README Document

AIRS Level-3 Version 005 Quantization Products

AIRX3QP5 / AIRS3QP5 / AIRH3QP5 / AIRX3QPM / AIRS3QPM / AIRH3QPM

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Introduction

This document applies to the Atmospheric Infrared Sounder (AIRS) Level-3 Quantization Products. The quantization products are distributional summaries derived from the Level-2 standard retrieval products (of swath type). The primary aim of the quantization products is to provide a more comprehensive set of statistical summaries than the traditional means and standard deviation. They preserve the multivariate distributional features of the original data and so provide a compressed data set that more accurately describes the disparate atmospheric states that is in the original Level-2 swath data set.

Currently, there are three different flavors of AIRS Level-2 standard retrieval products, which are the inputs to the Level-3 quantization products, namely:

- AIRX2RET: Level-2 retrieval product crated using AIRS IR, AMSU without-HSB
- AIRS2RET: Level-2 retrieval product created using AIRS IR only
- AIRH2RET: Level-2 retrieval product created using AIRS IR, AMSU and with-HSB.

They are carried over to the Level-3 product suite. Furthermore, each flavor of the Level-3 quantization products is produced in two different aggregation periods, the 5-day and monthly. Therefore, this document covers 6 data products in total:

Level-3 quantization products of 5-day aggregation:

- AIRX3QP5: Level-3 quantized cluster analysis product based on Level-2 AIRX2RET product.
- AIRS3QP5: Level-3 quantized cluster analysis product based on Level-2 AIRS2RET product.
- AIRH3QP5: Level-3 quantized cluster analysis product based on Level-2 AIRH2RET product.

Level-3 quantization products of Monthly aggregation:

- AIRX3QPM: Level-3 quantized cluster analysis product based on Level-2 AIRX2RET product.
- AIRS3QPM: Level-3 quantized cluster analysis product based on Level-2 AIRS2RET product.
- AIRH3QPM: Level-3 quantized cluster analysis product based on Level-2 AIRH2RET product.

The Level-3 quantization products are first introduced in version 5.0.14.0 release (or simply referred to as Version 5). The first product file for AIRS Level-3 quantization product file starts on 2002-08-30.

1.1 AIRS Instrument Description

1.1.1 AIRS

AIRS is a continuously operating cross-track scanning sounder, consisting of a telescope that feeds an echelle spectrometer. Figure 1 shows the cutaway drawing of the AIRS instrument. The AIRS infrared spectrometer acquires 2378 spectral samples at resolutions, $\lambda/\Delta\lambda$, ranging from 1086 to 1570, in three bands: 3.74 μm to 4.61 μm, 6.20 μm to 8.22 μm, and 8.8 μm to 15.4 μm. The spatial footprint of the infrared channels is 1.1° in diameter, which corresponds to about 13.5x13.5 km in the nadir. The instrument characteristics are listed in table 1.

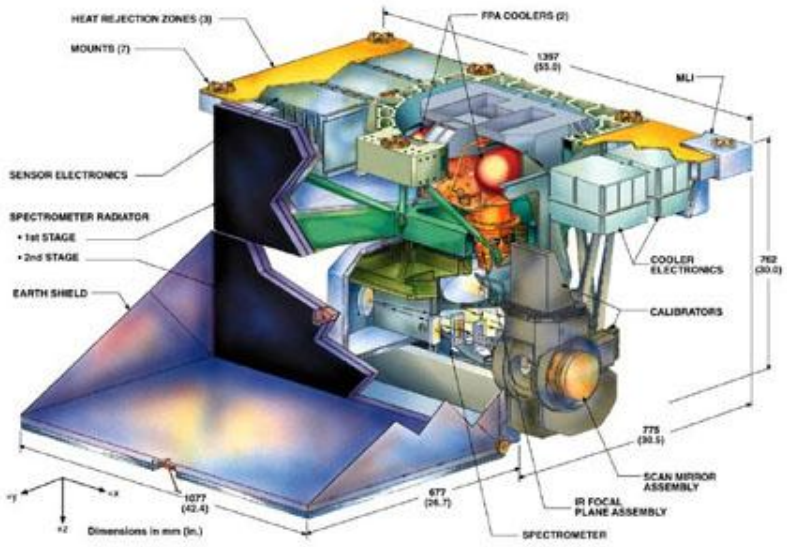

Figure 1. AIRS instrument cutaway drawing.

