Data Reading Program Guide (COTS version)

1. Introduction

This document provides instructions for using the Global Precipitation Measurement (GPM) products and the Global Satellite Mapping of Precipitation (GSMaP) products in netCDF format with commercial off-the-shelf (COTS).

The GPM L3 products and GSMaP L3 products were provided in GeoTIFF format up to product version 07, but this will no longer be available starting from version 08. Users utilizing GeoTIFF format products are encouraged to refer to this document to use GPM products in netCDF format, as well as to create and use GeoTIFF format products from the original netCDF format products using Python code. For information on how to create GeoTIFF format products using Python code, please refer to "GPM Data Reading Program Guide (Python Edition) ", specifically section "3.8 GeoTIFF Conversion".

2. Target Products

This document covers GPM and GSMaP products in netCDF format, distributed via the Earth Observation Satellite Data Provision System (G-Portal).

3. Using Data with COTS

This section explains how to use netCDF format products with COTS. The COTS introduced in this document are listed in Table 3-1 COTS Product List.

Table 3-1 COTS Product List

No	COTS Name	Overview	Verified Version
1	QGIS	A Geographic Information System (GIS) for viewing, editing, and analyzing geospatial data. https://qgis.org/	3.40.14
2	Panoply	A data viewer for netCDF and HDF formats published by NASA GISS. https://www.giss.nasa.gov/tools/panoply/	5.8.1
3	HDF View	A data viewer for netCDF and HDF formats published by the HDF Group. https://www.hdfgroup.org/download-hdfview/	3.1.4

3.1. QGIS

QGIS is a Geographic Information System (GIS) for viewing, editing, and analyzing geospatial data. This document provides an overview of the steps to display GPM products. For other procedures, please refer to the official QGIS documentation.

(https://www.qgis.org/resources/hub/)

3.1.1. Converting Data Formats

When loading GPM NetCDF products directly into QGIS, they may not be rendered correctly . Before loading, please convert the data to GeoTIFF format by referring to the "GPM Data Loading Program Guide (Python Edition)", specifically section "3.8 GeoTIFF Conversion".

3.1.2. Viewing Data

When you launch the tool, the following screen will appear.

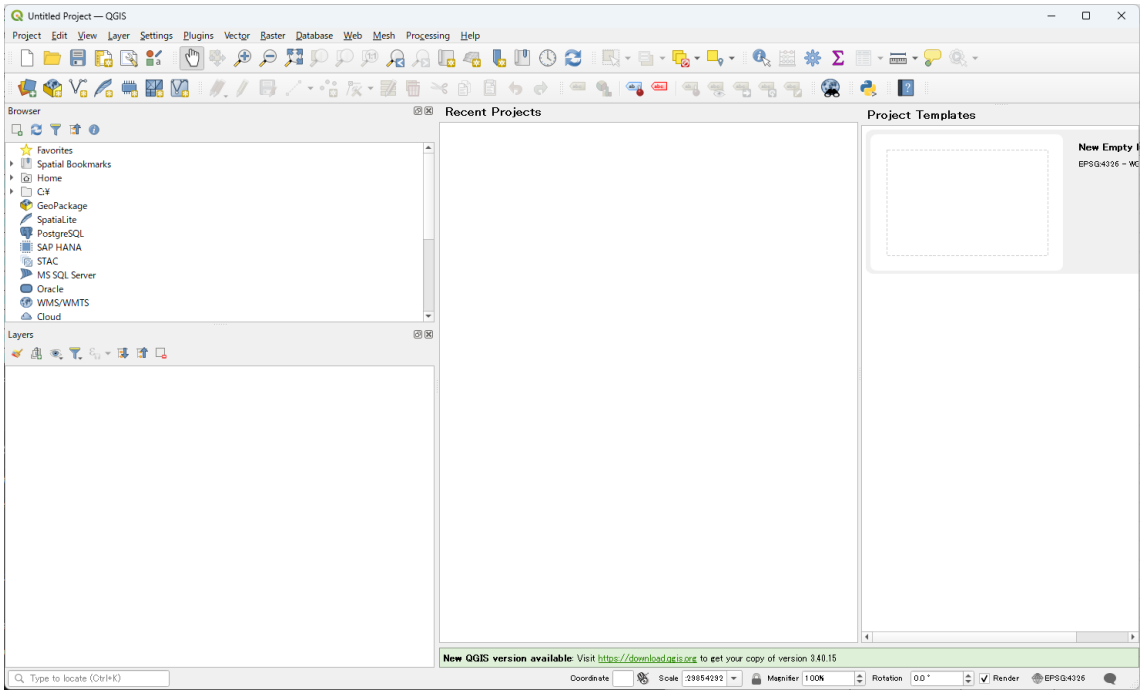


Figure 3-1 QGIS Startup Screen

From menu, select “Layer”, then "Data Source Manager" to display the Data Source Manager window. From the list on the left side of the window, select "Raster," set the source type to "File," click the "..." button, and select the GeoTIFF file.

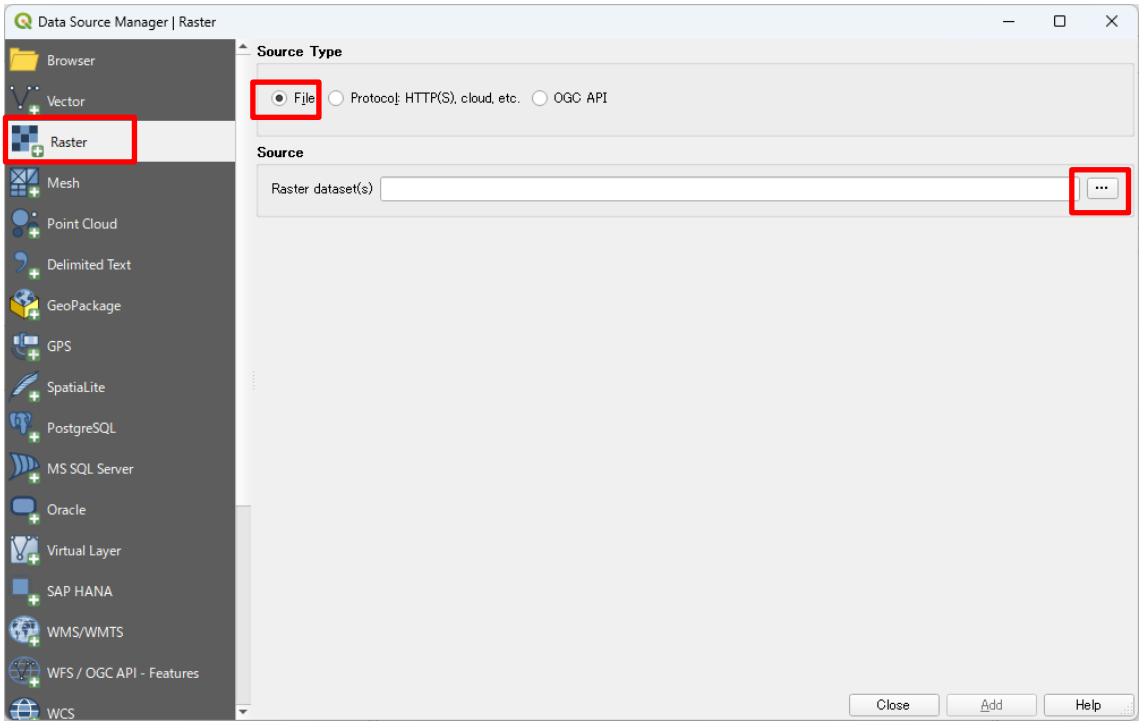


Figure 3-2 Data Source Manager

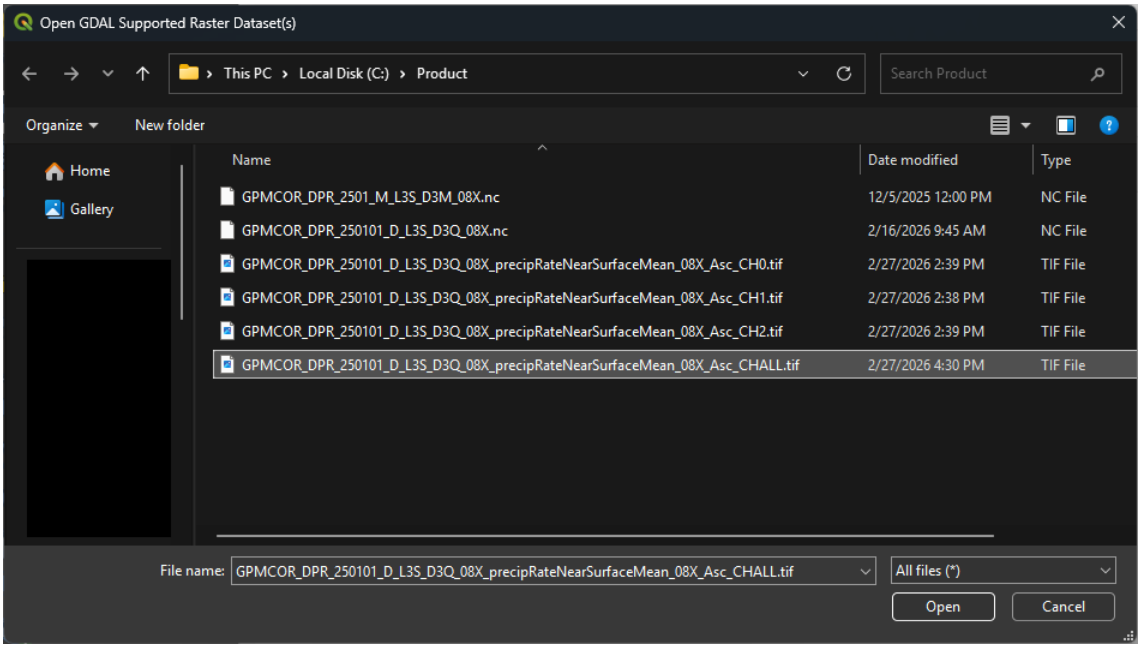


Figure 3-3 File Selection

Options will be added to the Data Source Manager. Configure them as needed, then click "Add".

