

# Basic guidelines on the software Panoply

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# Software requirements

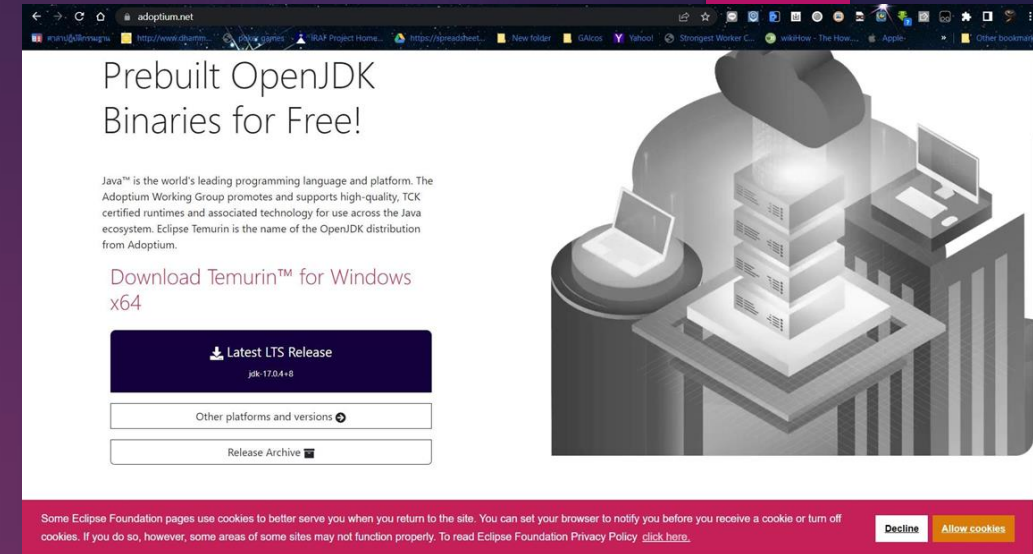
- ▶ Java version 11 or later
- ▶ Panoply vi

<https://www.giss.nasa.gov/tools/panoply/download>

- ▶ Please elect the option that is compatible with your operation system

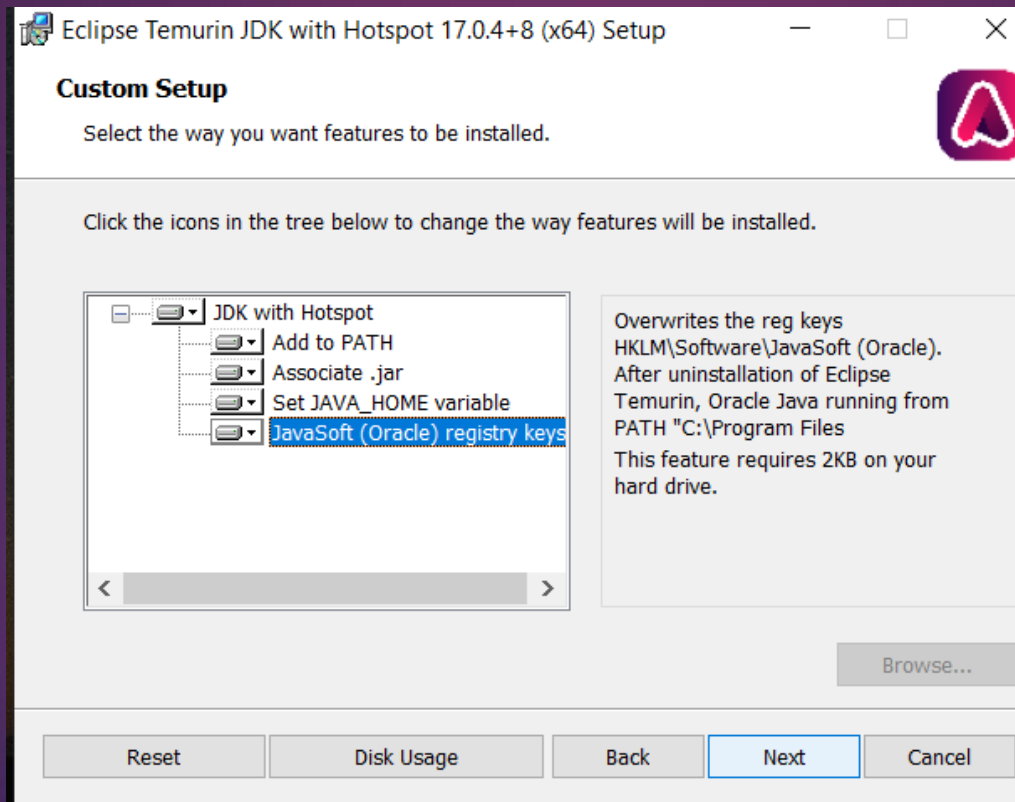
## Java installation

- ▶ We suggest downloading Java installation from <https://adoptium.net>
- ▶ On the home page, you can directly download the latest version of Java ( Java 17 is compatible with Panoply)



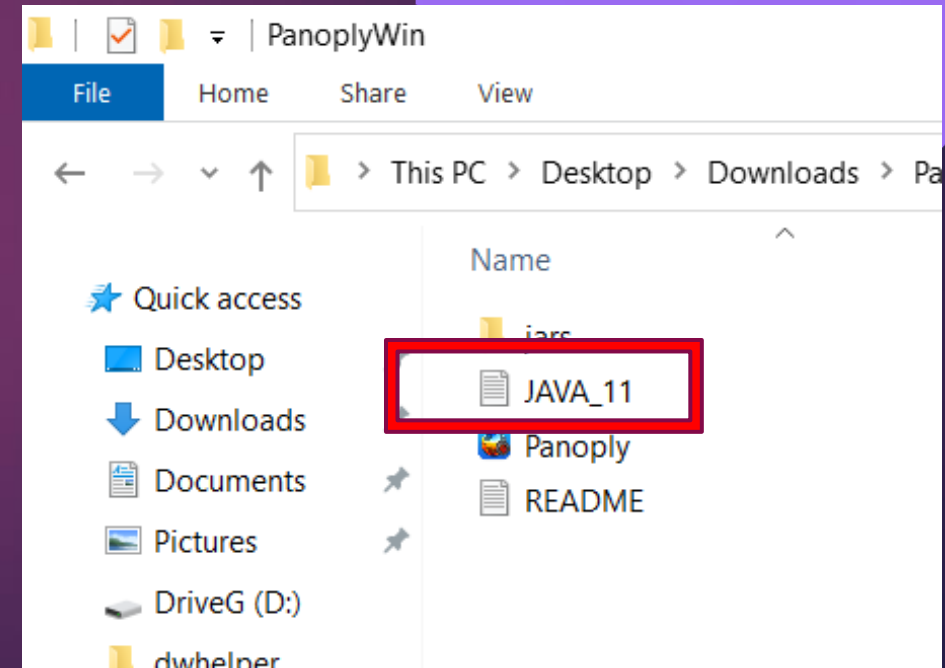
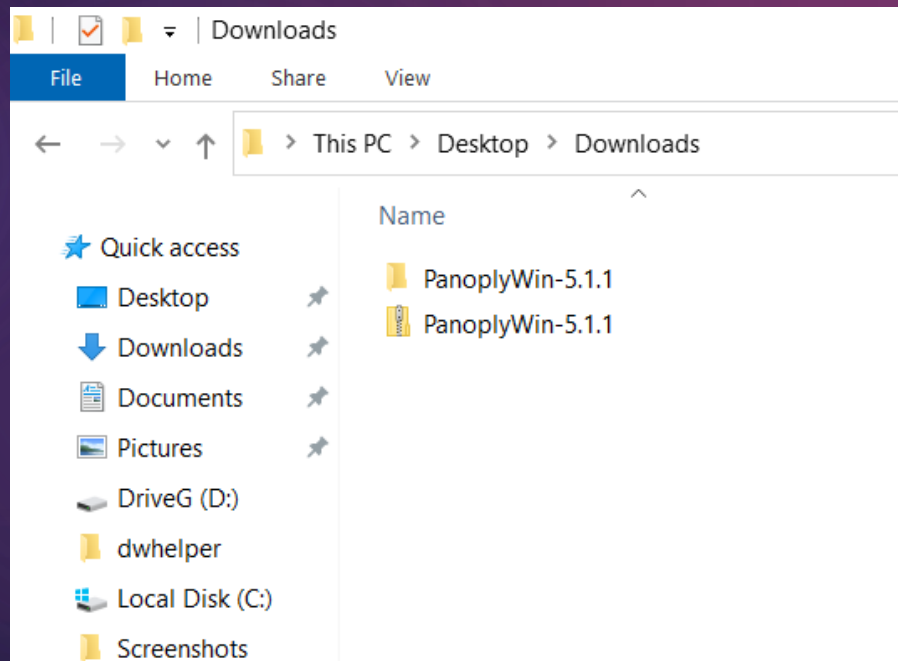
# For Window users

- ▶ On the installation prompt, please select all the options available.

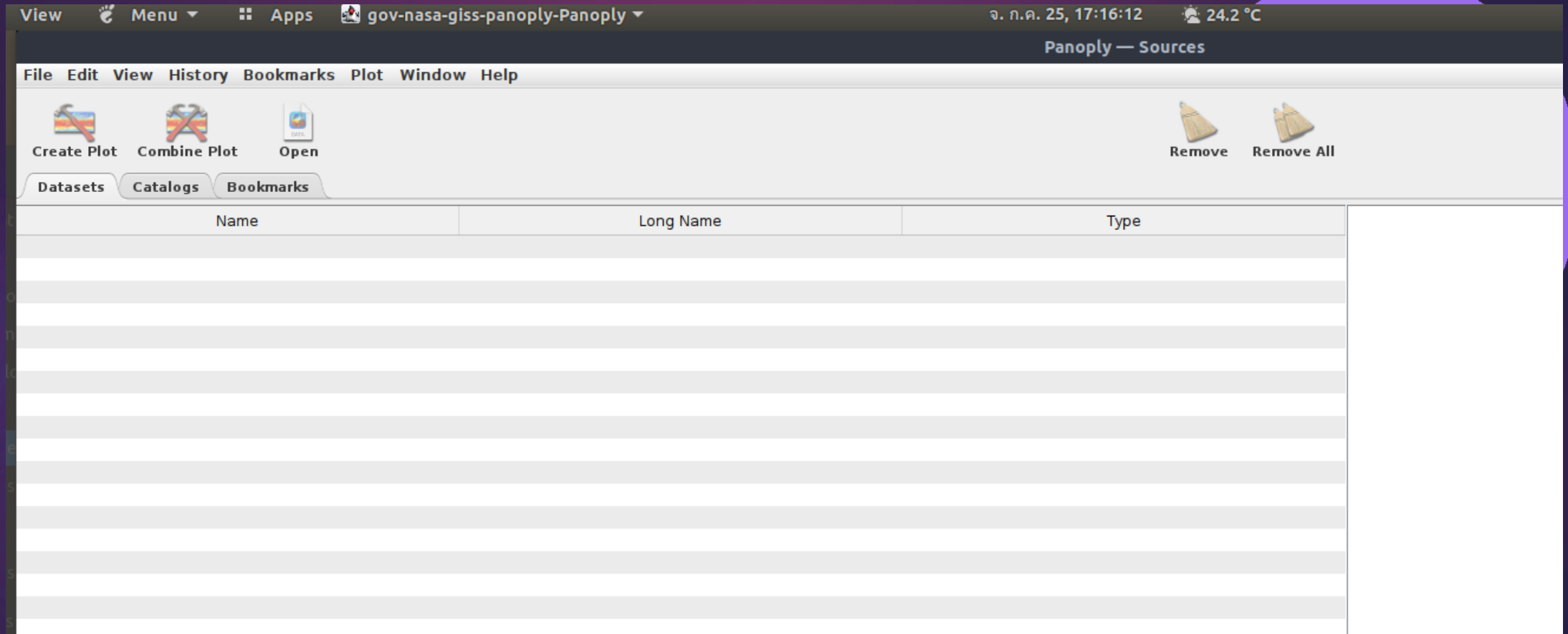


# Using Panoply (for Windows)

- ▶ Extract "PanoplyWin-5.1.1.zip" into your working directory
- ▶ Browse the directory "PanoplyWin-5.1.1" then go to "PanoplyWin"
- ▶ Run the file "Panoply.exe"

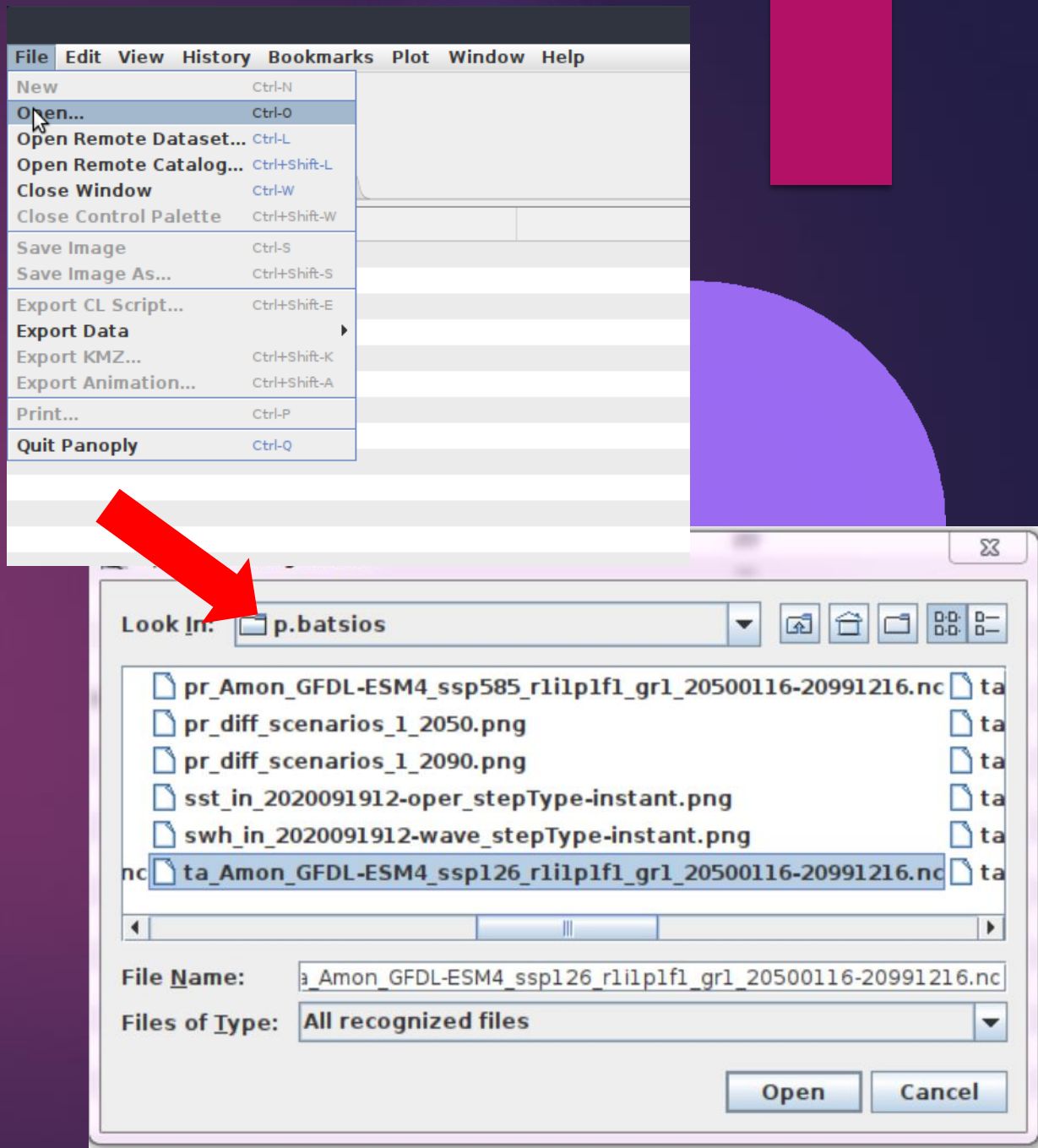


# Panoply - prompt window



# Open file

- ▶ Click "File" and select "Open"
- ▶ Select "ta\_Amon\_GFDL-ESM4\_ssp126\_r1i1p1f1\_gr1\_20500116-20991216.nc" and "ta\_Amon\_GFDL-ESM4\_ssp585\_r1i1p1f1\_gr1\_20500116-20991216.nc" from your download directory. The datasets represent the SSP126 and SSP585 climate change scenarios from the IPCC's Shared Socioeconomic Pathways (SSPs).