During each scan, the rotating external mirror scans the underlying Earth scene from 49° on one side of the nadir to 49° on the other side, in 90 integration periods, and provides two views of dark space (one before and one after the Earth scene), one view of an internal radiometric calibration target, and one view of an internal spectral calibration target. Thus each scan produces 94 sets of measurements (90 earth scenes and 4 calibrations). The scan is repeated every 8/3 seconds. The downlink data rate from the AIRS instrument is 1.2 Mbit/sec.

The IR focal plane is cooled to about 58 K by a Stirling/pulse tube cryocooler. The scan antenna operates at approximately 265 K due to radiative coupling to the Earth and space and to the 150 K IR spectrometer. Cooling of the IR optics and detectors is necessary to achieve the required instrument sensitivity.

Table 1. Technology - Specifications

Instrument Type	Multi-aperture, non-Littrow echelle array grating spectrometer.
Infrared Spectral Coverage	3.74 - 4.61 μm 6.20 - 8.22 μm 8.80 - 15.4 μm
Spectral Response	$\lambda/\Delta\lambda > 1200$ nominal
Spectral Resolution	$\Delta\lambda/2$
Spectral Sampling	1 $\Delta\lambda$
Integrated Response (95%)	0.05 $\Delta\lambda$ 24 hours
Wavelength Stability	0.01 $\Delta\lambda$
Scan Angle	±49.5° around nadir
Swath Width	1650 km nominal
Instantaneous Field of View (IFOV)	1.1°
Measurement Simultaneity	>99%
Sensitivity (NEDT)	0.14 K at 4.2 μm 0.20 K from 3.7 - 13.6 μm 0.35 K from 13.6 - 15.4 μm
Radiometric Calibration	±3% absolute error

1.1.2 Advanced Microwave Sounding Unit (AMSU-A)

AMSU-A (as seen in Figure 2) primarily provides temperature soundings. It is a 15-channel microwave temperature sounder implemented as two independently operated modules. Module 1 (AMSU-A1) has 12 channels in the 50-58 GHz oxygen absorption band which provide the primary temperature sounding capabilities and 1 channel at 89 GHz which provides surface and moisture information. Module 2 (AMSU-A2) has 2 channels: one at 23.8 GHz and one at 31.4 GHz which provide surface and moisture information (total precipitable water and cloud liquid water). Like AIRS, AMSU-A is a cross-track scanner. The three receiving antennas, two for AMSU-A1 and one for AMSU-A2, are parabolic focusing reflectors that are mounted on a scan axis at a 45° Tilt angle, so that radiation is reflected from a direction along the scan axis (a 90° reflection). AMSU-A scans three times as slowly as AIRS (once per 8 seconds) and its footprints are approximately three times as large as those of AIRS (45 km at nadir). This result in three AIRS scans per AMSU-A scans and nine AIRS footprints per AMSU-A footprint.

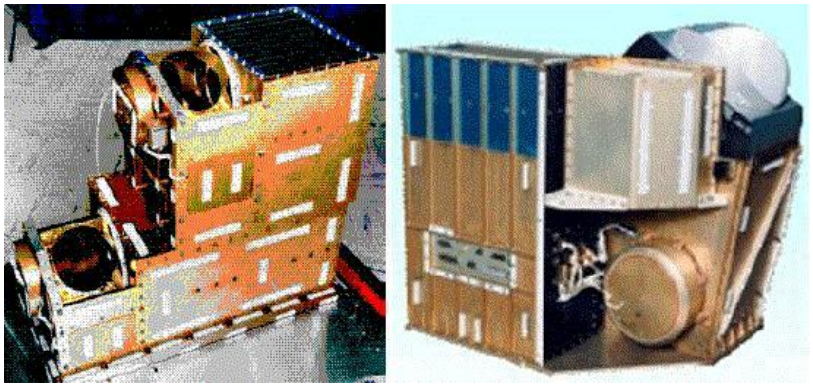

Figure 2. View of AMSU-A1 (left) and AMSU-A2 right.