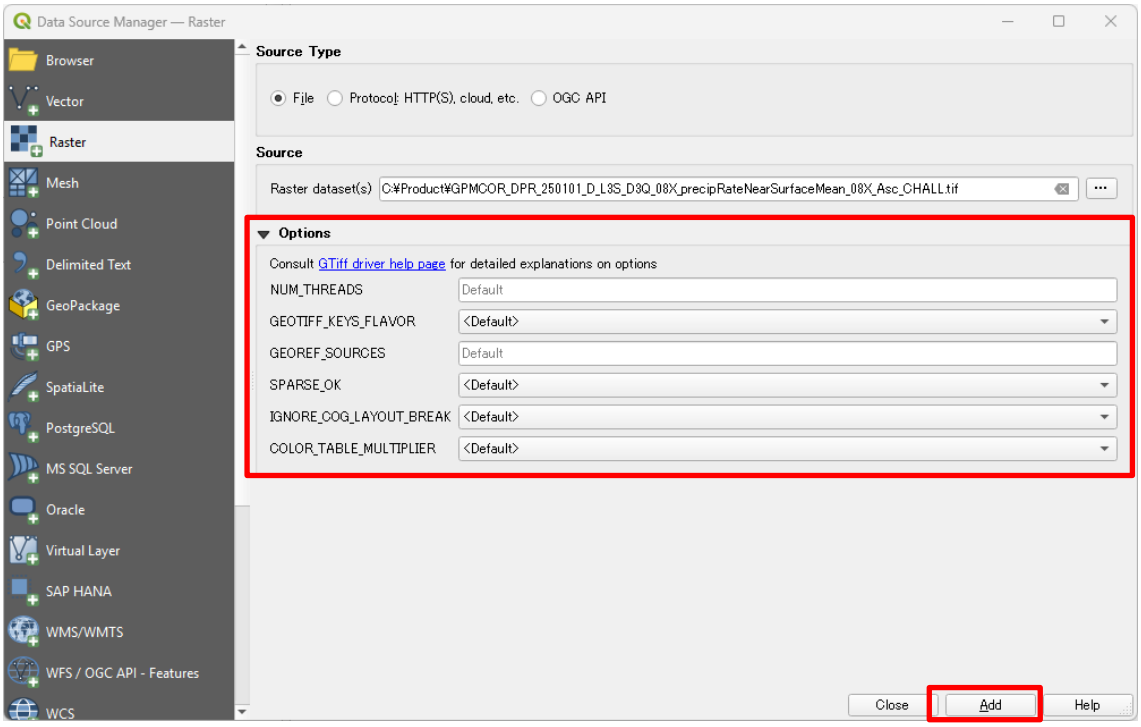


Figure 3-4 Raster Dataset Selection

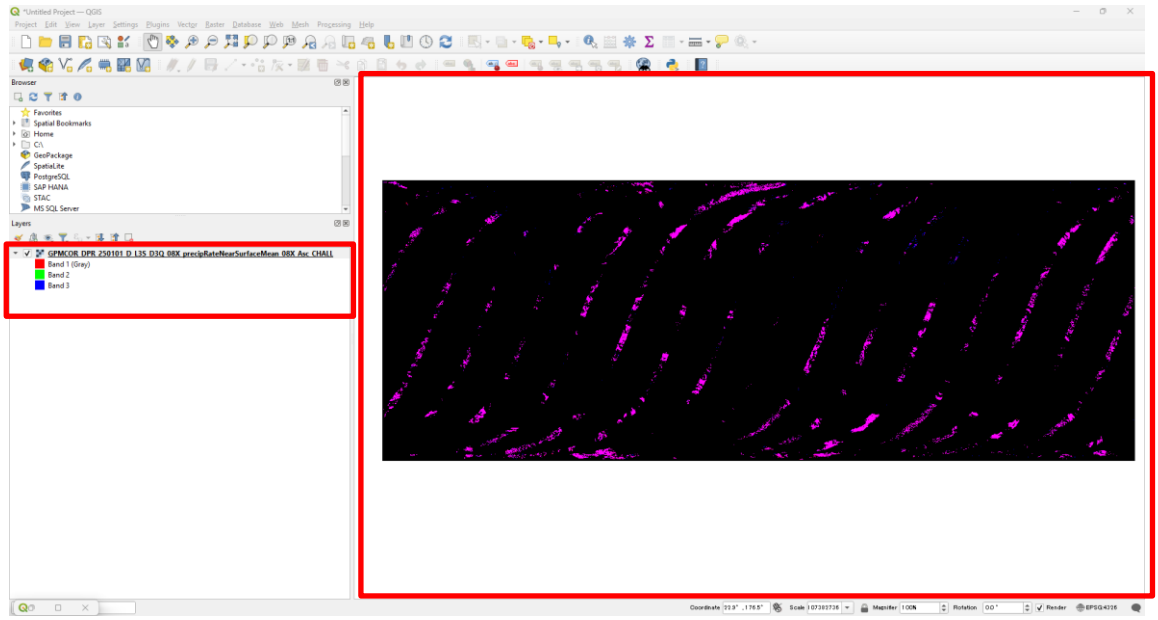


Figure 3-5 Data Display

3.1.3. Switching Layer

After importing multiple datasets to QGIS, you can switch the display layers to view the corresponding images. Follow the steps in "3.1.2 Viewing Data" to display multiple images. In this document, we will overlay two images onto a map. The map data used is "OpenStreetMap," which can be selected in QGIS.

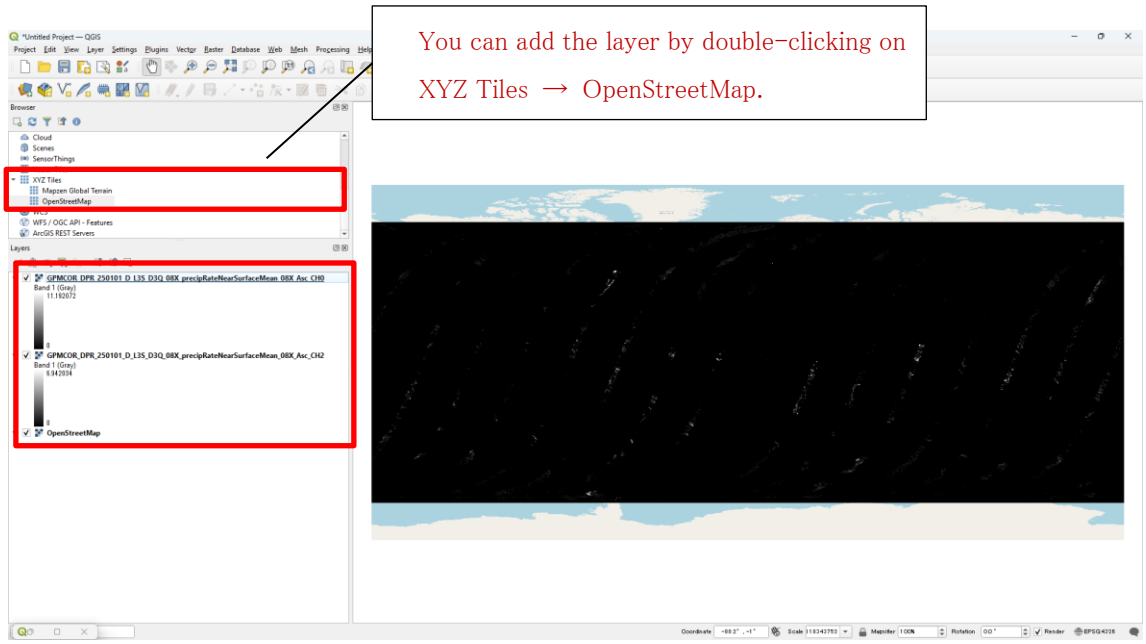


Figure 3-6 Display Multiple Datasets

The data displayed on the right side of the screen shows layers in the same order as the layers on the left side, from top to bottom. You can change the order of the layers on the left side to rearrange the displayed data on the right. To change the order, simply drag and drop the layers on the left side.

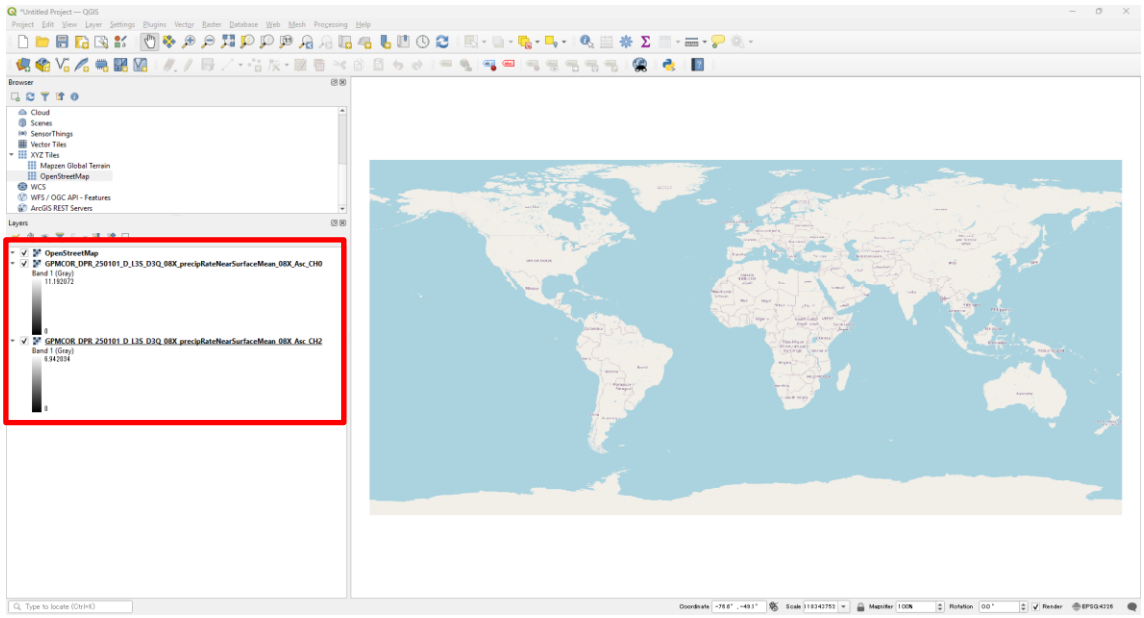


Figure 3-7 Rearrange Layer Order

You can toggle each layer's display with the checkboxes on the left side of each layer.

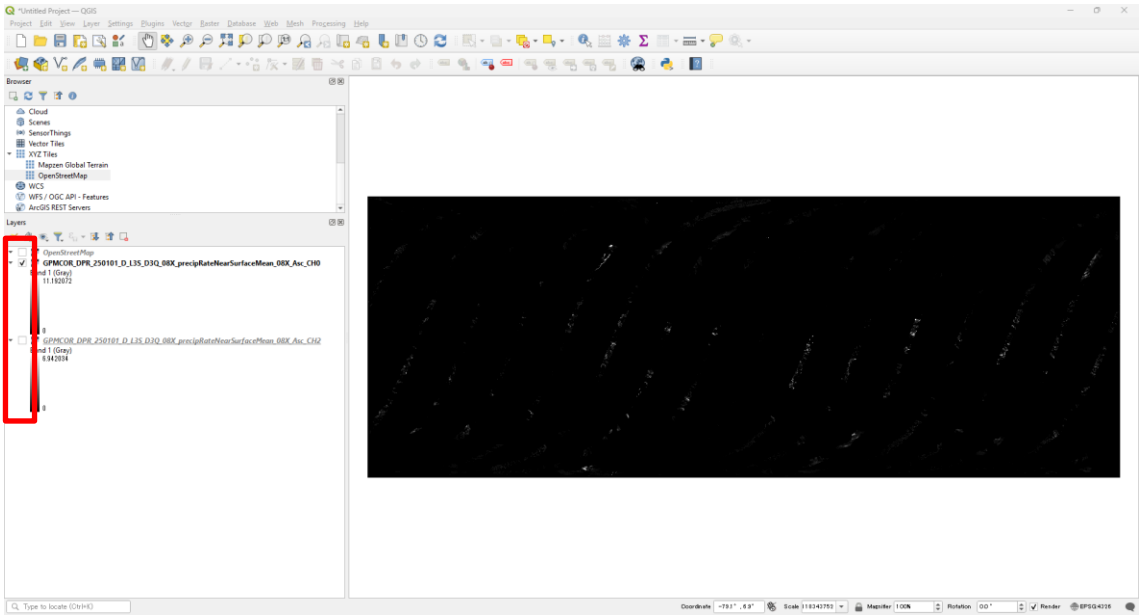


Figure 3-8 Switch Layer Display

3.1.4. Setting Color and Transparency

For files with a single band, the default display is in grayscale, but you can also set this to another color. The color settings are explained in "3.1.5 Settings Band Color".

The layer data can be made transparent by specifying the transparency values. Double-click the layer for which you want to set the transparency to display the layer properties.

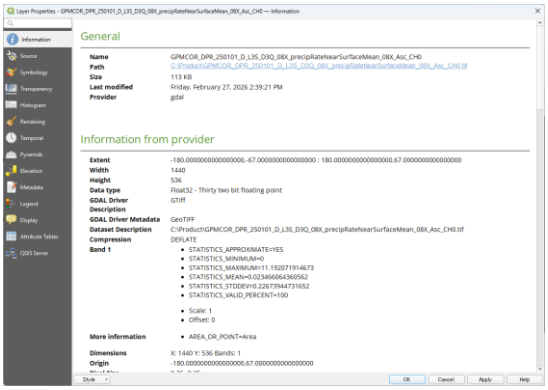


Figure 3-9 Display Layer Properties

To set transparency, from the menu on the left side of the window, select "Transparency." In the "NoData value" section, enter the transparency value in the "Additional NoData value" field. Click the "Apply" button to apply the settings.

