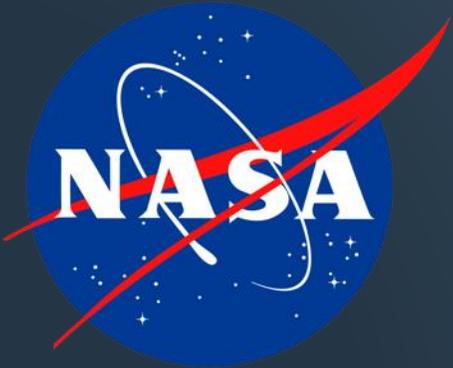


# ASDC Data Services

Matt Tisdale, [matthew.s.tisdale@nasa.gov](mailto:matthew.s.tisdale@nasa.gov)



# Impact of GIS at NASA

- Significant increase in the number of users interested in using NASA Earth Science data in a GIS
  - Per the ACSI survey 2017 & 2018 results for “Top tools used to work with data”: ArcGIS ranked number at 64% followed by QGIS at 42% and ENVI at 32%
- GIS is utilized to support the delivery of priority data products, experiment with various geospatial technologies, and expand geospatial capabilities. Interest is growing...
  - ESDSWG Geospatial Working Group (2013-2015) &
  - ESDSWG Geospatial Web Services Working Group (2016-2017)
- Exploration in GIS has led to opportunities for on-going software enhancements and mission partner technical coordination

## 2018 ACSI RESULTS – All DAACs

	2018 %
<b>Tool(s) used to work with data~</b>	
ArcGIS	64%
Convert to Vector	6%
ENVI	32%
ERDAS/IMAGINE	20%
Excel	29%
Ferret	1%
Geomatica	4%
Global Mapper	15%
GrADS	3%
GRASS	12%
HDFLook	2%
HDFView	10%
HEG	1%
IDL	7%
IDV	1%
IDRISI	7%
MapReady	2%
MATLAB	18%
MODIS Reprojection Tool (MRT)	9%
NCL	3%
Panoply	9%
Quantum GIS (QGIS)	42%
R	22%
SeaDAS	3%
Other/open source	23%
Don't know/Not applicable	1%
Number of Respondents	3,656