Table 2. AMSU instrument characteristics

	AMSU-A1	AMSU-A2
Data Rate	1.3 kbits/s	0.4 kbits/s
Antenna Size	15 cm (2 units)	31 cm (1unit)
Instantaneous Field of View (IFOV)	3.3°	3.3°
Swath Width	100; 1650 km	100; 1650 km
Pointing Accuracy	0.2°	0.2°
Number of Channels	13	2

Sensor	Channel	Central Frequency (GHz)	Bandwidth (MHz)	Sensitivity NEDT (K)
AMSU-A2	1	23.8	280	0.3
	2	31.4	180	0.3
AMSU-A1	1	50.300	180	0.4
	2	52.800	400	0.25
	3	53.596±0.115	170	0.25
	4	54.400	400	0.25
	5	54.940	400	0.25
	6	55.500	330	0.25
	7	57.290344 = Flo	330	0.25
	8	Flo±0.217	78	0.4
	9	Flo±0.3222 (±0.048)	36	0.4
	10	Flo±0.3222 (±0.022)	16	0.6
	11	Flo±0.3222 (±0.010)	8	0.8
	12	Flo±0.3222 (±0.0045)	3	1.2
	13	89.000	6000	0.5

1.1.3 Humidity Sounder – Brazil (HSB)

The Humidity Sounder for Brazil (HSB) was a four-channel passive microwave radiometer, providing supplementary water vapor and liquid data to be used in the cloud clearing process. HSB was manufactured by Matra Marconi Space, Limited (MMS), in the United Kingdom under a contract with the Brazilian National Institute for Space Research, INPE. The scan mirror motor failed on February 5, 2003. Thus, all data processed with HSB information ends on that day.

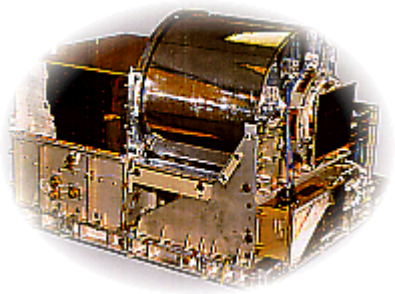

Figure 3. HSB instrument. (http://www.inpe.br/programas/hsb/ingl/index.html)

The HSB is 4 moist sounding channel version of AMSU-B, designed to detect radiances in the range of 150 to 183.31 GHz. One window channel (at 150 GHz) measures a part of the water vapor continuum, while three are grouped around the 183-GHz water vapor absorption line. Like AMSU-B, it samples ninety 1.1 ° scenes per 2.67-second cross track scan. Due to the higher spatial resolution (which equals that of AIRS IR) and a higher scan rate, the measurement density is 2.4 times that of AMSU-A (20 % less than for AMSU-B). HSB is very similar to AMSU-A, except that is contains only one antenna/receiver system. It was a part of a sounding system that acts in a synergic way, and provided humidity and profile much more accurately than that of sounders currently in the market. It also had the capacity of detecting precipitation under the clouds. Instrument and channel characteristics are summarized in table 3.