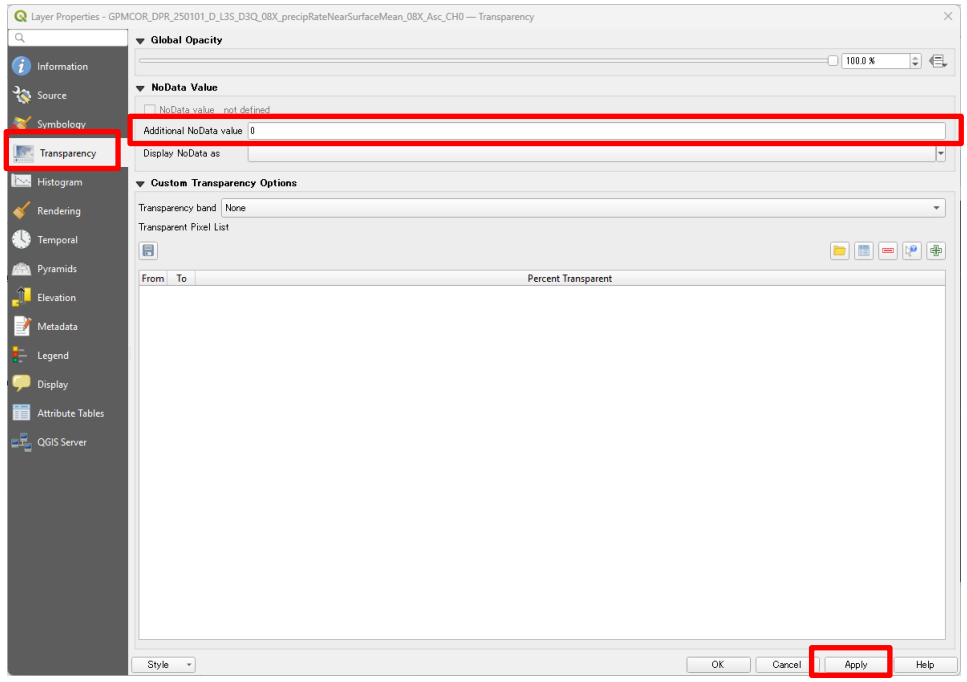


Figure 3-10 Setting Transparency

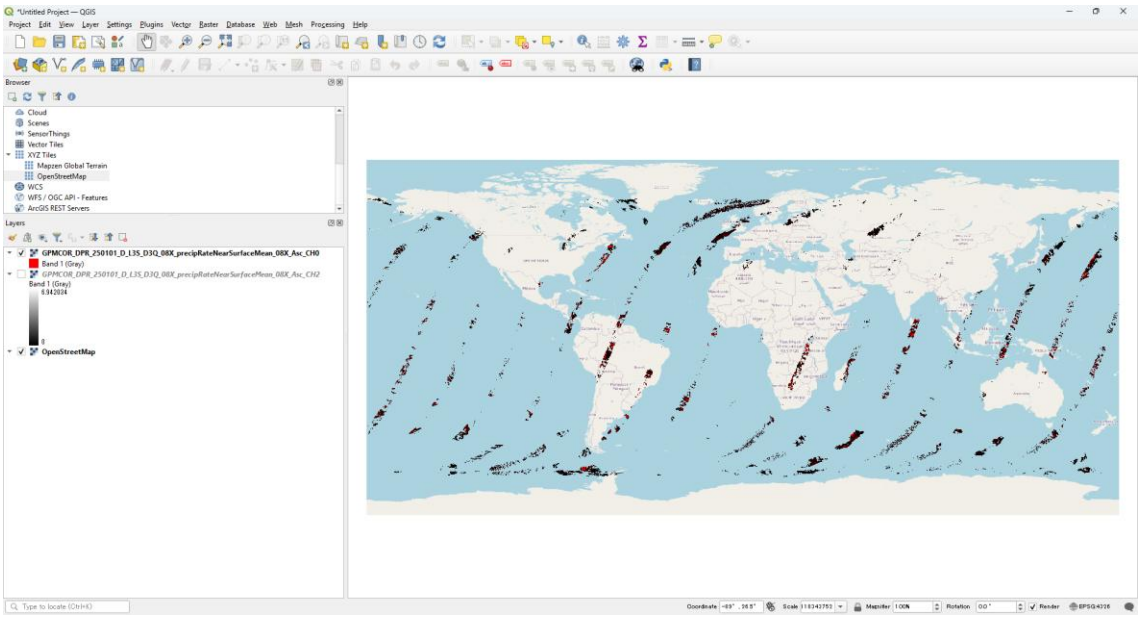


Figure 3-11 Example after Color and Transparency Settings

3.1.5. Setting Band Color

In a dataset with multiple bands, you can specify the colors assigned to each band. Double-click the layer for which you want to set the band colors to display their layer properties.

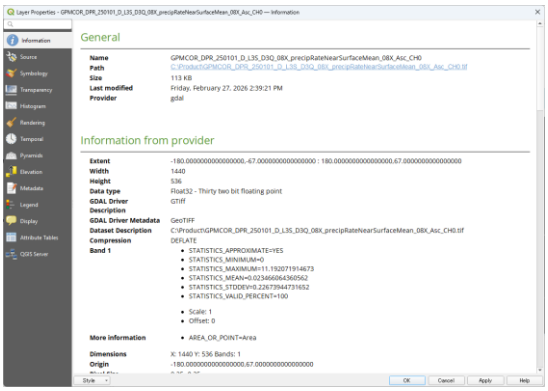


Figure 3-12 Display Layer Properties

To set symbology, from the menu on the left side of the window, select "Symbology". From the "Band Rendering" menu, choose the data for each band to assign to the "Red Band," "Green Band," and "Blue Band". By selecting "Unset" for each color band, you can display only specific bands. Click the "Apply" button to apply the settings.

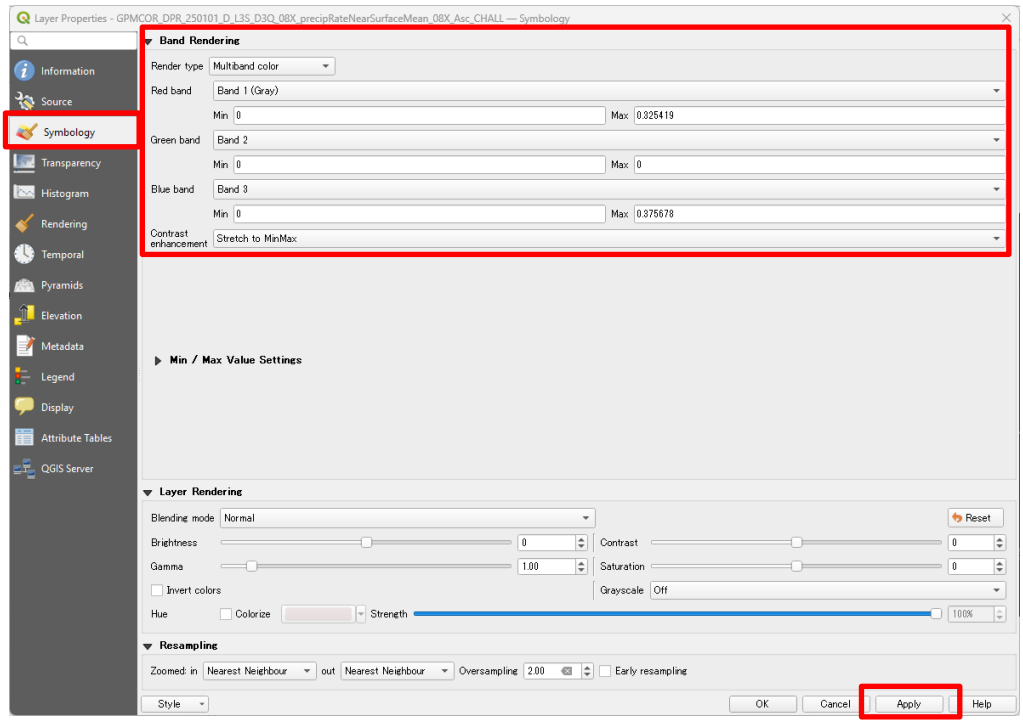


Figure 3-13 Symbology Settings

Figure 3-14 to Figure 3-17 show examples of changing the band color assignments for the same GeoTIFF file.

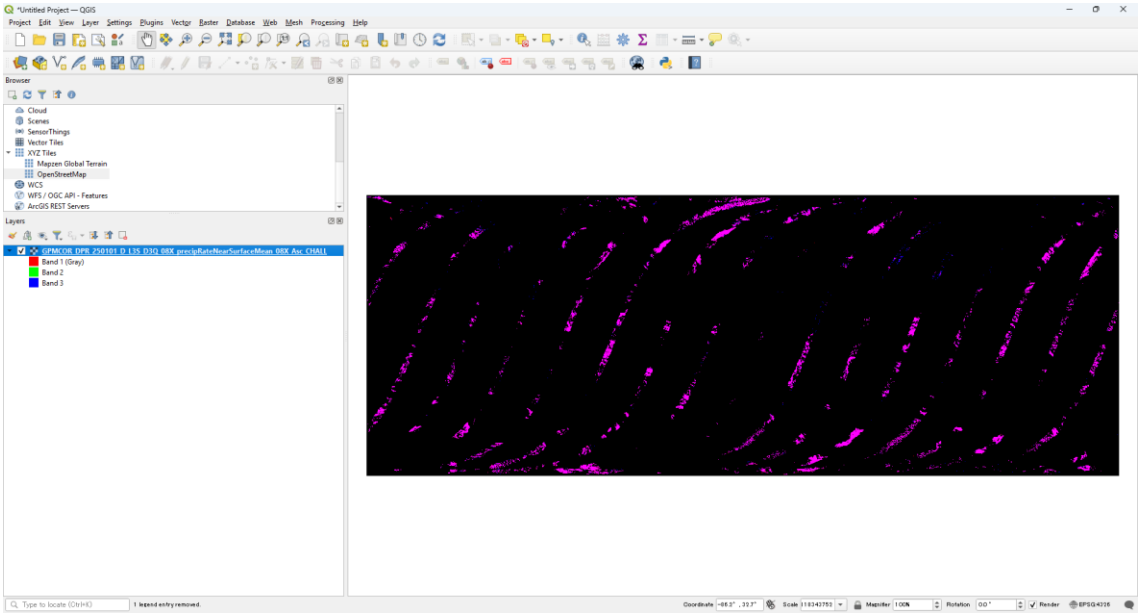


Figure 3-14 Example:Band Color Settings (Red: Band 1, Green: Band 2, Blue: Band 3)