Data tables are presented in the left panel.

The right panel contains the information of the selected table.

The screenshot shows the Panoply software interface. The main window is titled "Panoply - Sources <@PowerEdgeR730>". The interface is divided into several panels:

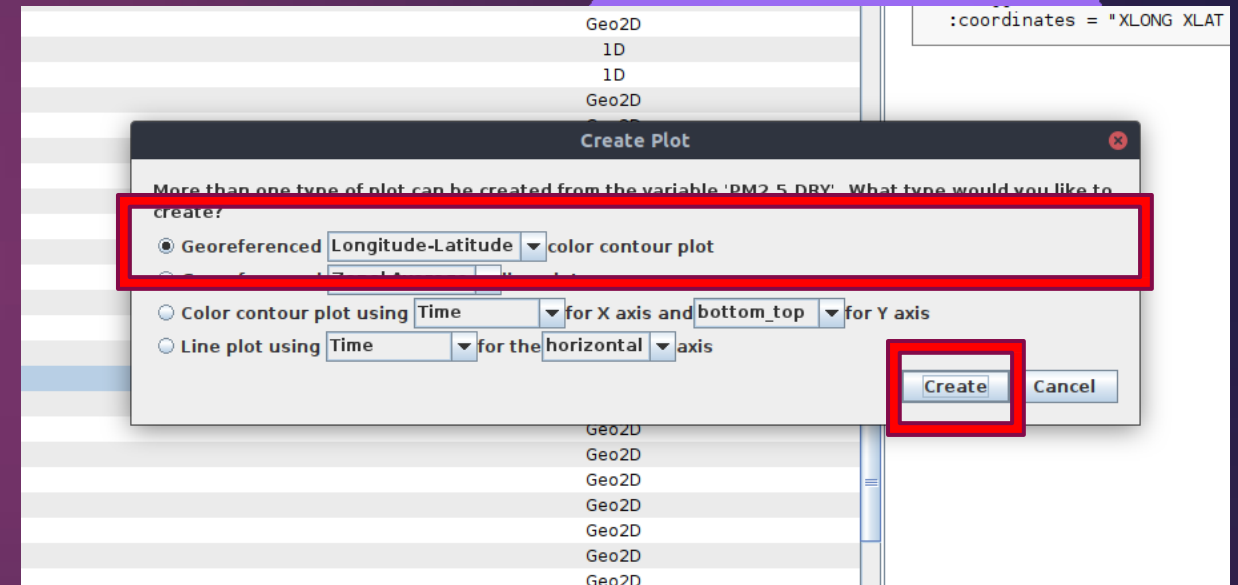
- Top Panel:** Contains menu options (File, Edit, View, History, Bookmarks, Plot, Window, Help) and icons for "Create Plot", "Refresh Plot", and "Plot". A tooltip says "Click to create a new plot from the selected variable".
- Left Panel (Dataset Catalog):** Displays a list of datasets. The selected dataset is "ta\_Amon\_GFDL-ESM4\_vsp126\_r11p1f1\_gr1\_205001...". The variables listed are: 

Name	Long Name	Type
verts	vertex number	10
lat	latitude	10
lat_bnds	latitude bounds	20
lon	longitude	10
lon_bnds	longitude bounds	20
plev	pressure	--
ta	Air Temperature	Geo2D
time	time	10
time_bnds	time axis boundaries	20
- Right Panel (Variable Information):** Shows details for the selected variable "ta". It includes the file path and a list of metadata: 

```
In file "ta_Amon_GFDL-ESM4_vsp126_r11p1f1_gr1_20500116-20991216.nc"  
float ta(time=600, plev=1, lat=90, lon=280);  
_FillValue = 1.0E20f; // float  
_LongName = "Air Temperature";  
_units = "K";  
_cell_methods = "time: mean";  
_cell_measures = "area: areacella";  
_standard_name = "air_temperature";  
_interp_method = "conservative";  
_original_name = "ta";  
_missing_value = 1.0E20f; // float  
_ChunkSize = 10, 30, 1800, 2880; // size
```
- Bottom Panel:** A "Show:" dropdown menu is set to "All variables".

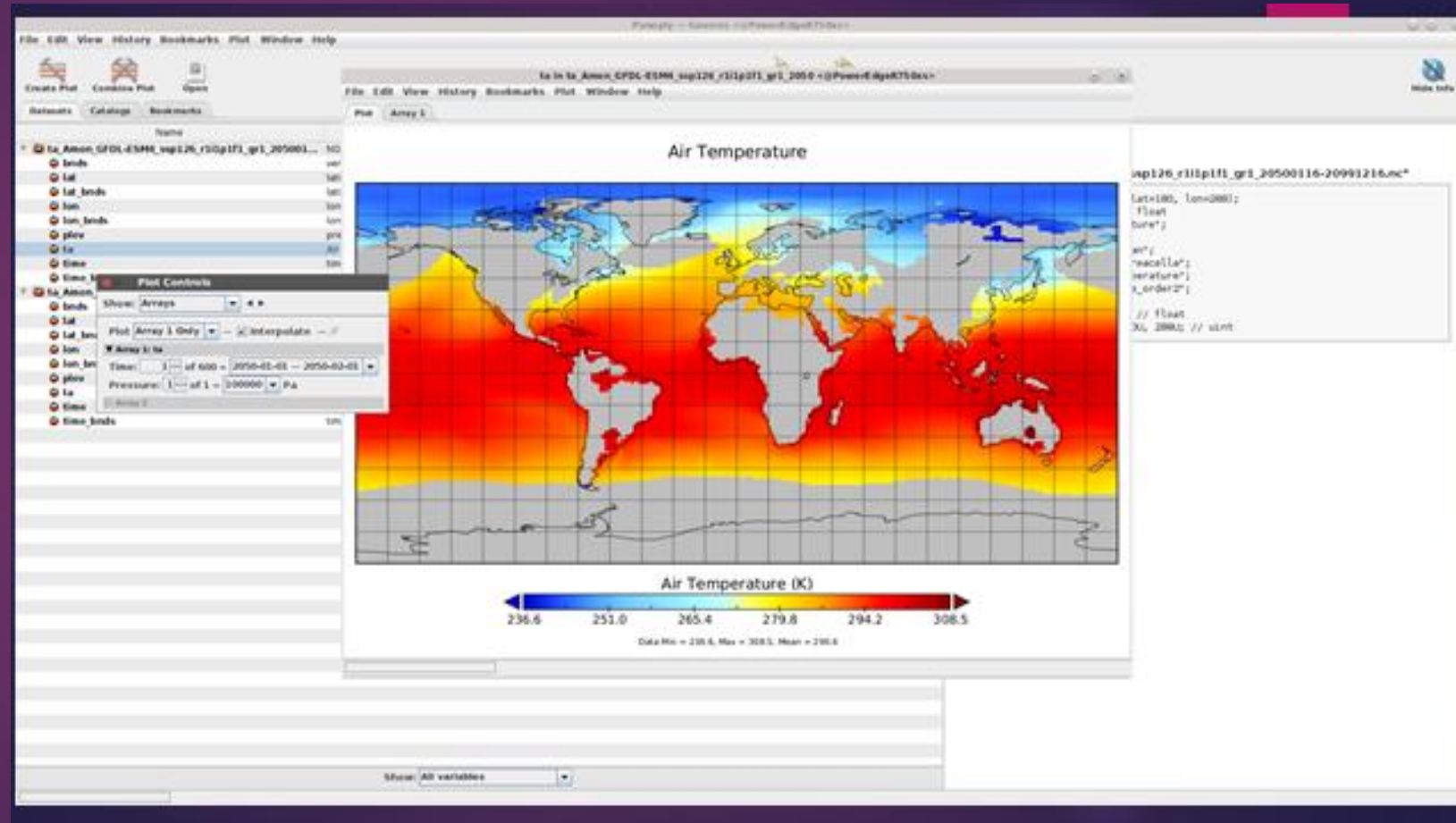
# Example: Air Temperature plot

- ▶ In column "Name" search for "ta - Air Temperature"
- ▶ Create plot by:
  - ▶ Double click on "ta" or
    - ▶ On menu bar, click "plot" then select "create plot" or
    - ▶ Right click on row "ta" then select "create plot"
  - ▶ On pop-up window select "Georeferenced Longitude-Latitude color contour plot" (The 1st row) then "create"



# Window menu - plot manipulation

- ▶ Selecting options from "Window" tap in the menu bar.
- ▶ There are 4 windows in this example
- ▶ Arrays - data selection
  - ▶ Scale - for plot manipulation: color scheme, data limit, tick length, etc.
  - ▶ Map projection -- change projection, map center
  - ▶ Grid - manipulate grid size, lines



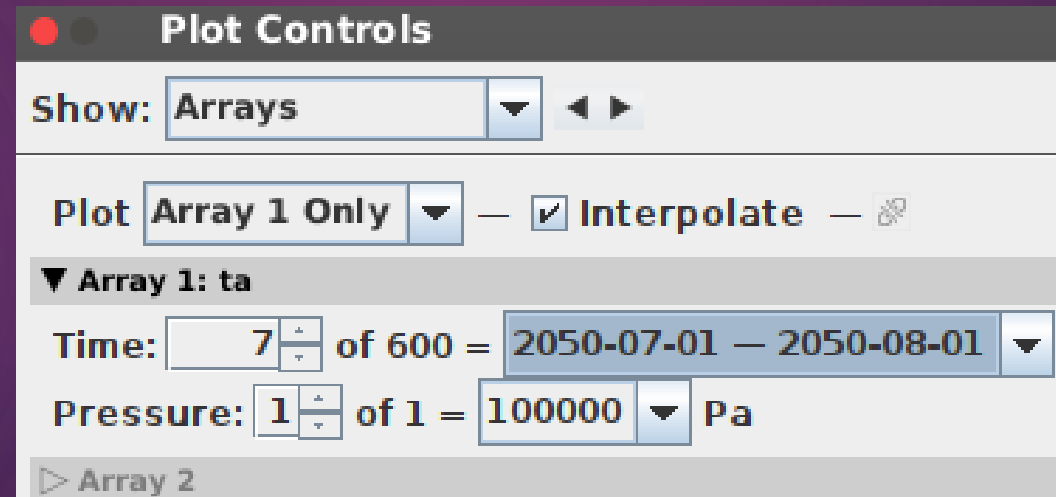
# Zoom-in and out

- ▶ Hold "ctrl + alt" keys then press
- ▶ "+" key to zoom-in the magnified region will center at the specified coordinate in the "Map Projection" panel
- ▶ "-" key to zoom-out, again, the scaled image is centered at the specified coordinate



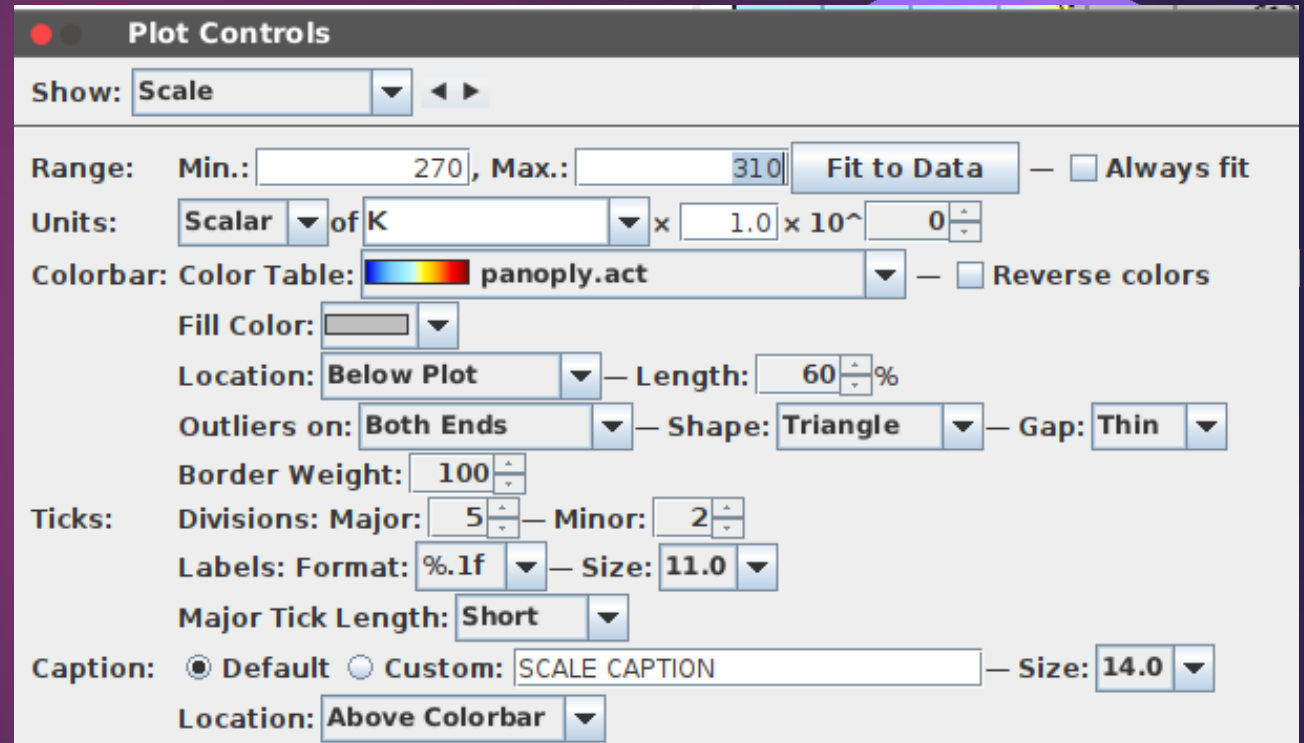
# Arrays and Scale panels

1. At “Plot Controls”, under Array 1: ta you can select the data at specific time bin. For our exercise we select Time 7 (July 2050)



# Arrays and Scale panels

- ▶ Scale
- ▶ Range: adjust min-max range for data display. This parameter needs to be adjusted for correct display.
- ▶ A quick input is to click "Fit to Data" which will choose min-max value from the specified time-bin and table slice.
- ▶ The other options can be changed according to your preferences. Change the values and see the according results.




