National Aeronautics and Space Administration
Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for Suomi-National Polar-Orbiting Partnership (S-NPP) Sounder Science Investigator-led Processing System (SIPS) Advanced Technology Microwave Sounder ATMS) Level 1B Products

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Last Revised August 2018

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Revision History

Revision Date	***Changes***	***Author***
July 2018	User Guide	Ruth Monarrez
August 28, 2018	Changed User Guide to README	Lena Iredell

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1.0 Introduction

This document provides basic information for using Version 2 of the Advanced TechnologyMicrowave Sounder (ATMS) Level 1B (SNPPATMSL1B) products produced by the Suomi-National Polar-Orbiting Partnership (S-NPP) Sounder Science Investigator-led Processing System (SIPS) at the NASA Goddard Space Flight Center (GSFC).

The SNPPATMSL1B consists of L1B products generated from the ATMS instrument, a 22-channel cross-track scanning microwave instrument which measures data for temperature and humidity soundings.

1.1 Dataset/Mission Instrument Description

The S-NPP satellite was launched on October 28, 2011 from Vandenburg Air Force Base in California into an orbit with an altitude of 824 km above the Earth surface, an inclination angle of 98.7 deg and a 13:30 local time ascending node. SNPP is the first in a series of next generation U.S. weather satellites of the Joint Polar Satellite System (JPSS). For additional information about the mission and project please see the User Guide for “Suomi-National Polar-Orbiting Partnership (S-NPP) Sounder Science Investigator-led Processing System (SIPS) Advanced Technology Microwave Sounder ATMS) Level 1B Products”.

Table 1.2.1 Instrument parameters

Platform	Instrument	Instrument Type	Scan Rate(s)	Scan Range(°)	Scan Pattern	FOR Dia (km, nadir)	Spectral Channels
S-NPP	ATMS	Microwave (MW)	8/3	±53	96	16-75	22

Table 1.2.2 Approximate orbital parameters

Platform	Altitude (km)	Orbit Incl. (°)	Equator Crossing Time	Period	Repeat Orbits	Repeat Days	Launch
S-NPP	824	98.7	13.30*	101	228	16	28 Oct 2011

The ATMS Level 1B product is generated using L0 data, processed by the Earth Observing System (EOS) Data and Operations System (EDOS) located at NASA’s Goddard Earth Sciences Data and Information Services Center (GES DISC). The ATMS Level 1B products consists of calibrated radiances and geolocation along with any metadata necessary to use and interpret this product.

1.2 Algorithm Background

The Sounder SIPS ATMS L1B data products are a product of processing NASA Level 0 data through Level 1A/Geolocation and Level 1B.

The ATMS Level 1A processing extracts radiance counts from ATMS science telemetry, converts engineering counts from the health and status telemetries into physical measurements such as temperatures. The L1A geolocation processing derives spacecraft positions and altitude according to spacecraft diary telemetry. It also projects ATMS sounding field-of-views (FOV) onto the topographic surface with geolocation, line-of-site (LOS) view angles, solar angles, and surface parameters such as elevations and land fractions. All the geolocation parameters from L1A processing are propagated to the L1B product.

The L1B processing then applies calibration coefficients (gain and offset) and non-linearity correction to the radiance counts to convert them to antenna temperatures.

Technical details of the L1B processing steps and calibrations can be found in the Algorithm Theoretical Basis Document, NASA L1b: Advanced Technology Microwave Sounder Algorithm Theoretical Basis Document (ATBD) [Reference 1].

1.3 Data Disclaimer

Version 2.0 ATMS Level 1B data are released to the public as is. Every effort has been made to properly represent the data for which this document describes.

The ATMS instrument's Scan Drive Mechanism on S-NPP has been experiencing additional wear on the bearings. To extend the life of the instrument, a decision was made to perform scan reversals for the purpose of 're-wetting' the bearings. The scan reversals are now occurring twice per orbit, starting August 9, 2016. The end result of this maneuver is a slight loss of data. This loss of data is represented by the use of Fill Values.

Attention should be given to quality flags and checked for fill values before being used for any analysis or higher processing of the L1B product.

On occasion, there will be data that is missing for whatever reason. In the situation where there are incomplete granules within the 6-minute product granule, the missing data will be filled with a 'Fill Values'. The fill value is indicated by the attribute '_FillValue'. The fill value will exist in the same location the missing data would exist. This will preserve the shape of the 6-minute granule. Should the

data for an entire 6-minute granule be missing, a granule will still be produced and will contain all fill values. In other words, a full fill-value granule will be produced. With this in mind, it is advised to check the data for fill values before it is used. The fill values per variable data type are listed in the table below.

Table: 1.3 Fill Values

Variable Type	Fill Value
ubyte	255UB
ushort	65535US
uint	4294967295U
float	9.96921e+36f
double	9.96920996838687e+36

At the scan level, the ATMS L1B Program Generation Executive (PGE) tries to calculate antenna temperature for all scans, even there is not enough information to calculate scan-specific calibration coefficients. If we can't calculate coefficients for a particular scan, but we do have science counts for this scan, then we use calibration coefficients from the nearest, earlier scan. If we don't have good coefficients from the earlier scan, we use nearest coefficients from the later scan. So, in fact, if we can calculate a calibration coefficients for any scan within a 10 minute interval from a current scan, we will calculate a 'degraded' antenna temperature for a current scan. The PGE sets the corresponding quality flags if the antenna temperature for a scan was calculated using calibration coefficients from a different scan.

See the Algorithm Theoretical Basis Document NASA L1B: Advanced Technology Microwave Sounder (ATMS) , the Joint Polar Satellite System (JPSS) ATMS SDR Radiometric Calibration ATBD, the Product Quality Assessment, or the ATMS L1B User Guide for additional information.

1.3.1 Acknowledgment

To cite the data in publications use:
Jet Propulsion Laboratory: Bjorn Lambrigtsen (2018), Suomi NPP ATMS Sounder Science Investigator-led Processing System (SIPS) Level 1B Brightness Temperature V2, Greenbelt, MD, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: **[*Data Access Date*]**, 10.5067/HFDD6A30MA10

1.3.2 Contact Information

For information, questions or concerns with this ATMS L1B data set, please contact: Ruth Monarrez at Ruth.Monarrez@jpl.nasa.gov or send your question to: sounder.sips@jpl.nasa.gov.

