 - 12:13:48
18	2004/323	Nov 18	15:32:02	14:30:00 - 17:17:00
19	2005/012	Jan 12	18:32:51	17:46:00 - 20:26:50
20	2005/061	Mar 3	17:47:00	16:58:00 - 19:28:50
21 aborted	2005/131	May 11	N/A	14:40:00 - 17:21:50
21	2005/133	May 13	16:20:00	15:50:00 - 18:01:50
22	2005/215	Aug 3	16:40:00	15:52:00 - 18:31:50
23	2005/279	Oct 6	16:05:00	14:55:00 - 17:51:50

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24 aborted	2005/335	Dec 1	N/A	14:03:00 - 16:51:50
24	2005/342	Dec 8	15:26:00	14:17:00 - 17:07:50
25	2006/032	Feb 1	15:41:10	15:18:00 - 17:22:50
26	2006/109	Apr 19	15:33:10	14:48:00 - 17:29:50
27	2006/165	Jun 14	14:22:03	13:58:00 - 16:03:50
28	2006/319	Nov 15	15:19:17	14:47:00 - 17:18:50
29	2007/004	Jan 4	16:20:00	16:03:00 - 18:01:50

Version 5 (Collection 5) Data Advisory

Over time, we will endeavor to update this section to provide in one place a catalog of features and bugs discovered in the V5 data products.

August 8, 2007 – O3 First Guess above 0.5 mb

The ozone first guess used to initialize the V5 retrieval is likely too high at pressures below ~0.5 mb (altitudes above ~55 km) due to an error in extrapolation in its creation. This has a negligible effect on **totO3Std** and the portion of **O3VMRStd** profile at pressures greater than 0.5 mb. At pressures lower than 0.5 mb, biases in **O3VMRStd** are estimated to be between ~10% to ~50%. The extrapolation error occurs in the lowest 6 pressure levels of the support pressure level array (i.e., in the L2 Support Product **O3CDSup** array elements 1, 2, 3, 4, 5 and 6.

August 24, 2007 – Clear AIRS FOVs Reported in L1B Radiance Product and Calibration Subset Product

The AIRS FOVs designated as "clear" in the L1B AIRS Radiance Product (AIRIBRAD) and the Calibration Subset Product (AIRXBCAL) will overlap but are not identical sets in Version 5 (Collection 5) for three reasons:

- The Calibration Subset Product uses a more recent version of the "clear FOV" algorithm which employs among its tests pseudo lapse rates obtained from 2-degree global grids, differentiated by month of year and ascending/descending node. The L1B AIRS Radiance Product employs a constant pseudo lapse rate among its tests.
- AIRS FOVs are never flagged as "clear" for Granule 240 in the L1B AIRS Radiance Product, due to a programming error that fails to set the AIRS FOV's **spectral_clear_indicator**. The Calibration Subset Product flags clear AIRS FOV's in Granule 240 correctly, i.e. **reason** is set to 1 for AIRS FOVs satisfying the Calibration Subset clear test.
- Each of the 240 6-minute granules per day contains 12,150 FOVs (i.e., a granule contains 90 AIRS scene footprints in each of 135 AIRS scans). The first footprint in the first granule of a day is always taken at 5 minutes, 31.36 seconds, after midnight. The L1B AIRS Radiance Product always includes the 12,150 FOVs for each granule, including Granule 240. The Calibration Subset Product processing begins and ends exactly at midnight. The midnight boundary is reached during scan 11, between scene footprints 89 and 90, in Granule 240. Thus clear AIRS FOVs for Granule 240 will be divided amongst the Calibration Subset Product files for two consecutive days.