**Plot Controls**

Show: **Scale** ◻ ◀ ▶

Range: Min.: , Max.:  **Fit to Data** —  Always fit

Units: **Scalar** ◻ of **K** ◻ x  x 10

Colorbar: Color Table:  **panoply.act** ◻ —  Reverse colors

Fill Color:  ◻

Location: **Below Plot** ◻ — Length:  %

Outliers on: **Both Ends** ◻ — Shape: **Triangle** ◻ — Gap: **Thin** ◻

Border Weight:

Ticks: Divisions: Major:  — Minor:

Labels: Format: **%.1f** ◻ — Size: **11.0** ◻

Major Tick Length: **Short** ◻

Caption:  Default  Custom:  — Size: **14.0** ◻

Location: **Above Colorbar** ◻



Create Plot



Combine Plot



Open



Hide Info

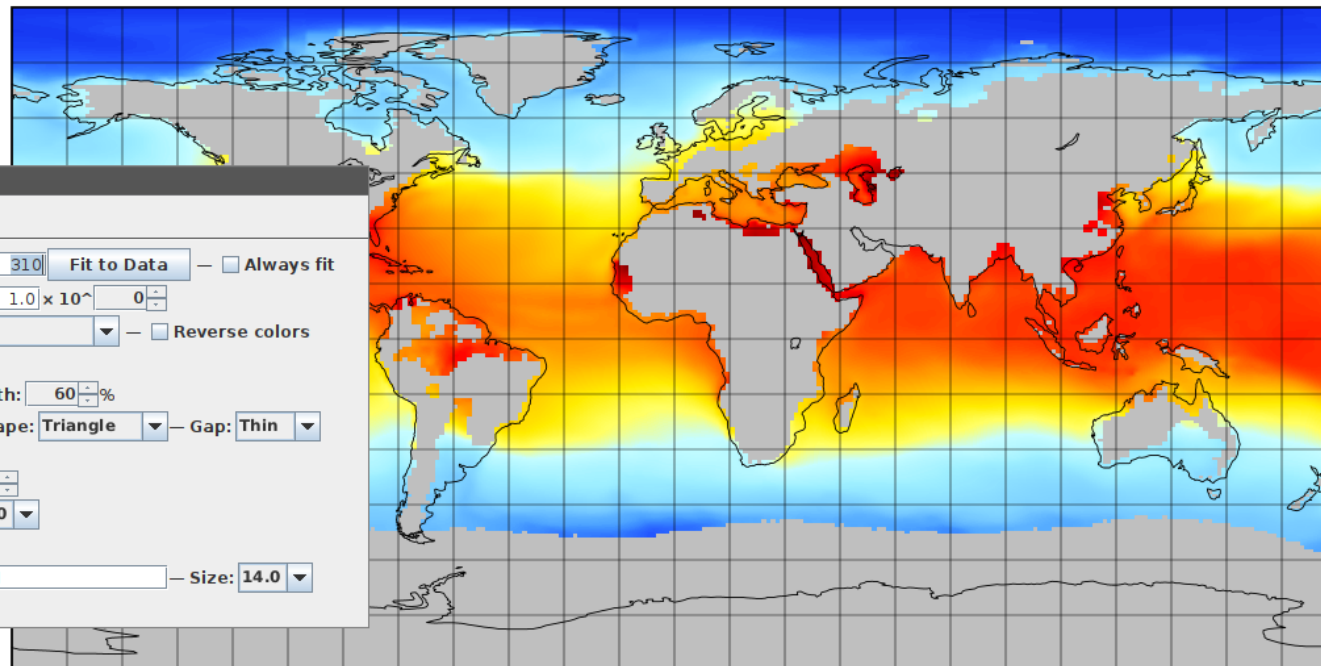
Datasets Catalogs Bookmarks

Name	
ta_Amon_GFDL-ESM4_ssp126_r1i1p1f1_gr1_205001...	NO.
bnds	ver
lat	lati
lat_bnds	lati
lon	lon
lon_bnds	lon
plev	pre
ta	Air
time	tim

 ta in ta\_Amon\_GFDL-ESM4\_ssp126\_r1i1p1f1\_gr1\_2050 <@PowerEdgeR750xs>
   
File Edit View History Bookmarks Plot Window Help

Plot Array 1

## Air Temperature



## Air Temperature (K)



Data Min = 271.9, Max = 310.1, Mean = 292.0

**Plot Controls**

Show: **Scale**

Range: Min.:  Max.:  **Fit to Data**  Always fit

Units: **Scalar** of **K** x  x 10

Colorbar: Color Table: **panoply.act**  Reverse colors

Fill Color:

Location: **Below Plot** Length:  %

Outliers on: **Both Ends** Shape: **Triangle** Gap: **Thin**

Border Weight:

Ticks: Divisions: Major:  Minor:

Labels: Format: **%.1f** Size:

Major Tick Length: **Short**

Caption:  Default  Custom:  Size:

Location: **Above Colorbar**

ssp126\_r1i1p1f1\_gr1\_20500116-20991216.nc"

```
lat=180, lon=288;
float
ture";
```

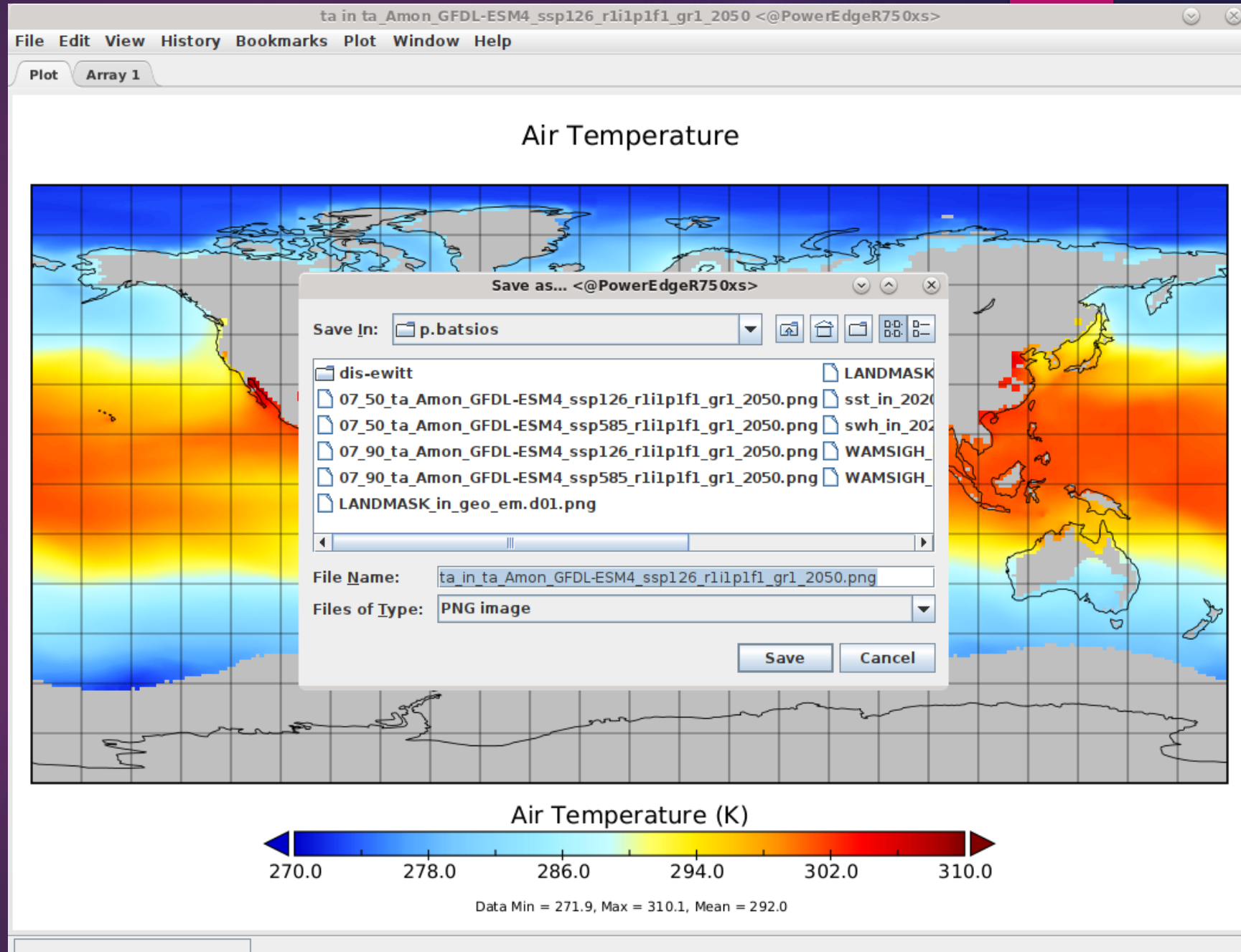
```
an";
reacella";
perature";
e_order2";
```

```
// float
0U, 288U; // uint
```

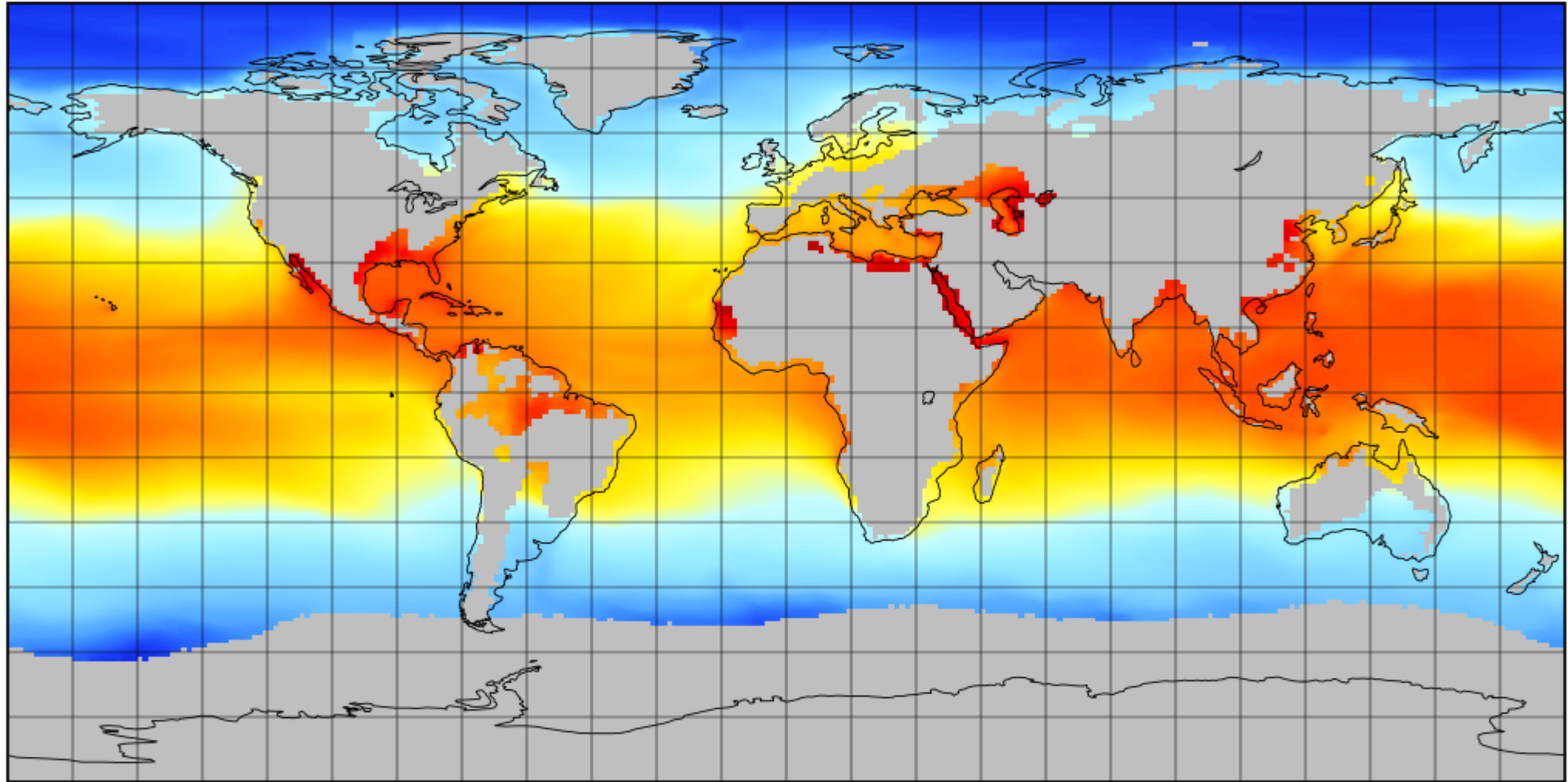
Show: **All variables**

# Save Plot

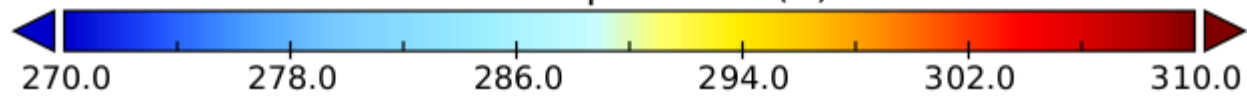
- ▶ Once you are satisfied with the graphic(s), you can save it as image (default format .jpeg).
- ▶ On the File menu of the plot window, you can select Save As and choose the format



# Air Temperature



Air Temperature (K)



Data Min = 271.9, Max = 310.1, Mean = 292.0

# Comparing Data Using Combination Plots in Panoply

- ▶ Open Your First Dataset
- ▶ Click the data set you wish to Plot (1).
- ▶ Click Create Plot (2)

Select the variables that you wish to display.

- ▶ Click Create.