For additional information concerning data access contact the GES DISC Help Desk Support Group (gsfc-help-disc@lists.nasa.gov , 301-614-5224).

1.4 What's New?

Version 2 of the ATMS L1B algorithm includes: Improvements to the geolocation, complete implementation of all L1A QA definitions, updated the correction coefficients, re-designed calibration degraded quality flag, and added a brightness temperature status flag.

1.4.1 Version 2

- Geolocation:
  - Corrected the skewed Field of View (FOV) shapes that had appeared at edges of the granule swath.
  - Several new geolocation fields were added: local_solar_time, sat_sol_zen, sat_sol_azi, mean_anom_wrt_equat, asc_node_tai93, asc_node_lon, asc_node_local_solar_time, and solar_beta_angle.
- Complete implementation of all L1a QA definitions, including qa_pct_data_missing, qa_pct_data_geo, qa_pct_sci
- Correction coefficients were updated: warm bias and non-linearity. These coefficients were updated to stay consistent with the values used by NOAA. These changes directly affect the antenna temperatures.
- Re-designed calib_degraded quality flag. Replaced the calib_degraded quality flag with more specific quality flags: cal_qualflag, cal_space_qualflag, cal_blackbody_qualflag
- Added a brightness temperature status flag: antenna_temp_qc. The dimensions match that of antenna_temp. Basically, if any of the above three 'cal_' flags are set, then antenna_temp_qc is set to 1 per channel corresponding to the 'cal_' flag. If instrument_state or geo_qualflag is not set to zero then antenna_temp_qc is set to 2. Also, if any of the following geolocation fields (lat, lat_geoid, land_frac, surf_alt, obs_time_tai93, sol_zen, sol_azi, sat_zen, sat_azi, view_ang, sat_range) are fill-value then antenna_temp_qc is set to 2.

2.0 Data Organization

The ATMS L1B data are organized as 6-minute swath product granules written in Network Common Data Format version 4/Hierarchical Data Format version 5 (NetCDF4/HDF5) format. There are approximately 240 granules per day.

The ATMS product is divided into a series of 6-minute segments or granules with each granule making up one file and 240 granules per day. Each file contains all observations for a given type made during a period of exactly 6 minutes. For each day, each 240 files are identified by granule number in the filename. For example, g156 for granule 156 out of 240. The nominal start time of granule 1 is defined to be 00:00:00. Because both CrIS (Cross-track Infrared Sounder) and ATMS instruments are synced to TAI, the start time of the first 8-second scanset of a day can be anywhere up to 8 seconds later. It moves 1 second with each leap second. If the first scanset start 8 seconds after the nominal start time, then the data can extend up to 8 seconds past the nominal end time.

The ability to uniquely identify a granule is built into the ATMS L1B product. This is extremely useful when publishing analysis results. The nominal time coverage, represented as a string: yyyymmddThhmm, is used to construct a unique qranule identifier called “gran_id”. gran-id is stored as a global attribute that is also used in the filename.

In addition, there is an observation identifier variable called “obs_id” that can further uniquely identify an observation within the granule. The obs_id is formatted as the gran_id with observation information appended to it.

The format of obs_is is: yyyymmddThhmm.aaaExx where ‘aaa’ is the 3-digit along-track index (001 – 135) and xx is the cross-track index (01 – 96). The “E” indicated earth view.

Example of obs_id: 20170401T2354.001E01

2.1 File Naming Convention

File naming for ATMS L1B products will be unique and include the following tokens separated by the delimiter ‘.’ For each token that makes up the filename, there will be an attribute in the data product that it maps to.

<Sounder_SIPS_ID>.<platform>.<inst_ID>.<granuleID>.<product_granularity>.<granule_number>.
<product_type>.<variant>.<version>.<production_location>.<prod_timestamp>.<extension>

Where:

1.1 **Sounder_SIPS_ID** as a project identifier <product_name_project> = SNDR

1.2 **platform** <product_name_platform> = SNPP

1.3 **inst_ID** <product_name_instr> = ATMS

1.4 **granuleID** (yyyymmddThhmm) <gran_id> nominal start time where:

1.4.1 yyyy = year

1.4.2 mm = month of year (01-12)

1.4.3 dd = day of month (01-31)

1.4.4 hh = hour (00-24)

1.4.5 mm = minute (00-59)

1.5 **product_granularity** <product_name_duration> = m06 (6 minute)

1.6 **granule_number** <granule_number> = g###

1.7 **product_type** with an optional identifier for testing <product_type_name_id>

1.7.1 L1B for ATMS Level 1B

1.8 **variant** <product_name_variant> = std

1.9 **version** vmm_mm <product_name_version> - eg. v02_00

1.9.1 Versioning will be synchronized across Sounder SIPS products

1.10 **production_location** <product_name_producer>- J=SIPS at JPL, G=Operations, T=Test, W = CrIS Team at Univ of Wisc

1.11 **prod_timestamp** so each product has a unique name (yymmddhhmmss) <product_name_timestamp>- 150407123456

1.12 **Extension** (.nc)

For example:

SNDR.SNPP.ATMS.*yyyymmdd*T*hhmm*.m06.g196.L1B.std.v*mm_mm*.G.*yymmddhhmmss*.nc

SNDR.SNPP.ATMS.20150407T1106.m06.g196.L1B.std.v02_05.G.150407123459.nc

Table 2.1 ATMS file naming

Filename token	Attribute name in CDF (mapping)	Format	Value(s)	Notes
Sounder_SIPS_ID	product_name_project		SNDR	
platform	product_name_platform		SNPP	
inst_ID	product_name_instr		ATMS, CrIS	
granuleID	gran_id	yyyymmddThhmm	Nominal start time	
product_granularity	product_name_duration		m06	6 minutes
granule_number	granule_number	g###	g001 – g240	Only for 6-minute granule products
product_type	product_name_type_id + optional identifier for uniqueness		L1B	
Version	product_name_version	v02_##; v02_##_##		e.g. v02_05; v02_05_00 (when produced at JPL)
variant	product_name_variant	Freeform text. No whitespace or any punctuation except underscore.	std	Used to identify special runs. The default is: std = standard.
production_location	product_name_producer		J: Jet Propulsion Laboratory G: Goddard Space Flight Center T: Test W: University of Wisconsin	
prod_timestamp	product_name_timestamp	yymmddhhmmss		

