

# Bringing Analysis Closer to Data: Developing a Visualization Tool for L2 Earth Science Satellite Data

The poster is titled "Bringing Analysis Closer to Data: Developing a Visualization Tool for L2 Earth Science Satellite Data" and features the NASA logo and AGU 100 logo. It is presented by Tiffany Shreves (1), Paul Huwe (2,3), Binita KC (2,3), Arif Albayrak (2,3), Dana Ostrenga (2,3), and Angela Li (2). The poster is divided into several sections:

- Background - Level 2 Earth Science Satellite Data:** Discusses the challenges of Level 2 data, such as its storage in independent variables and the need for a common interface for data extraction and processing.
- Project Description:** Shows a globe with a grid overlay, representing the Earth Science satellite data visualization tool.
- Internal Use Case:** Displays a screenshot of the tool's interface, showing a list of data products and a search function.
- GES DISC Level 2 Subsetter Service Integration (Coming Soon):** Shows a screenshot of the tool's interface, highlighting the integration with the GES DISC Level 2 Subsetter Service.
- Acknowledgments and Contact Information:** Lists the authors and their affiliations, including the University of North Carolina at Asheville, NASA Goddard Space Flight Center, and ADNET Systems Inc.

The poster also includes a section titled "Earth Science satellite sensor provide a unique opportunity for scientists to visualize complex and multifaceted observations projected geographically across maps of the Earth. While visualization tools can help scientists comprehend, analyze, and share data, including Level 2 Earth Science data, users do face specific set of challenges. In coordination with NASA's Goddard Earth Science Data Information Services Center (GES DISC), the team developed a Level 2 Earth Science data visualization tool that aims to address some of the complexities associated with working with L2 data. This tool offers command-line and graphical interface support for file and variable selection for accommodate varying file sizes and degrees of user familiarity with the structure of a given file. The visualization tool is written in Python 3 and utilizes a modular approach to facilitate continued expansion and reuse. In addressing some common complex issues related to working with L2 Earth Science data, the tool aims to help to take the process of analysis more directly with data acquisition and visualization, bringing analysis

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ADVANCING EARTH  
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## BACKGROUND - LEVEL 2 EARTH SCIENCE SATELLITE DATA

Level-2 processed Earth Science satellite data can provide valuable insights to scientists; however, it comes with its own set of challenges, particularly regarding visualizing this type of data. Since the geospatial information in Level-2 data files is stored in independent variables, the plotting process necessitates a process to match dimensional information, such as latitude and longitude, with a selected variable. Variables are also stored in different ways across various Earth Science data file formats, which complicates the process of extracting data and plotting variables from a given file without requiring extensive user input and prerequisite familiarity with the file type variable structure.

## ACKNOWLEDGMENTS AND CONTACT INFORMATION

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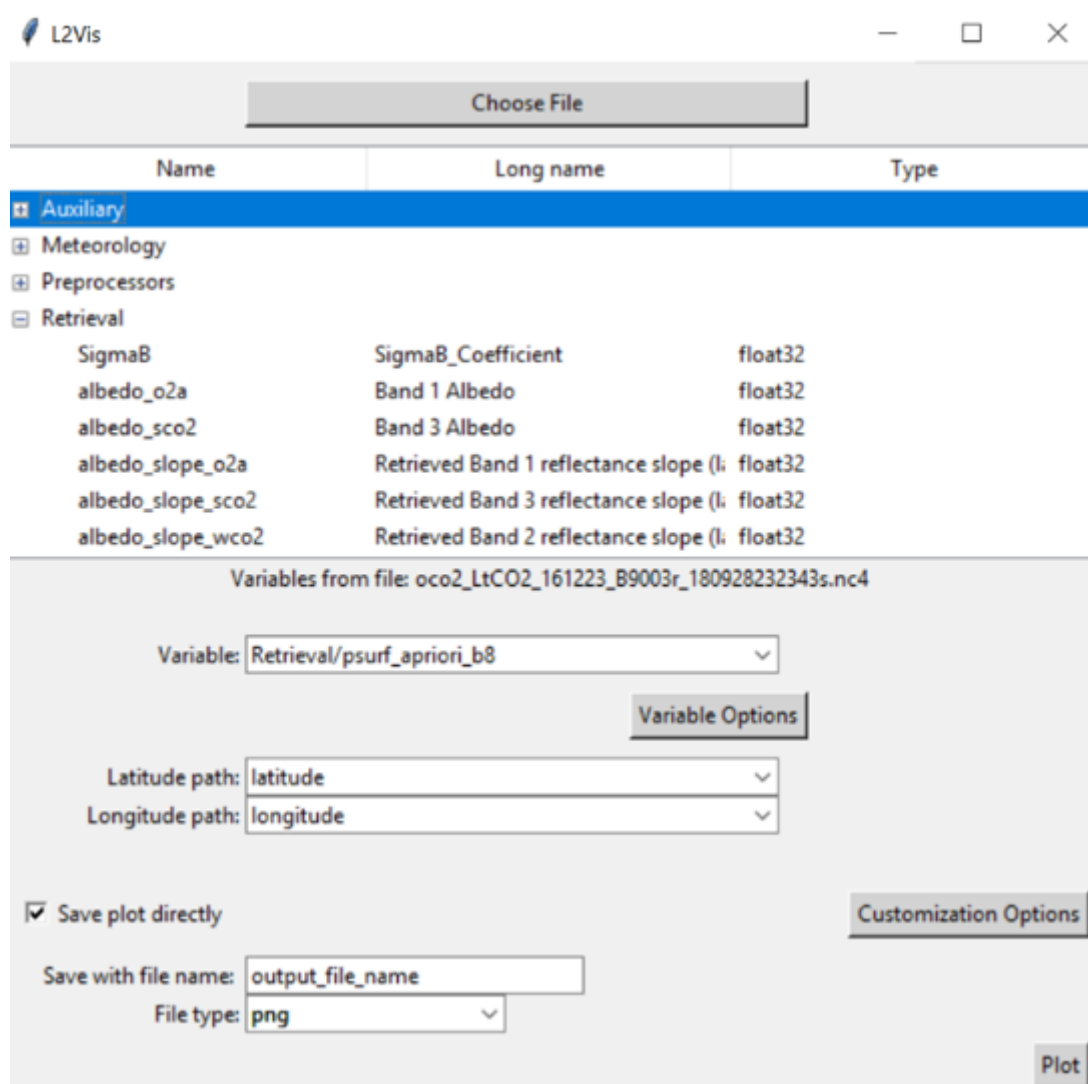
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## PROJECT DESCRIPTION