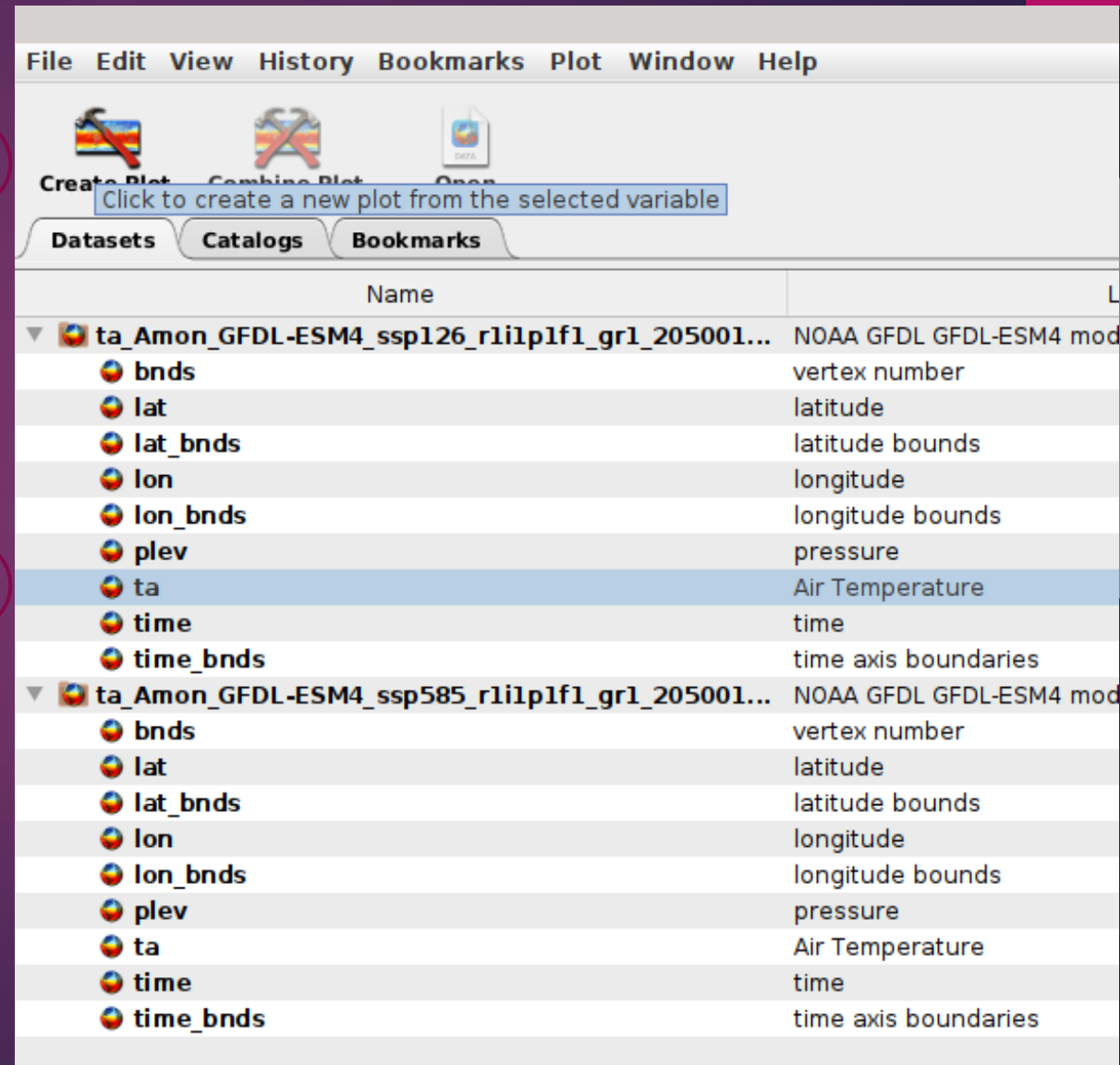
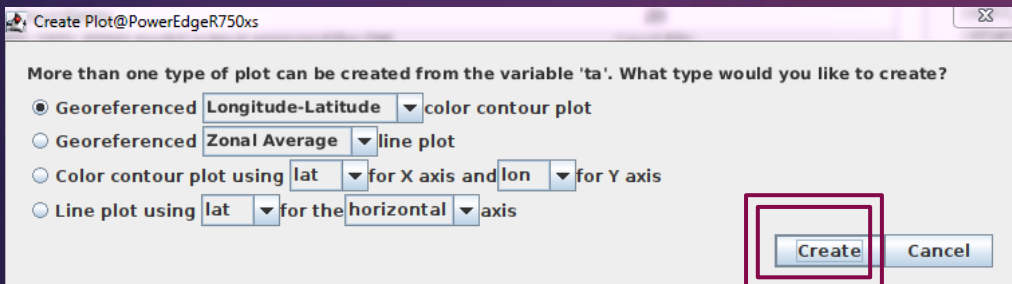
Note: The variables displayed are the variables that are part of the dataset



2



1



# Comparing Data Using Combination Plots in Panoply

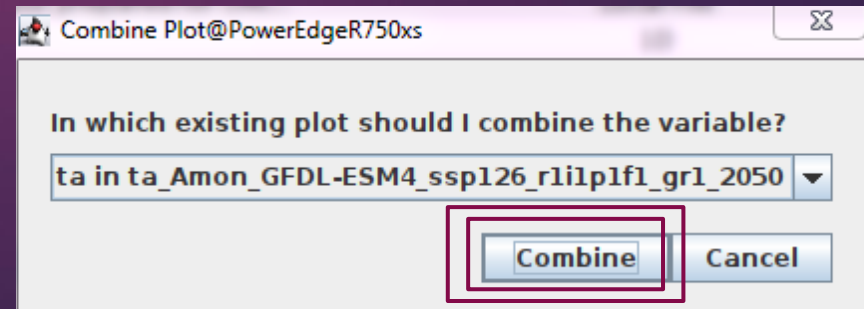
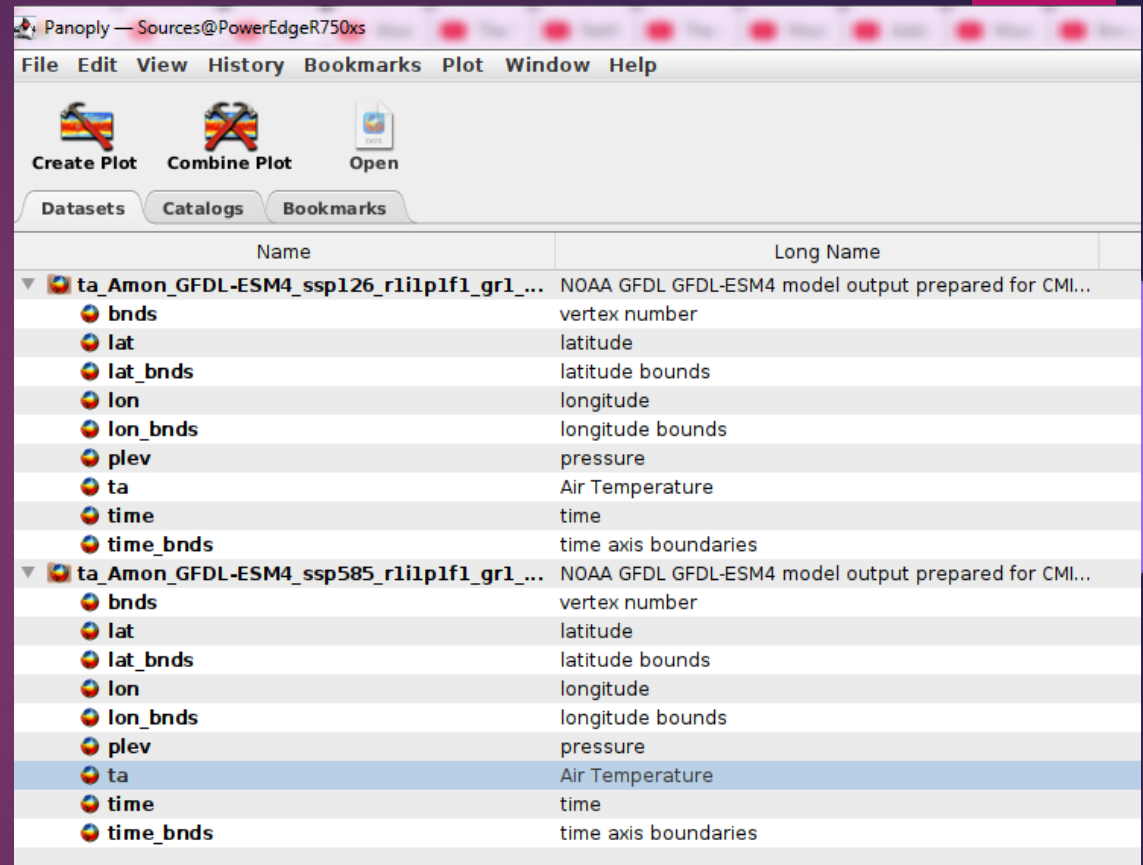
- ▶ Open Your Second Dataset or Select the Same Dataset from the Panoply Sources Browser
- ▶ Click the data set you wish to Plot (1). *Note: This can be the same dataset or different datasets with the same units (parameters can vary).*
- ▶ Click Combine Plot (2). Select the plot with which to combine the variable (i.e., the plot you opened in the first step.)
- ▶ Click Combine.



2



1





Datasets Catalogs Bookmarks

Name

ta_Amon_GFDL-ESM4_ssp126_r1i1p1f1_gr1_205001...	NO.
bnds	ver
lat	lati
lat_bnds	lati
lon	lon
lon_bnds	lon
plev	pre
ta	Air
time	tim
time_b	
ta_Amon	
bnds	
lat	
lat_b	
lon	
lon_b	
plev	
ta	
time	
time_b	

**Plot Controls**

Show: Arrays

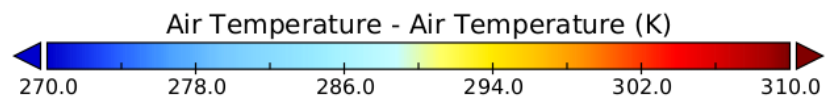
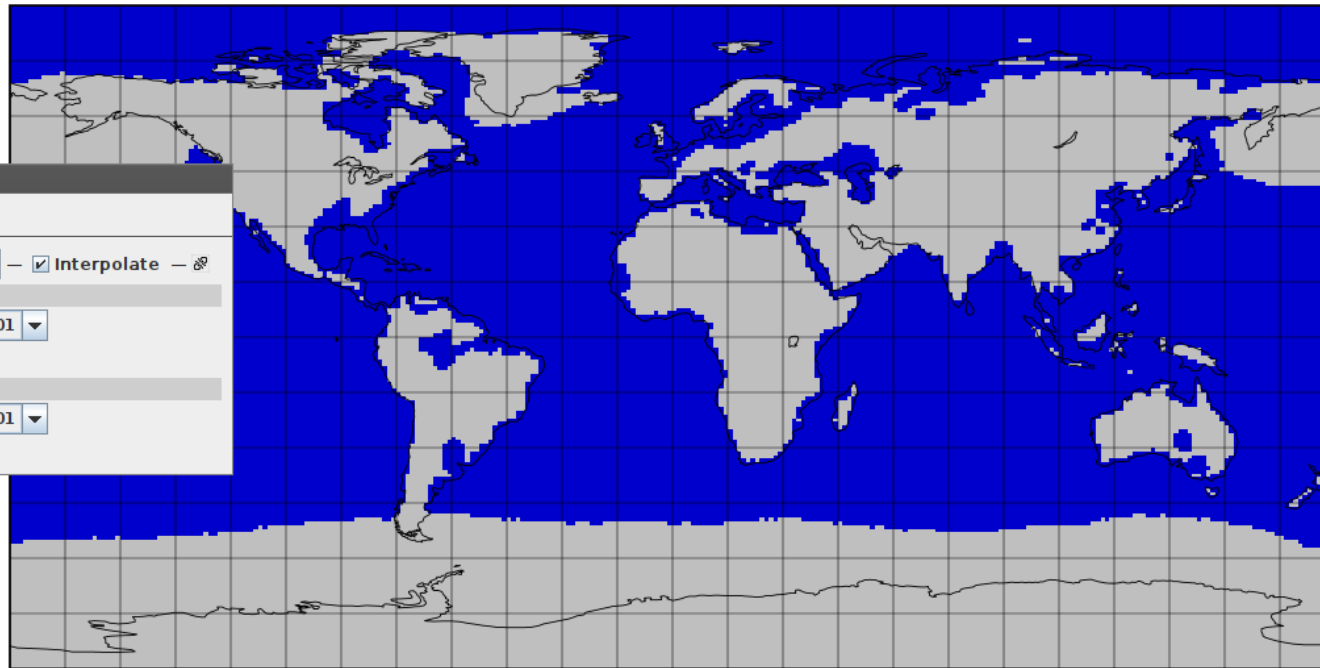
Plot: Array 1 - Array 2  Interpolate

▼ Array 1: ta  
Time: 7 of 60 = 2050-07-01 - 2050-08-01  
Pressure: 1 of 1 = 100000 Pa

▼ Array 2: ta  
Time: 1 of 60 = 2050-01-01 - 2050-02-01  
Pressure: 1 of 1 = 100000 Pa

Plot Array 1 Array 2

## Air Temperature



Data Min = -21.5, Max = 43.8, Mean = 1.4

Show: All variables



Hide Info

ssp585\_r1i1p1f1\_gr1\_20500116-20991216.nc"

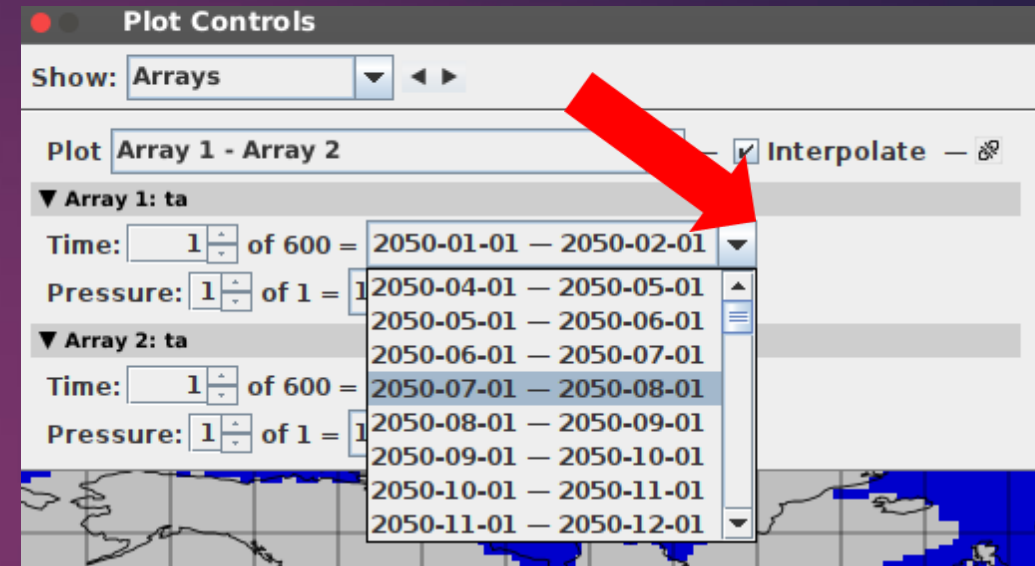
```
lat=180, lon=288);
float
ture";
```

```
an";
"acella";
perature";
e_order2";
```

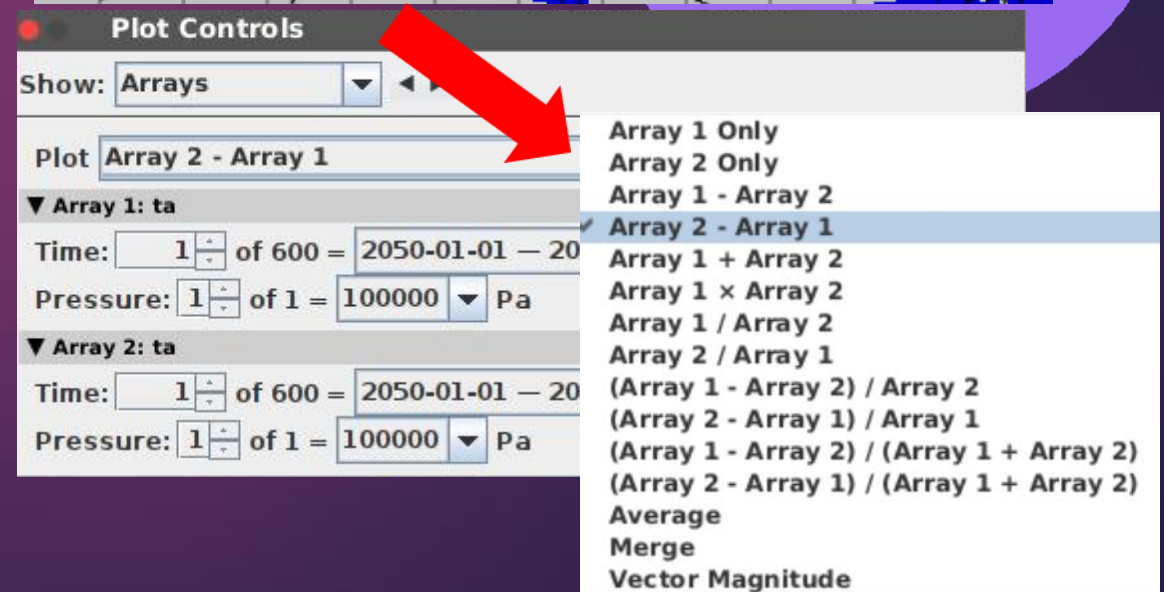
```
// float
0U, 288U; // uint
```

# Comparing Data Using Combination Plots in Panoply

- ▶ On the Array(s) tab, select dates to compare (both for Array 1 and Array 2). Here we choose July 2050.