2.2 File Format and Structure

The files use the NetCDF-4 terms of groups, dimensions, variables, and attributes (global and variable). In each swath the spatial dimensions are 135 along-track by 96 cross-track.
Geolocation variables are located in the file at the root level. The include latitudes and longitudes associated with each observation, as well as satellite and solar geometry information, spacecraft position and orbital characteristics, surface information and related metadata.
Geolocation parameter are used for determining location of each observation on earth. The key geolocation variables are:

Table 2.2.1 Geolocation Dimensions

Dimension name	Size	Meaning
atrack	135	Along-track spatial dimension
xtrack	96	Cross-track spatial dimension

Table 2.2.2 Geolocation Variables

Geolocation Variable	Dimensions	Type	Meaning
lat	atrack, xtrack	32-bit floating-point	latitude of fov center
lon	atrack, xtrack	32-bit floating-point	longitude of fov center
obs_time_tai	atrack, xtrack	64-bit floating-point	earth view observation midtime for each fov in units of seconds since 1993-01-01T00:00:00
obs_time_utc	atrack, xtrack, utc_tuple	16-bit integer	UTC earth view observation time as an array of integers: year, month, day, hour, minute, second, msec

2.1.1 Time Representation

Times in the ATMS L1B product are generally represented as UTC (**Universal Time Coordinated**). However, observation times are provided in both UTC and TAI93 representations as a convenience to users.

UTC is the international standard for representation of time. UTC times are expressed in human-readable form, as a set of values indicating year, month, day, hour and so on. In the data stream received from the satellite, observation times are represented as UTC. Timestamps in ATMS L1B product filenames and attributes are represented as UTC and formatted according to the “ISO

8601:2004” standard. For example, the time January 25, 2016 at 13:00 may be represented as either of the following:

2016-01-25T13:00Z

20160125T1300

The longer form is used in attributes, and the more compact form is used in filenames. The character “Z” indicates “Zulu time”, or UTC.

International Atomic Time (TAI) is expressed as number of seconds elapsed on the surface of the Earth since some reference UTC time. The term “TAI93” indicates that the reference time is the beginning of the year 1993, or 1993-01-01T00:00:00Z. This reference time was chosen to be consistent with data products from other instruments, and to allow for precise representation of times spanning the expected mission length.

Leap seconds are one-second adjustments that are occasionally applied to UTC as 23:59:60, to account for irregularities in the rotation of the Earth. There were 27 leap seconds applied to UTC between Jan 1, 1958 and Jan 1, 1993. Between Jan 1, 1993 and Jan 1, 2017, an additional 10 leap seconds were applied to UTC. Leap seconds must be accounted for when doing certain kinds of time calculations, especially in astronomy and satellite applications. Leap seconds can occur on December 31 or June 30 of a given year, and are announced months in advance.

Leap seconds must be accounted for in the following operations:

- When calculating exact elapsed time between two UTC times. If one or more leap seconds were inserted between the UTC endpoints, they must be accounted for in order for the result to be accurate.
- When converting between UTC and TAI times. Any leap seconds that occurred between the TAI reference time and the UTC time must be accounted for, or the result will be wrong.
- When comparing TAI times with different reference times, or converting from one TAI reference time to the other. Any leap seconds that occurred between the reference times must be accounted for, or the result will be wrong. An example would be when comparing TAI93 times in L1B products to “IET” microseconds in operational ATMS SDR products, which use a

reference time of 1958-01-01T00:00Z. In this case 27 leap seconds occurred between the reference times.

In general, these operations can be error-prone. Therefore it is recommended that time calculations and conversions be done with leap-second-aware third party tools that rely on an up-to-date table of leap seconds, such as the “astropy” python package. As a generality, it can be assumed that most computational systems use POSIX time scale and cannot represent leap seconds, unless specifically stated in the software specifications.

2.3 Key Science Data Fields

Key science data fields and the aux group and their dimensions are defined below.

Table 2.3.1 Key Science Data Fields

Variable Name	Dimensions	Type	Meaning
antenna_temp	atrack, xtrack, channel	32-bit floating-point	Calibrated scene brightness temperature for each ATMS channel and beam position. This output is the Rayleigh equivalent temperature and not the Planck blackbody equivalent temperature
cold_nedt	channel	32-bit floating-point	Noise equivalent delta temperature derived from observations of cold space
warm_nedt	channel	32-bit floating-point	Noise equivalent delta temperature derived from observations of the warm calibration target

3.0 Data Contents

The ATMS L1B data products are written in NetCDF4 format and therefore makes use of groups, dimensions, variables, and attributes (global and variable). Every NetCDF4/HDF5 file contains, at a minimum, one root group which is unnamed.

Attention should be given to quality flags and checked for fill values before being used for any analysis or higher processing of the L1B product.

3.1 Dimensions

Key dimensions used through the ATMS L1B product.

Table 3.1 Dimensions

Dimension name	Size	Meaning
atrack	135	Along-track spatial dimension
xtrack	96	Cross-track spatial dimension
channel	22	ATMS channels
band	5	Microwave bands: K, Ka, V, W, G
utc_tuple	8	Parts of the UTC date/time: year, month, day, hour, minute, second, millisec, microsec
spatial	3	Directions: x, y, z
fov_poly	8	Lat/lon points defining the polygon bounding an fov (anticlockwise as viewed from above)
attitude	3	Roll, pitch, yaw
spacetrack	4	Space view

3.2 Global Attributes

There are two types of attributes: global and variable. In this section we will talk about global attributes. Global attributes, sometimes referred to as ‘file-level attributes’, provide information about the entire file or 6-minute granule. This includes observation times, publisher and creator information, data provenance, geolocation information. Many attributes are required to conform to the CF (Climate and Forecast) and ACDD (Attribute Convention for Data Discovery) standards while other attributes are written for consistency with legacy products, hence, you may find some information to be a little redundant or differing in the naming convention.