Table 3 (a). HSB Instrument Characteristics

Weight	60 kg
Dimensions	526 mm x 700 mm x 650 mm
Power	80W
Swath	1650 km
Spatial resolution	13.5 km at nadir
Field of View	1.1º
Data Rate	4.2 Kbps
Temperature Sensitivity	1.0 K to 1.2 K
Scan: angle	± 48.95º period: 8/3 s

Table 3 (b). HSB Channel Characteristics

Channel No.	Center Freq (GHz)	Bandwidth (GHz)	Function	NEDT (K)
1*				N/A
2	150.0	4000	Water Vapor	0.68
3	183.31 ± 1.0	2x500	Water Vapor	0.57
4	183.31 ± 3.0	2x1000	Water Vapor	0.39
5	183.31 ± 7.0	2x2000	Water Vapor	0.30

* Channel 1 (89 GHz) has been deleted for the HSB

1.2 Background on Algorithm

Please refer to the Level-3 Quantization Product Quick Start guide. Here is the table of contents:

Another source of information can be found on the web, created by the author of the quantization products Dr. Amy Braverman (Amy.Braverman@jpl.nasa.gov):
http://sciflo.jpl.nasa.gov/aist/#L3

1.3 Data Disclaimer

There is no specific disclaimer applied to the AIRS quantization products at this time. However the AIRS science team does provide AIRS/AMSU/HSB Version 5 Data Disclaimer document as a part of version 005 general release, here is the table of contents:

2. Data Organization

2.1 Granularity

Results from each aggregation period are stored in a file. The aggregation periods for the 5-day quantization products are days 1-5, 6-10, 11-15, 16-20, 20-25, and 26 through the end of the calendar month. Monthly products are computed using Level-2 files for an entire month. In both cases, the starting time is 00:00:00 UTC of the starting day of the aggregation period and ends on the 23:59:59 UTC of the end day.

2.2 Filenaming Convention

The AIRS Level-3 quantization product files are named by the following convention:

AIRS.*yyyy***.***mm***.***dd***.L3.***ProductNameAggregationPeriod***.v***m***.***m***.***r***.***b***.***productionTimeStamp***.hdf**
Where:

- yyyy = 4 digit year number [2002 -].
- mm = 2 digit month number [01-12]
- dd = day of the month [01-26], it is the starting of the aggregation period.
- ProductName = is one of RetQuant, RetQuant_IR, RetQuant_H
- Aggregation Period: 005 or 006 for the pentad and 030 or 031 for the monthly
- m.m.r.b = algorithm version identifier is made up of major version, minor version, release version and build number respectively.
- productionTimeStamp = file creation time stamp. Starts off with a letter G for GES DISC processing facility, followed by yydddhhmmss.
  - yy: year number without century;
  - ddd: day of a year [1-366];
  - hhmmss: hours, minutes and seconds UTC time.

The filename examples can be found in table 3.

Table 3. Filename Examples of Level-3 Quantization Products

Data Types	Sample Filenames
AIRX3QP5	AIRS.2007.12.21.L3.RetQuant005.v5.0.14.0.G08016175542.hdf
AIRX3QPM	AIRS.2007.11.01.L3.RetQuant030.v5.0.14.0.G07340233341.hdf
AIRS3QP5	AIRS.2007.12.11.L3.RetQuant_IR005.v5.0.14.0.G07362151110.hdf
AIRS3QPM	AIRS.2007.06.01.L3.RetQuant_IR030.v5.0.14.0.G07319044806.hdf
AIRH3QP5	AIRS.2003.01.21.L3.RetQuant_H005.v5.0.14.0.G07296074921.hdf
AIRH3QPM	AIRS.2002.09.01.L3.RetQuant_H030.v5.0.14.0.G07191213218.hdf

2.3 File Format and Structure

AIRS Level-3 quantization files are written in the HDF-EOS4 format. HDF-EOS4 format is an extension of the HDF4 format (developed by NCSA) to meet the needs of EOS data products. These extensions facilitate the creation of Grid, Point and Swath data structures, in the case of AIRS Level-3 quantization products; they are of the grid structure. When working with HDF-EOS files, one is not concerned with exactly how the data are stored physically; rather you interact with the data file by knowing the identifiers (filename, swath/grid names, parameter names, attribute names etc) and through a set of application programming interface (APIs) methods. Among five categories of methods, the access methods, basic I/O methods and inquiry methods are relevant for reading the data[1].