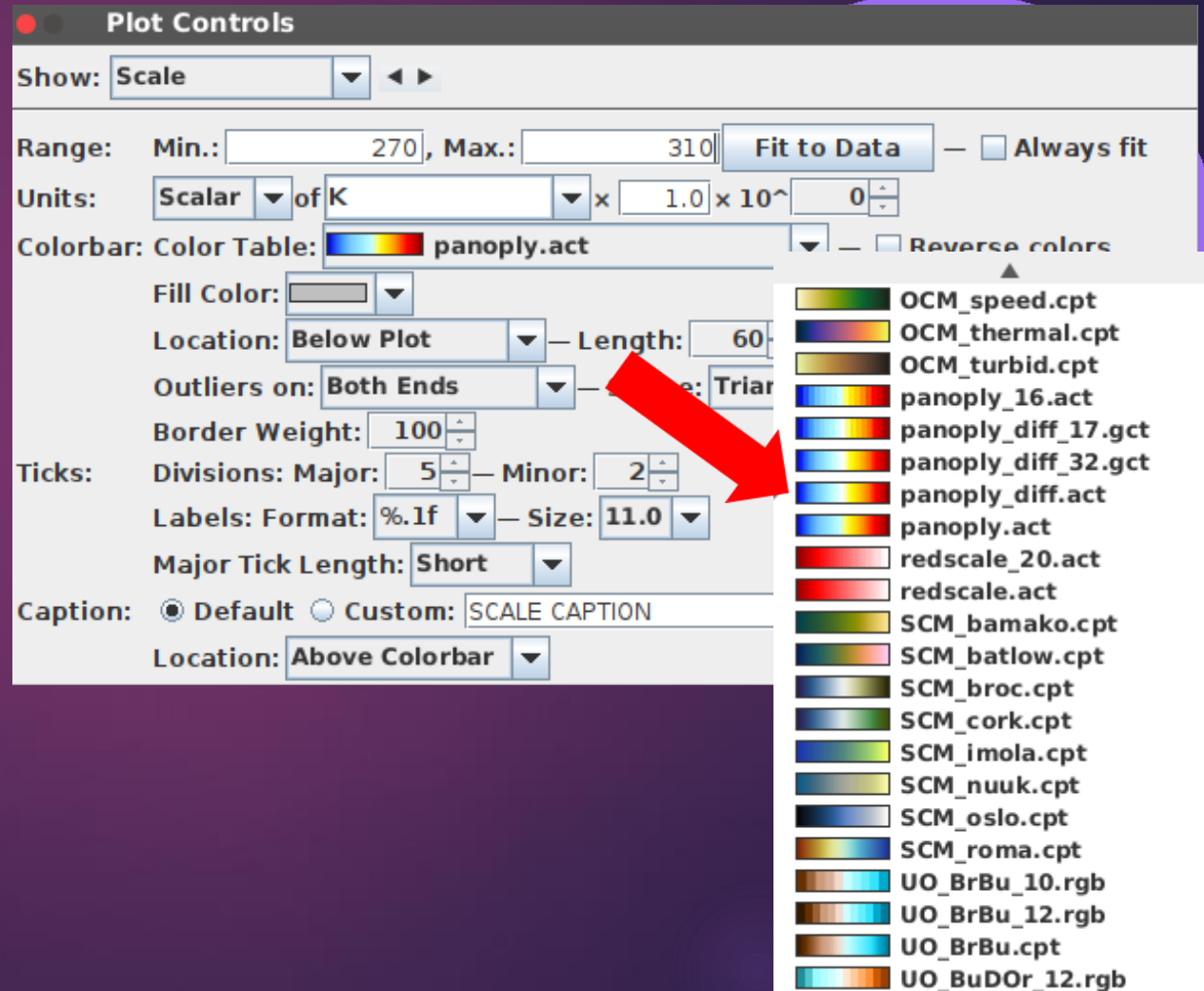


- ▶ On the Array(s) tab, select how you want to combine the datasets from the drop down menu.

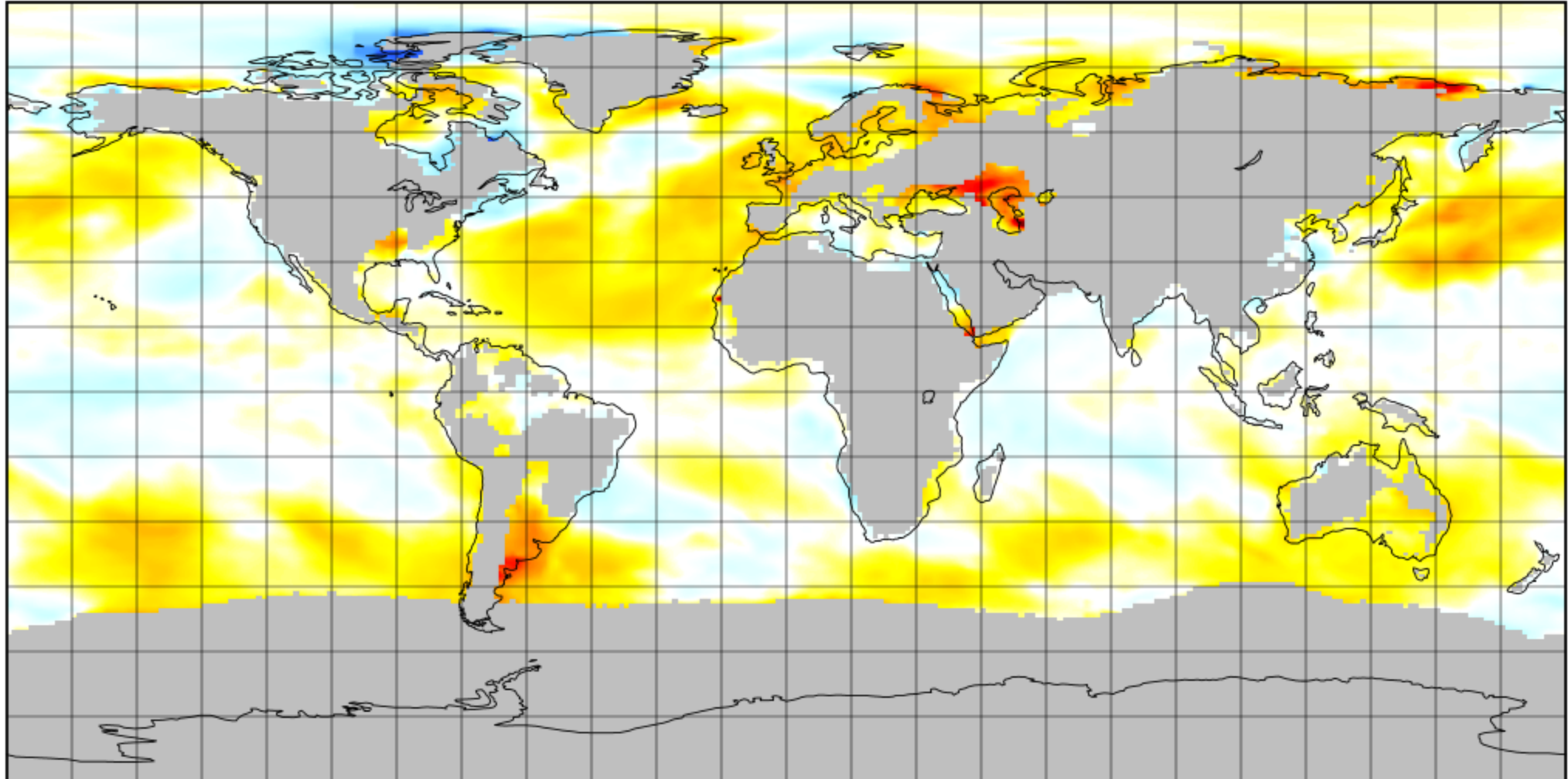


# Comparing Data Using Combination Plots in Panoply

- ▶ On the Scale tab, adjust min-max range for data display.
- ▶ Tip: On the Color Table we choose an option with white color representing zero which is more preferable for difference plots. Change the values and see the according results.



# Air Temperature



Air Temperature - Air Temperature (K)

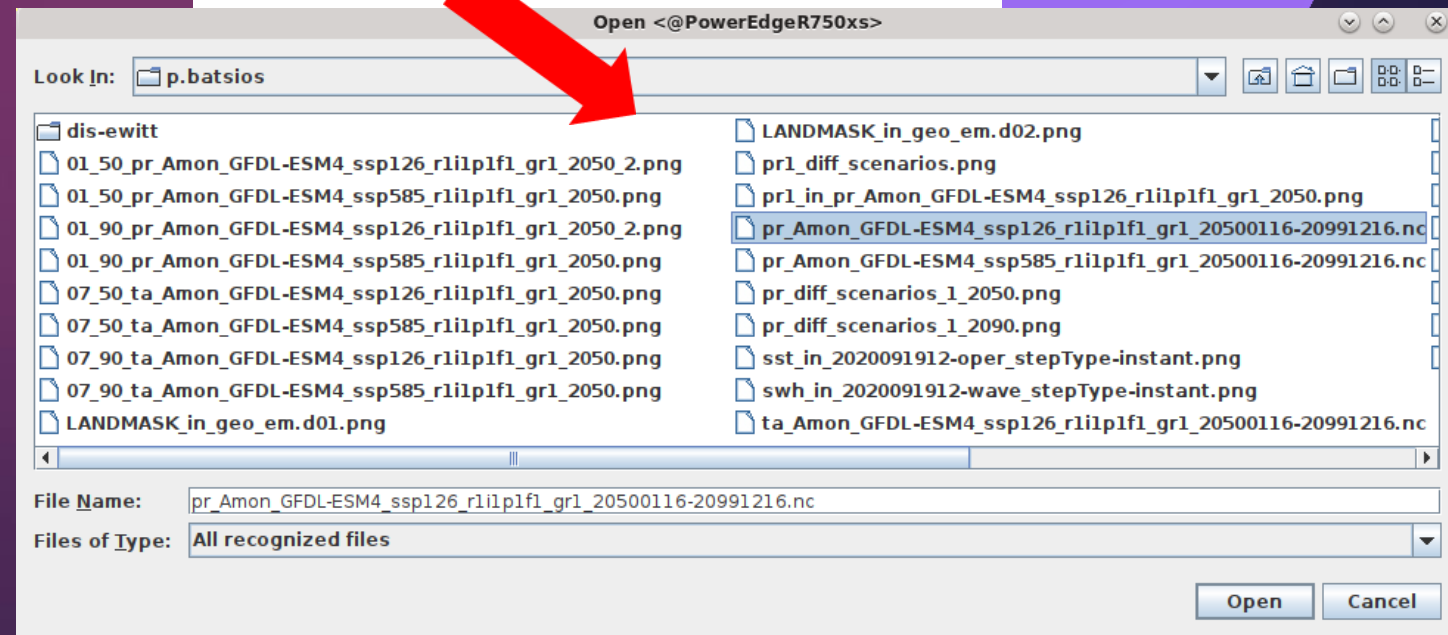
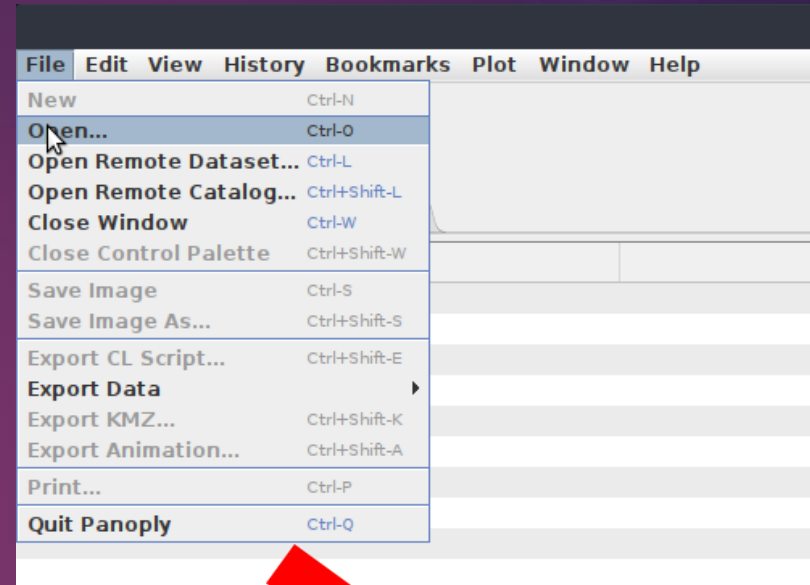


Data Min = -5.5, Max = 6.9, Mean = 0.5

# Example: Precipitation plot

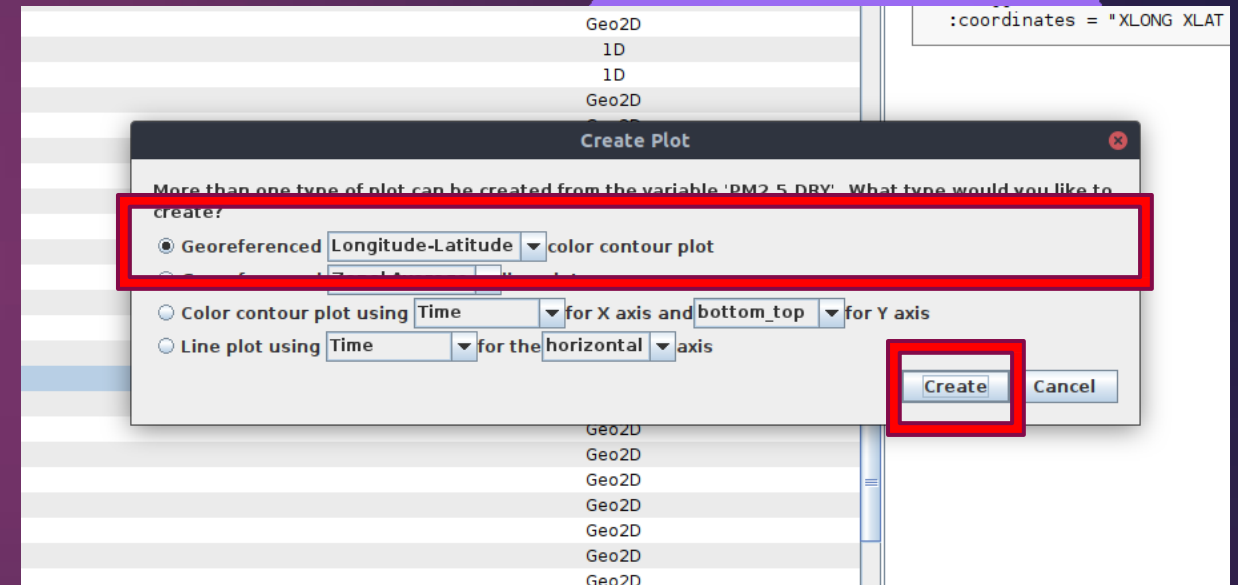
## Open files

- ▶ Click "File" and select "Open"
- ▶ Select "pr\_Amon\_GFDL-ESM4\_ssp126\_r1i1p1f1\_gr1\_20500116-20991216.nc" and "pr\_Amon\_GFDL-ESM4\_ssp585\_r1i1p1f1\_gr1\_20500116-20991216.nc" from your download directory. The datasets represent the SSP126 and SSP585 climate change scenarios from the IPCC's Shared Socioeconomic Pathways (SSPs).

