Panoply Instructions for WRFV4

Updated: February 2023

Preliminaries

• Choose the appropriate version of Panoply for your OS; download and install by following the instructions:

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

- For Mac OS computers with Intel hardware, choose "use native filechooser"
- If you are running a newer Mac OS computer with Apple M1/M2 chips, choose "requires M1/M2 Mac with ARM64 Java"
- Note that you may need to have Java 11 JRE/JDK installed for Panoply to work
 - However, as of this document, Panoply 5.2.3 is able to run on a Macbook Pro 2016, running macOS Monterrey and Java 8
 - The newest versions of Java can be found and downloaded from here: <u>https://www.oracle.com/ca-en/java/technologies/downloads/#java19</u>
- ***Panoply only recognizes files that are suffixed with expected file formats, i.e. NetCDF files suffixed with .nc
 - By default, wrfout* files are NOT suffixed with .nc; consequently, Panoply won't be able to open them without renaming
 - Rename all wrfout files by adding ".nc" at the end, e.g.

mv wrfout_d01_2018-12-20_23:00:00 wrfout_d01_2018-12-20_23:00:00.nc

2D Contours and Configuring Plots

• •		Panoply — Sources	
reate Plot Combine Plot Open		Remove Rem	ove All
Name	Long Name	Туре	
⊌ wrfout_d01_2018-12-20_23:00:00	0.nc OUTPUT FROM WRF V4.1.3 MODEL	Local File	File "wrfout d01 20
ACGRDFLX	ACGRDFLX	Geo2D	
ACHFX	ACHFX	Geo2D	File type: NetCDF-3/CDM
ACLHF	ACLHF	Geo2D	
ACLWDNB	ACLWDNB	Geo2D	netcdf file:/Users/
	ACLWDNBC	Geo2D	dimensions:
ACLWDNT	ACLWDNT	Geo2D	Time = UNLIMITE
ACLWDNTC	ACLWDNTC	Geo2D	DateStrLen = 19
ACLWUPB	ACLWUPB	Geo2D	west_east = 120
	ACIWUPBC	Geo2D	south_north = 17
	ACIWIPT	Geo2D	bottom_top = 40
		Geo2D	bottom_top_stag
	ACSNOM	Geo2D	soil_layers_stag
	ACSWONR	Geo2D	west_east_stag =
	ACSWOND	Geo2D	south_north_stag
	ACSWONT	Geo2D	variables:
	ACSWONTC	Geo2D	char Times(Time
	ACSWER	Geo2D	
	ACSWURD	Geo2D	float XLAT(Time:
	ACSWUPEC	Geo2D	:FieldType = 1
	ACSWUFT	Geo2D	:MemoryOrder
	ALBROK	Geo2D	:description =
	ALBERG	Geo2D	:units = "deg
	ALBEDO	GeozD	:stagger = "";
	CIF	ID	:coordinates =
	CIH	ID	float XLONG(Tim
	C2F	ID	:FieldType =
	C2H C2F	ID	:MemoryOrder :
	C3F	10	:description :
USH CIT	C3H	ID	:units = "deg
C4F	C4F	1D	:stagger = ""
C4H	C4H	1D	:coordinates =
CANWAT	CANWAT	Geo2D	
	CF1	-	FioldTure
	CF2	-	:FieldType = .
CF3	CF3	-	description
CFN	CFN	-	:units = "":
CFN1	CFN1	-	:stagger = ""
CLAT	CLAT	Geo2D	:coordinates

- Open up a wrfout file by running Panoply, and choosing a wrfout file to load; alternatively, once Panoply is opened, you can select your file by choosing **File > Open** (top left)
- You should see the listing of raw variable names associated with that file in the left panel, and a description of the netcdf file and variables on the right (i.e. what you would get by running **ncdump** on the file)