Each AIRS Level-3 quantization product file contains a grid whose name is "L3Quant". This grid is made up of four major groups: projections, dimensions, data fields and attributes. The HDF-EOS programming interface provides information query function calls on all three groups. The content inside each group is detailed in the data content section.

2.3.1 Projections

this is what differentiates grid type from swath type in the HDF-EOS. The projection provides a convenient way to encode geolocation information as a set of mathematical equations which enables transformations of spherical Earth coordinates (latitudes and longitudes) to X-Y coordinates on a plane. The projection information is comprised of:

- USGS General Cartographic Transformation Package (GCTP) projection code
- Universal Transverse Mercator (UTM) zone code
- GCTP spheroid code
- 13 projection parameters.

AIRS Level-3 quantization products are created in geographic projection using the default Clarke 1866 spheroid. Therefore, the UTM zone code and projection parameters are not used for anything.

2.3.2 Dimensions

These are dimensions of parameters stored in the Level-3 quantization files. The description of NumDimPhysical is listed separately for clarity. Here, the array index is 1-base.

[1] See section 3.3 for more details.

Dimensions in the Level-3 Quantization Products

Dimension Name	Dimension Size	Description
LonDim	72	Number of Longitude grid cells. 72 5-degree cells amount to 360 degrees. Cells are ordered West to East, from -180 to +180.
LatDim	36	Number of Latitude grid cells. 36 5-degree cells amount to 180 degrees. Cells are ordered North to South, from -90 to +90.
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.
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)

Description of NumDimPhysical

Array Index	Content Description
1 through 11	Temperatures at 150, 200, 250, 300, 400, 500, 600, 700, 850, 925, 1000 mb levels.
12	Specific humidity in layer bounded by TOA and 150 mb layer
13	Specific humidity in layer bounded by 150 mb and 200 mb layer
14	Specific humidity in layer bounded by 200 mb and 250 mb layer
15	Specific humidity in layer bounded by 250 mb 300 mb layer
16	Specific humidity in layer bounded by 300 mb and 400 mb layer
17	Specific humidity in layer bounded by 400 mb and 500 mb layer
18	Specific humidity in layer bounded by 500 mb and 600 mb layer
19	Specific humidity in layer bounded by 600 mb and 700 mb layer
20	Specific humidity in layer bounded by 700 mb and 850 mb layer
21	Specific humidity in layer bounded by 850 mb and 925 mb layer
22	Specific humidity in layer bounded by 925 mb and 1000 mb layer
23	Cloud fraction with cloud top pressure 200 mb layer
24	Cloud fraction for which 200 mb < PCldTop 250 mb layer
25	Cloud fraction for which 250 mb < PCldTop 300 mb layer
26	Cloud fraction for which 300 mb < PCldTop 400 mb layer
27	Cloud fraction for which 400 mb < PCldTop 500 mb layer
28	Cloud fraction for which 500 mb < PCldTop 600 mb layer
29	Cloud fraction for which 600 mb < PCldTop 700 mb layer
30	Cloud fraction for which 700 mb < PCldTop 850 mb layer
31	Cloud fraction for which 850 mb < PCldTop 925 mb layer
32	Cloud fraction for which 925 mb < PCldTop 1000 mb layer
33	Scene land fraction
34	Fraction of good quality observations
35	Fraction of observations that are daytime

2.3.3 Swath Attributes

These are scalar or string fields that appear only once per granule. They are attributes in the HDF-EOS Swath sense.

Attribute Name	Extra 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…)
CovarianceMatrix	NumDimPhysical,NumDimPhysical	Covariance matrix
Eigenvectors	NumDimPhysical,NumDimPhysical	Eigen vectors
PhysicalValuesDescriptor	NumDimPhysical	An array of string values describing the contents of Physical Values. (e.g., “Temperature at 350 mb (K)”)
Lambda	None	

2.3.4 Data Fields

Data fields in a grid data set are rectilinear arrays of two or more dimensions (a.k.a “extra dimensions”). They are related to each other by the common geolocations. In other words, a single set of geolocation information is used for all data fields within one grid data set.