Earth Science satellite missions provide a unique opportunity for scientists to visualize complex and multifaceted observations projected geospatially across maps of the Earth. While visualization tools can help scientists comprehend, analyze, and share data, visualizing Level-2 Earth Sciences data poses its own specific set of challenges. In coordination with NASA's Goddard Earth Sciences Data Information Services Center (GES DISC), the team developed a Level-2 Earth Science data visualization tool that aims to address some of the complexities associated with plotting Level-2 data. This tool offers command-line and graphical interface support for file and variable selection to accommodate varying use cases and degrees of user familiarity with the structure of a given file. The visualization tool is written in Python 3 and utilizes a modular approach to facilitate continued expansion and reuse. In addressing some common complications involved in plotting Level-2 Earth Sciences data, the tool aims to help to link the process of analysis more directly with data acquisition and visualization, bringing analysis closer to data across levels of processing.

## INTERNAL USE CASE



The internal use case provides a way to plot previously downloaded files through a graphical interface or through the command line, with options to customize output, plot limits, geospatial projection, plot titles, color mappings and displays, and value ranges.

Command Line Parameters	Description	Example Format Usage
'-fn', '--filename'	Provide the relative path name of the file, written in single or double quotes.	--filename "C:/path/to/your/file.nc4" or -fn 'C:/path/to/your/file.nc4'
'-v', '--variable'	Provide the path name of the variable being plotted within the file, written in single or double quotes.	--variable 'groupname/variablename' or -v "groupname/variablename"

'-f', '--filename'	Saves the figure directly without displaying the plot and customization windows. Provide the name to be used for saving the figure. If the '--filename' argument is not used, the figure will be saved as a png.	--filename figure1 <u>or</u> -fn figure1 (if this argument is passed without the --fileouttype argument, figure1 would be saved as a png)
'-ft', '--fileouttype'	Specifies the file type used to save the file directly. If this argument is used without also using the '--filename' argument, this will be ignored. Recognized extensions are eps, jpeg, pdf, pgf, png, ps, raw, rgba, svg, svgz, tif, and tiff and default is png if this argument is not given and no recognized extension is provided.	(--filename figure1)  --fileouttype jpeg <u>or</u> -ft jpeg
'-lo', '--lonname'	Overrides automated matching of longitude with the given variable. Provide the path names of the longitude variable within the file to be used when plotting the provided variable.	--lonname "groupname/longitudename" <u>or</u> -lo 'groupname/longitudename'
'-la', '--latname'	Overrides automated matching of latitude with the given variable. Provide the path names of the latitude variable within the file to be used when plotting the provided variable.	--latname 'groupname/latitudename' <u>or</u> -la "groupname/latitudename"
'-e', '--extent'	Changes the x and y limits of the map or plot. Provide four integer values in the following order, separated by spaces: 1. minimum x/longitude value 2. maximum x/longitude value 3. minimum y/latitude value 4. maximum y/latitude value	--extent 30 60 25 80 <u>or</u> -e 30 60 25 80
'-j', '--projection'	Changes the projection of the map if the provided variable can be plotted geospatially. Provide the name of a map projection supported by the cartopy mapping package. A full list of the projections supported by cartopy can be found at the link below. This parameter will be ignored if the variable cannot be plotted geospatially.	--projection Geostationary <u>or</u> -j Geostationary
'-t', '--title'	Changes the title of the map or plot. The default will be the name of the file being used to plot.	--title Title of Your Plot <u>or</u> -t Title of Your Plot
'-b', '--subtitle'	Changes the subtitle of the map or plot. The default will be the name of the variable being plotted	--subtitle Subtitle of Your Plot <u>or</u> -b Subtitle of Your Plot
'-cm', '--colormap'	Changes the colors that are used to plot the data from the selected variable, including all of the colormaps provided by the matplotlib pyplot colormaps. The default is the RdBu colormap.	--colormap viridis <u>or</u> -cm viridis
'-cb', '--colorbar'	Changes whether or not the colorbar is enabled for geospatial maps. By default this argument is set to True, so include this argument only if you want to disable the colorbar, entering 'false' or 'f' (any capitalization)	--colorbar False <u>or</u> -cb False
'-x', '--max'	Changes the maximum value being plotted from the chosen variable. The default will be the maximum value in that variable.	--max 40 <u>or</u> -x 40
'-n', '--min'	Changes the minimum value being plotted from the chosen variable. The default will be the minimum value in that variable.	--min 30 <u>or</u> -n 30