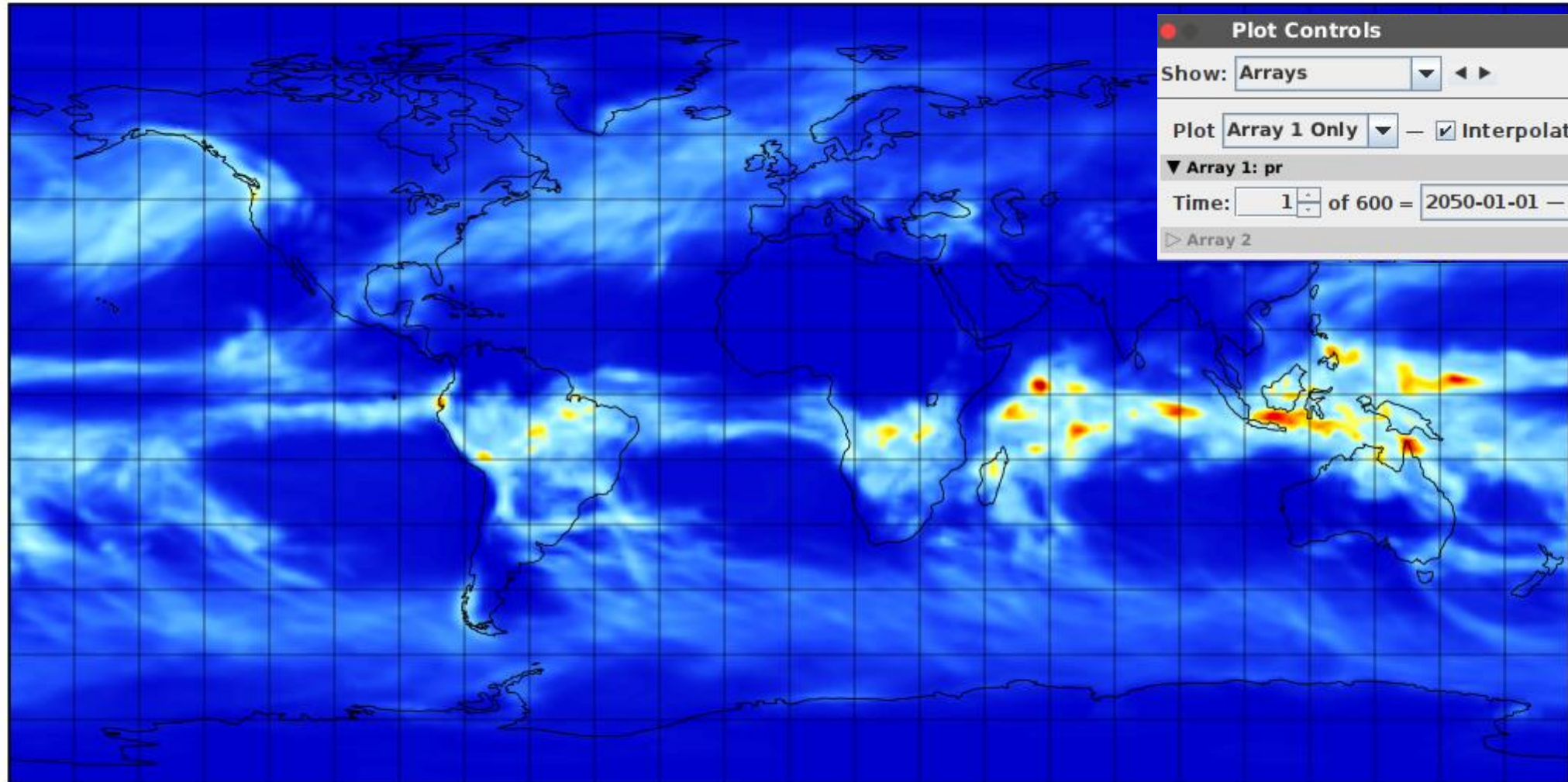


# Example: Precipitation plot

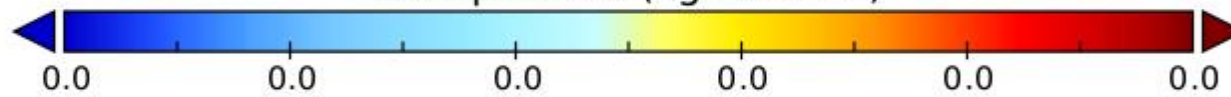
- ▶ As in the previous example, in column "Name" search for "pr - Precipitation"
- ▶ Create plot by:
  - ▶ Double click on "pr" or
    - ▶ On menu bar, click "plot" then select "create plot" or
    - ▶ Right click on row "pr" then select "create plot"
  - ▶ On pop-up window select "Georeferenced Longitude-Latitude color contour plot" (The 1st row) then "create"



# Precipitation



Precipitation (kg m<sup>-2</sup> s<sup>-1</sup>)

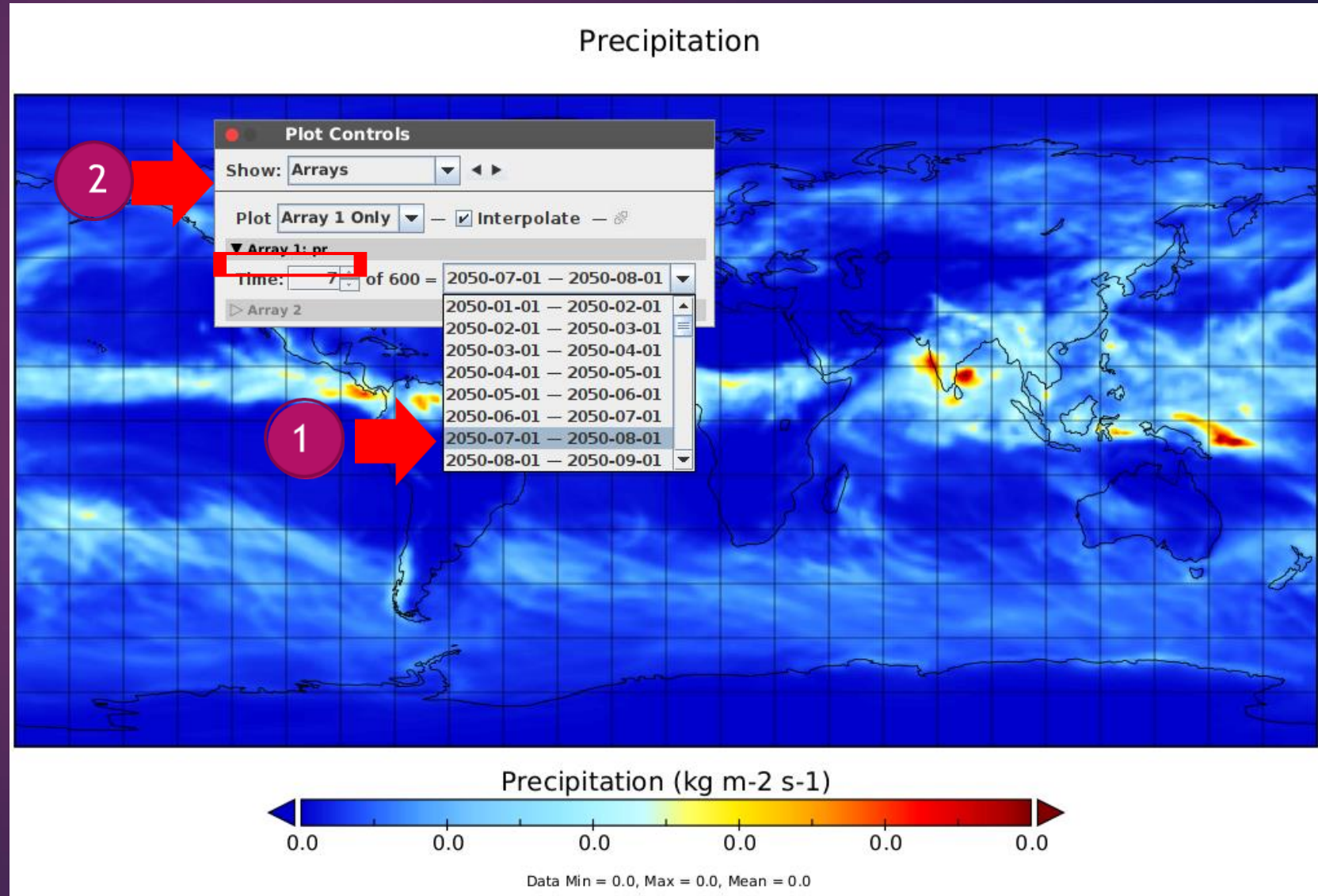


Data Min = 0.0, Max = 0.0, Mean = 0.0

# Example: Precipitation plot

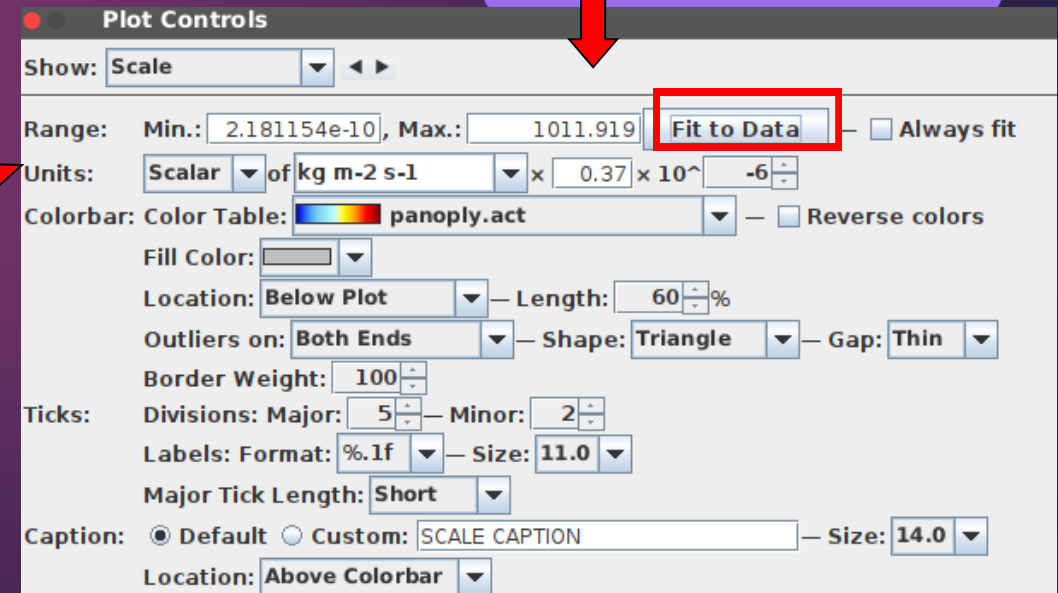
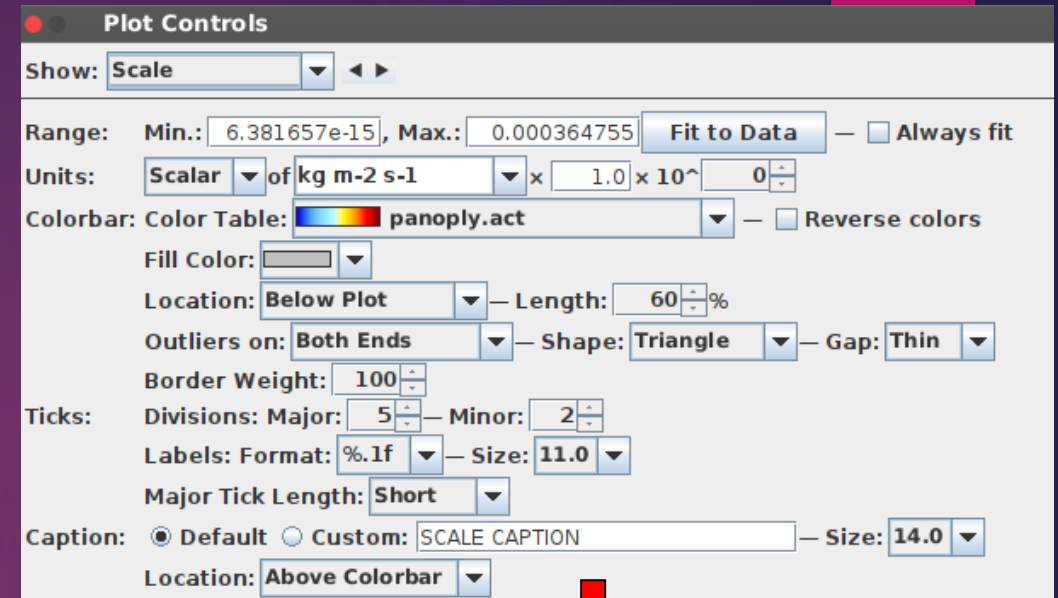
1. At “Plot Controls”, under Array 1: you can select the data at specific time bin. For our exercise we select Time 7 (July 2050)

