1.

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

README Document for the Suomi-NPP OMPS NMEV L1B Product

Version 2.0

Last Revised 6 July 2017

Goddard Earth Sciences Data and Information Services Center (GES DISC)
http://disc.gsfc.nasa.gov
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771 USA

Prepared By:

James Johnson

Name
GES DISC
GSFC Code 610.2

05/08/2017

Date

Colin Seftor

Name
SSAI/NASA GSFC Code 614

Reviewed By:

Reviewer Name

Reviewer Name
GES DISC
GSFC Code 613.2

Date

Date

Goddard Space Flight Center

Greenbelt, Maryland

Revision History

Revision Date	Changes	Author
8 May 2017	First release	C. Seftor
06 July 2017	Corrected the definitions of InstrumentQualityFlag and GroundPixelQualityFlag in Section 3.2.2 (they were swapped, one for the other). Corrected some meta-data entries in Section 3.2	C. Seftor

Table of Contents

1.0 Introduction

This document provides basic information for using the Suomi National Polar-orbiting Partnership (NPP) Ozone Mapping and Profiling Suite (OMPS) Nadir Mapper (NM) Earth View (EV) Level 1B product, or OMPS-NPP_NMEV_L1B for short. OMPS-NPP_NMEV_L1B provides geolocated, calibration radiances measured by the NM sensor; each file contains one orbit's worth of data.

1.1 OMPS Instrument Description

The Ozone Mapping and Profiling Suite (OMPS) is designed to measure the global distribution of total column ozone on a daily basis, as well as the vertical distribution of ozone in the stratosphere and lower mesosphere (~15-60 km). OMPS on the Suomi NPP satellite consists of three instruments:

Nadir Mapper (NM) – The Nadir Mapper measures total column ozone using backscattered UV radiation between 300-380 nm. A wide field-of-view telescope enables full daily global coverage using 50 km x 50 km pixels. Other quantities, such as aerosol index and column SO_2 abundance, can be derived from NM measurements.

Nadir Profiler (NP) – The Nadir Profiler measures stratospheric profile ozone with moderate vertical resolution (6-8 km) using backscattered UV radiation between 250-310 nm. The along-track footprint of NP is 250 km x 250 km.

Limb Profiler (LP) – The Limb Profiler measures limb scattered radiation in the UV, visible, and near-IR spectral regions to retrieve ozone density and aerosol extinction coefficient profiles from the lower stratosphere (10-15 km) to the upper stratosphere (55 km).

Only OMPS NM L1B measurements and products will be described here.

1.1.1 Nadir Mapper

The OMPS nadir instrument is composed of two spectrometers that share the same telescope. A dichroic filter downstream of the telescope redirects photons into either the NM or the Nadir Profiler (NP) spectrometer. The telescope itself has a 110° total across-track field of view (FOV), resulting in 2800 km instantaneous coverage at the Earth's surface; this is sufficient to provide daily full global coverage at the equator for the NM sensor. The telescope includes a pseudo depolarizer [McClain et al., 1992] designed to minimize the system's sensitivity to incoming polarization. The dichroic filter is optimized to reflect most of the 250–310 nm light to the NP spectrometer and transmit most of the 300–380 nm light to the NM spectrometer.

Once split, the light from the NM spectrometer is dispersed via a diffraction grating onto one dimension of a two dimensional charge-coupled device (CCD) located at the spectrometer's focal plane. The second dimension reflects the cross-track spatial coverage provided by the slit aperture and optics. The CCD consists of 340 pixels along the spectral dimension and 740 pixels in the across-track spatial dimension.

Measurements meeting the 300–380 nm wavelength range specification required by the NM sensor are obtained by illuminating 196 of the 340 pixels in the spectral dimension. In the across-track dimension, 708 pixels are illuminated. For nominal operations, the pixel signals are summed into 35 separate "macropixel" FOVs; all but the two outer FOVs contain 20 pixels per macropixel; the left outermost macropixel contains 26 pixels, while the right outermost contains 22. Since the readout of the CCD is split in the center, measurements comprising the central FOV are actually split (although not symmetrically). Rather than rebinning these measurements in ground processing, they remain split, resulting in 36 cross-track FOVs. In this case, the central two FOVs comprise 12 pixels (30× 50km) and 8 pixels (20 × 50 km), respectively.