## GES DISC LEVEL 2 SUBSETTER SERVICE INTEGRATION (COMING SOON)

▲ Get OCO-2 Level 2 geolocated XCO2 retrievals results, physical model V8 data

Estimated size of results  
31 days, 491 links, 34.32 GB

Refine Search ⓘ

▼ Refine Date Range: 2017-11-09 to 2017-12-09 [Reset]

From:  To:

Available Range: 2017-11-09 to 2019-07-28 [Default Range]

November 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	01	02	03	04
05	06	07	08	09	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	01	02
03	04	05	06	07	08	09

December 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	01
02	03	04	05	06	07	08
09	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	01	02	03	04	05
06	07	08	09	10	11	12

▼ Refine Spatial Region: -180, -90, 180, 90 [Reset]

[Default Range]



Available Range: -180, -90, 180, 90 Cursor Coordinates: 27.898, 162.638

Subset Options ⓘ

▼ Variables: Get all variables [Reset]

NOTE: By default, ALL variables are sent in the subset request.

- retrieval\_time\_tag0 (Data acquisition time for the sounding based upon the three footprint times in seconds since Jan. 1, 1993)
- xco2 (Column-averaged CO2 dry air mole fraction)
- xco2\_sptrn (a priori of column-averaged CO2 dry air mole fraction)
- xco2\_avg\_kernel (Column averaging kernel)
- xco2\_avg\_kernel\_norm (Normalized column averaging kernel)
- xco2\_pressure\_weighting\_function (Pressure weighting function used to form XCO2)
- xco2\_uncert (Uncertainty in column averaged CO2 dry air mole fraction)

Output format ⓘ

▼ File Format: HDF5 [Reset]

- ASCII
- HDF5 (Default)
- NetCDF4

Automated dimensional matching modules from Level-2 Subsetter modules facilitates the integration of the visualization tool into the online GES DISC Level-2 Subsetter. The subsetter service will soon allow users to plot variables directly from the subsetter, and to download these files without necessitating them to download files and plot the data from those files themselves. This service will make use of the command line functionality of the visualization tool and will provide an easy and intuitive way for users to interact with data in a more direct, visual way to help bring the process of analysis one step closer to the source of the data.

For more information about the Level-2 Subsetter, check out the NASA EarthData article: GES DISC Introduces Satellite Level 2 Products Subsetter (<https://disc.gsfc.nasa.gov/information/howto?keywords=level%20&title=How%20to%20Subset%20Level-2%20Data>).



Sorry but time is up!

## ABSTRACT

Earth Science satellite missions provide a unique opportunity for scientists to visualize complex and multifaceted observations projected geospatially across maps of the Earth. While visualization tools can help scientists comprehend, analyze, and share data, visualizing Level-2 Earth Sciences data poses its own specific set of challenges. Since the geospatial information in Level-2 data files is stored as independent variables, the plotting process involves matching dimensional information from latitude and longitude with a desired variable. Variables are stored in different ways across various Earth Science data file formats, which complicates the process of extracting data and plotting variables from a given file without requiring extensive user input and prerequisite familiarity with the file type variable structure. In coordination with NASA's Goddard Earth Sciences Data Information Services Center (GES DISC), the team developed a Level-2 Earth Science data visualization tool that aims to address some of the complexities associated with plotting Level-2 data. This tool offers command-line and user interface support for file and variable selection to accommodate varying use cases and degrees of user familiarity with the structure of a given file. The visualization tool is written in Python 3 and utilizes a modular approach to facilitate continued expansion and reuse. In addressing some common complications involved in plotting Level-2 Earth Sciences data, the tool aims to help to link the process of analysis more directly with data acquisition and visualization, bringing analysis closer to data across levels of processing.

## SWITCH TEMPLATE