Parameter Name	Extra Dimensions	Data Type	Description
LatCenter	None	32-bit float	Center Latitude of 5x5 grid cell (-90.0, +90.0), degrees North
LonCenter	None	32-bit float	Center Longitude of 5x5 grid cell (-180.0, +180.0), degrees East
SouthLatBound	None	32-bit float	Minimum bounding latitude in a 5x5 degree grid cell. (-90.0, +90.0), degrees North
NorthLatBound	None	32-bit float	Maximum bounding latitude in a 5x5 degree grid cell. (-90.0, +90.0), degrees North
WestLonBound	None	32-bit float	Minimum bounding longitude in a 5x5 degree grid cell. (-180.0, +180.0), degrees East
EastLonBound	None	32-bit float	Maximum bounding longitude in a 5x5 degree grid cell. (-180.0, +180.0), degrees East
NumClusters	None	16-bit int	Number of clusters in a 5x5 degree grid cell. Cannot exceed *MaxNumClusters*, unitless
NormalizedValues	MaxNumClusters, NumDimNorm	32-bit float	Normalized observations, averaged over each cluster, unitless
PhysicalValues	NumClusters, NumDimPhysical	32-bit float	Raw physical observations averaged over each cluster. *PhysicalValuesDescription* in Global Attributes gives mapping of contents to physical values (e.g., T, H2O…), various physical units.
NumObsInCluster	MaxNumClusters	16-bit int	Number of Observations represented by this cluster, unitless
ClusterMeanSquaredError	MaxNumClusters	32-bit float	Mean square error in each cluster
Entropy	NumTrials	32-bit float	Entropy
GridCellMeanSquaredError	NumTrials	32-bit float	Mean square error in each grid cell
PentadComposition	MaxNumClusters,Nu	16-bit int	Present in Monthly files only.

	mPentad		Number of observations in each cluster derived from each pentad. Values must sum to *NumObsInCluster*, unitless
ClusterDistortion	MaxNumClusters	32-bit float	

3. Options for Reading Data

3.1 Command-line utilities

3.1.1 read_hdf

The read_hdf tool is a command-line utility developed by GES DISC. It allows user to browse the file structure and display data values if desired.

Command line syntax:

```
read_hdf [-l] | [[-i | -d] [-a <output> | -b <base>.*.bin ]]  filename

Options/Arguments:

   [-i] -- run in interactive mode (default), or
   [-l] -- list a tree of file objects, or
   [-d] -- dump all HDF object types (no filtering)
   [-a <output>] -- ASCII output file name (default is <filename>.txt)
   [-b <base>] -- base binary output file name (default is <filename>)
                          creates two files per HDF object:
                          <base>.*.met for metadata, and <base>.*.bin
for binary data
                          (default output to stdout)
   filename -- name of the input HDF file
```

The source code is written in C language and can be obtained from GES DISC ftp server: ftp://disc1.gsfc.nasa.gov/software/aura/read_hdf/read_hdf.tar

3.1.2 ncdump

The ncdump tool can be used as a simple browser for HDF data files, to display the dimension names and sizes; variable names, types, and shapes; attribute names and values; and optionally, the values of data for all variables or selected variables in a netCDF file. The most common use of ncdump is with the –h option, in which only the header information is displayed.

```
ncdump [-c|-h] [-v ...] [[-b|-f] [c|f]] [-l len] [-n name] [-d n[,n]]
filename

Options/Arguments:

  [-c]                  Coordinate variable data and header information
```

```
  [-h]                  Header information only, no data
  [-v var1[,...]]       Data for variable(s) <var1>,... only
  [-b [c|f]]            Brief annotations for C or Fortran indices in
data
  [-f [c|f]]            Full annotations for C or Fortran indices in
data
  [-l len]              Line length maximum in data section (default
80)
  [-n name]       Name for netCDF (default derived from file name)
  [-d n[,n]]            Approximate floating-point values with less
precision
  filename        File name of input netCDF file
```

Note: the ncdump tool will only display variables whose ranks are great than 1. In other words, you will not see one dimensional vectors such as *satheight* using this tool.