Because macropixels are constructed in programmable flight electronics, the OMPS nadir temporal (along-track) and spatial (across-track) resolutions are highly configurable. High-resolution measurements, approximately 10 km× 10 km at nadir, have been routinely collected 1 day per week for the first 2 years of the mission. To remain within the telemetry bandwidth constraints, a set of only 59 wavelengths was selected; this selection still allows retrievals of total column ozone and other quantities (such as SO_2).

1.2 Algorithm Background

There are three distinct phase of computation within the L1B processing. The first is the aggregation of table files into a macro-pixel format, and involves basic summing, averaging, and scaling by integration time (when applicable) of the micro pixel tables into macro pixels that correspond to the measured data. The other phases are Geolocation and Radiometric Calibration, both of which are described below.

1.2.1 Geolocation

The calculation of geolocation information utilizes functionality contained in the SDP Toolkit. The inputs to this algorithm consist of pre-launch spatial registration information, attitude and ephemeris data obtained from the spacecraft, and timing information.

As a first step, the ephemeris and attitude are transformed to the Toolkit Frame, and the Earth-

Centered Inertial Ephemeris and Euler deviation angles from geocentric spacecraft frame are produced.

The next step is to extract measurement timing information downloaded from the satellite. This information is used to calculate the central time of each measurement (times in the L1A correspond to the last coadded image of each measurement).

With this information, the SDP Toolkit interpolates ephemeris and attitude to science data times. The Toolkit also calculates many other fields, including solar angles, the subsatellite point, the Sun-Earth distance, the solar and view angles at the center of the ground pixel and the subsatellite point latitude, longitude, and solar zenith angle.

1.2.2 Radiometric Calibration

The Radiometric Calibration portion of the L1B can be summarized by a single formula:

$$R = r_{coeff}(C_{Total} - C_{Smear} - C_{Dark} - C_{Stray})$$

where R is the calibrated radiance, r_{coeff} is the radiometric calibration coefficient, C_{Total} is the total measured counts, C_{Smear} is the smear correction (i.e., parallel overclock), C_{Dark} is the dark current correction, and C_{Stray} is the stray light correction. The linearity correction is made on board the spacecraft. r_{coeff} and C_{Dark} are obtained from the binned table files, while C_{smear} and C_{Stray} are calculated from the science data found within the L1A. Note that the instrument bias is included as part of C_{Smear}, and is thus removed from the measurement along with the smear. For details on the stray light correction, please see reference 1.

1.3 Data Disclaimer

Special high resolution diagnostic data were taken every Sunday from the beginning of the mission until 4 August 2013. Between 4 August 2013 and 25 June 2016, these data were taken every Saturday. Data for these days are not included as part of this V2.1 dataset but are available via special request to colin.seftor@ssaihq.com.

1.4 What's New?

V2.0 is the first version of the dataset released through the GSFC DISC. The previous V1.0 dataset was available through NASA's OMPS science team's web site:

https://ozoneaq.gsfc.nasa.gov/omps

1.4.1 Version 2.0

Changes from V1.0 to V2.0 include:

Non science related changes

Nomenclature and Naming Convention

1) The naming convention for the L1B dataset has been changed from TC_SDR_EV_NASA to NMEV-L1B:
    a. TC (Total Column) has been replaced by NM (Nadir Mapper).
    b. NOAA nomenclature (SDR) has been replaced by NASA nomenclature (L1B).
2) All capitalization of names within the file has been replaced by camel casing.
3) Underlines in all names have been eliminated.

Data Structure

1) The directory hierarchy has been modified; CalibrationData, GeolocationData and ScienceData now appear under the BinSchemeN directory (where N represents the bin scheme of the data).
2) A separate file directory containing housekeeping data has been added.
3) The ANC_DATA directory was removed and placed into a separate file: NM-L1-ANC.