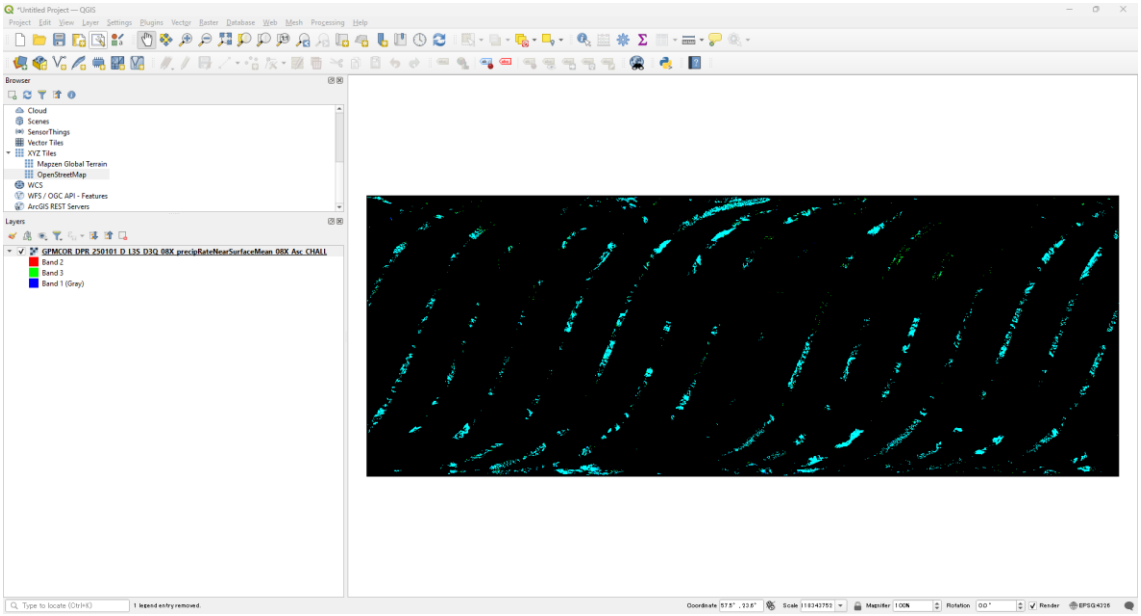


Figure 3-15 Example:Band Color Settings (Red: Band 2, Green: Band 3, Blue: Band 1)

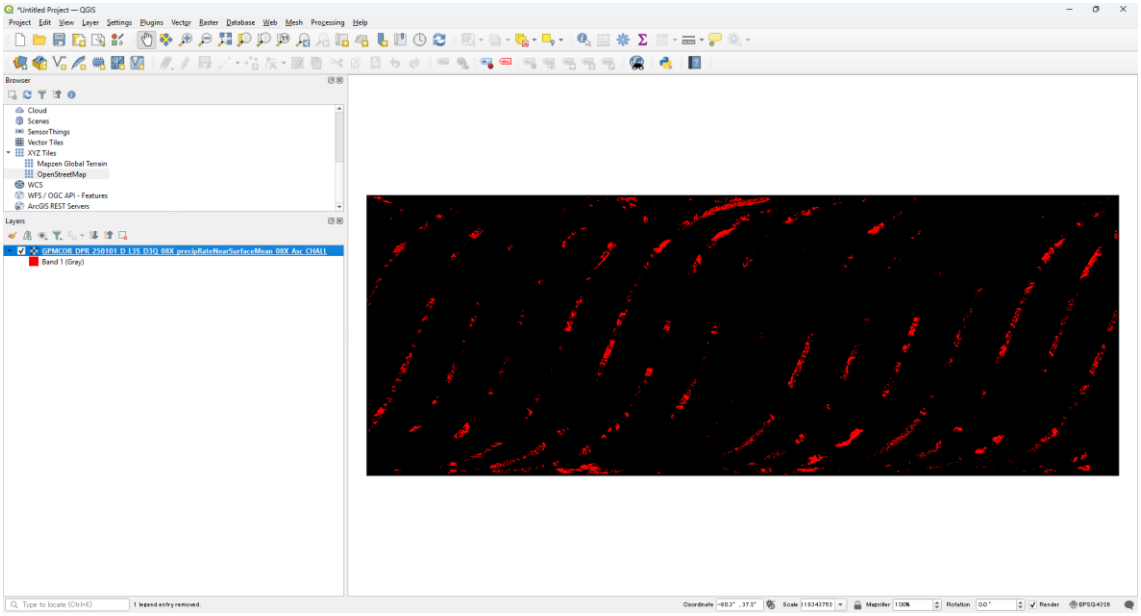


Figure 3-16 Example：Band Color Settings (Red: Band 1, Green: Unset, Blue: Unset)

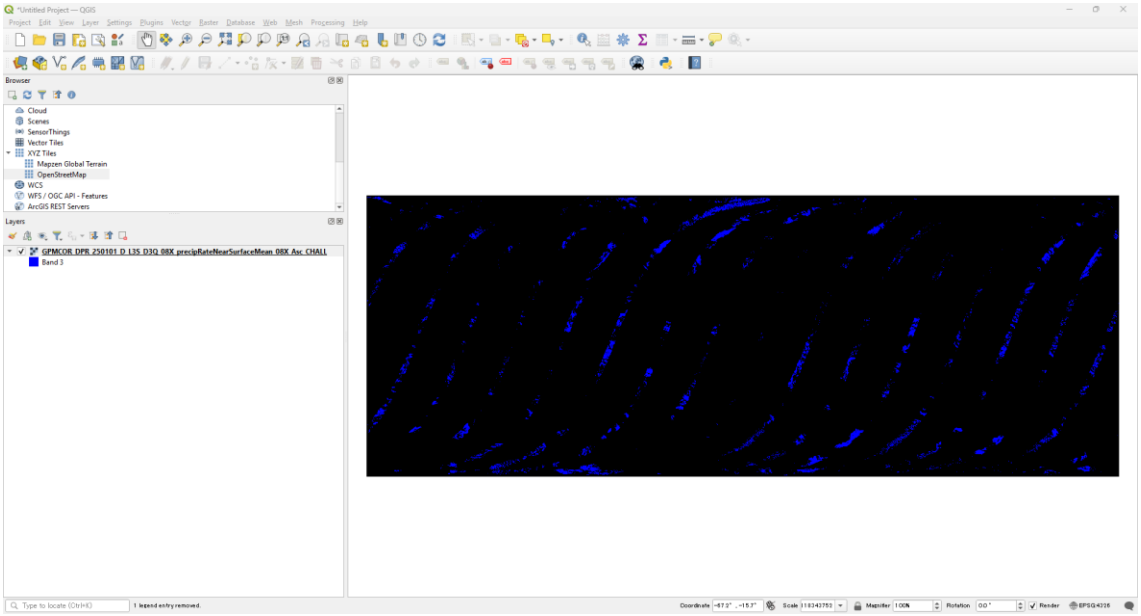


Figure 3-17 Example：Band Color Settings (Red: Unset, Green: Unset, Blue: Band 3)

3.2. Panoply

Panoply is a data viewer for netCDF and HDF format files published by NASA GISS. Panoply can plot datasets and display the contents of datasets. This document provides an overview of the steps to display GPM products. For other procedures, please refer to the official Panoply documentation. (https://www.giss.nasa.gov/tools/panoply/help/)

3.2.1. Opening Files

When you launch the tool, the following screen will appear.

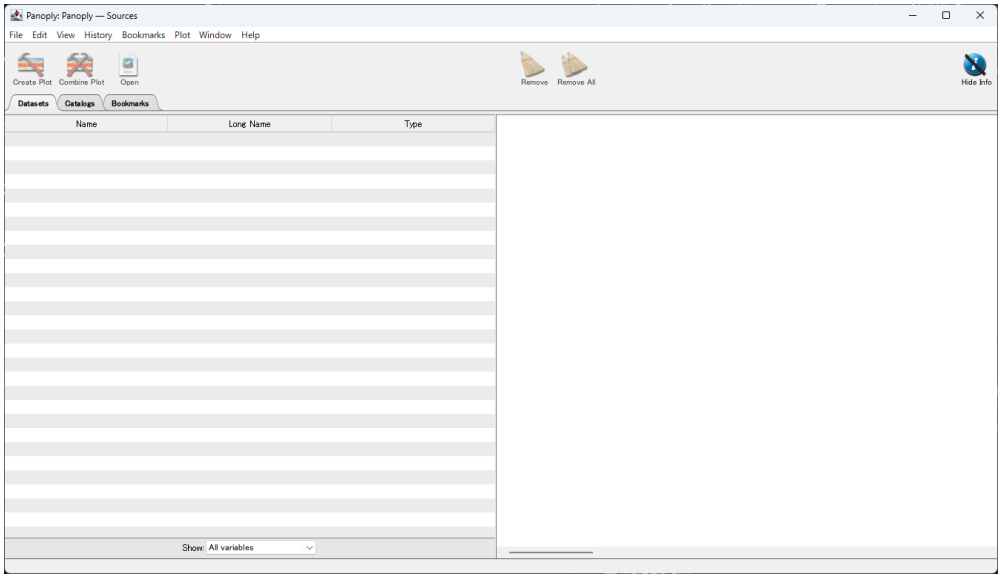


Figure 3-18 Panoply Startup Screen

From menu, select “File”, then “Open”, and a file selection dialog will appear. Choose the file to be loaded and click the ″Open″ button.

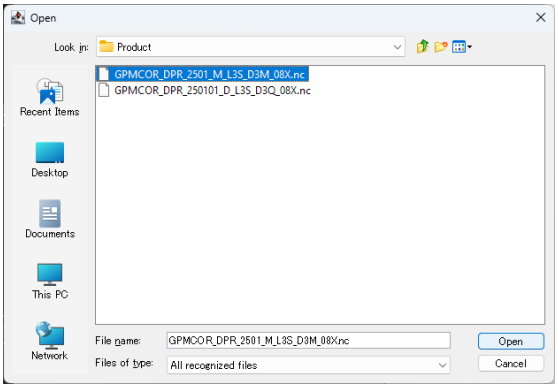


Figure 3-19 File Selection Dialog

The selected file will load, and the dataset will be displayed in a tree format on the left side of the window.

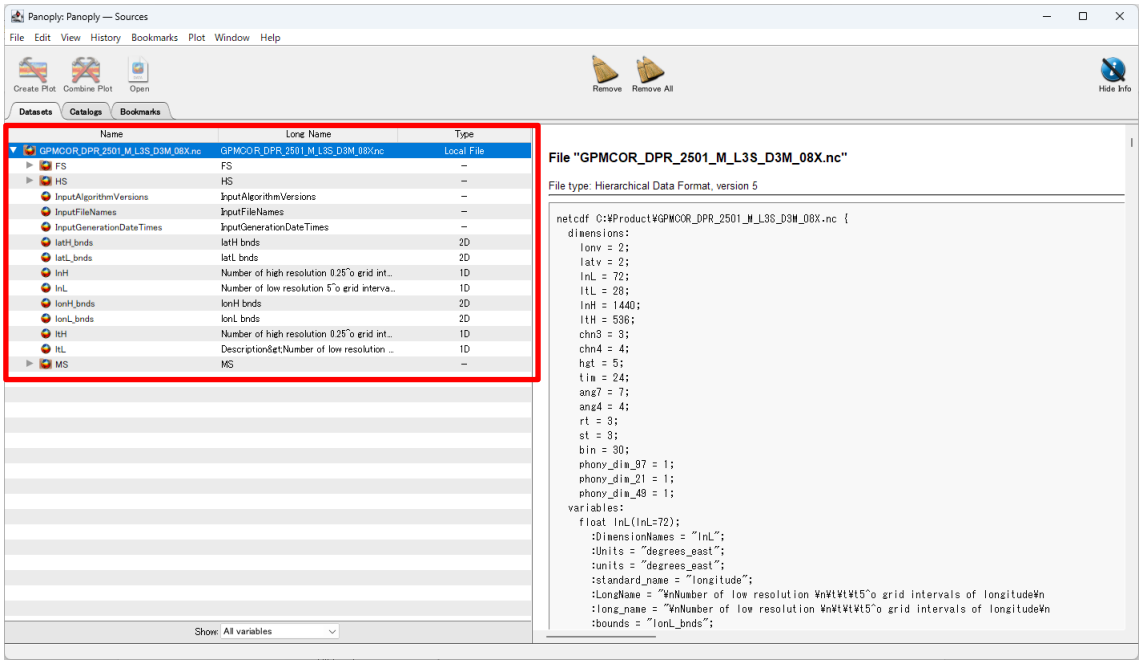


Figure 3-20 Dataset Tree View

3.2.2. Viewing Attributes

To view the overview and global attributes of a file, expand the tree on the left side and select a file. The overview will be displayed on the right side. Scroll down to view the global attributes.