2. Then under the tab “Show” choose the “Scale” panel.



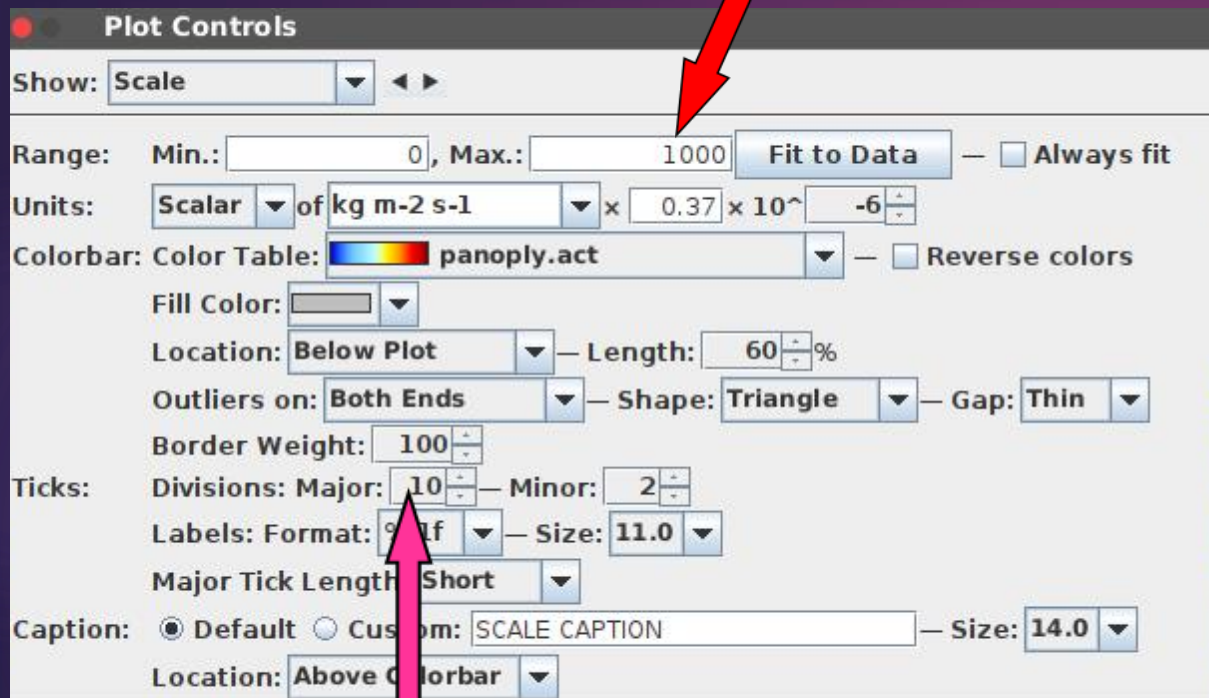
# Example: Precipitation plot

- ▶  $\text{kg/m}^2/\text{s}$  are the units used for "precipitation\_flux" or "precipitation" data of CMIP5 or CMIP6.
- ▶ We know that  $1\text{kg} = 1\text{Liter} = 10^6\text{ mm}^3$  and  $1\text{m}^2 = 10^6\text{ mm}^2$ . Therefore  $1\text{kg}$  of rain over  $1\text{m}^2$  is equivalent to  $1\text{mm}$ .
- ▶ So we just need a factor of 86400 (seconds in a day)  $1\text{ kg/m}^2/\text{s} = 86400\text{ mm/day}$ . Therefore for July we have  $31\text{ days} \times 86400\text{ mm/day} = 2678400$  or  $2,68 \times 10^6\text{ mm}$  of Total Precipitation.
- ▶ In Panoply, at the Scale panel go to the Units tab and you should multiply by  $2,68 \times 10^6$  (If you do that you will realize that for an unexplained reason Panoply subtracts rather than multiplies. We could bypass this problem by "multiplying" with  $1/(2,68 \times 10^6) \rightarrow 0,37 \times 10^{-6}$ ). Then click "Fit to Data" .



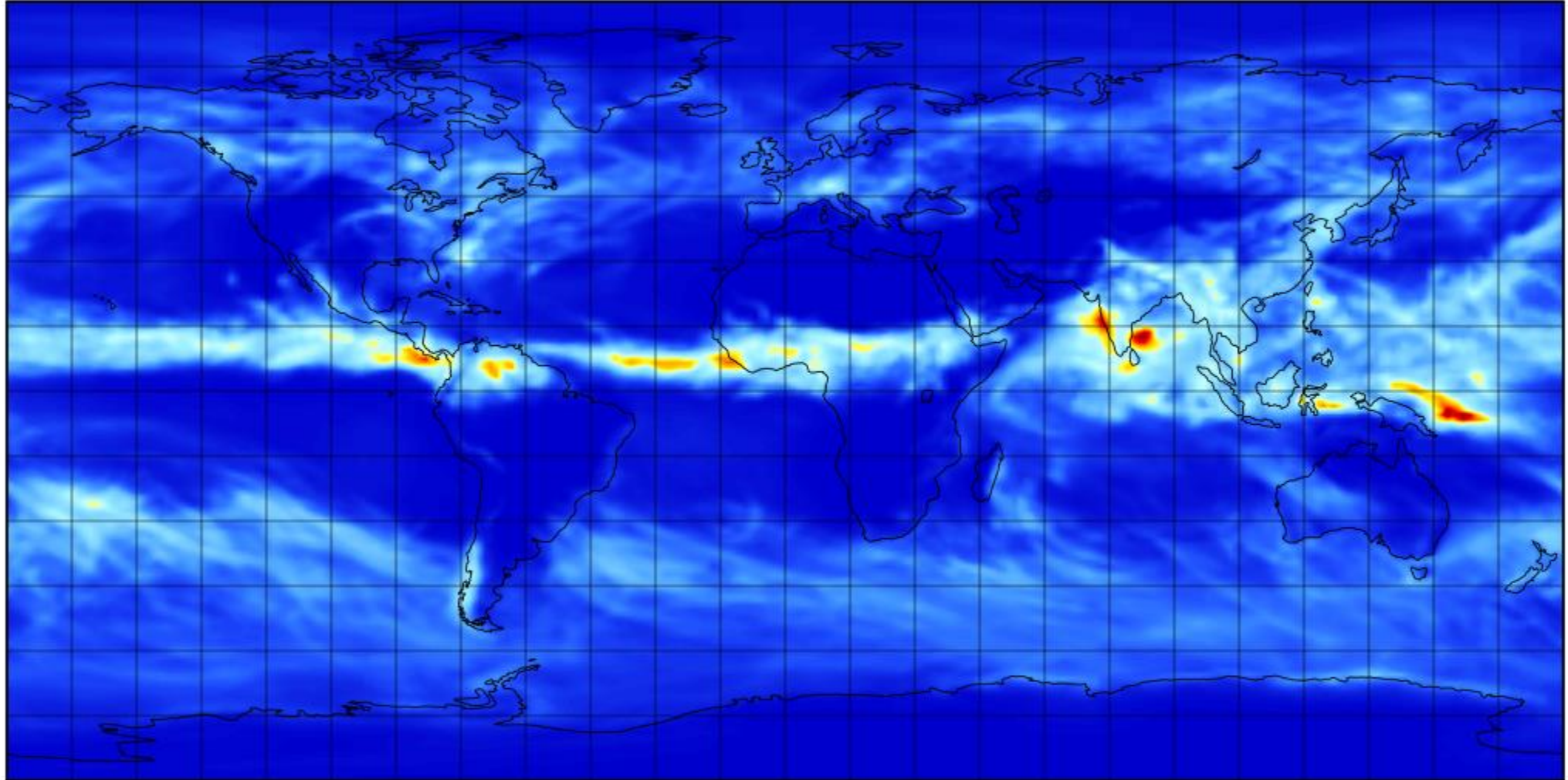
# Example: Precipitation plot

On the tab Range we adjust min-max range for better data display.



On the tab "Ticks" we change "Divisions : Major" to 10, according to our preferences. You now can see the according results and save your plot.

# Precipitation



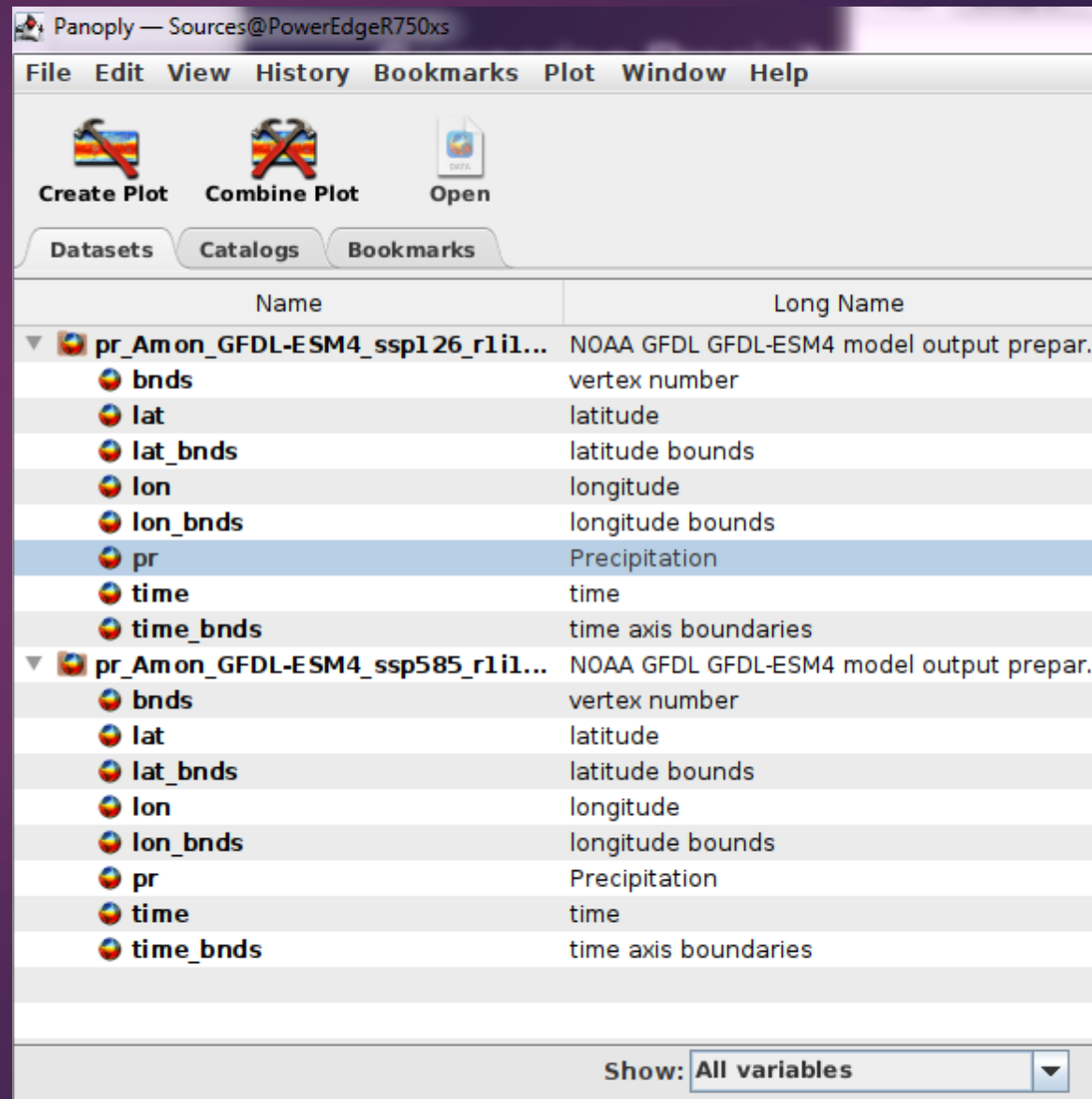
Precipitation ( $3.7e-07 \text{ kg.m}^{-2}.\text{s}^{-1}$ )



Data Min = 0.0, Max = 1011.9, Mean = 96.6

# Comparing Precipitation Data Using Combination Plots in Panoply

We have already created the plot of our First Dataset and selected the variables that we want to display.

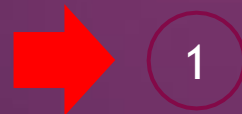


# Comparing Precipitation Data Using Combination Plots in Panoply

- ▶ Open Your Second Dataset or Select the Same Dataset from the Panoply Sources Browser
- ▶ Click the data set you wish to Plot (1). *Note: This can be the same dataset or different datasets with the same units (parameters can vary).*
- ▶ Click Combine Plot (2). Select the plot with which to combine the variable (i.e., the plot you opened in the first step.)
- ▶ Click Combine.



2



1

Panoply — Sources@PowerEdgeR750xs

File Edit View History Bookmarks Plot Window Help

Create Plot Combine Plot Open Remove Re

Datasets Catalogs Bookmarks

Name	Long Name	Type
pr_Amon_GFDL-ESM4_ssp126_r1i1...	NOAA GFDL GFDL-ESM4 model output prepar...	Local File
bnds	vertex number	1D
lat	latitude	1D
lat_bnds	latitude bounds	2D
lon	longitude	1D
lon_bnds	longitude bounds	2D
pr	Precipitation	Geo2D
time	time	1D
time_bnds	time axis boundaries	2D
pr_Amon_GFDL-ESM4_ssp585_r1i1...	NOAA GFDL GFDL-ESM4 model output prepar...	Local File
bnds	vertex number	1D
lat	latitude	1D
lat_bnds	latitude bounds	2D
lon	longitude	1D
lon_bnds	longitude bounds	2D
pr	Precipitation	Geo2D
time	time	1D
time_bnds	time axis boundaries	2D

Show: All variables

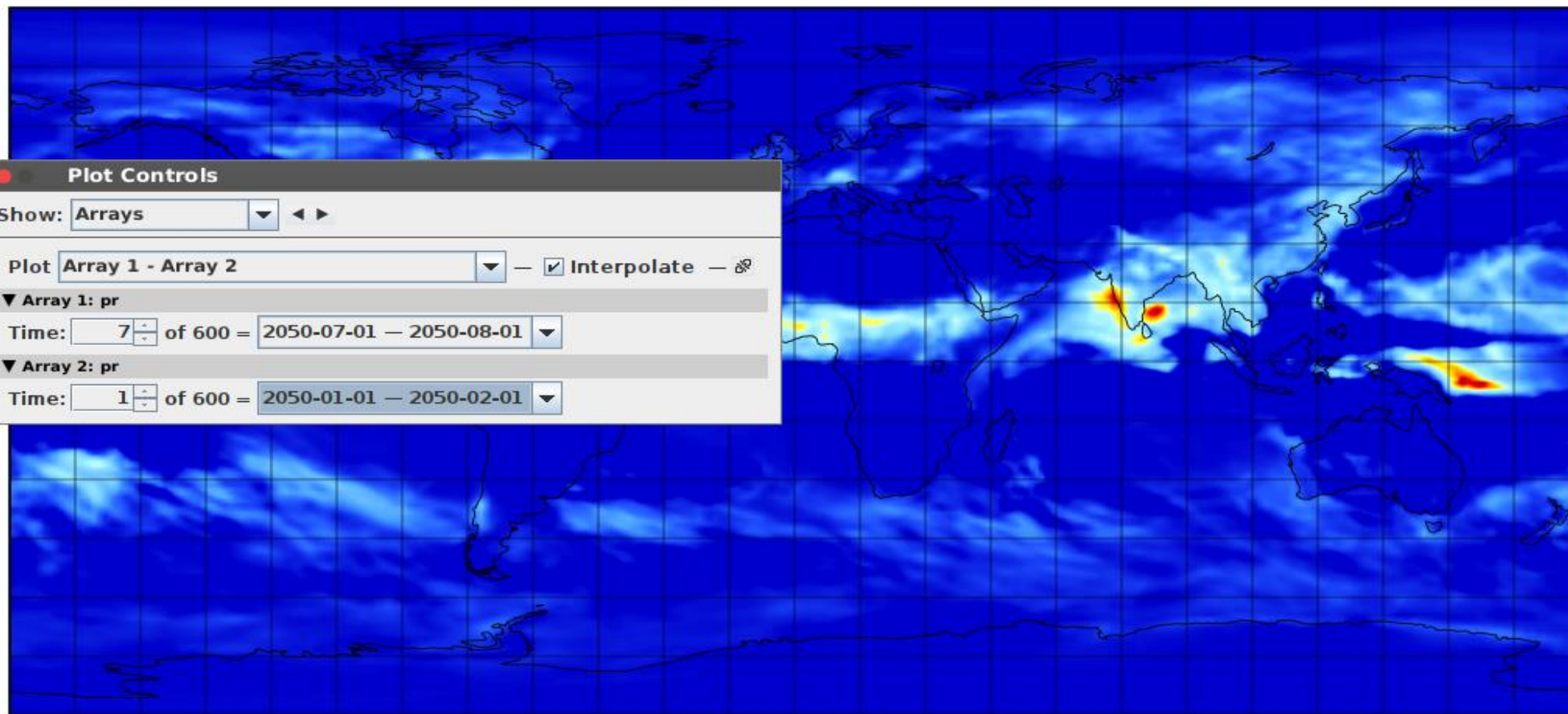
Combine Plot@PowerEdgeR750xs

In which existing plot should I combine the variable?