Science related changes

Calibration Data

1) Channel bandcenters and bandpasses within the NM dichroic region (300 to 310 nm) were recalculated to take into account the dichroic sensitivity function. The wavelength registration analysis used these new values in the overall analysis to determine BandCentered wavelengths
2) Wavelength registration for fields-of-view 35 and 36 were significantly modified through improved analysis.
3) To account for temperature dependent along-orbit wavelength changes, BandCenteredWavelengths now change with swath position (note that, although we provided a separate set of wavelengths for each along-track swath position in Version 1, the along-track component did not change).
4) RadianceCalCoefficients have been modified to exhibit smoother wavelength-to-wavelength behavior

5) Stray light has been updated to reflect improved analysis and results; the effect of this improvement is noticeable for wavelengths less than 310 nm.
6) SolarFlux is now based on a set of four measurements taken in March and April of 2012.
7) SolarFlux is now adjusted to the sun-earth distance of the radiance measurements contained in the L1B file

Geolocation Data

1) The latitudes and longitude of the corner points for each ground pixel's field-of-view have been added

2.0 Data Organization

The V2.0 file contains swath-based radiance data for the daylit part of one orbit. There are typically 36 cross-track measurements per swath and 400 swath-based observations per orbit. Radiance data are taken at 196 wavelengths between 300 and 380 nm.

2.1 File Naming Convention

The OMPS Nadir Mapper data products use the following file name convention:

OMPS-satellite_sensorproduct-**L**level-measurement_**v**m.n_observationDate_productionTime.**h5**

Where:

- satellite = NPP
- sensorproduct = NMEV
- level = 1B
- measurement = p000
- m.n = algorithm version identifier (m = major, n = minor)
- observationDate = start date of measurements in *yyyymmdd* format
    - o *yyyy* = 4-digit year number[2012-current]
    - o *mm* = 2-digit month number [01-12]
    - o *dd* = 2-digit day number [01-31]
- productionTime = file creation stamp in *yyyy***m***mmdd***t***hhmmss* format
    - o *hhmmss* = production time [local time]

Filename example:

OMPS-NPP_NMEV-L1B-p000_v2.0_2012m0403t085210_o02242_2016m1130t110320.h5

2.2 File Format and Structure

The top-most level in the HDF5 hierarchy of NMEV-L1B files is denoted BinSchemeN, where N is a number. If there is but a single cross-track binning, used for every wavelength samples, thenall that appears in the file is BinScheme1. In the case of high resolution data, there is also BinScheme2. In principle, there could be up to 340 different binning schemes. (Note: Since there is only a single bin scheme in current nominal operations, the idea was considered to omit the BinSchemeN structure when only one scheme was used, but this notion was discarded in order to make all NMEV-L1B files more uniform in structure.)

Nestled beneath each BinSchemeN directory, there are three different directories, one for each type of pixel-dependent data: CalibrationData (containing data used to create calibrated radiances), GeolocationData (containing data to geolocate each pixel, as well as spacecraft location and pointing information), and ScienceData (containing the calibrated radiances, quality flags, and error terms). These three groups are described in more detail in Section 3.

2.3 Key Science Data Fields

The data fields most likely to be used by typical users of the NMEV-L1B product are listed in this section. Important information about data temporal coverage and data quality is also provided.

Parameter	Group
Date	GeolocationFields
Latitude	GeolocationFields
Longitude	GeolocationFields
BandCenterWavelengths	CalibrationData
SolarFlux	CalibrationData
SolarFluxWavelengths	CalibrationData
Radiance	ScienceData

2.3.1 Data Temporal Coverage

The first OMPS NMEV measurements used to create the NMEV-L1B product were taken on January 28, 2012. Data for February-March 2012 have numerous gaps due to variations in instrument. Regular operations began on April 2, 2012. Note that the OMPS Nadir Mapper conducted high-resolution measurements approximately one day per week from April 2012 to June 2016.

3.0 Data Contents

3.1 Dimensions

NMEV-L1B includes the following dimension terms:

Name	long_name	Size
DimAlongTrack	Along-track dimension	400
DimCrossTrack	Cross-track dimension	36
DimWavelength	Wavelength dimension	196
DimRowColumn	Row/Column dimension	2
DimCorners	Row/Column dimension (CCW relative to flight direction: LL,LR,UR,UL)	4
DimXYX	XYZ dimension	3

3.2 Global Attributes

Metadata in NMEV-L1B data files includes attributes whose value is constant for all files and attributes whose value is unique to each individual file. Table 3.2.1 summarizes these global attributes.