The ncdump program can be found in bin directory of the HDF installation area. Consult your local computer system administrator for the specifics.

3.1.3 hdp

The hdp utility is a HDF dumper developed by HDF group at NCSA.

```
Usage: hdp [-H] command [command options] <filelist>

         -H  Display usage information about the specified command.
             If no command is specified, -H lists all commands.

         Commands:
             list       lists contents of files in <filelist>
             dumpsds    displays data of SDSs in <filelist>
             dumpvd     displays data of vdatas in <filelist>.
             dumpvg     displays data of vgroups in <filelist>.
             dumprig    displays data of RIs in <filelist>.
             dumpgr     displays data of RIs in <filelist>.
```

For more information, please visit the NCSA web site: http://hdf.ncsa.uiuc.edu/hdp.html

3.2 GUI Tools

The HDFView is a visual tool for browsing and editing NCSA HDF4 and HDF5 files. Using HDFView, you can:

(1) view a file hierarchy in a tree structure

(2) create new file, add or delete groups and datasets
(3) view and modify the content of a dataset
(4) add, delete and modify attributes
(5) replace I/O and GUI components such as table view, image view and metadata view

More information can be found at the official HDFView web site. There is an add-on plug-in for handling HDFEOS data specifically.

3.3 Programming

AIRS science team provides reader software in IDL, MATLAB, C and FORTRAN programming language. You can download them from GES DISC's AIRS web portal:

(1) IDL / MATLAB suite along with sample HDF-EOS data files
(2) FORTRAN / C suite along with sample HDF-EOS data files

Specific to AIRS Level-3 products, a grid reader is provided only in IDL/MATLAB, not yet in FORTRAN or C at present. If you wish to program yourself to read the AIRS Level-3 quantization products, the HDFEOS programming model for accessing a grid data set through the grid (GD) interface is as follows:

(1) Open the file and obtain a file id from a file name.
(2) Open a grid data set by obtaining a grid id from a grid name, in this case is *L3Quant*
(3) Perform desired operations on the data set.
(4) Close the grid data set by disposing of the grid id.
(5) Terminate grid access to the file by disposing of the file id.

A complete list of grid interface routines is summarized in the next two pages. To read an HDFEOS data file, access, basic I/O and inquiry routines are of particular interest.