There are some QA global attributes that should be considered before using the data in analysis or processing. See Table 3.2.2 Global Attributes or Appendix C: CDL File Definition for full definition.

Table 3.2.1 QA

Attribute Name	Type	Dimens	Description

		ion	
AutomaticQualityFlag	string		**Passed**: the granule contains a non-degraded calibrated brightness temperature or radiance for at least one channel in a geolocated FOV **Suspect**: the granule does not qualify as "Passed" but contains a (possibly degraded) calibrated brightness temperature or radiance for at least one channel (possibly without associated geolocation) **Failed**: the granule contains no calibrated brightness temperatures/radiances.
geo_qual	ushort	atrack, xtrack	Overall value of 0 indicates no critical issues. Bit 2 (surface_loc)- Failed geolocation on Earth topographic surface Bit 3 (DEM) - Could not set FOV surface elevations and land water fraction Bit 4 (geoid_loc) - Failed geolocation on Earth geoid Bit 5 (solar_ang) - Failed to set solar zenith or azimuth angles Bit 6 (spacecraft_ang) - Failed to set spacecraft zenith or azimuth angles Bit 7 - Unused (0) Bit 8 (band_specific) - Failed geolocation of some bands
qa_no_data	string		A simple indicator of whether this is an "empty" granule with no data from the instrument. "TRUE" or "FALSE".

Table 3.2.2 Variable Attributes

Attribute	Relevant standard(s)	Description
units	CF, UDUNITS	units, for variables that represent physical quantities
_FillValue	CF, NetCDF	a single sentinel value indicating the data point contains fill instead of valid data
standard_name	CF	standard name from the CF standard name table, if one exists for the quantity being represented
long_name	CF	a longer name describing the quantity being represented, suitable for a plot title

valid_range	CF	a pair of values indicating the minimum and maximum values to be considered valid
coordinates	CF	a space-separated list of the names of other variables that are coordinates for this variable
description		a longer description of the quantity being represented
coverage_content_type	ACDD, ISO 19115-1	indicates the source of the data
ancillary_variables	CF	a space-separated list of the names of other variables that contain information about this variable
bounds	CF	defines the extent, for cell variables
cell_methods	CF	describes statistical methods used to derive data, for cell variables
flag_values	CF	a comma-separated list of flag values, for variables that represent flags
flag_meanings	CF	a space separated list of the meanings of each flag value, for variables that represent flags
flag_masks	CF	a comma-separated list of flag masks, for variables that represent flags. If this attribute is present, the basic rule is “apply the flag mask and if you get the flag value, it means the flag meaning”

Table 3.2.2 Global Attributes

Variable Name	Type	Description	Heritage
naming_authority	string	The organization that provides the initial id (see above) for the dataset. The naming authority should be uniquely specified by this attribute. We recommend using reverse-DNS naming for the naming authority; URIs are also acceptable. Example: 'edu.ucar.unidata'.	ACDD Recommended
history	string	Provides an audit trail for modifications to the original data. This attribute is also in the NetCDF Users Guide: 'This is a character array with a line for each invocation of a program that has modified the dataset. Well-behaved generic netCDF applications should append a line containing: date, time of day, user name, program name and command arguments.' To include a more complete description you can append a reference to an ISO Lineage entity; see NOAA EDM ISO	CF, ACDD Recommended

Variable Name	Type	Description	Heritage
		Lineage guidance.	
source	string	The method of production of the original data. If it was model-generated, source should name the model and its version. If it is observational, source should characterize it. This attribute is defined in the CF Conventions. Examples: 'temperature from CTD #1234'; 'world model v.0.1'.	CF, ACDD Recommended
processing_level	string	A textual description of the processing (or quality control) level of the data.	ACDD Recommended
product_name_type_id	string	Product name as it appears in product_name (L1A, L1B, L2, SNO_AIRS_CrIS)	
comment	string	Miscellaneous information about the data or methods used to produce it. Can be empty.	CF, ACDD Recommended
acknowledgment	string	A place to acknowledge various types of support for the project that produced this data.	ACDD Recommended
license	string	Provide the URL to a standard or specific license, enter "Freely Distributed" or "None", or describe any restrictions to data access and distribution in free text.	ACDD Recommended
standard_name_vocabulary	string	The name and version of the controlled vocabulary from which variable standard names are taken. (Values for any standard_name attribute must come from the CF Standard Names vocabulary for the data file or product to comply with CF.) Example: 'CF Standard Name Table v27'.	ACDD Recommended
date_created	string	The date on which this version of the data was created. (Modification of values implies a new version, hence this would be assigned the date of the most recent values modification.) Metadata changes are not considered when assigning the date_created. The ISO 8601:2004 extended date format is recommended, as described in the Attribute Content Guidance section.	ACDD Recommended, ECS/AIRS ProductionDateTime
creator_name	string	The name of the person (or other creator type specified by the creator_type attribute) principally	ACDD Recommended

Variable Name	Type	Description	Heritage
		responsible for creating this data.	
creator_email	string	The email address of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.	ACDD Recommended
creator_url	string	The URL of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.	ACDD Recommended
institution	string	Processing facility that produced this file.	CF, ACDD Recommended
project	string	The name of the project(s) principally responsible for originating this data. Multiple projects can be separated by commas, as described under Attribute Content Guidelines. Examples: 'PATMOS-X', 'Extended Continental Shelf Project'	ACDD Recommended
publisher_name	string	The name of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or product to users, with its current metadata and format.	ACDD Recommended
publisher_email	string	The email address of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or product to users, with its current metadata and format.	ACDD Recommended
publisher_url	string	The URL of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or the product to users, with its current metadata and format.	ACDD Recommended
geospatial_bounds	srting	Describes the data's 2D or 3D geospatial extent in OGC's Well-Known Text (WKT) Geometry format (reference the OGC Simple Feature Access (SFA) specification). The meaning and order of values for each point's coordinates depends on the coordinates reference system (CRS). Tje ACDD default is 2D geometry ni the EPSG:4326 coordinate reference system. The default may be overridden with geospatial_bounds_crs and geospatial_bounds_vertical_crs (see	ACDD Recommended