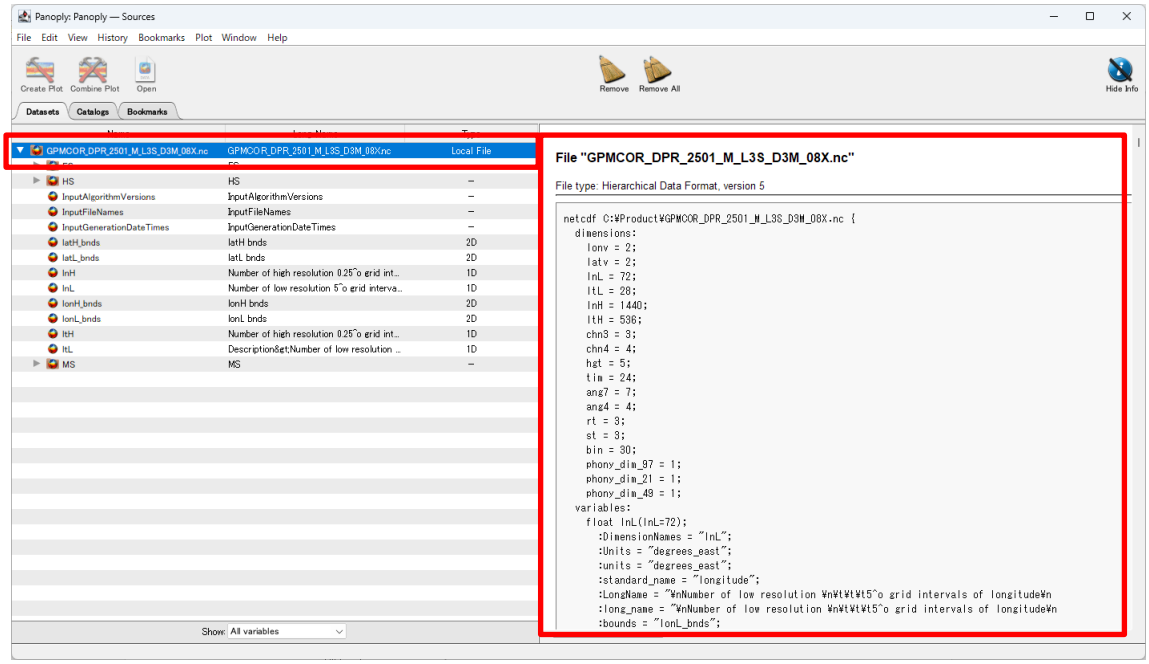


Figure 3-21 File Overview Display

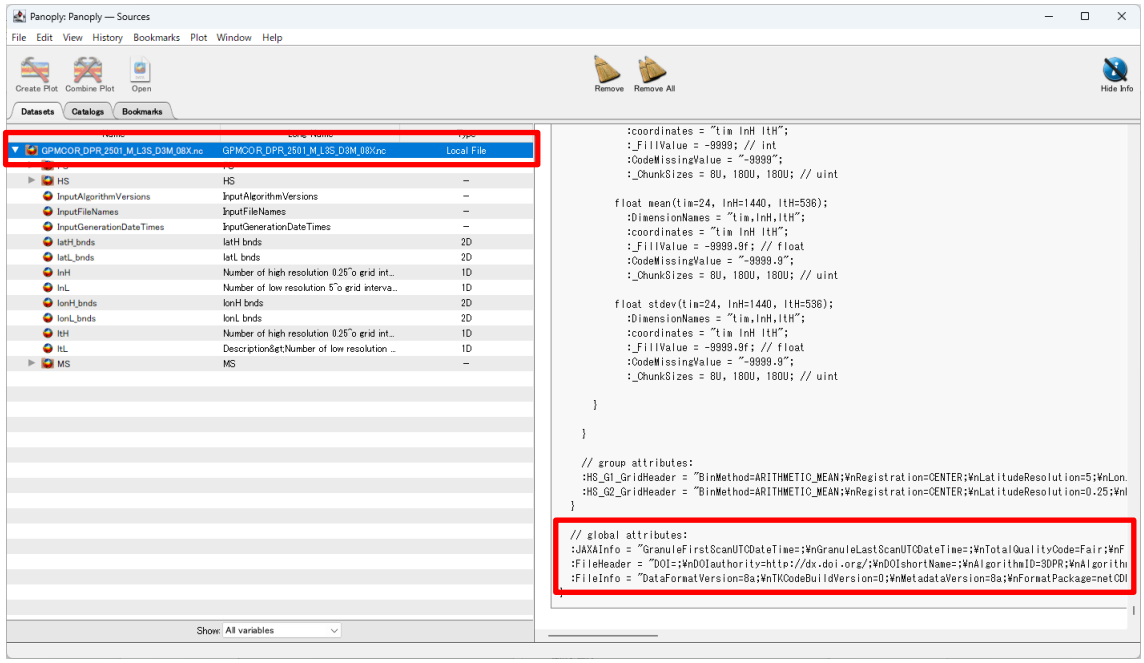


Figure 3-22 Display of Global Attributes

To view the dataset attributes of a dataset, expand the tree on the left side and select a dataset. The dataset attributes will be displayed on the right side.

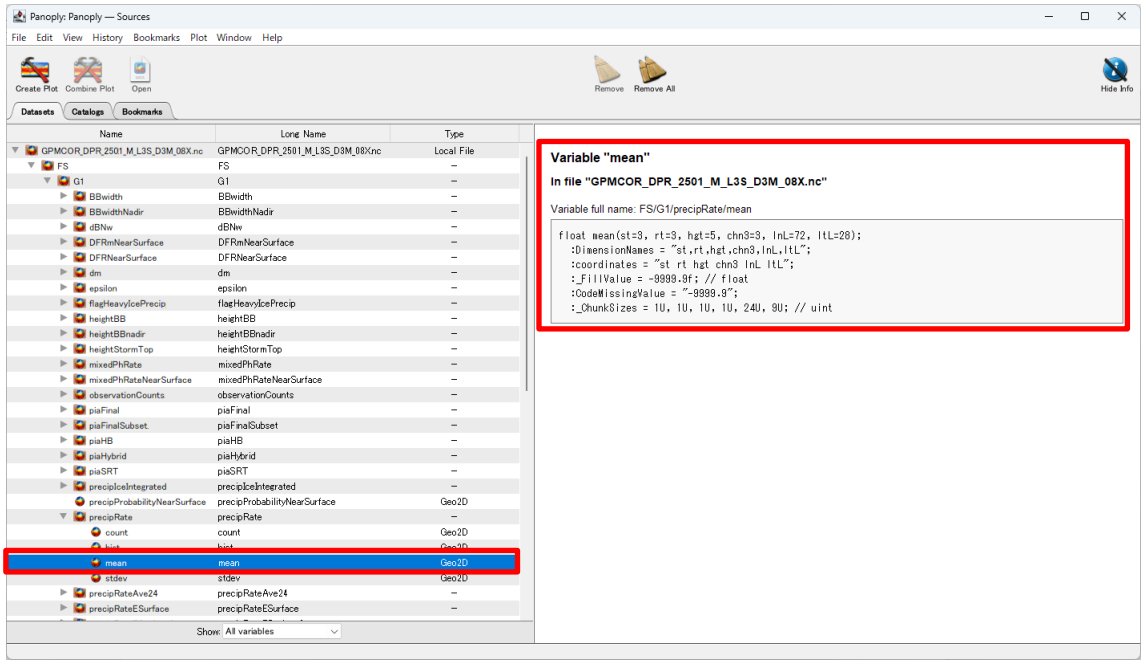


Figure 3-23 Dataset Attribute Display

3.2.3. Plotting Data

To specify the plotting method, on the left side of the window, double-click on the dataset you want to plot data. This will display the plot generation window.

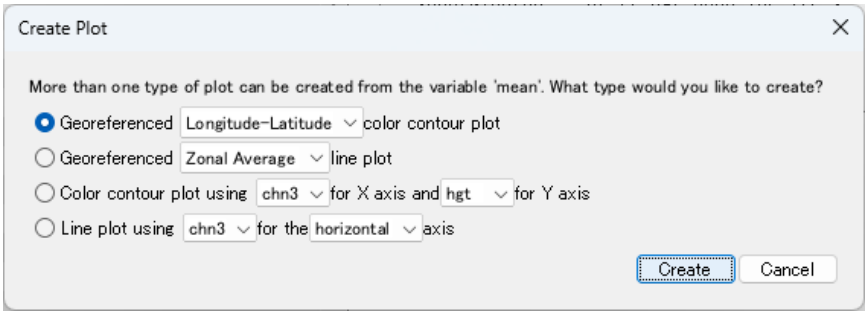


Figure 3-24 Specifying the Plotting Method

After selecting the plotting method and clicking "Create," the dataset will be visualized as an image in the window according to the specified settings.