• • •			Panoply — Sources	
Create Plot Combine Plot Open			Remove A	.11
Name	Lon	g Name	Туре	
🖕 Т	т		Geo2D	Variable "T2"
🖕 тоо	тоо		_	Variable 12
🗳 Т2	T2		Geo2D	In file "wrfout_d01_20
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THM	ТНМ		Geo2D	:FieldType = 104; :MemoryOrder = "X
🤤 Time	synthesized time coordinate	ate from Times(time)	_	description = "T
🤤 Times	Times		_	units = "K":
TISO	TISO		_	:stagger = "";
TKE_PBL	TKE PBL		Geo2D	:coordinates = "X
TLP	TLP		_	
TLP_STRAT	TLP STRAT		Create Plot	-
G TMN	TMN			
TSK	TSK	More than one type of p	lot can be created from the variable 'T2'. What typ	e would you like to create?
TSK_FORCE	TSK FORCE	more than one type of p	iot can be created nom the variable 121 mat typ	e would you like to create.
TSK_FORCE_TEND	TSK FORCE TEND	Georeferenced Lo	ngitude-Latitude 😒 color contour plot	
TSLB	TSLB	Georeferenced Zo	nal Average 📀 line plot	
🝚 U	U			_
😂 U10	U10	Color contour plot u	using south_north 📀 for X axis and west_ea	ist 🧿 for Y axis
UDROFF	UDROFF	Line plot using	outh north 😋 for the horizontal 😋 axis	
UST	UST			
🖕 V	V			Cancel Create
V10	V10			
VAR	VAR		Geo2D	
VAR_SSO	VAR SSO		Geo2D	
VEGFRA	VEGFRA		Geo2D	
👄 W	W		Geo2D	
⊖ x	synthesized GeoX coordi	nate from DX attribute	1D	
x_stag	synthesized GeoX coordi	nate from DX attribute	1D	
SICEM	XICEM		Geo2D	
XLAND	XLAND		Geo2D	\cap
XLAT	XLAT		Geo2D	
XLAT_U	XLAT U		Geo2D	
XLAT_V	XLAT V		Geo2D	
XLONG	XLONG		Geo2D	
XLONG_U	XLONG U		Geo2D	
SLONG_V	XLONG V		Geo2D	U
XTIME	XTIME		_	
	Show: All varia	bles 💿		

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• Scroll down, and choose "T2" —> select the first option "Georeferenced Longitude-Latitude color contour plot", and select Create



- You should now see your T2 color-filled contour plot appear, with the polar-stereographic domain projected onto an equirectangular map (hence the "tilt" of your domain)
- At the top, select "Window > Plot Controls" to enable configurations for the plot



- With Plot Controls, you can configure what your plot looks like
- The "Show" dropdown menu allows you to access different portions of the configuration
- The figure above shows the effects of selecting "Grid" and changing the "Spacing" of the latitude and longitude grid lines
 - Note that the plotted base projection was changed earlier (not shown) due to selecting the Stereographic projection under "Map Projection"
 - The next page shows the effects of changing the Map Projection and the zoom



- Under Map Projection in the "Show" dropdown, you can change the Projection to Stereographic, and also define the center latitude and longitude of the map
- "Edge Angle" determines the zoom of the map...the lower the number, the higher the zoom



- You can add political boundaries and higher-res coastlines in the "Overlays" option of the "Show" dropdown
- In "Overlay 1", in the "Name" dropdown, select "MWDB_Coasts_NA_1.cnob" —> this will produce the North American national and sub-national boundaries, as well as a better coastline



- To change the colormap and units of the variables, go to "Scale" in the "Show" dropdown
- Here, you can change the range of the data, as well as the units (e.g. click on the "K" next to "Units" and change to "Celsius")
 - In regards to the data range, "Fit to Data" will automatically adjust the range to the minimum and maximum of the variable
- Note on animations: unlike IDV, Panoply will only support animation creation if multiple time steps are contained within a single netcdf file
 - \circ To create an animation, in the top left, select File > Export Animation
 - The animation generation will use the configuration you provided when customizing your individual plots for all of the frames (i.e. projection, zoom, colormap, etc.)



• You can also export your image as a .kmz (File > Export KMZ), and open with Google Earth...see what you get!

