Satellite – Frequently Asked Questions

The following is a list of frequently asked questions (FAQ) regarding scientific satellite datasets with links to answers provided by scientists at NCDC.

GOES Data

- o [How do I read the GOES Imager data provided by CLASS?](#)

- o [How do I navigate GOES Imager AREA files provided by CLASS?](#)

- o [How do I calibrate GOES Imager satellite data?](#)

- o [How do I read the cloud drift wind data?](#)

- o [Can GOES AREA files be used within GIS?](#)

NetCDF SSM/I and SSMIS Data

- o [How do I read netCDF SSM/I or SSMIS TDR/SDR data provided by CLASS?](#)

Format Description Documents

- o [POES Satellites](#)
- o [NOAA KLM Series](#)
- o [NOAA-N Series](#)

Note: GOES, AVHRR and netCDF-SSMI data may be ordered online through [CLASS](#)

Goes Data

How do I read the Geostationary Operational Environmental Satellite (GOES) Imager data provided by CLASS?

The Geostationary Operational Environmental Satellite (GOES) data provided by the Comprehensive Large Array-data Stewardship System (CLASS) comes in a few formats. The weather and climate toolkit developed at the National Climatic Data Center (NCDC) will calibrate and remap CLASS-Area files to various output formats, some of which can be used with GIS software.

Image Formats: GIF and JPG

Network Common Data Form (NetCDF)

Area

Raw

Image Formats: GIF/JPG
This format is primarily for qualitative use of the data. Data provided in image formats (GIF, JPG) can generally be read by numerous software applications.

netCDF
This data is primarily for quantitative use of the data. NetCDF data can be read using various applications. See the netCDF website for more information on using the netCDF library to read netCDF files. For your reference sample output from the ncdump utility on a netCDF file provided by CLASS is provided.

Area
This data is primarily for quantitative use of the data. Although the Area format is a Man computer Interactive Data Access System (McIDAS) format, the files can be read using other software.

- McIDAS Area files can be directly read, navigated and calibrated using the McIDAS software. Also, see the McIDAS Users' Group web site for more details.
- Fortran code can be made available for reading Area files from NCDC. The code is compiled on a linux system using Lahey-Fujitsu Fortran 95 compiler (lf95) version 6.20d. However, the current version uses compiler-specific functions (lstat) to perform the read. Contact the NCDC.Satorder@noaa.gov if you think this may be the best option for you.
- IDL - Scientists at NCDC have made their read routines available for IDL users. The routines read Area files provided by CLASS (an example is provided which can be used with the sample data). Routines and data are available as a gzipped tar file

Other tools are available for displaying GOES McIDAS area files. These include the IDV (Unidata's Integrated Data Viewer

If you are interested in developing your own Area format reader (or your required programming language is not listed above) the area format is described by the McIDAS Users' Group:

- The new format describes Area files, including the GVAR Area files.
- An older Area format is also described, which includes the GOES formats for GOES-4-7.
- More details (such as details on the line prefix documentation) of the AREA format are also available from the McIDAS Programmer's Manual Version 2003

Raw
Imagery in the "Raw" format is in the raw data format received by the data provider. For GOES-Imager data, this format is GOES VARiable (GVAR). The vast majority of users will not need GVAR data format. Users of imagery should order image formats (mentioned above) and others interested in using the data quantitatively should make use of the Area format options. The GVAR format is summarized in NOAA Technical Report NESDIS 82. **At present, there are no known, publicly-available GVAR readers.**

How do I navigate GOES Imager AREA files provided by CLASS?

Navigation
Satellite imagery in its raw format is simply what the sensor observes. To use the data quantitatively (or even to simply overlay a map) requires the calculation of the Earth location for each pixel. Generally, the Earth location is described in latitude/longitude pairs.

CLASS Navigation (automatic)

- GIF/JPG imagery by overlaying map coordinates on the image.

- netCDF files by providing latitude and longitude as variables in the file

However, McIDAS Area files will need to be navigated by the user, which depends on whether the data originates from the:

- Mode Files: GOES-1,2,3,4,5,6,7 (i.e., pre GOES-8)

- GVAR Files: GOES-8,9,10,11,12,... (GOES-Next in GVAR format)

Mode Navigation

Mode data was just recently made available from CLASS. A description of the navigation will be included here at a later date.

GVAR Navigation

- The GVAR navigation is described in the [NESDIS Earth Location User's Guide (ELUG)](#) .

- The ELUG describes a navigation algorithm which has been coded in Fortran 77 and is available from the [GOES Project Science Office](#).

NCDC scientists have brought this code up-to-date by upgrading it to Fotran95 and also converting it to IDL.

Navigation Tools

- The **weather and climate toolkit** developed at NCDC will calibrate and remap CLASS-Area files to *various output formats, some of which can be used with GIS software.*

- **IDL** - NCDC has a library of routines which can be used to navigate GOES Area files. The routines are provided as part of a [tarball distribution](#) which includes IDL code to read and navigate GOES GVAR McIDAS Area files.