Variable Name	Type	Description	Heritage
		those attributes). ESPG:4326 coordinate values are latitude (decimal degrees_north) and longitude (decimal degrees_east), in that order. Longitude values in the default case are limited to the -180, 180) range, Example 'POLYGON ((40.26 – 111.29, 41.26 -111.29, 41.26 -1110.29, 40.26 -110.29, 40.26 -111.29))'.	
geospatial_bounds_crs	string	The coordinate reference system (CRS) of the point coordinates in the geospatial_bounds attribute. This CRS may be 2-dimensional or 3-dimensional, but together with geospatial_bounds_vertical_crs, if that attribute is supplied, must match the dimensionality, order, and meaning of point coordinate values in the geospatial_bounds attribute. If geospatial_bounds_vertical_crs is also present then this attribute must only specify a 2D CRS. EPSG CRSs are strongly recommended. If this attribute is not specified, the CRS is assumed to be EPSG:4326. Examples: 'EPSG:4979' (the 3D WGS84 CRS), 'EPSG:4047'.	ACDD Recommend
geospatial_lat_min	float	Describes a simple lower latitude limit; may be part of a 2- or 3-dimensional bounding region. Geospatial_lat_min specifies the southernmost latitude covered by the dataset.	ACDD Recommend
geospatial_lat_max	float	Describes a simple upper latitude limit; may be part of a 2- or 3-dimensional bounding region. Geospatial_lat_max specifies the northernmost latitude covered by the dataset.	ACDD Recommend
geospatial_lon_min	float	Describes a simple longitude limit; may be part of a 2- or 3-dimensional bounding region. geospatial_lon_min specifies the westernmost longitude covered by the dataset. See also geospatial_lon_max.	ACDD Recommend
geospatial_lon_max	float	Describes a simple longitude limit; may be part of a 2- or 3-dimensional bounding region. geospatial_lon_max specifies the easternmost longitude covered by	ACDD Recommend

Variable Name	Type	Description	Heritage
		the dataset. Cases where geospatial_lon_min is greater than geospatial_lon_max indicate the bounding box extends from geospatial_lon_max, through the longitude range discontinuity meridian (either the antimeridian for -180:180 values, or Prime Meridian for 0:360 values), to geospatial_lon_min; for example, geospatial_lon_min=170 and geospatial_lon_max=-175 incorporates 15 degrees of longitude (ranges 170 to 180 and -180 to -175).	
time_coverage_start	string	Nominal start time. Describes the time of the first data point in the data set. Use the ISO 8601:2004 date format, preferably the extended format as recommended in the Attribute Content Guidance section.	ACDD Recommend
time_of_first_valid_obs	string	Describes the time of the first valid data point in the data set. Use the ISO 8601:2004 date extended format.	
time_coverage_mid	string	Describes the midpoint between the nominal start and end times. Use the ISO 8601:2004 date format, preferably the extended format as recommended in the Attribute Content Guidance section.	Sounder SIPS extension by analogy with ACDD time_coverage_start and time_coverage_end
time_coverage_end	string	Nominal end time. Describes the time of the last data point in the data set. Use ISO 8601:2004 date format, preferably the extended format as recommended in the Attribute Content Guidance section.	ACDD Recommend
time_of_last_valid_obs	string		
time_coverage_duration	string	Describes the duration of the data set. Use ISO 8601:2004 duration format, preferably the extended format as recommended in the Attribute Content Guidance section.	ACDD Recommend
product_name_duration	string	Product duration as it appears in product_name (m06 means six minutes)	

Variable Name	Type	Description	Heritage
creator_type	string	Specifies type of creator with one of the following: 'person', 'group', 'institution', or 'position'. If this attribute is not specified, the creator is assumed to be a person.	ACDD Suggested
creator_institution	string	The institution of the creator; should uniquely identify the creator's institution. This attribute's value should be specified even if it matches the value of publisher_institution, or if creator_type is institution.	ACDD Suggested
product_version	string	Version identifier of the data file or product as assigned by the data creator. For example, a new algorithm or methodology could result in a new product_version.	ACDD Suggested
keywords_vocabulary	string	If you are using a controlled vocabulary for the words/phrases in your "keywords" attribute, this is the unique name or identifier of the vocabulary from which keywords are taken. If more than one keyword vocabulary is used, each may be presented with a prefix and a following comma, so that keywords may optionally be prefixed with the controlled vocabulary key. Example: 'GCMD:GCMD Keywords, CF:NetCDF COARDS Climate and Forecast Standard Names'.	ACDD Suggested
platform	string	Name of the platform(s) that supported the sensor data used to create this data set or product. Platforms can be of any type, including satellite, ship, station, aircraft or other. Indicate controlled vocabulary used in platform_vocabulary.	ACDD Suggested
platform_vocabulary	string	Controlled vocabulary for the names used in the "platform" attribute.	ACDD Suggested
product_name_platform	string	Platform name as it appears in product_name	
instrument	string	Name of the contributing instrument(s) or sensor(s) used to create this data set or product. Indicate controlled vocabulary used in instrument_vocabulary.	ACDD Suggested
instrument_vocabulary	string	Controlled vocabulary for the names used in the "instrument" attribute.	ACDD Suggested

Variable Name	Type	Description	Heritage
product_name_instr	string	Instrument name as it appears in product_name	
product_name	string	Canonical fully qualified product name (official file name)	ECS LocalGranuleID
product_name_variant	string	Processing variant identifier as it appears in product_name. 'std' (shorthand for 'standard') is to be the default and should be what is seen in all public products.	
product_name_version	string	Version number as it appears in product_name (v01_00_00)	
product_name_producer	string	Production facility as it appears in product_name (single character) 'T' is the default, for unofficial local test products	
product_name_timestamp	string	Processing timestamp as it appears in product_name (yymmddhhmmss)	
product_name_extension	string	File extension as it appears in product_name (typically nc)	
granule_number	string	granule number of day (1-240)	AIRS
product_name_granule_number	string	zero-padded string for granule number of day (g001-g240)	AIRS
gran_id	string	Unique granule identifier yyyymmddThhmm of granule start, including year, month, day, hour, and minute of granule start time	
geospatial_lat_mid	float	granule center latitude	AIRS LatgranuleCen
geospatial_lon_mid	float	granule center longitude	AIRS LongranuleCen
featureType	string	structure of data in file	CF
data_structure	string	A character string indicating the internal organization of the data with currently allowed values of 'grid', 'station', 'trajectory', or 'swath'. The 'structure' here generally describes the horizontal structure and in all cases data may also be functions, for example, of a vertical coordinate and/or time. (If using CMOR pass this in a call to cmor_set_cur_dataset_attribute.)	CMIP5/CMOR
cdm_data_type	string	The data type, as derived from Unidata's Common Data Model Scientific Data types and understood by THREDDS. (This is a THREDDS	ACDD Suggested