Summary of HDF-EOS Grid Interface

Category	Routine Name		Description
	C	FORTRAN	
Access	GDopen	gdopen	creates a new file or opens an existing one
	GDcreate	gdcreate	creates a new grid in the file
	GDattach	gdattach	attaches to a grid
	GDdetach	gddetach	detaches from grid interface
	GDclose	gdclose	closes file
Definition	GDdeforigin	gddeforigin	defines origin of grid
	GDdefdim	gddefdim	defines dimensions for a grid
	GDdefproj	gddefproj	defines projection of grid
	GDdefpixreg	gddefpixreg	defines pixel registration within grid cell
	GDdeffield	gddeffld	defines data fields to be stored in a grid
	GDdefcomp	gddefcomp	defines a field compression scheme
	GDblkSOMoffset	none	This is a special function for SOM MISR data. Write block SOM offset values.
	GDsettilecomp	none	This routine was added as a fix to a bug in HDF-EOS. The current method of implementation didn't allow the user to have a field with fill values and use tiling and compression. This function allows the user to access all of these features.
	GDwritefieldmeta	gdwrmeta	writes metadata for field already existing in file
Basic I/O	GDwritefield	gdwrfld	writes data to a grid field.
	GDreadfield	gdrdfld	reads data from a grid field
	GDwriteattr	gdwrattr	writes/updates attribute in a grid.
	GDwritegrpattr	gswrgattr	writes/updates group attribute in a grid
	GDwritelocattr	gdwrlattr	Writes/updates local attribute in a grid
	GDreadattr	gdrdattr	reads attribute from a grid
	GDreadgrpattr	gdrdgattr	reads group attribute from a grid
	GDreadlocattr	gdrdlattr	reads local attribute from a grid
	GDsetfillvalue	gdsetfill	sets fill value for the specified field
	GDgetfillvalue	gdgetfill	retrieves fill value for the specified field
Inquiry	GDinqdims	gdinqdims	retrieves information about dimensions defined in grid
	GDinqfields	gdinqdflds	retrieves information about the data fields defined in grid
	GDinqattrs	gdinqattrs	retrieves number and names of attributes defined
	GDinqgrpattrs	gdinqgattrs	retrieves number and names of group attributes defined
	GDinqlocattrs	gdgattrinfo	returns information about grid group attributes
	GDnentries	gdnentries	returns number of entries and descriptive string buffer size for a specified entity
	GDgridinfo	gdgridinfo	returns dimensions of grid and X-Y coordinates of corners
	GDgrpattrinfo	gdgattrinfo	returns information about grid group attributes
	GDlocattrinfo	gdlattrinfo	Returns information about grid local attributes
	GDprojinfo	gdprojinfo	returns all GCTP projection information
	GDdiminfo	gddiminfo	retrieves size of specified dimension
	GDcompinfo	gdcompinfo	retrieve compression information about a field

continued on the next page…

Summary of HDF-EOS Grid Interface (continued)

Category	Routine Name		Description
	C	FORTRAN	
	GDfieldinfo	gdfldinfo	retrieves information about a specific geolocation or data field in the grid
	GDinqgrid	gdinqgrid	retrieves number and names of grids in file
	GDattrinfo	gdattrinfo	returns information about grid attributes
	GDorigininfo	gdorginfo	return information about grid origin
	GDpixreginfo	gdpreginfo	return pixel registration information for given grid
	GDdefboxregion	gddefboxreg	define region of interest by latitude/longitude
	GDregioninfo	gdreginfo	returns information about a defined region
Subset	GDextractregion	gdextrreg	read a region of interest from a field
	GDdeftimeperiod	gddeftmeper	define a time period of interest
	GDdefvrtregion	gddefvrtreg	define a region of interest by vertical field
	GDgetpixels	gdgetpix	get row/columns for lon/lat pairs
	GDgetpixvalues	gdgetpixval	get field values for specified pixels
	GDinterpolate	gdinterpolate	perform bilinear interpolation on a grid field
	GDdupregion	gddupreg	duplicate a region or time period
Tiling	GDdeftile	gddeftle	define a tiling scheme
	GDtileinfo	gdtleinfo	returns information about tiling for a field
	GDsettilecache	gdsettleche	set tiling cache parameters
	GDreadtile	gdrdtle	read data from a single tile
	GDwritetile	gdwrtile	write data to a single tile
Utility	GDrs2ll	gdrs2ll	convert (r,s) coordinates to (lon,lat) for EASE grid

4. Data Services

N/A.

5. Data Interpretation and Screen

N/A.

6. More Information

Web resources for AIRS data users:

NASA/JPL:

- AIRS Project Web Site: http://airs.jpl.nasa.gov/
- Ask AIRS Science Questions: http://airs.jpl.nasa.gov/AskAirs/

NASA/GSFC:

- AIRS Data Support Main Page: http://disc.sci.gsfc.nasa.gov/AIRS/
- AIRS Data Access: http://disc.sci.gsfc.nasa.gov/AIRS/data_access.shtml
- AIRS Documentation: http://disc.sci.gsfc.nasa.gov/AIRS/documentation.shtml
- AIRS Products: http://disc.sci.gsfc.nasa.gov/AIRS/data_products.shtml

For further assistance, please use this contact information:

Email: gsfc-help-disc@lists.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268

Mailing Address:
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