- **Fortran** - If you are interested in the Fortran code for GVAR navigation, please contact NCDC.Satorder@noaa.gov to request the code. The Fortran code has some compiler-specific calls (Lahey Fortran 95) which may preclude it from working with all Fortran compilers.

How do I calibrate GOES AREA files provided by CLASS?

Satellites measure upwelling radiation from the Earth. Visible radiation is generally what our eyes see. Infrared radiation is sensitive to the temperature of the surface (e.g., clouds, oceans, etc). The satellites sensor converts radiation falling on the sensor to a voltage which is generally reported in counts (often ranging from 0-255 counts for 1-byte data or 0-1023 for 10-bit data). Satellite image calibration is the conversion of this count value to a radiance, which is then often converted to a temperature (for infrared) or reflectance (for visible). The **weather and climate toolkit** developed at NCDC will calibrate and remap CLASS-Area files to various output formats, some of which can be used with GIS software.

Image formats: GIF/JPG

For imagery data from CLASS, there is little to do. GIF and JPG imagery are not calibrated, but are simply displayed in a scale appropriate for visual analysis.

netCDF

The netCDF files raw provide satellite data from the Area files. So data in netCDF files must first be converted from 16-bit to 10-bit data by dividing by 32. Then use this result to calibrate the IR observations to radiance or brightness temperature and the visible observations to radiance or scaled reflectance.

Information on the conversion from 10-bit data to radiance/brightness temperature/reflectance can be found at:

- The GVAR calibration is described on the NESDIS GOES Calibration website

- Calibration information is also available from NASA at the GOES project office.

McIDAS Area Files - GVAR

These files are Area files which originate from GVAR data. This includes the following satellites: GOES-8,9,10,11,12,...

The user will need to read the data from the files, then calibrate the data using the information provided by the links above.

McIDAS Area Files - Mode data

These files are Area files which originate from mode A/AA/AAA data. This includes the following satellites: GOES-1,2,3,4,5,6,7

A description of the calibration will be included here at a later date.

Raw

Raw data from GVAR files are calibrated in the same manner as described in the links above.

How do I read the cloud drift wind data?

What are cloud drift winds?

Geostationary satellites track winds in the upper atmosphere by observing the movement of image features in time. The distance traveled by a feature in the time between images is the speed. The height of the feature is often determined from its temperature. We reference features, because while clouds are easy to track by our eyes, features in water vapor imagery are easier to track with a computer and provide information on upper level winds in the absence of clouds. Examples of operational cloud drift winds are available on the NESDIS High Density Winds website.

How do I access NCDC-archived cloud drift wind files?

The files can be accessed via HDSS Access System at http://www.ncdc.noaa.gov/has/has.dsselect. In the Satellite section select GOES Products>click on 'submit selection'>select Satellite ID (note: GOESE and

GOESW replaced individual SAT IDS on April 17, 2003) and finally select CDFTWIND from the data types list.

What is the format of the NCDC-archived cloud drift wind files?

Data are stored in flat-binary files. Data records contain information for one wind observation and the number of records per file is deduced from the file size. A record is 200 bytes which consists of 18 4-byte integers containing data followed by 32 4-byte integers containing zeros. The following table describes the data within the first 18 integers.

The information in this table is provided as guidance and is not to be considered the final documentation of the data. This was derived from page 165 of the GOES Satellite Derived Winds Processing System (HD WINDS) Programmer Maintenance Manual.

Offset	Description	Units	Scale
0	Date of observation	YYYYMMDD	1
1	Time of observation	HHMM (UTC)	1
2	Date created	YYYYMMDD	1
3	Time created	HHMM (UTC)	1
4	Pressure Level of the Obs.	mb	10
5	Temperature	Kelvin	1
6	Latitude	Degrees North	100
7	Longitude	Degrees West	100
8	Wind Direction	Degrees East of North	1
9	Wind Speed	meters / second	10
10	Unknown		
11	Unknown		
12	Unkown		

13	Unknown		
14	Unknown		
15	Unknown		
16	Unknown		
17	Unknown		

To convert the integer value to the actual value, divide by the scale. An IDL routine is also available which will read the data.

Can AREA files be used within GIS?

The **weather and climate toolkit** developed at NCDC will calibrate and remap CLASS-Area files to various output formats, some of which can be used with GIS software.

NetCDF SSM/I and SSMIS Data

How do I read netCDF SSM/I or SSMIS TDR/SDR data provided by CLASS?

netCDF

NetCDF data can be read using various applications. See the netCDF website for more information on using the netCDF library to read netCDF files. NetCDF Tools UI WebStartallows users to view netCDF data using a Graphical User Interface.

IDL

A read routine reads netCDF SSM/I and SSMIS TDR/SDR data provided by CLASS.