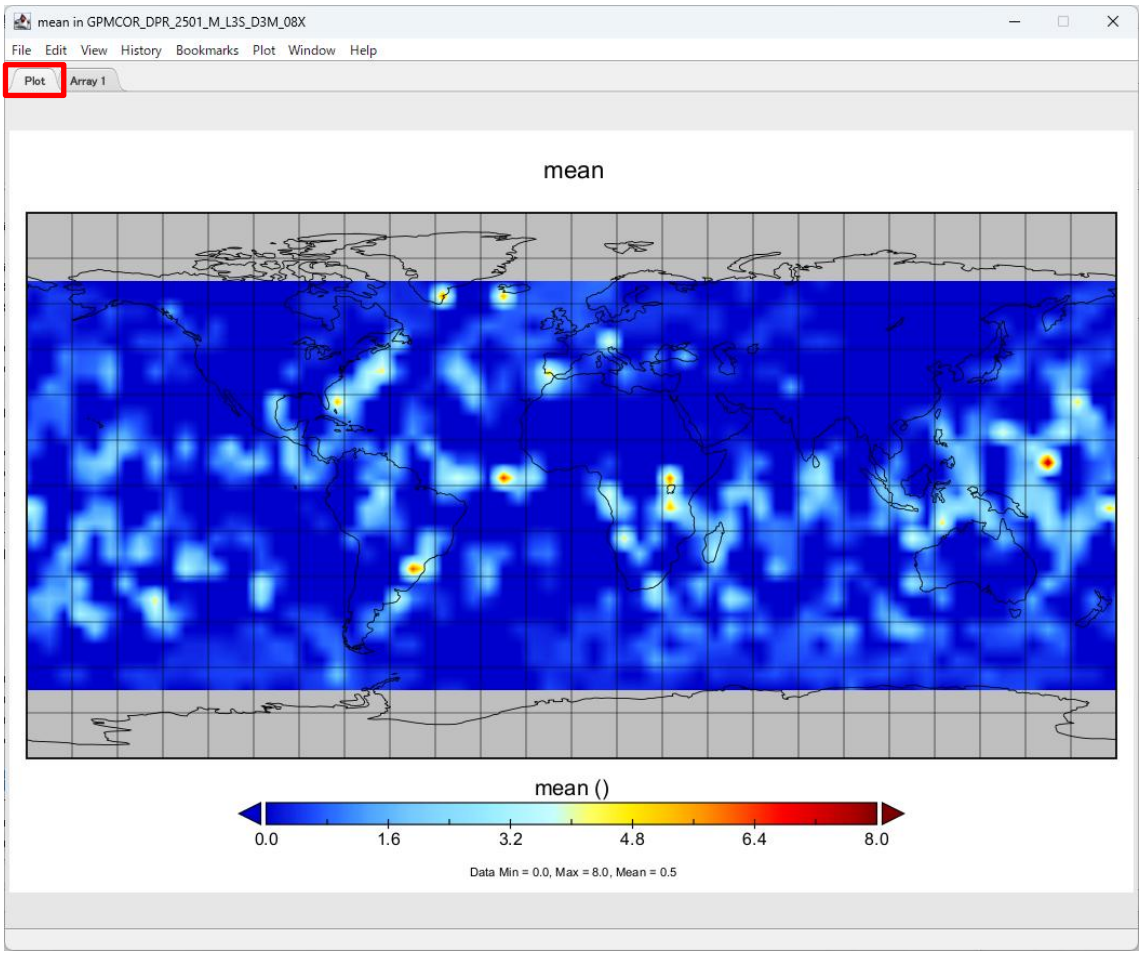
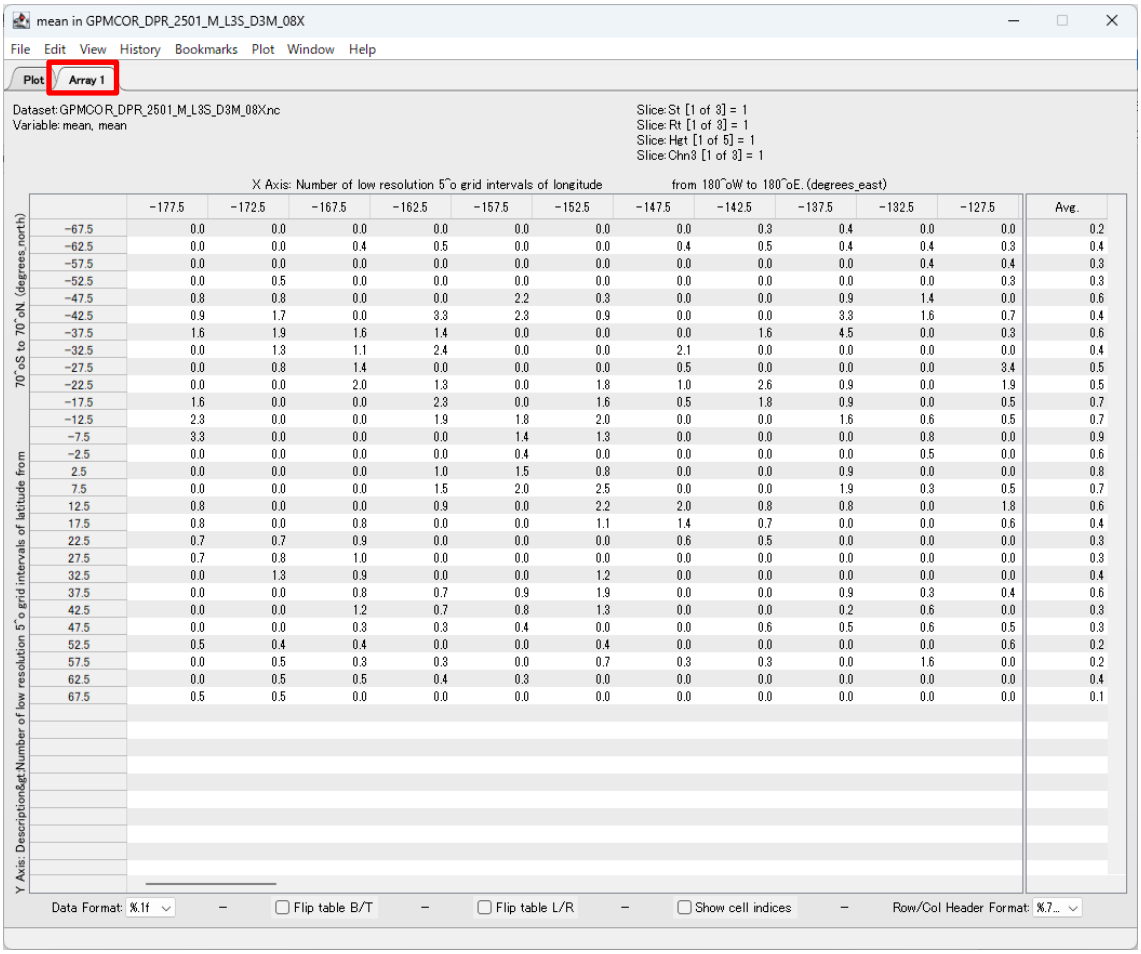


Figure 3-25 Display of Plot Image

By clicking on the ″Array 1″ tab, the stored values of the dataset will be displayed.



	-177.5	-172.5	-167.5	-162.5	-157.5	-152.5	-147.5	-142.5	-137.5	-132.5	-127.5	Avg.
-67.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.2
-62.5	0.0	0.0	0.4	0.5	0.0	0.0	0.4	0.5	0.4	0.4	0.3	0.4
-57.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.3
-52.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3
-47.5	0.8	0.8	0.0	0.0	2.2	0.3	0.0	0.0	0.9	1.4	0.0	0.6
-42.5	0.9	1.7	0.0	3.3	2.3	0.9	0.0	0.0	3.3	1.6	0.7	0.4
-37.5	1.6	1.9	1.6	1.4	0.0	0.0	0.0	1.6	4.5	0.0	0.3	0.6
-32.5	0.0	1.3	1.1	2.4	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.4
-27.5	0.0	0.8	1.4	0.0	0.0	0.0	0.5	0.0	0.0	0.0	3.4	0.5
-22.5	0.0	0.0	2.0	1.3	0.0	1.8	1.0	2.6	0.9	0.0	1.9	0.5
-17.5	1.6	0.0	0.0	2.3	0.0	1.6	0.5	1.8	0.9	0.0	0.5	0.7
-12.5	2.3	0.0	0.0	1.9	1.8	2.0	0.0	0.0	1.6	0.6	0.5	0.7
-7.5	3.3	0.0	0.0	0.0	1.4	1.3	0.0	0.0	0.0	0.8	0.0	0.9
-2.5	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.0	0.6
2.5	0.0	0.0	0.0	1.0	1.5	0.8	0.0	0.0	0.9	0.0	0.0	0.8
7.5	0.0	0.0	0.0	1.5	2.0	2.5	0.0	0.0	1.9	0.3	0.5	0.7
12.5	0.8	0.0	0.0	0.9	0.0	2.2	2.0	0.8	0.8	0.0	1.8	0.6
17.5	0.8	0.0	0.8	0.0	0.0	1.1	1.4	0.7	0.0	0.0	0.6	0.4
22.5	0.7	0.7	0.9	0.0	0.0	0.0	0.6	0.5	0.0	0.0	0.0	0.3
27.5	0.7	0.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
32.5	0.0	1.3	0.9	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.4
37.5	0.0	0.0	0.8	0.7	0.9	1.9	0.0	0.0	0.9	0.3	0.4	0.6
42.5	0.0	0.0	1.2	0.7	0.8	1.3	0.0	0.0	0.2	0.6	0.0	0.3
47.5	0.0	0.0	0.3	0.3	0.4	0.0	0.0	0.6	0.5	0.6	0.5	0.3
52.5	0.5	0.4	0.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.6	0.2
57.5	0.0	0.5	0.3	0.3	0.0	0.7	0.3	0.3	0.0	1.6	0.0	0.2
62.5	0.0	0.5	0.5	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4
67.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Figure 3-26 Display of Dataset Stored Values

3.3. HDF View

HDF View is a data viewer for netCDF and HDF formats. You can select the dimensions to display and plot/export data. This document provides an overview of the steps to display GPM products. For other procedures, please refer to The HDF Group's official user guide.

(support.hdfgroup.org/documentation/hdfview/latest/)

3.3.1. Opening Files

When you launch the tool, the following screen will appear.

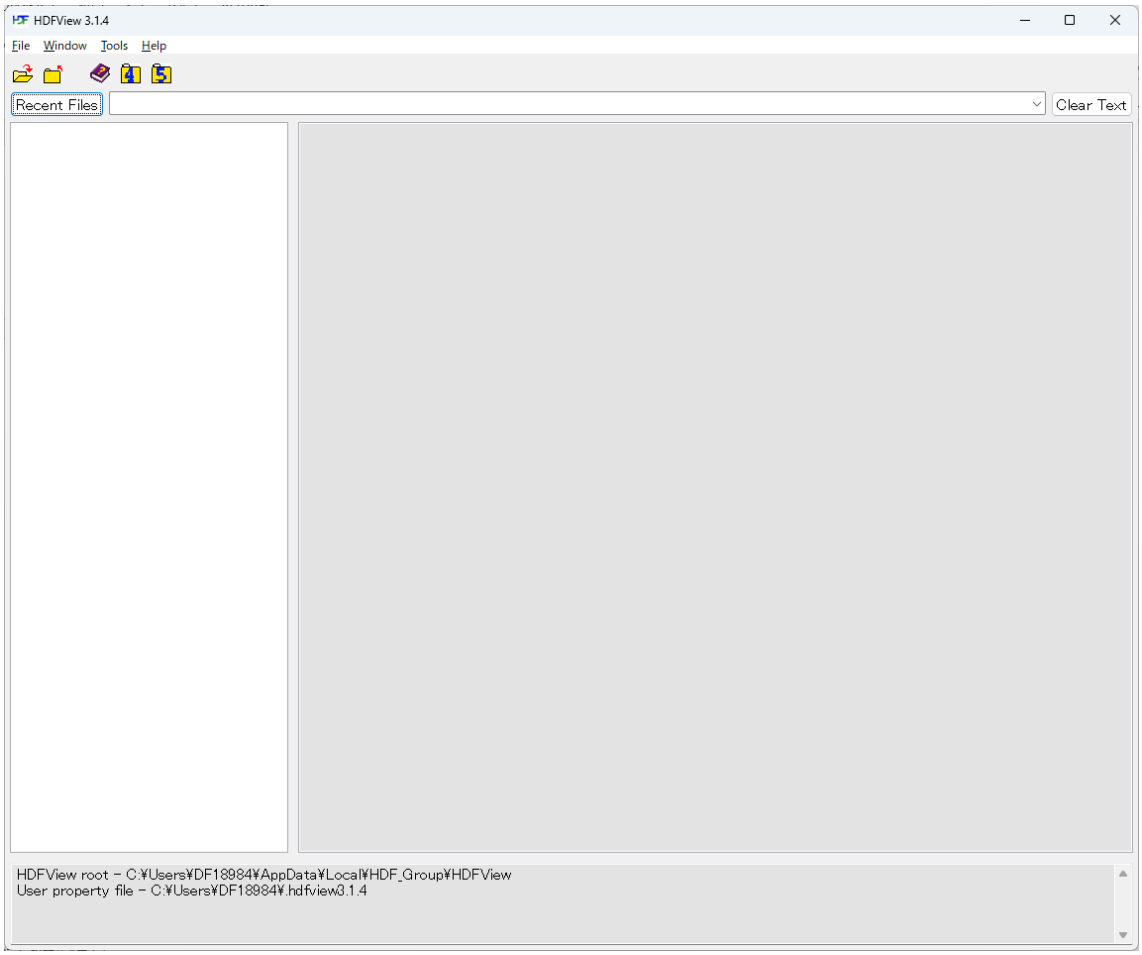


Figure 3-27 HDF View Startup Screen

From menu, select "File", then "Open", and a file selection dialog will appear. Choose the file to be loaded and click the "Open" button.