Global Attribute	Type	Description
APPVersion	String	Software version
Conventions	String	Name of convention(s) for metadata
DATA_QUALITY	Integer	Quality of data
DOI	String	DOI value
DayNightFlag	String	Identify day or night measurements
EquatorCrossingDate	String	Date of equator crossing
EquatorCrossingLongitude	Real*4	Longitude of equator crossing
EquatorCorssingTime	String	Time of equator crossing
Format	String	Data file format
LocalGranuleID	String	File name
LongName	String	Full product name
OrbitNumberStart	Integer*8	First orbit number of day
OrbitNumberStop	Integer*8	Last orbit number of day
PGEVersion	String	Software version (same as APPVersion)
ProductDateTime	String	Time of file creation
RangeBeginningDateTime	String	Starting date and time of data
RangeEndingDateTime	String	Ending date and time of data

ShortName	String	Short product name
VersionID	Integer*4	Version ID for this product
VersionNumber	String	Version number for this product
acknowledgement	String	Acknowledgement of data producer
comment	String	Any additional comments
contributor_name	String	Name of data creator
contributor_role	String	Role of data creator
creator_email	String	e-mail address of data creator
creator_institution	String	Organization of data creator
creator_name	String	Name of data creator
creator_type	String	Type of data creator (e.g. person, organization)
date_created	String	Date of file creation
history	String	History of file
id	String	Short product name
institution	String	Producer of data
instrument	String	Instrument making measurements
instrument_vocabulary	String	Source of instrument terms
keywords	String	Identifying keywords
keywords_vocabulary	String	Source of keywords used in metadata
license	String	Source of data information regulations
metadata link	String	Web address for metadata DOI
naming_authority	String	Organization providing naming information
platform	String	Platform for measuring instrument
processing_level	String	Level of data product (e.g. L1B, L2)
program	String	Type of measurement program
project	String	Name of project
publisher_email	String	e-mail address of data publisher
publisher_institution	String	Organization of data publisher
publisher_name	String	Name of data publisher
publisher_type	String	Organization type of data publisher
publisher_url	String	URL of data publisher
references	String	Reference material for data product
source	String	Source of measurement data
summary	String	Any additional summary
time_coverage_end	String	Ending data and time of data
time_coverage_start	String	Starting date and time of data
title	String	Title of data product

3.3 Products/Parameters

3.3.1 CalibrationData Group

Dataset Name	Description	Dimensions	Units
CCDRowsColIndices	CCD coordinates of the macropixel	DimRowColumn, DimCrossTrack, DimWavelength	None
BandCenterWavelengths	Channel band centers for each pixel	DimAlongTrack, DimCrossTrack, DimWavelength	Nanometers
DarkCurrentCorrection	Dark current correction for each pixel	DimCrossTrack, DimWavelength	Counts
RadianceCalCoeff	Radiometric calibration coefficients for each pixel	DimCrossTrack, DimWavelength	(w/cm^3/strad)/count
SmearCorrection	Smear correction for each pixel	DimAlongTrack, DimCrossTrack, DimWavelength	Counts
SolarFlux	Solar irradiance values	DimCrossTrack, DimWavelength	w/cm^3
SolarFluxWavelengths	Solar irradiance wavelengths	DimCrossTrack, DimWavelength	Nanometers
StrayLightCorrection	Stray light correction applied to each pixel	DimAlongTrack, DimCrossTrack, DimWavelength	Counts

Note that SolarFlux (i.e., Irradiance) is corrected for Sun-Earth distance, so that to calculate I/F one simply needs to divide the Radiance by the SolarFlux. The SunEarthDistance is reported in the metadata.