Plot Combinations and Vectors

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reate Plot Combine Plot Open		Remove All	Nide Info		
Datasets Catalogs Bookmarks					010
Name	Long Name	Туре			
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🤤 Time	synthesized time coordinate from Ti	. —	Variable "V10"	A A A A A A A A A A A A A A A A A A A	
🗳 Times	Times	_	In file "wrfout d01 2018-12-20 23:00:00 nc"		
🗳 TISO	TISO	-		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1 2
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TLP_STRAT	TLP STRAT	_	:MemoryOrder = "XY ";		2m m
TMN	TMN	Geo2D	:description = "V at 10 M";		2 mg
TSK	TSK	Geo2D	:units = "m s-1";		$\int \frac{1}{\sqrt{2}}$
TSK_FORCE	TSK FORCE	-	:stagger = "";		
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🗳 V10	V10				
VAR	VAR	Cancel			6
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🖕 W	W	Geo2D		New York	

- To plot vectors of U10 and V10, first plot U10 as normal (like plotting T2)
- Then, select V10, but do not click "Create Plot" —> instead, select "Combine Plot", and choose the shown option to merge the plot with U10





- By default, combining plots will subtract the two fields; instead, we want to compute vectors
 - In the "Show" dropdown of Plot Controls, select "Arrays"
 - Then under the "Plot" dropdown, choose "Vector Magnitude"
 - This will now change the plot to show wind vectors, as well as wind speed as a color-filled contour



- The plot above was zoomed into the domain by holding right click on the mouse, and dragging it over the area of interest
- Under "Plot Controls" → "Show" → "Vectors", you can configure the vectors as you please
 - Try reducing "Spacing" to increase the density of plotted vectors, and "Reference Value" to change the base length of the vectors

Transects

• • •		Panoply — Sources				
Create Plot Combine Plot Open		Remove Remove All	Kide Info			
Name	Long Name	Туре				
	ТНМ	Geo2D				
 Time 	synthesized time coordinate from Ti	_	Variable "U"			
Times	Times	_	In file "wrfout_d01_2018-12-20_23:00:00.nc"			
	TISO	_				
TKE PBL	TKE PBL	Geo2D	<pre>float U(Time=1, bottom_top=40, south_north</pre>			
G TLP	TLP	_	:FieldType = 104; // int			
TLP STRAT	TLP STRAT	_	:MemoryOrder = "XYZ";			
TMN	TMN	Geo2D	uescription = x - wind component;			
TSK	TSK	Geo2D	:stagger = "X":			
STSK_FORCE			:coordinates = "XLONG_U XLAT_U XTIME";			
STSK_FORCE_TEND		Create Plot				
TSLB						
😜 U	More than one type of plot can be creat	ted from the variable 'U'. What type wou	Ild you like to create?			
😜 U10	Ceoreferenced Longitude-Latitu	de 😫 color contour plot				
UDROFF	Georeferencea Longitude-Latitude 🥣 Color contour plot					
🗳 UST	🔵 Georeferenced 🛛 Zonal Average 🧧	Georeferenced Zonal Average 😮 line plot				
⊖ v	Color contour plot using south north A for Y axis and bottom ton C for Y axis					
V10						
VAR	 Line plot using bottom_top 	ᅌ for the 🛛 horizontal 😒 axis				
VAR_SSO						
VEGFRA						
🖕 W						
🖕 x	synthesized GeoX coordinate from D	1D				
x_stag	synthesized GeoX coordinate from D	1D				
SICEM	XICEM	Geo2D				
XLAND	XLAND	Geo2D				
XLAT	XLAT	Geo2D				
XLAT_U	XLAT U	Geo2D				
XLAT_V	XLAT V	Geo2D				
XLONG	XLONG	Geo2D				
SLONG_U	XLONG U	Geo2D				
SLONG_V	XLONG V	Geo2D				
S XTIME	XTIME	_				
⊖ y	synthesized GeoY coordinate from D	1D				
y_stag	synthesized GeoY coordinate from D	1D				
	Show: All variables					

 Select U in the variable list (3D U-wind), and create a "Color contour plot using..." —> but change set the X axis as "south_north" and Y axis as "bottom_top"



- We now get a color-filled contour of U along a vertical slice, across latitudes
- We can choose the longitudinal position of our slice by choosing "Arrays" in Plot Controls, and incrementing (or selecting) "West_east_stag"