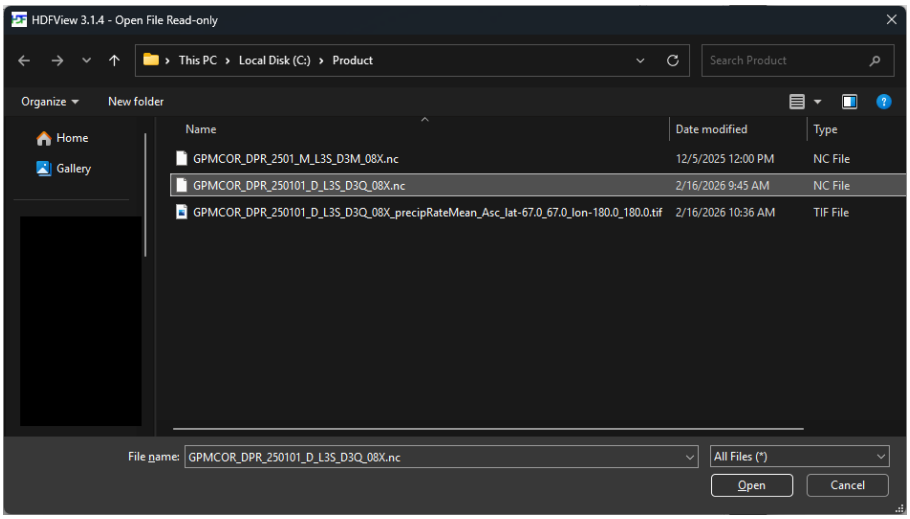


Figure 3-28 File Selection Dialog

The selected file will load, and the dataset will be displayed in a tree format on the left side of the window.

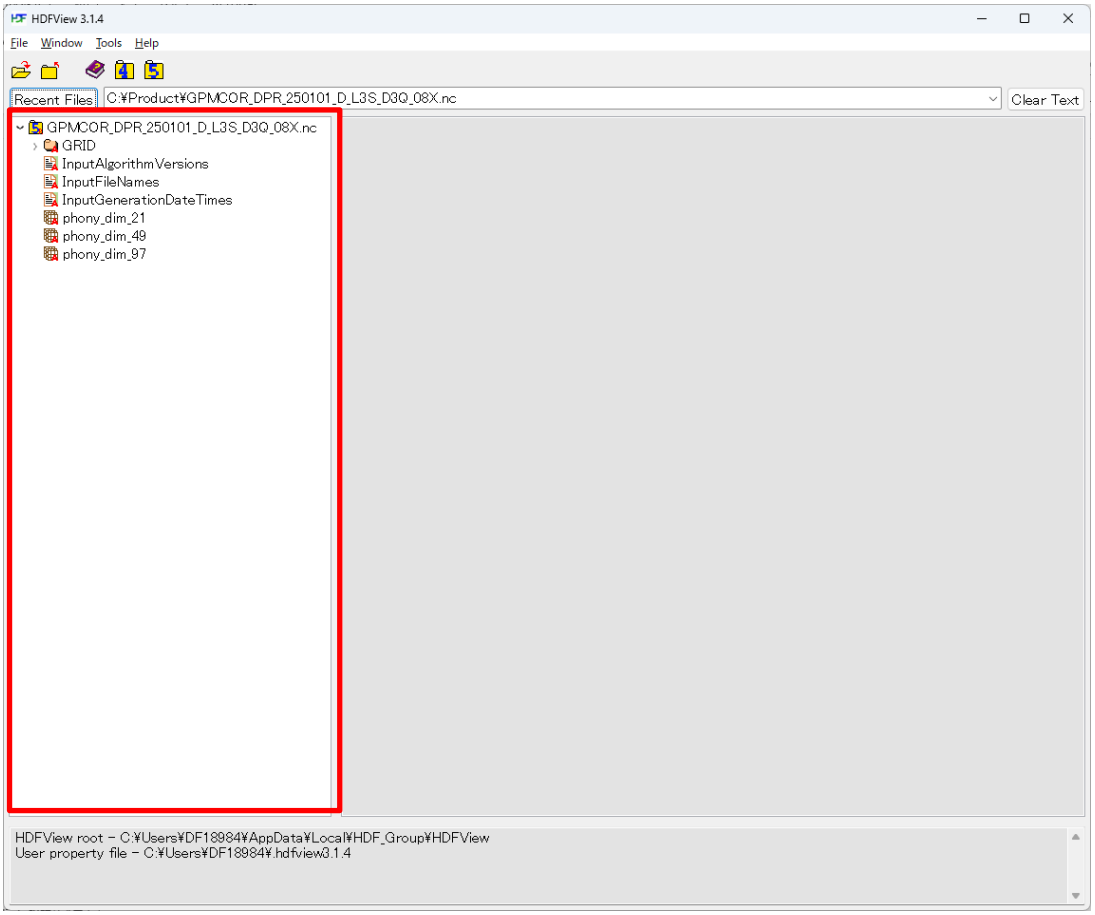


Figure 3-29 Dataset Tree Display

3.3.2. Viewing Attributes

To display the global attributes overview of a file, click a file name in the tree on the left side of the window. The file overview will be displayed on the right side.

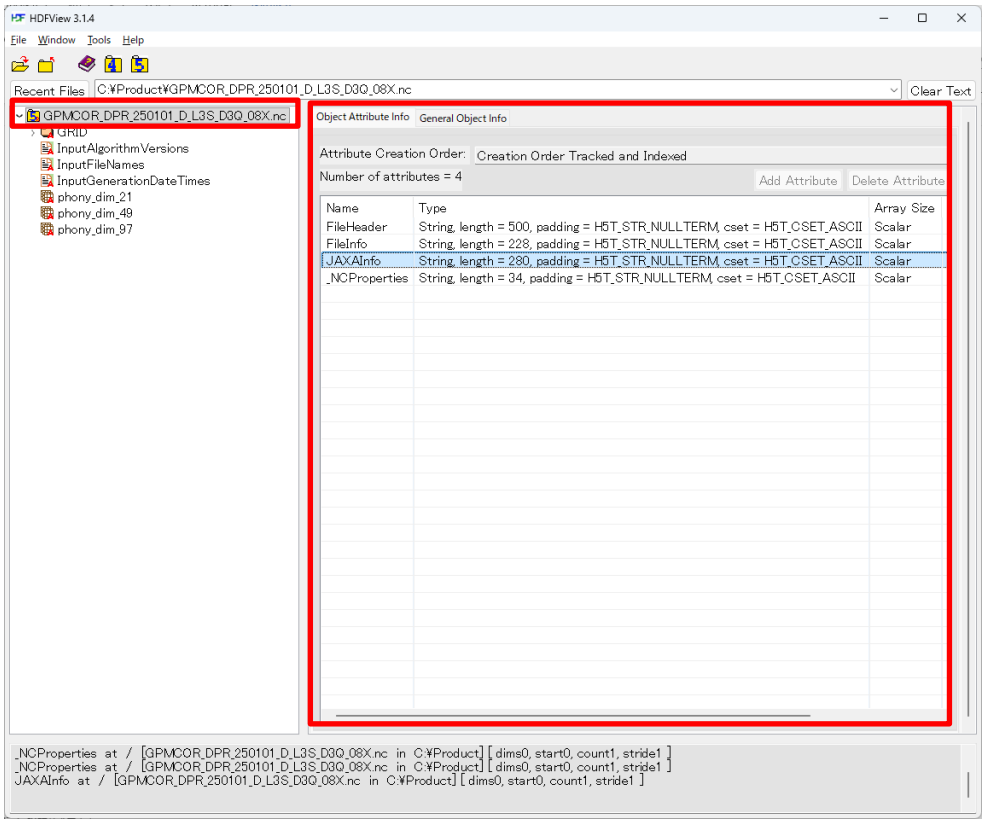


Figure 3-30 Display of Global Attributes

To display set values of global attributes, double-click the global attribute name. It will display the set values in a new window.

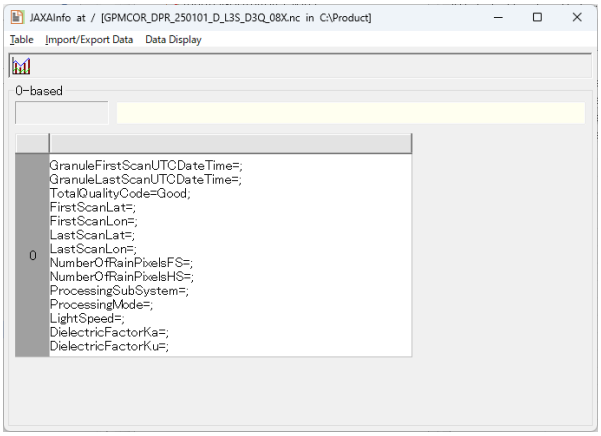


Figure 3-31 Display of Global Attribute Setting Values

To display dataset attributes, click the dataset name in the tree on the left side of the window. The dataset attributes will be displayed on the right.

To display set values of an attribute, similar to global attributes, double-clicking the attribute name will open a separate window which shows the set values.

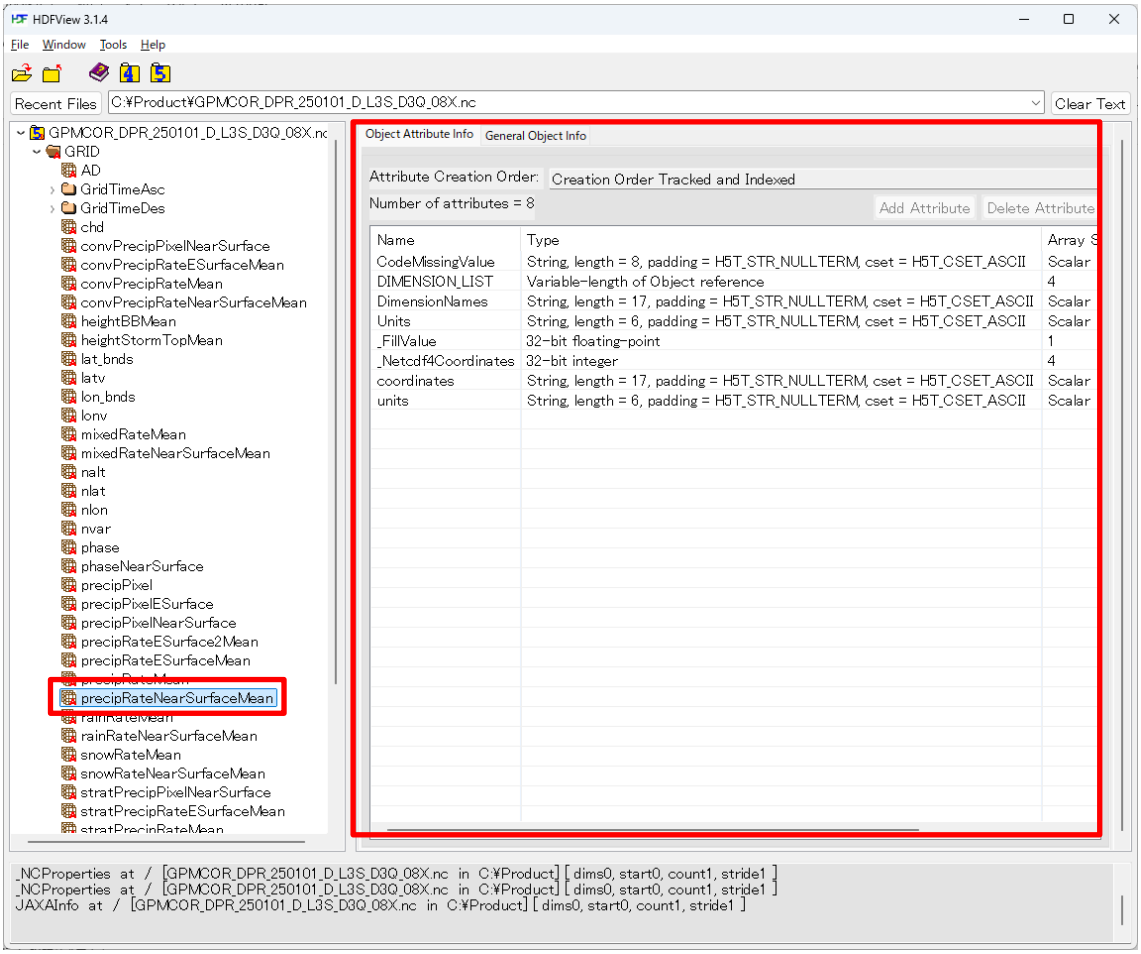


Figure 3-32 Dataset Attribute Display

3.3.3. Viewing Dataset

To display the stored value of a dataset, right-click the dataset whose stored values you want to display in the tree on the left side of the window, click "Open As". This will open the display settings window .