3.3.2 GeolocationData Group

Dataset Name	Description	Dimensions	Units
ECISolarDeclination	Solar declination of each pixel	DimAlongTrack	Degrees
ECISolarRightAscension	Solar right ascension of each pixel	DimAlongTrack	Degrees
ECISolarUnitVector	Vector pointing from the center of the Earth towards the center of the Sun in the ECI reference frame	DimAlongTrack, DimXYZ	No Units
ECISpacecraftPosition	Spacecraft position in ECI coordinates	DimAlongTrack, DimXYZ	Meters
ECISpacecraftVelocity	Spacecraft velocity in ECI coordinates	DimAlongTrack, DimXYZ	Meters/sec
GoniometricSolarAzimuth	Spacecraft solar azimuth (for use in Calibration L1B)	DimAlongTrack	Radians
GoniometricSolarElevation	Spacecraft solar elevation (for use in Calibration L1B)	DimAlongTrack	Radians
GroundPixelQualityFlags	Ground pixel quality flag (bit packed)	DimAlongTrack DimXyZ	No Units
ImageMidpoint_TAI93	Times at the center of the image (in TAI93)	DimAlongTrack	seconds
InstrumentQualityFlags	Bit-packed error flags for each pixel	DimAlongTrack	No Units
Latitude	Ground pixel latitude	DimAlongTrack, DimCrossTrack	Degrees
LatitudeCorner	Corner points of ground pixel latitude	DimAlongTrack, DimCrossTrack, 4	Degrees
Longitude	Ground pixel longitude	DimAlongTrack, DimCrossTrack	Degrees
LongitudeCorner	Corner points of ground pixel longitude	DimAlongTrack, DimCrossTrack, 4	Degrees
SatelliteAzimuthAngle	Satellite azimuth of each pixel	DimAlongTrack,	Degrees

		DimCrossTrack	
SatelliteZenithAngle	Satellite zenith angle of each pixel	DimAlongTrack, DimCrossTrack	Degrees
SolarAzimuthAngle	Solar azimuth of each pixel	DimAlongTrack, DimCrossTrack	Degrees
SolarBetaAngle	Angles between a geocentric Sun vector and its projection on the NPP orbital plane	DimAlongTrack	No Units
SolarZenithAngle	Solar zenith angle of each pixel	DimAlongTrack, DimCrossTrack	Degrees
SpacecraftAltitude	Spacecraft altitude	DimAlongTrack	Meters
SpacecraftLatitude	Spacecraft Latitude	DimAlongTrack	Degrees
SpacecraftLongitude	Spacecraft Longitude	DimAlongTrack	Degrees
SubSatelliteSolarZenithAngle	Solar zenith angle at subsatellite point	DimAlongTrack	Degrees
UTC_CCDSDS_A	Twenty-seven character UTC date-and-time string	DimAlongTrack	No Units

Definition of bit-packed InstrumentQualityFlags

0-3	Unused		
4-5	SAA Flag	WARNING	Indicates location of spacecraft w.r.t. SAA 0 = outside SAA boundaries 1 = <5% of nominal maximum SAA effect 2 = between 5% and 40% of nominal maximum SAA effect 3 = >40% of nominal maximum SAA effect
6-19	Unused		
20	Maneuver Flag	WARNING	Indicates a spacecraft attitude maneuver was in progress during the measurement
21	Attitude Threshold Flag	WARNING	Indicates any of the 3 geodetic spacecraft attitude Euler angles exceeds a defined threshold
22-31	Unused		

Definition of GroundPixelQualityFlags

0-7	Unused		
8	Eclipse Flag	WARNING	Indicates ground pixel is within umbra or penumbra of the moon
9-15	Unused		

3.3.3 ScienceData Group

Dataset Name	Description	Dimensions	Units
ExposureTime	Exposure time of this pixel (in milliseconds)	DimAlongTrack	msec
NumberCoadds	Number of coadds for this pixel	DimAlongTrack	No Units
PixelQualityFlags	Bit-packed error flags for each pixel	DimAlongTrack, DimCrossTrack, DimWavelength	No Units
Radiance	Calibrated radiance values	DimAlongTrack, DimCrossTrack, DimWavelength	w/cm^3/strad
RadianceError	Error in Radiance	DimAlongTrack, DimCrossTrack,	w/cm^3/strad