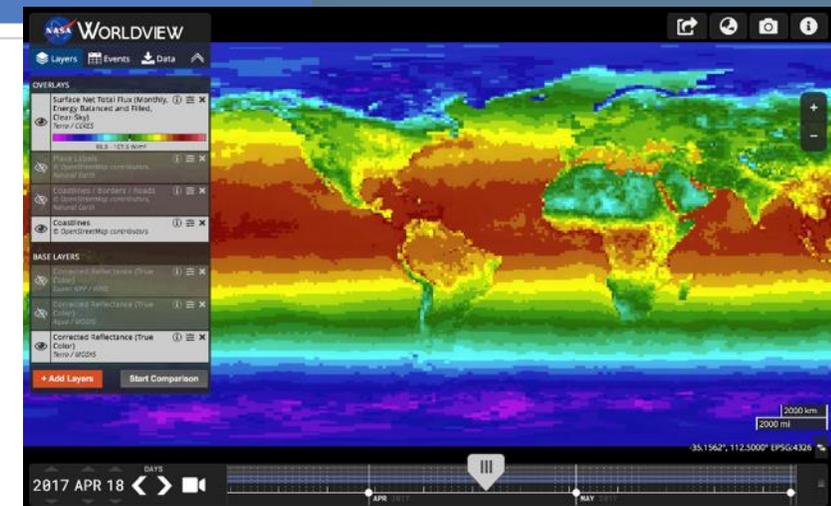
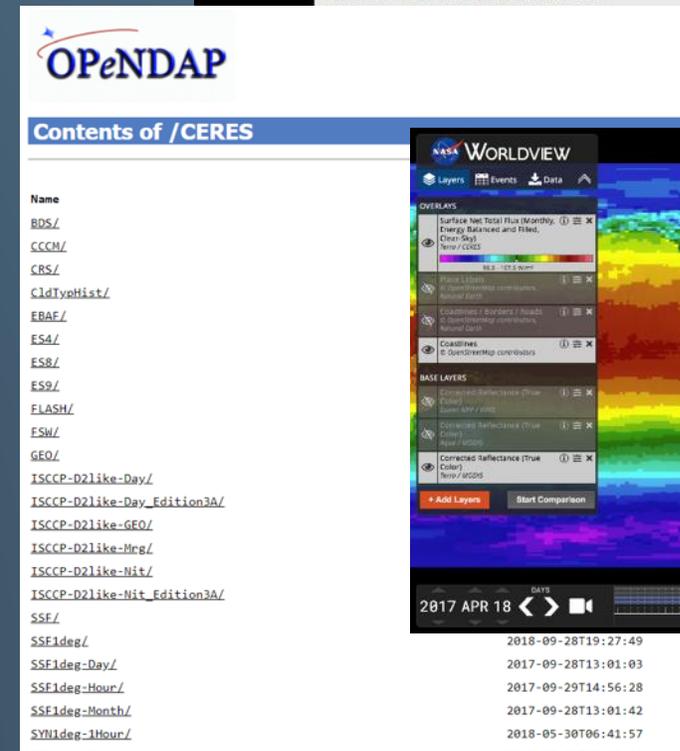
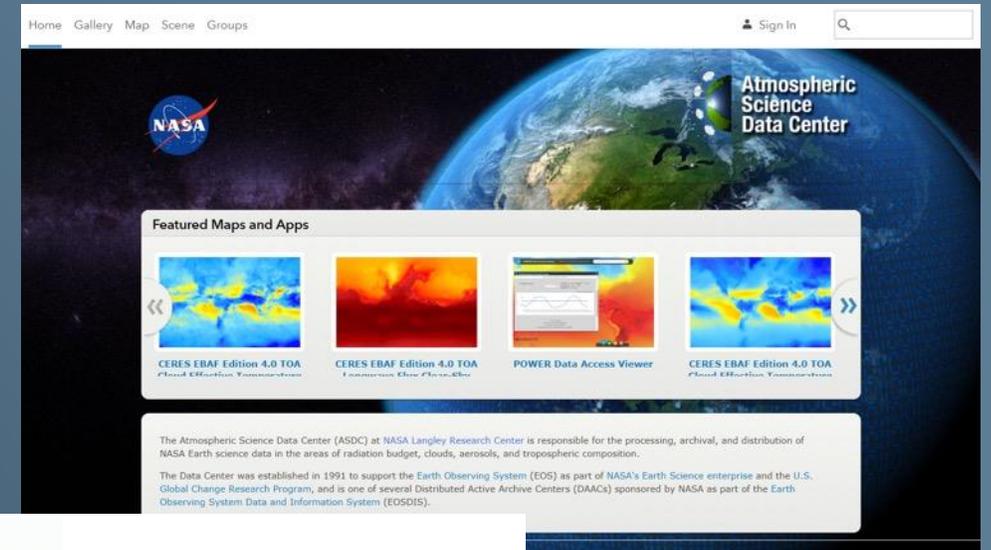
# ASDC Data Services