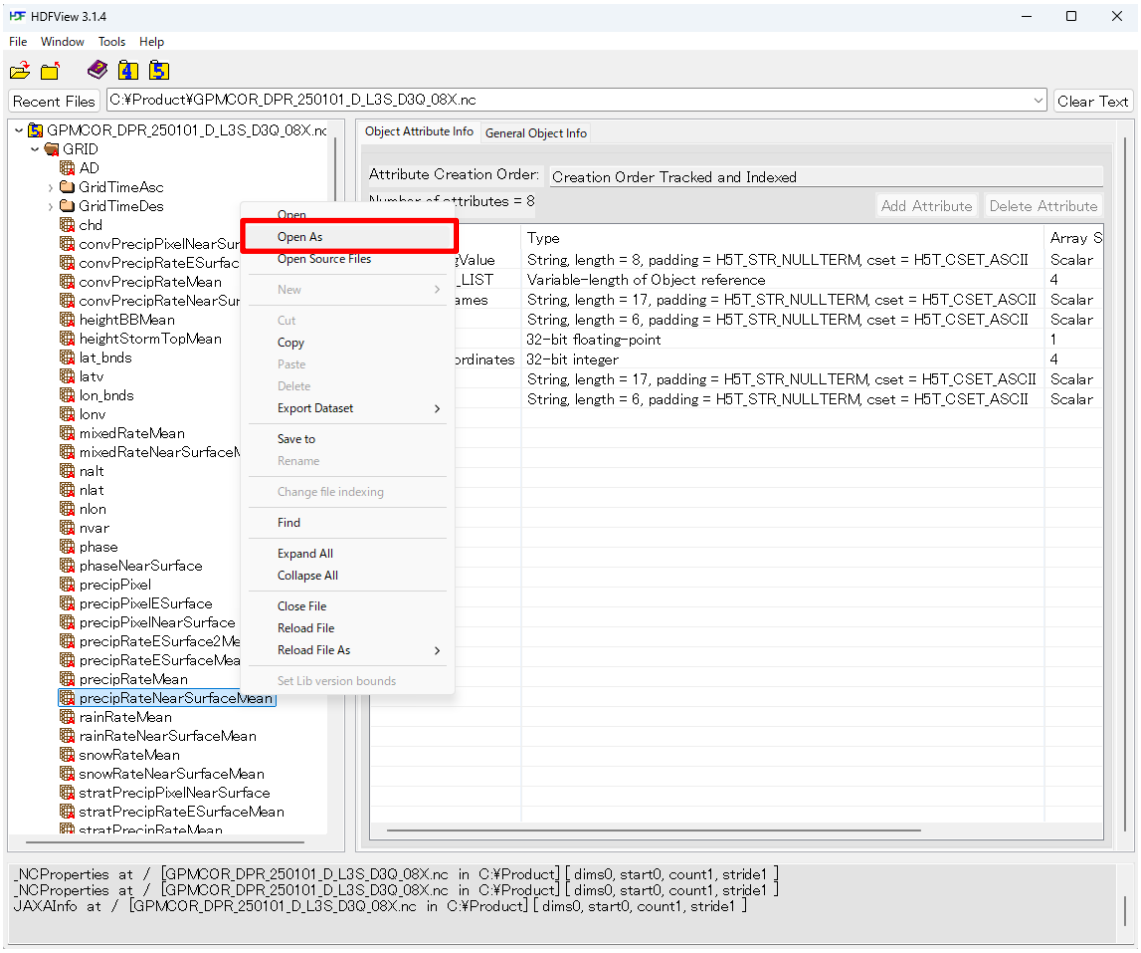


Figure 3-33 Display of Dataset Stored Value Display Settings

In the display settings window, you can specify the origin of the index and the dimensions to be set for each axis. After making changes to the settings, click "OK" to display the stored values.

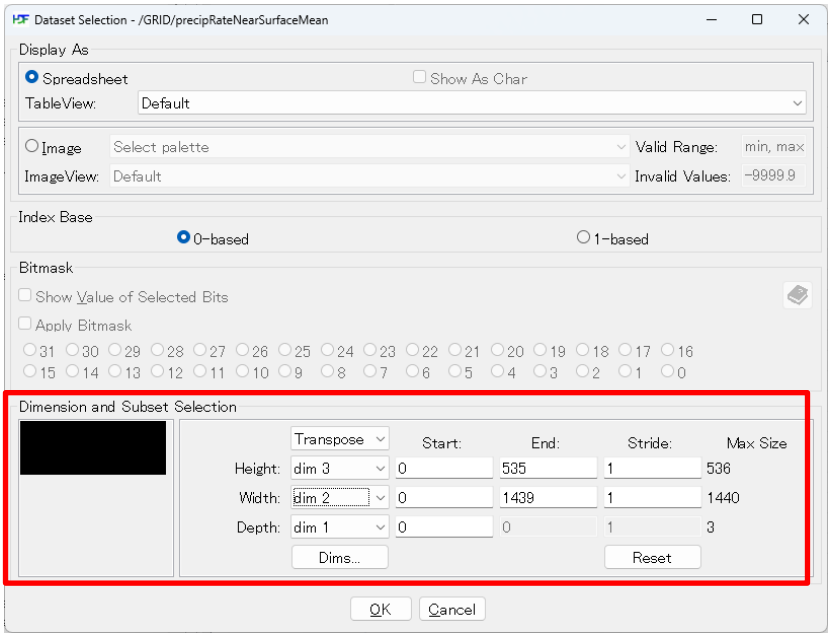


Figure 3-34 Dataset Display Settings

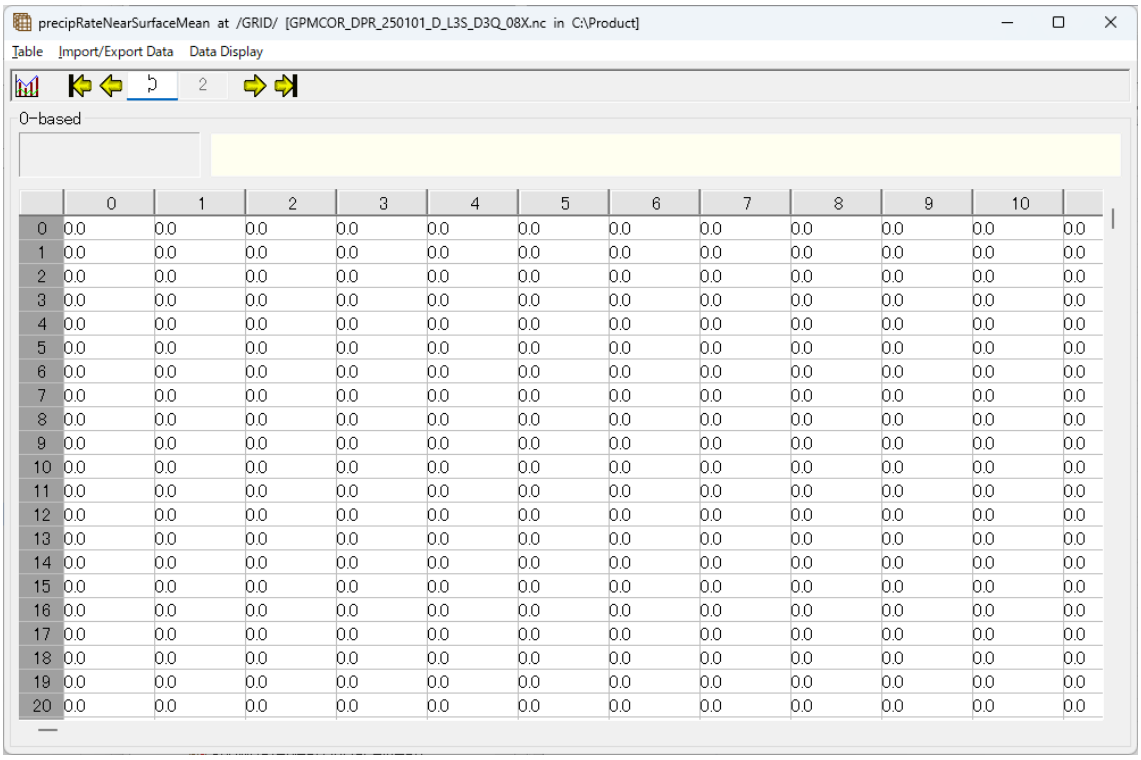


Figure 3-35 Display of Dataset Stored Values

3.3.4. Exporting Dataset

You can export the displayed dataset stored values to a file by selecting "Import/Export Data" from menu, then selecting "Export Data to". When exporting as a "Text File," the data is exported as a tab-delimited file.

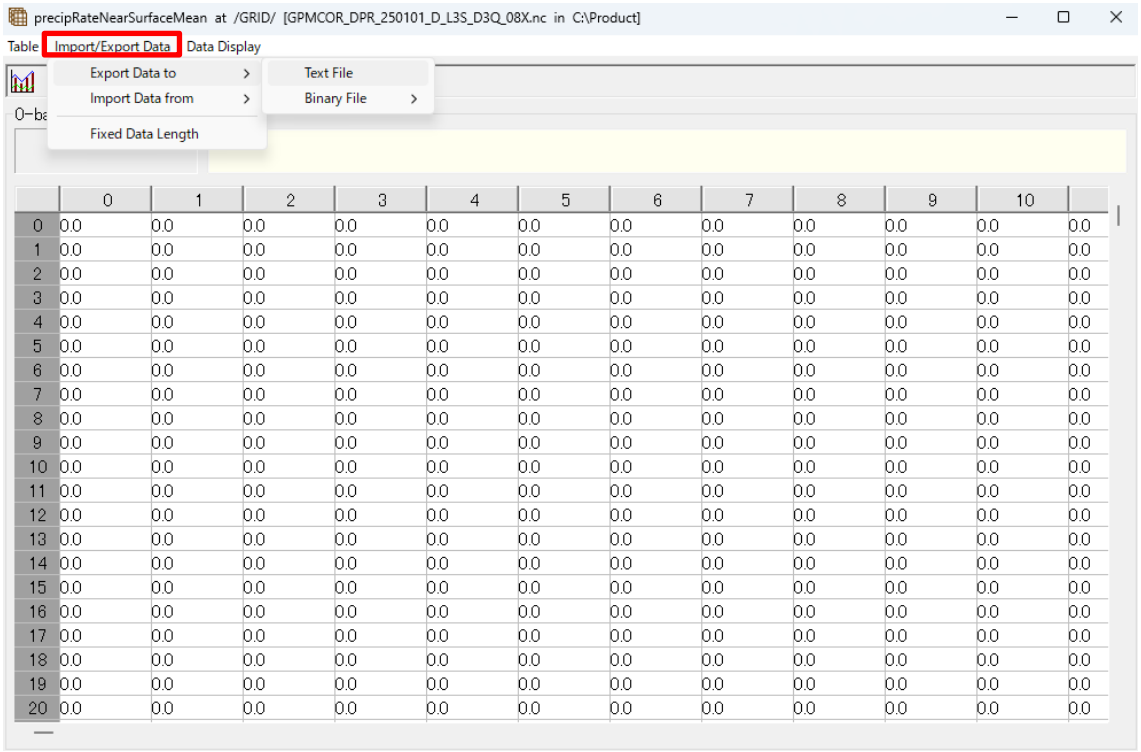


Figure 3-36 Export of Dataset Stored Values