pr in pr\_Amon\_GFDL-ESM4\_ssp126\_r1i1p1f1\_gr1\_2050

Combine Cancel

# Precipitation



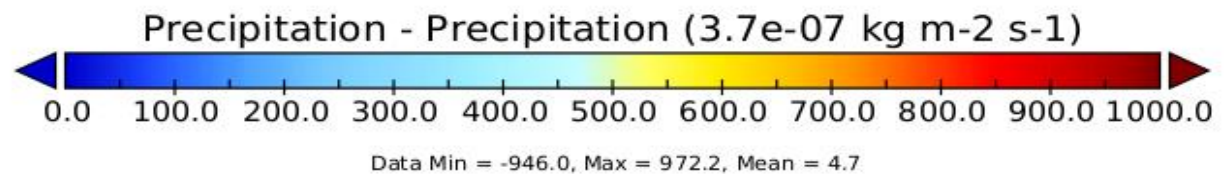
**Plot Controls**

Show: Arrays ▾ ◀ ▶

Plot Array 1 - Array 2 ▾ —  Interpolate — ⌂

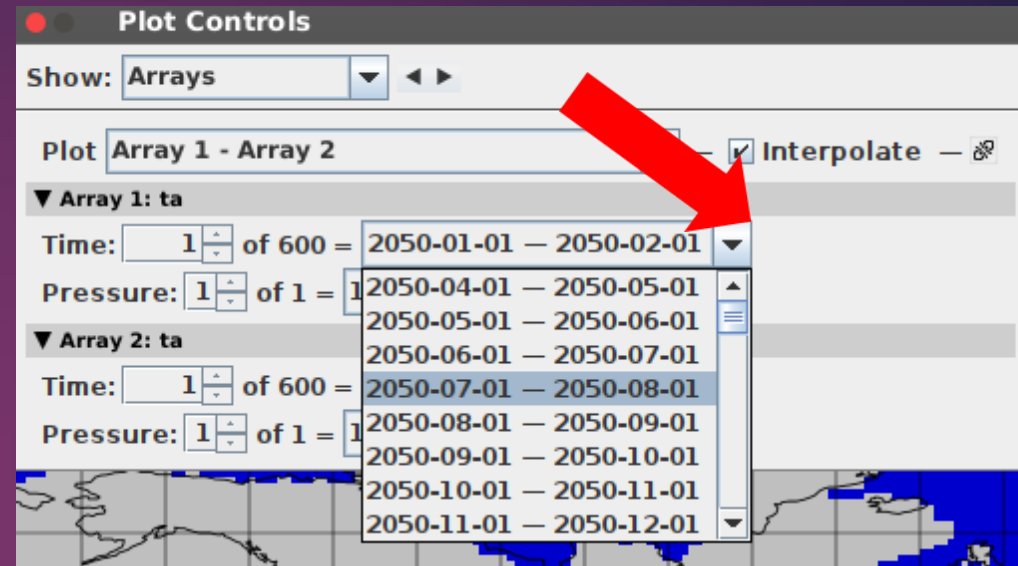
▼ Array 1: pr  
Time: 7 of 600 = 2050-07-01 — 2050-08-01 ▾

▼ Array 2: pr  
Time: 1 of 600 = 2050-01-01 — 2050-02-01 ▾

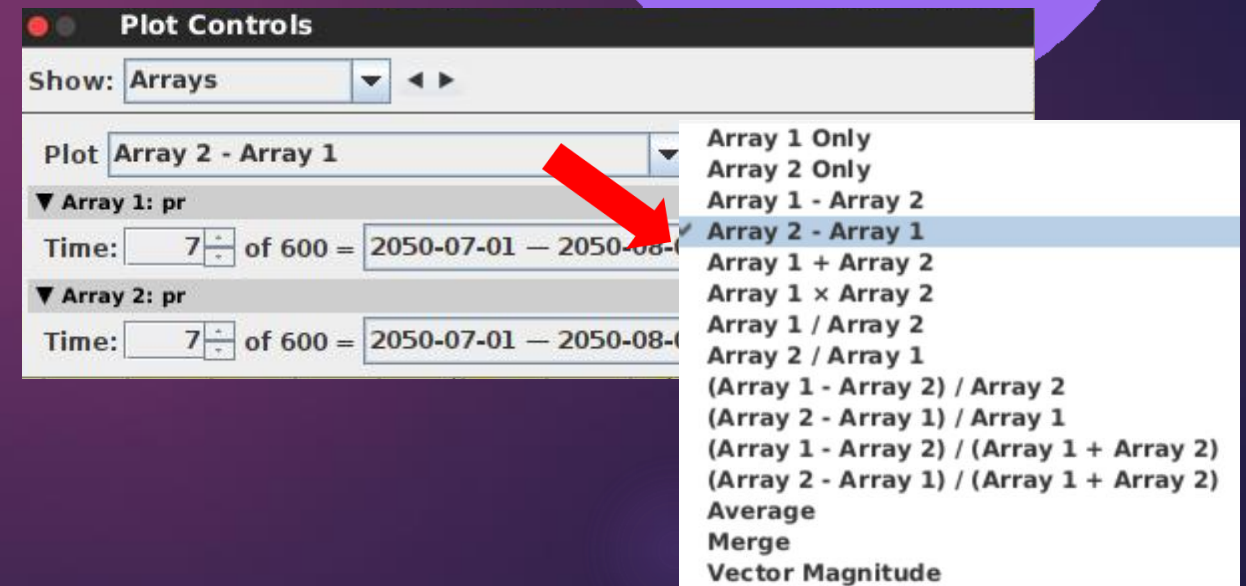


# Comparing Data Using Combination Plots in Panoply

- ▶ On the Array(s) tab, select dates to compare (both for Array 1 and Array 2). Here we choose July 2050.

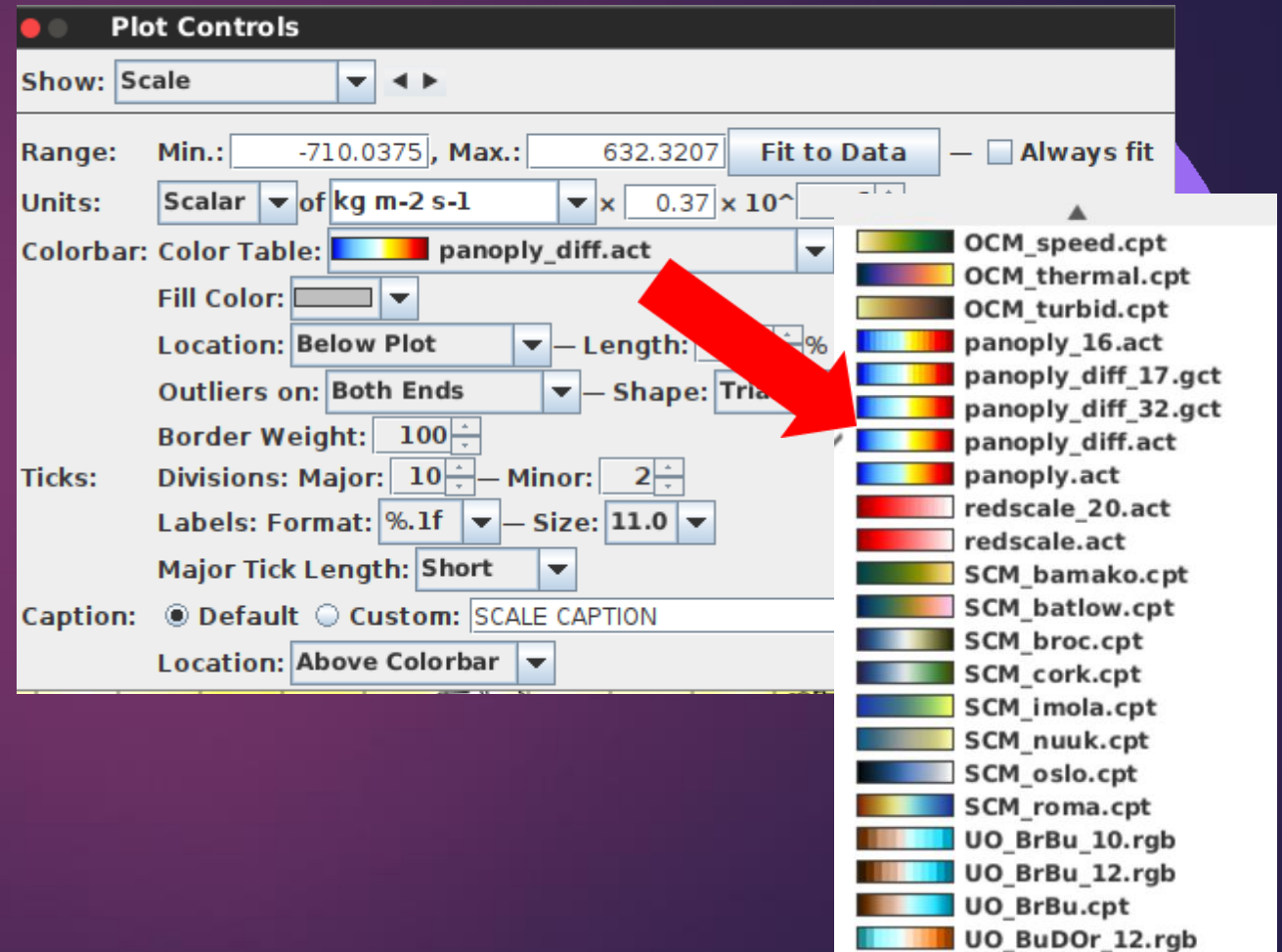


- ▶ On the Array(s) tab, select how you want to combine the datasets from the drop down menu.

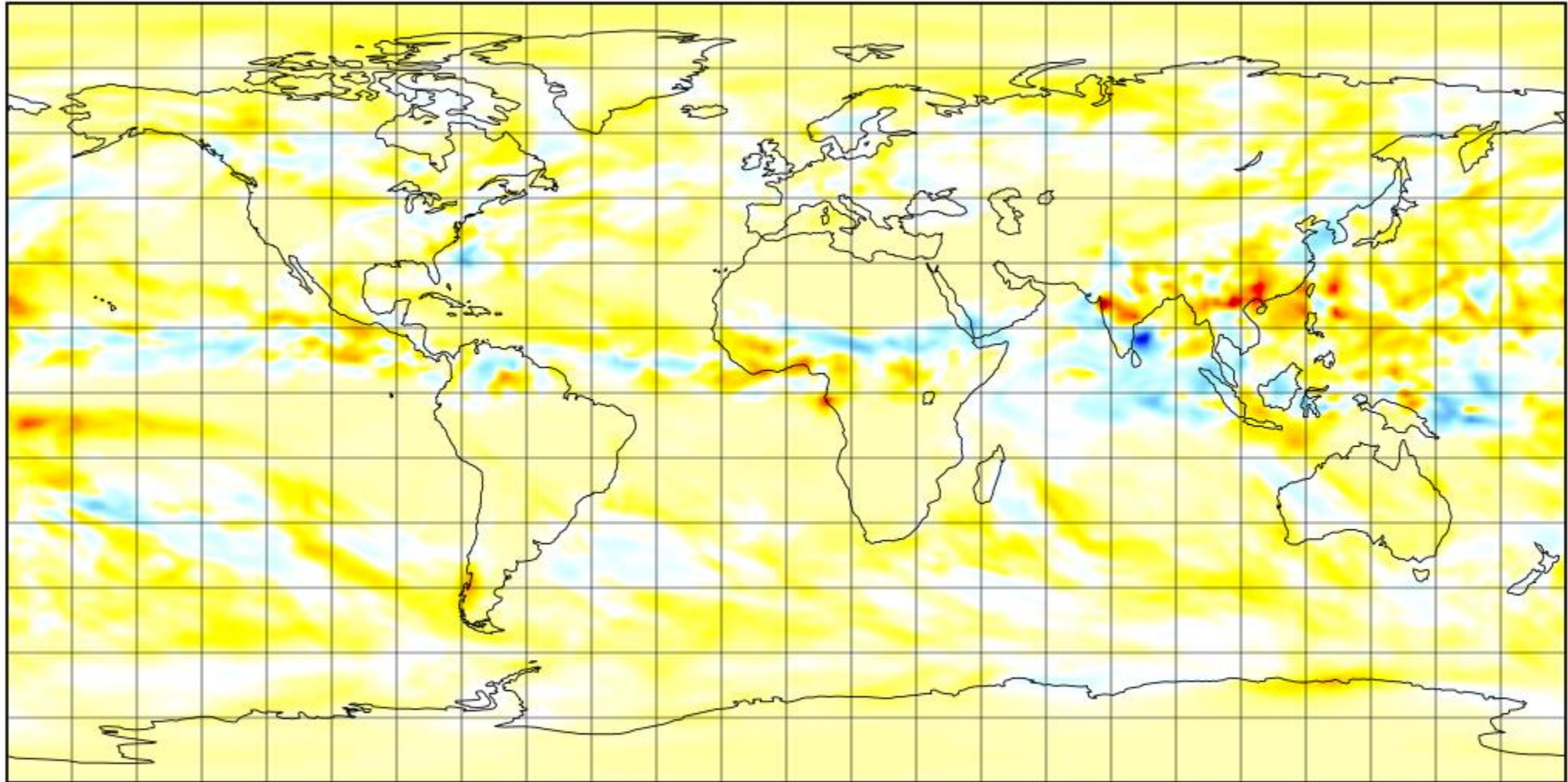


# Comparing Data Using Combination Plots in Panoply

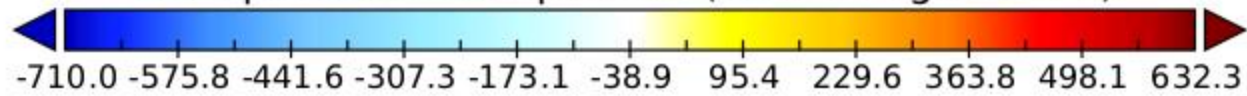
- ▶ On the Scale tab, adjust min-max range for data display. Tip: It helps to click first “Fit to data” and then re-adjust accordingly.
- ▶ Tip: On the Color Table we choose an option with white color representing zero which is more preferable for difference plots. Change the values and see the according results.



# Precipitation



Precipitation - Precipitation ( $3.7e-07 \text{ kg.m}^{-2}\text{s}^{-1}$ )



Data Min = -710.0, Max = 632.3, Mean = -1.5