## Service Types

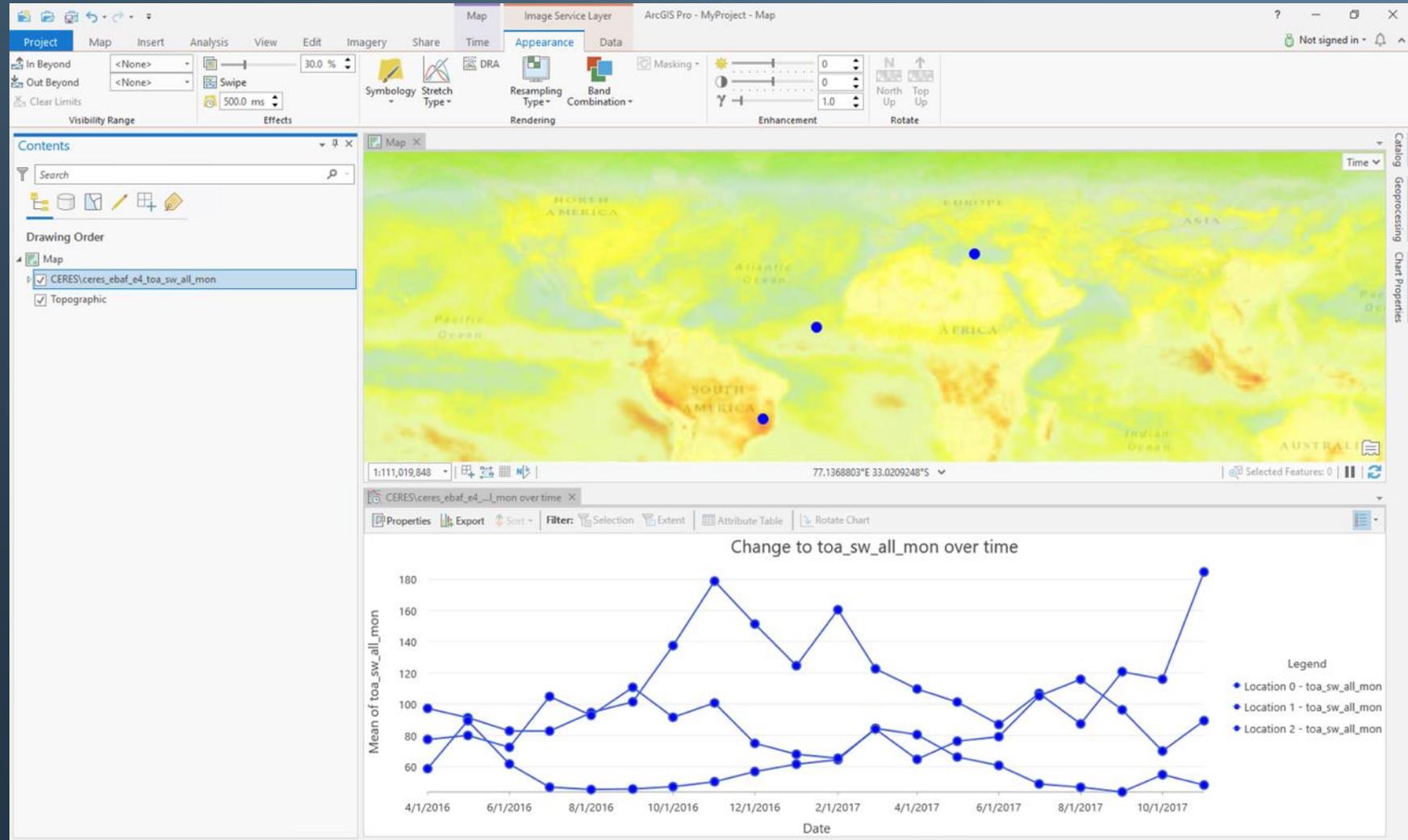
- Hyrax Data Access Protocol (DAP)
- ArcGIS Image Services
- GIBS Web Mapping Tile Service (WMTS)
- GIBS Web Mapping Service (WMS)

## Resources:

- ASDC ArcGIS Portal: <https://asdc-arcgis.larc.nasa.gov/portal/home/>
- ASDC OPeNDAP: <https://opendap.larc.nasa.gov/opendap/>
- Global Imagery Browse Service (GIBS): <https://earthdata.nasa.gov/about/science-system-description/eosdis-components/global-imagery-browse-services-gibs>



# ArcGIS Pro: Accessing Data Through ArcGIS Image Services / OPeNDAP



# Earthdata Search: Using Data Services

The screenshot displays the Earthdata Search interface for a specific data collection. The main window is titled "Edit Options" and shows the following sections:

- Edit Options:** CERES Energy Balanced and Filled(EBAF) TOA Monthly means data in netCDF Edition4.0
- Select Data Access Method:** Two options are available: "Direct Download" (selected) and "Customize (OPeNDAP)".
- Variable Selection:** A section with instructions: "Use science keywords to subset your collection granules by measurements and variables. No variables selected. All variables will be included in download." A button labeled "Edit Variables" is present.
- Output Format Selection:** A section with instructions: "Choose from output format options like GeoTIFF, NETCDF, and other file types." A dropdown menu is set to "NETCDF-4".

On the left sidebar, the project is named "Untitled Project" and contains one granule of 819.0 MB. The selected data is "CERES Energy Balanced and Filled(EBAF) TOA Monthly means data in netCDF...". A green "DOWNLOAD DATA" button is visible at the bottom of the sidebar.

At the bottom of the main window, a timeline shows the data is available from June to May. The current selection is for the month of June 2019. A "Done" button is located at the bottom right of the edit options panel.

The footer of the interface includes the version "v 1.91.4", search time, NASA Official information (Stephen Berrick), FOIA, NASA Privacy Policy, USA.gov, and a link to "Earthdata Access: A Section 508 accessible alternative".