Variable Name	Type	Description	Heritage
		"dataType", and is different from the CF NetCDF attribute 'featureType', which indicates a Discrete Sampling Geometry file in CF.)	
identifier_product_doi _authority	string	digital signature source	AIRS
algorithm_version	string	The version of the algorithm in whatever format is selected by the developers. Versions from multiple sub-algorithms may be concatenated with semicolon separators. (ex: 'CCAST 4.2; BB emis from MIT 2016-04-01')	
production_host	string	Identifying information about the host computer for this run. (Output of linux "uname -a" command.)	
format_version	string	Format version.	
input_file_names	string	Semicolon-separated list of names or unique identifiers of files that were used to make this product. There will always be one space after each semicolon. There is no final semicolon.	ECS InputPointer; ISO Source Citation
input_file_types	string	Semicolon-separated list of tags giving the role of each input file in input_file_names. There will always be one space after each semicolon. There is no final semicolon.	ISO Source Description
input_file_dates	string	Semicolon-separated list of creation dates for each input file in input_file_names. There will always be one space after each semicolon. There is no final semicolon.	ISO Source Creation Date
orbitDirection	string	Orbit is ascending and/or descending. Values are "Ascending" or "Descending" if the entire granule fits that description. "NorthPole" and "SouthPole" are used for polar-crossing granules. "NA" is used when a determination cannot be made.	SMAP uses this attribute name but only asc/desc because files are half orbits. The values used here are similar to AIRS node_type.
day_night_flag	string	Data is day or night. "Day" means subsatellite point for all valid scans has solar zenith angle less than 90 degrees. "Night" means subsatellite point for all valid scans has solar zenith angle greater than 90 degrees. "Both" means the dataset contains valid observations with solar zenith	AIRS DayNightFlag

Variable Name	Type	Description	Heritage
		angle above and below 90 degrees. "NA" means a value could not be determined.	
AutomaticQualityFlag	string	"*Passed*": the granule contains a non-degraded calibrated brightness temperature or radiance for at least one channel in a geolocated FOV "*Suspect*": the granule does not qualify as "Passed" but contains a (possibly degraded) calibrated brightness temperature or radiance for at least one channel (possibly without associated geolocation) "*Failed*": the granule contains no calibrated brightness temperatures/radiances.	ECS. AIRS called it AutomaticQA Flag in HDF attributes but AutomaticQuality Flag in metadata.
qa_pct_data_missing	float	Percentage of expected observations that are missing.	ECS, maps to (part of) ISO 19115 Completeness Commission
qa_pct_data_geo	float	Percentage of expected observations that are successfully geolocated.	maps to (part of) ISO 19115 Completeness Commission
qa_pct_data_sci_mode	float	Percentage of expected observations that were taken while the instrument was in science mode and are successfully geolocated.	maps to (part of) ISO 19115 Completeness Commission
qa_no_data	string	A simple indicator of whether this is an "empty" granule with no data from the instrument. "TRUE" or "FALSE".	

3.3 Products/Parameters

Table 3.3.1 Variables

Variable Name	Dimensions	Type	Units	Description
obs_id	atrack, xtrack	string	1	unique earth view observation identifier: yyyymmddThhmm.aa[a]Exx . Includes gran_id plus two- or three-digit along-track index (01-45 or 001-135) and 2-digit cross-track index (01-96)
instrument_state	atrack,xtrack	ubyte	1	instrument/data state: 0 = 'Process' - Data is usable for

Variable Name	Dimensions	Type	Units	Description
				science; 1 = 'Special' - Observations are valid but instrument is not configured for science data (ex: stare mode); 2 = 'Erroneous' - Data is not usable (ex: checksum error); 3 = 'Missing' - No data was received.
obs_time_tai93	atrack, xtrack	double	seconds since 1993-01-01 00:00	earth view observation midtime for each FOV
obs_time_utc	atrack,xtrack, utc_tuple	ushort	1	UTC earth view observation time as an array of integers: year, month, day, hour, minute, second, millisec, microsec
lat	atrack, xtrack	float	degrees north	latitude of FOV center
lat_geoid	atrack,xtrack	float	degrees north	latitude of FOV center on the geoid (without terrain correction)
lon	atrack, xtrack	float	degrees east	latitude of FOV center on the geoid (without terrain correction)
lon_geoid	atrack, xtrack	float	degrees east	longitude of FOV center on the geoid (without terrain correction)
lat_bnds	atrack, xtrack, fov_poly	float	degrees north	latitudes of points forming a polygon around the perimeter of the FOV
lon_bnds	atrack, xtrack, fov_poly	float	degrees east	longitudes of points forming a polygon around the perimeter of the FOV
land_frac	atrack, xtrack	float	1	land fraction over the FOV
surf_alt	atrack, xtrack	float	m	mean surface altitude wrt earth model over the FOV
surf_alt_sdev	atrack, xtrack	float	m	standard deviation of surface altitude within the FOV
sun_glint_lat	atrack, xtrack	float	degrees north	sun glint spot latitude at scan_mid_time. Fill for night observations.
sun_glint_lon	atrack, xtrack	float	degrees east	sun glint spot longitude at scan_mid_time. Fill for night observations.
sol_zen	atrack, xtrack	float	degree	solar zenith angle at the center of the spot
sol_azi	atrack, xtrack	float	degree	solar azimuth angle at the center of the spot (clockwise from North)
sun_glint_dist	atrack, xtrack	float	m	distance of sun glint spot to the center of the spot. Fill for night observations