		DimWavelength	
RawCounts	Raw counts of each pixel (physical CCD only)	DimAlongTrack, DimCrossTrack, DimWavelength	Counts
ReportIntervalQualityFlags	Bit-packed error/warning flags for each image (bit packed)	DimAlongTrack	No Units
SensorStatusBits	Bit-packed flags indicating status of sensor (undefined)	DimAlongTrack	No Units

Definition of PixelQualityFlags

0	Invalid Raw Signal	BAD	Raw counts values are outside a valid positive range (1 - ncoadd*16383)
1	Bad Pixel	BAD	Valid pixel flag in NM_RAD from sensor vendor was not set OR the sample table has excluded a pixel from binning
2	Non-Optics Pixel	WARNING	Indicates that the selected pixel does not occur in the optics region and therefore has no valid radiometric coefficient
3	Transient Warning	WARNING	Indicates an anomalous signal with a reasonable probability of being a transient
4	RTS Warning	WARNING	
5	Saturation Possibility	WARNING	At least one of the co-added measurements of at least one of the binned pixels has a reasonable probability of having filled the 14-bit A/D converter
6	Unused		
7	Dark Signal Warning	WARNING	Indicates the age of the dark measurement used in the correction exceeds a limit (expressed in days)
8	Smear Warning	WARNING	Indicates the contents of the relevant smear pixel exceeds a limit (expressed in counts per frame per smear pixel)
9	Unused		
10	Stray Light Warning	WARNING	Indicates that stray light correction has returned a correction exceeding limits (expressed as percent of signal)
11	Non-Linearity Warning	WARNING	
12	Invalid Corrected Signal	BAD	Corrected counts values are outside a valid positive range (1 - ncoadd*16383
13	Wavelength Assign Warning	WARNING	
14-31	Unused		

Definition of ReportIntervalQualityFlags

0	Stray Light Warning	WARNING	An error was detected in the stray light calculation for this image
1-31	Unused		

4.0 Options for Reading the Data

There are many tools and visualization packages (free and commercial) for viewing and dumping the contents of HDF5 files. Libraries are available in several programming languages for writing software to read HDF5 files. A few simple to use command-line and visualization tools, as well as programming languages for reading the L2 HDF5 data files are listed in the sections below. For a comprehensive list of HDF5 tools and software, please see the HDF Group's web page at https://www.hdfgroup.org/products/hdf5_tools/.

4.1 Command Line Utilities

4.1.1 h5dump (free)

The h5dump tool, developed by the HDFGroup, enables users to examine the contents of an HDF5 file and dump those contents, in human readable form, to an ASCII file, or alternatively to an XML file or binary output. It can display the contents of the entire HDF5 file or selected objects, which can be groups, datasets, a subset of a dataset, links, attributes, or datatypes. The h5dump tool is included as part of the HDF5 library, or separately as a stand-alone binary tool:

https://www.hdfgroup.org/HDF5/release/obtain5.html

4.1.2 ncdump (free)

The ncdump tool, developed by Unidata, will print the contents of a netCDF or compatible file to standard out as CDL text (ASCII) format. The tool may also be used as a simple browser, to display the dimension names and lengths; variable names, types, and shapes; attribute names and values; and optionally, the values of data for all variables or selected variables. To view HDF5 data files, version 4.1 or higher is required. The ncdump tool is included with the netCDF library. **NOTE: you must include HDF5 support during build.**

http://www.unidata.ucar.edu/downloads/netcdf/

4.1.3 H5_PARSE (IDL/commercial)

The H5_PARSE function recursively descends through an HDF5 file or group and creates an IDL structure containing object information and data values. You must purchase an IDL package, version 8 or higher, to read the L2 HDF5 data files.

http://www.harrisgeospatial.com/ProductsandTechnology/Software/IDL.aspx

4.2 Visualization Tools

4.2.1 HDFView (free)

HDFView, developed by the HDFGroup, is a Java-based graphic utility designed for viewing and editing the contents of HDF4 and HDF5 files. It allows users to browse through any HDF file, starting with a tree view of all top-level objects in an HDF file's hierarchy. HDFView allows a user to descend through the hierarchy and navigate among the file's data objects. Editing features allow a user to create, delete, and modify the value of HDF objects and attributes. For more info see:

https://www.hdfgroup.org/hdf-java-html/hdfview/

4.2.2 Panoply (free)

Panoply, developed at the Goddard Institute for Space Studies (GISS), is a cross-platform application which plots geo-gridded arrays from netCDF, HDF and GRIB dataset required. The tool allows one to slice and plot latitude-longitude, latitude-vertical, longitude-vertical, or time-latitude arrays from larger multidimensional variables, combine two arrays in one plot by differencing, summing or averaging, and change map projections. One may also access files remotely into the Panoply application.