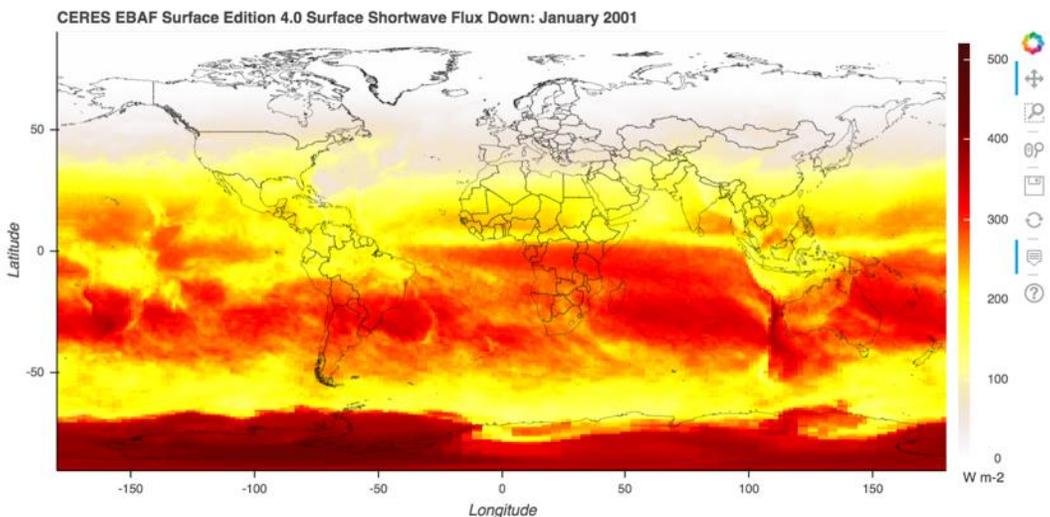
# Python Notebooks: OPeNDAP / ArcGIS

```
In [4]: Parameter = "sfc_sw_down_all_mon"
Source = "https://opendap.larc.nasa.gov/opendap/CERES/EBAF/Surface_Edition4.0/CERES_EBAF-Surface_Edition4.0_200003-201803.nc"
```

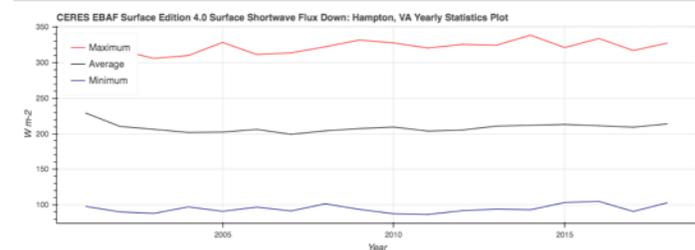
```
In [5]: ds = xr.open_dataset(Source)[Parameter]
ds
```

```
Out[5]: <xarray.DataArray 'sfc_sw_down_all_mon' (time: 217, lat: 180, lon: 360)>
[14061600 values with dtype=float32]
Coordinates:
  * lon      (lon) float32 0.5 1.5 2.5 3.5 4.5 ... 355.5 356.5 357.5 358.5 359.5
  * lat      (lat) float32 -89.5 -88.5 -87.5 -86.5 -85.5 ... 86.5 87.5 88.5 89.5
  * time     (time) datetime64[ns] 2000-03-15 2000-04-15 ... 2018-03-15
Attributes:
  long_name:      Surface Shortwave Flux Down, Monthly Means, All-Sky condi...
  standard_name:  Surface Shortwave Flux Down - All-Sky
  CF_name:        surface_downwelling_shortwave_flux_in_air
  units:          W m-2
  valid_min:      0.00000
  valid_max:      520.000
```

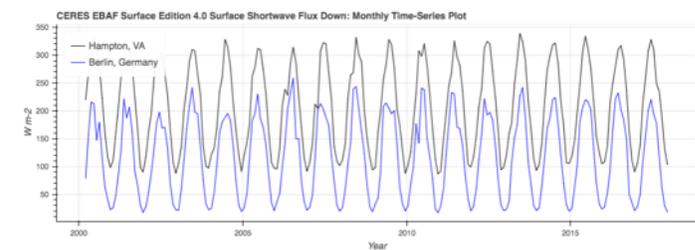
```
In [6]: Date = datetime(2001, 1, 15, 0, 0)
Title = 'CERES EBAF Surface Edition 4.0 Surface Shortwave Flux Down: January 2001'
show(Make_Map(ds.sel(time=[Date]), method='nearest').data.reshape(180, 360), Title))
```