Variable Name	Dimensions	Type	Units	Description
view_ang	atrack, xtrack	float	degree	off nadir pointing angle
sat_zen	atrack, xtrack	float	degree	satellite zenith angle at the center of the spot
sat_azi	atrack, xtrack	float	degree	satellite azimuth angle at the center of the spot (clockwise from North)
sat_range	atrack, xtrack	float	m	line of sight distance between satellite and spot center
asc_flag	atrack	ubyte	1	ascending orbit flag: 1 if ascending, 0 descending
subsat_lat	atrack	float	degrees north	sub-satellite latitude at scan_mid_time
subset_lon	atrack	float	degrees east	sub-satellite longitude at scan_mid_time
scan_mid_time	atrack	double	seconds since 1993-01-01 00:00	TAI93 at middle of earth scene scans
sat_alt	atrack	float	m	satellite altitude with respect to earth model at scan_mid_time
sat_pos	atrack, spatial	float	m	satellite ECR position at scan_mid_time
sat_vel	atrack, spatial	float	m s^{-1}	satellite ECR velocity at scan_mid_time
sat_att	atrack, attitude	float	degree	satellite attitude at scan_mid_time. An orthogonal triad. First element is angle about the +x (roll) ORB axis. +x axis is positively oriented in the direction of orbital flight. Second element is 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. Third element is 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.
moon_ang	atrack, spacextrack	float	degree	angle between moon and FOV center for space view
local_solar_time	atrack, xtrack	float	hours	local apparent solar time in hours from midnight
mean_anom_wrt_equat	atrack		degrees	spacecraft mean anomaly measured with respect to the ascending node

Variable Name	Dimensions	Type	Units	Description
sat_sol_zen	atrack	float	degrees	solar zenith angle at the satellite
sat_sol_azi	atrack	float	degree	solar azimuth angle at the satellite (clockwise from North)
asc_node_lon		float	degrees east	longitude of the last ascending node of spacecraft orbit before time_coverage_end.
asc_node_tai93		double	seconds since 1993-01-01 00:00	TAI93 time of the last ascending node of spacecraft orbit before time_coverage_end.
asc_node_local_solar_time		float	hours	local apparent solar time at the last ascending node before time_coverage_end in hours from midnight
solar_beta_angle		float	degrees	Beta angle for the spacecraft orbit, determining the percentage of the orbit that the spacecraft is in direct sunlight.
attitude_lbl	attitude	string		list of rotational directions (roll, pitch, yaw)
spatial_lbl	spatial	string		list of spatial directions (X, Y, Z)
utc_tuple_lbl	utc_tuple	string		names of the elements of UTC when it is expressed as an array of integers year,month,day,hour,minute,second, millisecond,microsecond
band_lat	atrack, xtrack, band	float	degrees north	band-specific FOV center latitude
band_lon	atrack, xtrack, band	float	degrees east	band-specific FOV center longitude
band_lat_bnds	atrack, xtrack, band, fov_poly	float	degrees north	latitudes of points forming a polygon around the perimeter of the band-specific FOV
band_lon_bnds	atrack, xtrack, band, fov_poly	float	degrees east	longitudes of points forming a polygon around the perimeter of the band-specific FOV
band_land_frac	atrack, xtrack, band	float	1	band-specific land fraction over the FOV
band_surf_alt	atrack, xtrack, band	float	m	band-specific mean surface altitude over the FOV
band_geoloc_chan	band	ushort	1	Channel used in determining the geolocation information for each band
antenna_temp	atrack, xtrack, channel	float	Kelvin	Calibrated scene brightness temperature for each ATMS channel and beam position. This output is the Rayleigh equivalent temperature and not the Planck blackbody

Variable Name	Dimensions	Type	Units	Description
				equivalent temperature
antenna_temp_qc	atrack, xtrack, channel	byte	1	antenna_temp QC flag Meaning=Best, Good, Do_Not_Use
cold_nedt	channel	float	Kelvin	Noise equivalent delta temperature derived from observations of cold space
warm_nedt	channel	float	Kelvin	Noise equivalent delta temperature derived from observations of warm calibration target
band_lbl	band	string		List of Microwave bands (K, Ka, V, W, G)
channel	channel	ushort	1	Number for each channel (1-22)
chan_band	channel	string		Name of band for each channel
antenna	channel	char		Name of antenna for each channel
center_freq	channel	float	MHz	Channel center frequency
if_offset_1	channel	float	MHz	Offset of first intermediate frequency stage (zero for no mixing)
if_offset_2	channel	float	MHz	Offset of second intermediate frequency stage (zero for no mixing)
bandwidth	channel	float	MHz	bandwidth of sum of 1, 2, or 4 channels
polarization	channel	char		Nominal polarization: Vertical or Horizontal
beam_width	channel	float	degrees	Nominal beam width

The auxillary information, provided in an aux group, is not readily used by the wider user community but is provided here for completeness. See Appendix B of the User Guide for additional information about these data products.

Table 3.3.2 Auxiliary Group Variables

Variable Name	Dimensions	Type	Units	Description
geo_qualflag	atrack, xtrack	int32	1	Bit 7 - Failed geolocation on Earth topographic surface (surface_loc)
				Bit 6 - Could not set FOV surface elevations and land water fraction (DEM)

				Bit 5 - Failed geolocation on Earth geoid (geoid_loc)
				Bit 4 - Failed to set solar zenith or azimuth angles (solar_ang)
				Bit 3 - Failed to set spacecraft zenith or azimuth angles (spacecraft_ang)
				Bit 2 - Unused (0)
				Bit 1 (LSB) - Failed geolocation of some bands (band_specific)
cal_qualflag	atrack, channel	int32	1	(Bit 32 is most significant. It is not used because it can cause confusion when this flag is used as a signed or unsigned integer.)
				Bit 7 : No usable calibration. Scan is not calibrated. (cal_failed)
				Bit 6 : Calibration values used from different scan. (cal_from_diff_scan)
				Bit 5: Insufficient valid shelf temperature values to use in a scan calibration. Fall-back constant shelf temperatures are used. (shelf_temp_bad)
				Bit 4: Excess noise (noise)
				Bit 3: Telemetry out of limits (telem)
				Bit 2: Spectral quality is poor (spectral)
				Bit 1 (LSB): reserved (0)
cal_space_qualflag	atrack, channel	int32	1	(Bit 32 is most significant. It is not used because it can cause confusion when this flag is used as a signed or unsigned integer.)
				Bit 14 : Insufficient valid space (cold calibration) observation counts to produce a scan-specific calibration. Scan may still be calibrated using coefficients from another scan. (cold_cal_bad)
				Bit 13: Insufficient effective space temperature values to produce a scan-specific calibration. Scan may still be calibrated using coefficients from another scan. (space_temp_bad)
				Bit 12: This scan's space view #1 not used because of lunar intrusion or other problem. A scan-specific calibration may still be calculated using space views from neighboring views and scans. (sv1_bad)
				Bit 11: This scan's space view #2 not