https://www.giss.nasa.gov/tools/panoply/

4.2.3 H5_BROWSER (IDL/commercial)

The H5_BROWSER function presents a graphical user interface for viewing and reading HDF5 files. The browser provides a tree view of the HDF5 file or files, a data preview window, and an information window for the selected objects. The browser may be created as either a selection dialog with Open/Cancel buttons, or as a standalone browser that can import data to the IDL main program. You must purchase an IDL package, version 8 or higher to view the L2 HDF5 data files.

http://www.harrisgeospatial.com/ProductsandTechnology/Software/IDL.aspx

4.3 Programming Languages

Advanced users may wish to write their own software to read HDF5 data files. The following is a list of available HDF5 programming languages:

Free:

C/C++, Fortran (https://support.hdfgroup.org/HDF5/)

Java (https://support.hdfgroup.org/products/java/release/download.html)

Python (http://www.h5py.org/)

GrADS (http://cola.gmu.edu/grads/)

Commercial:

IDL (http://www.harrisgeospatial.com/ProductsandTechnology/Software/IDL.aspx)

Matlab (http://www.mathworks.com/products/matlab/)

5.0 Data Services

Access of GES DISC data now requires users to register with the NASA Earthdata Login system and to request authorization to “NASA GESDISC DATA ARCHIVE Data Access”. Please note that the data are still free of charge to the public.

5.1 GES DISC Search

The GES DISC provides a keyword, spatial, temporal and advanced (event) searches through its unified search and download interface:

https://disc.gsfc.nasa.gov/

The interface offers various download and subsetting options that suit the user’s needs with different preferences and different levels of technical skills. Users can start from any point where they may know little about a particular set of data, its location, size, format, etc., and quickly find what they need by just providing relevant keywords, such as a data product (e.g. “OMPS”), or a parameter such as “ozone”.

5.2 Direct Download

The OMPS data products may be downloaded in their native file format directly from the archive using https access at:

https://snpp-omps.gesdisc.eosdis.nasa.gov/data/

5.3 OPeNDAP

The Open Source Project for a Network Data Access Protocol (OPeNDAP) provides remote access to individual variables within datasets in a form usable by many OPeNDAP enabled tools, such as Panoply, IDL, Matlab, GrADS, IDV, McIDAS-V, and Ferret. Data may be subsetted dimensionally and downloaded in a netCDF4, ASCII or binary (DAP) format. The GES DISC offers the OMPS data products through OPeNDAP:

https://snpp-omps.gesdisc.eosdis.nasa.gov/opendap/

6.0 More Information

Contact Information

Name: GES DISC Help Desk
URL: https://disc.gsfc.nasa.gov
E-mail: gsfc-help-disc@lists.nasa.gov
Phone: 301-614-5224
Fax: 301-614-5228
Address: Goddard Earth Sciences Data and Information Services Center
Attn: Help Desk
Code 610.2
NASA Goddard Space Flight Center
Greenbelt, MD 20771 USA

Additional OMPS and ozone data products

https://ozoneaq.gsfc.nasa.gov

Suomi-NPP mission web page

https://jointmission.gsfc.nasa.gov/suomi.html

7.0 Acknowledgements

These data should be acknowledged by citing the product in publication reference sections as follows:

Glen Jaross (2017), OMPS-NPP NM L1B V2.0, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), accessed ***[data access date]***, doi: 10.5067/DL081SQY7C89

References

Seftor, C.J., G. Jaross, M. Kowitt, M. Haken, J. Li, L.E. Flynn (2014), Post-Launch Performance of the Suomi NPP Ozone Mapping and Profiler Suite (OMPS) Nadir Sensors, J. Geophys. Res., doi: 10.1002/2013JD020472