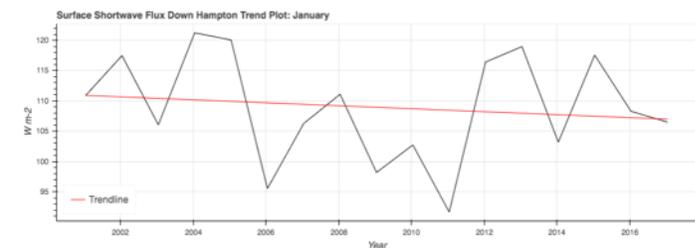
```
In [11]: Title = 'CERES EBAF Surface Edition 4.0 Surface Shortwave Flux Down: Hampton, VA Yearly S
tatics Plot'
show(Yearly_Statistics_Plot(yearly, Title))
```



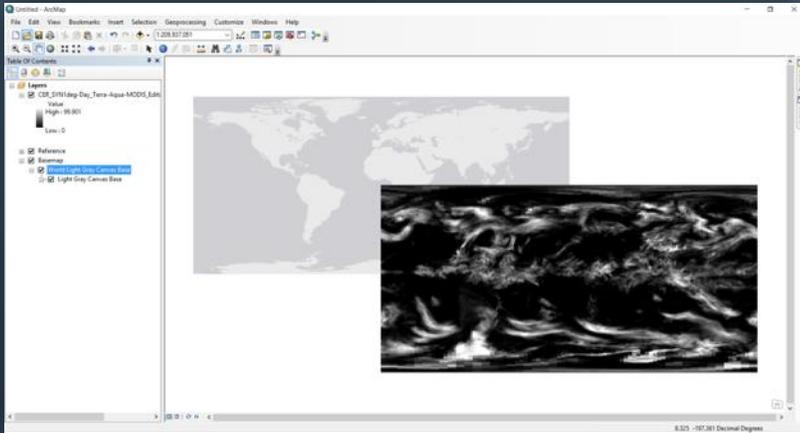
```
In [12]: Title = 'CERES EBAF Surface Edition 4.0 Surface Shortwave Flux Down: Monthly Time-Series
Plot'
show(Monthly_Time_Series_Plot(df, Title))
```



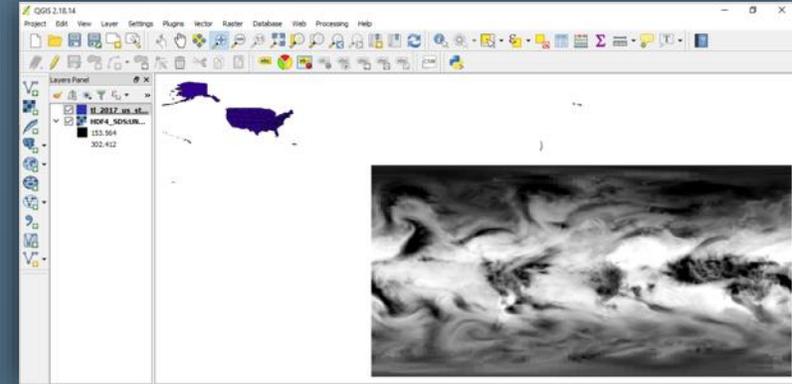
```
In [13]: show(Trend_Plot(df, "Hampton"))
```



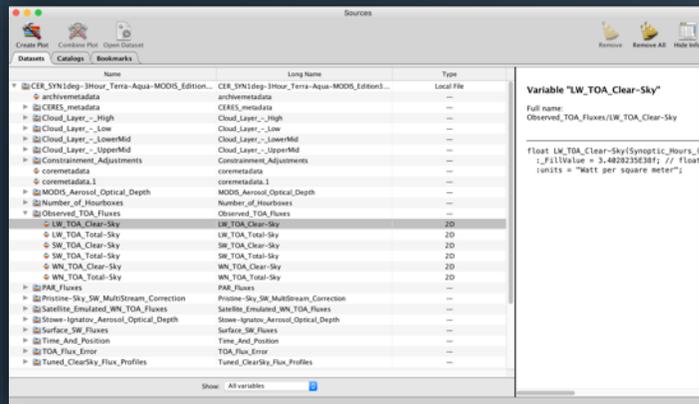
# Current User Issues with Applications (Sample)