				used because of lunar intrusion or other problem. A scan-specific calibration may still be calculated using space views from neighboring views and scans. (sv2_bad)
				Bit 10 : This scan's space view #3 not used because of lunar intrusion or other problem. A scan-specific calibration may still be calculated using space views from neighboring views and scans. (sv3_bad)
				Bit 9 : This scan's space view #4 not used because of lunar intrusion or other problem. A scan-specific calibration may still be calculated using space views from neighboring views and scans. (sv4_bad)
				Bit 8: Missing moon angle for this scan's space view #1. Lunar intrusion status is unknown. (sv1_moon_unknown)
				Bit 7: Missing moon angle for this scan's space view #2. Lunar intrusion status is unknown. (sv2_moon_unknown)
				Bit 6: Missing moon angle for this scan's space view #3. Lunar intrusion status is unknown. (sv3_moon_unknown)
				Bit 5: Missing moon angle for this scan's space view #4. Lunar intrusion status is unknown. (sv4_moon_unknown)
				Bits 1-4: reserved (0)
cal_blackbody_qualflag	atrack, channel	int32	1	(Bit 32 is most significant. It is not used because it can cause confusion when this flag is used as a signed or unsigned integer.)
				Bit 3: Insufficient valid black body (warm calibration) observation counts to produce a scan-specific calibration. Scan may still be calibrated using coefficients from another scan. (warm_cal_bad)
				Bit 2: Insufficient valid black body temperature readings to produce a scan-specific calibration. Scan may still be calibrated using coefficients from another scan. (bb_temp_bad)
				Bit 1 (LSB): This scan's black body view not used. A scan-specific calibration may still be calculated using black body views from

				neighboring scans. (bb_bad)
offset	atrack, channel	float	Kelvin	Offset used in calibrating earth scene brightness temps.
gain	atrack, channel	float	Count/ Kelvin	Gain factor used in calibrating earth scene brightness temps.
nonlin	atrack, xtrack, channel	float	Kelvin	Nonlinearity correction used in calibrating earth scene brightness temps.
cold_temp	atrack, channel	float	Kelvin	Effective temperature of cold calibration view (space) (Tcc)
warm_temp	atrack, channel	float	Kelvin	Effective temperature of warm calibration view (black body)(Twc)

4.0 Options for Reading the Data

4.1 Command Line Utilities

The ATMS L1B files are written in NetCDF4/HDF5. Because NetCDF4 builds upon the classic NetCDF data model using HDF5 as the storage layer, a user of the data product can take full advantage of tools and libraries readily available to access the data.

Every NetCDF4 file is considered an HDF5 file, however, not every HDF5 file is necessarily a NetCDF4 file. A limited subset of the HDF5 data model and file format features are used in NetCDF4 files. Conformance to the earlier mentioned CF and ACDD standards allows for users to take advantage of most NetCDF interfaces.

Tools and libraries for reading NetCDF4 as well as a NetCDF Users' Guide are written and maintained by Unidata and can be found online at:
https://www.unidata.ucar.edu/software/netcdf/workshops/2012/utilities/index.html

There are a number of interfaces available for reading NetCDF for different programming languages including: C/C++, Fortran, Matlab, IDL, Python and Perl.

4.2 Tools/Programs

Examples to use in this section are below:

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

NetCDF utilities can be found on the Unidata website:

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 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 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.

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

HDFView
HDFView is a Java based graphical user interface created by the HDF Group which can be used to browse all objects in an HDF file hierarchy which is represented as a tree structure.

HDFView can be downloaded at ftp://ftp.hdfgroup.org/HDF5/hdf-java/. Documentation for HDFView can be view at http://hdf.ncsa.uiuc.edu/hdf-java-html/hdfview/UsersGuide/index.html.

Panoply
NASA GIS provides the tool, Panoply, https://disc.gsfc.nasa.gov/information/howto/5761bc6a5ad5a18811681bfc which will read and plot netCDF files.

A list of software able to read data files can be found at:
https://hdfeos.org/zoo/index_openGESDISC_Examples.php

5.0 Data Services

The ATMS Level 1B products are available to the user community via the Goddard Earth Sciences and Information Services Center (GES DISC)

The ATMS Level 1A products are not archived at the GES IDSC and therefore not made publicly available. No other Data Services are provided for these products.

If you need assistance or wish to report a problem:

Email: gsfc-help-disc@lists.nasa.gov

Voice: 301-614-5224

Fax: 301-614-5268

Address:

Goddard Earth Sciences Data and Information Services Center NASA Goddard Space Flight Center Code 610.2 Greenbelt, MD 20771 USA

6.0 More InformationFor additional information see the SNPPATMSL1B_V02 User Guide.

For information, questions or concerns with this ATMS L1B data set, please contact:
Ruth Monarrez Ruth.Monarrez@jpl.nasa.gov at or send your question to: sounder.sips@jpl.nasa.gov .

7.0 Acknowledgements

Support of this research was provided by NASA.

References

1. B. Lambrigsten, Suomi National Polar Partnership Mission; Algorithm Theoretical Basis Document NASA L1b: Advanced Technology Microwave Sounder , Version 1, July 2004

2. M. Schreier, Advanced Technology Microwave Sounder (ATMS) Assessment Report for Suomi National Polar-orbiting Partnership (SNPP) Sounder Science Investigator-led Processing System (SIPS) Data Level 1 , Data Product Version 2.0, March 2018

3. NOAA Technical Report NESDIS 143 Cross Track Infrared Sounder (CrIS) Sensor Data Record (SDR) User's Guide . Version 1.0, Washington, D.C., December, 2013

4. NASA ESO EARTHDATA Standards, Requirements and References