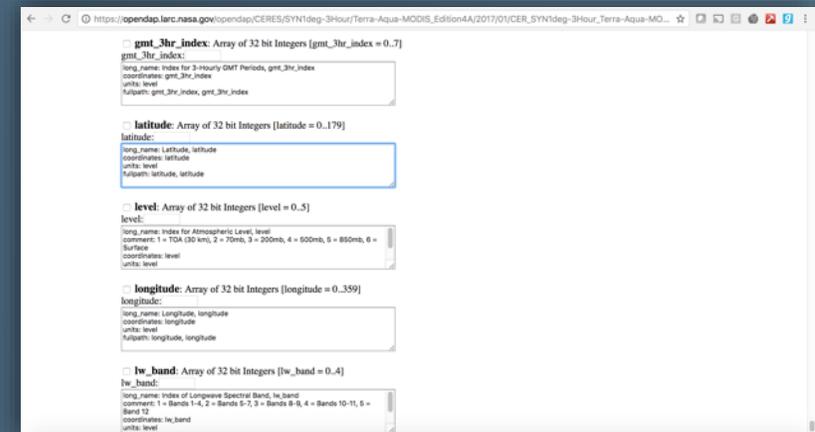
ArcGIS Desktop – Spatial coordinates not being interpreted by GDAL correctly



QGIS – Spatial coordinates not being interpreted by GDAL correctly



Panoply – Spatial data not being read correctly, read as 2D vs Geo2D



OPeNDAP – Spatial data not being read correctly, read as 2D vs Geo2D



Earth Observing System Data and Information System (EOSDIS) ▶ Earth Science Data and Information System (ESDIS) Project ▶ ESDIS Standards Office (ESO)  
▶ Standards and Requirements ▶ **Dataset Interoperability Recommendations for Earth Science**

## ESD-Approved Standards for use in NASA Earth Science Data Systems

[HDF 5](#)

[HDF EOS 5](#)

[NetCDF Classic](#)

[NetCDF-4/HDF5 File Format](#)

[OGC KML](#)

[ASCII File Format Guidelines for Earth Science Data](#)

[Unified Metadata Model \(UMM\)](#)

[GCMD Directory Interchange Format \(DIF\)](#)

# Dataset Interoperability Recommendations for Earth Science



## Summary

These documents contain a series of recommendations made by NASA's Earth Science Data System Working Groups ([ESDSWG](#)) Dataset Interoperability Working Group (DIWG) that are meant to increase and enhance the interoperability of [Earth Science data](#) product files. The DIWG recommendations herein embody best practices to reduce and bridge gaps between geoscience dataset formats widely used at NASA and elsewhere and to help ensure that Earth science datasets smoothly interoperate with each other regardless of their origin.

The first document, *Dataset Interoperability Recommendations for Earth Science*, was published in July 2016 and contains 12 recommendations. The second, *Dataset Interoperability Recommendations for Earth Science: Part 2*, was published in April 2019. These are a continuation of the 2016 recommendations with the same goal of improving the interoperability of Earth Science dataset files. Most cover new areas of interoperability while some expand on the 2016 recommendations.

# Dataset Interoperability Recommendations for Earth Science

- Maximize HDF5/netCDF4 interoperability via API accessibility
- Include Basic CF Attributes
- Use CF "bounds" attributes
- Verify CF compliance
- Distinguish clearly between HDF and netCDF packing conventions
- When to employ packing attributes
- Mapping between ACDD and ISO
- Make HDF5 files netCDF4-Compatible and CF-compliant within Groups
- Include time dimension in grid structured data
- Order dimensions to facilitate readability of grid structure datasets
- Consider "balanced" chunking for 3-D datasets in grid structures
- Include datum attributes for data in grid structures
- Character set for user-defined group, dataset, and attribute names
- Consistent units attribute value for variables across one data collection
- Use the units attribute only for variables with physical units
- Include time coordinate in swath structured data
- Keep coordinate values in coordinate variables
- Include Georeference Information with Geospatial Coordinates
- Not-a-Number (NaN) Value
- Standardize file extensions for HDF5/netCDF files
- Ensure Granule's Filename Uniqueness Across Different Dataset Releases
- Adopt Semantically Rich Dataset Release Identifiers
- Date-Time Information in Granule Filenames

Questions?