McIDAS-V Tutorial
Displaying Gridded Data
updated June 2012 (software version 1.2)

McIDAS-V is a free, open source, visualization and data analysis software package that is the next generation in SSEC's 35-year history of sophisticated McIDAS software packages. McIDAS-V displays weather satellite (including hyperspectral) and other geophysical data in 2- and 3-dimensions. McIDAS-V can also analyze and manipulate the data with its powerful mathematical functions. McIDAS-V is built on SSEC's VisAD and Unidata's IDV libraries, and contains "Bridge" software that enables McIDAS-X users to run their commands and tasks in the McIDAS-V environment. The functionality of SSEC's HYDRA software package is also being integrated into McIDAS-V for viewing and analyzing hyperspectral satellite data.

More training materials are available on the McIDAS-V webpage and in the Getting Started chapter of the McIDAS-V User's Guide, which is available from the Help menu within McIDAS-V. You will be notified at the startup of McIDAS-V when new versions are available on the McIDAS-V webpage - http://www.ssec.wisc.edu/mcidas/software/v/.

If you encounter an error or would like to request an enhancement, please post it to the McIDAS-V Support Forums - http://www.ssec.wisc.edu/mcidas/forums/. The forums also provide the opportunity to share information with other users.

This tutorial assumes that you have McIDAS-V installed on your machine, and that you know how to start McIDAS-V. If you can not start McIDAS-V on your machine, you should follow the instructions in the document entitled *McIDAS-V Tutorial – Installation and Introduction*.

In this McIDAS-V Tutorial, each exercise will be explained using two different methods of data access: pre-loaded data bundles and real-time access to default remote servers. If you have access to your own real-time servers, you may also use those, but be aware that different server configurations may make the explanations in this document not quite applicable to all data that you may load.

Terminology

There are two windows displayed when McIDAS-V first starts, the **McIDAS-V Main Display** (hereafter **Main Display**) and the **McIDAS-V Data Explorer** (hereafter **Data Explorer**).

The **Data Explorer** contains three tabs that appear in bold italics throughout this document: ***Data Sources***, ***Field Selector***, and ***Layer Controls***. Data is selected in the ***Data Sources*** tab, loaded into the ***Field Selector***, displayed in the **Main Display**, and output is formatted in the ***Layer Controls***.

Menu trees will be listed as a series (e.g. ***Edit ->Remove ->All Layers and Data Sources***).

Mouse clicks will be listed as combinations (e.g. *Shift+Left Click+Drag*).

Displaying Gridded data: 2D

1. Remove all layers and data sources from the previous displays.

2. If you are using real-time data, skip to step 3. Otherwise, load data bundle
   <local path>/**Gridded/Grid-GFS-Intro.mcvz**.

   a. In the Main Display, select *File -> Open File...*

   b. Navigate to the **Grid-GFS-Intro.mcvz** file and click **Open**.

   c. In the "Open Bundle" dialog box, select the *Replace session* option and click **OK.**

3. If you are using real-time data, follow the instructions below.

   a. Select the *Gridded Data -> Remote* chooser from the *Data Sources* tab.

   b. From the **Catalog** pull down menu, select http://motherlode.ucar.edu:8080/thredds/idv/models.xml.

   c. Add the *NCEP Model Data -> Global Forecast System Model -> NCEP GFS CONUS 80 km ->*
      Latest source.

4. Display the MSL Pressure.

   a. In the *Field Selector* select the *2D grid -> Pressure reduced to MSL @ msl* field.

   b. Select the *Color-Shaded Plan View* Display.

   c. In the *Times* tab, uncheck the **Use Default** checkbox and select the first six times.

   d. Create the Display.

5. In the *Layer Controls,* turn on the option to **Shade Colors**.

6. Go back to the *Field Selector*, change the Display type to
   Contour Plan View, and overlay the same parameter.

7. In the *Layer Controls*, click on the **Color Table** name
   (PressureMSL) to change the color table of the contours to
   System -> Solid Colors -> Black.

8. Zoom in over a region to see a display like that to the right.
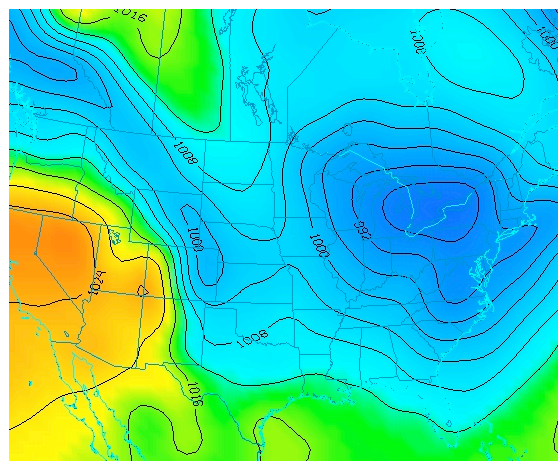
Displaying Gridded data: 3D

1. Remove all layers. In the *Field Selector*, select the *3D grid -> Temperature @ isobaric* field.

   a. Select the *Color-Filled Contour Plan View* display type.

   b. In the *Times* tab select the first 6 images.

   c. In the *Level* tab, select 500 hPa.

   d. Click **Create Display**.

2. Use the rotating and zooming controls to rotate the **Main Display** window. You can see that the 500hPa surface is displayed above the map layer.

3. Keep the **Main Display** rotated so the difference in height between the map and the display can be seen.

4. In the *Layer Controls*, use the **Levels** pull down menu to change the level of the contours. Note that when the level is changed, both the display and the z-level of the display change in the **Main Display**.

   a. Change the level to 850 hPa.

   b. Change the contour interval to 10 Celsius by clicking on the **Change** button in the Contour section of the *Layer Controls*.

5. Reset the projection and change the level to 250 hPa. You should notice that the map does not show up on the contours.

6. Move the map above the 250 hPa contours and change the map colors to white.

   a. In the *Layer Controls*, select "Default Background Maps" from the list of layers on the left side of the tab.

   b. In the **Settings** tab, move the Map Position slider to the right to move higher into the 3D display.

   c. Change the map colors of "North & Central America", "World Political Boundaries" , and "World Coastlines" to white.

Problem Sets

The previous examples were intended to give you a general knowledge of how to load and display gridded data. The problem sets below are intended to introduce you to new topics related to the data, as well as challenge your knowledge of McIDAS-V. We recommend that you attempt to complete each problem set before looking at the solutions, which are provided below the problem set.

1. Create a display of 2D Pressure as a 3D Color Shaded Image Over Topography display using the most recent time. Overlay Absolute Vorticity as an isosurface using the most recent time. Then, remove the Absolute Vorticity layer and add a cross section of Relative Humidity using the most recent time.

2. Create a 3D globe display of jet stream winds and 2D surface pressure from grids for the first three times. Use the bundle *<local path>*/**Gridded/Grid-Problem-Globe.mcvz** to load the grids. Create a movie of your display rotating and playing the loop. Note: This bundle is large, so it may take a minute to open the file.

3. Create a display showing the difference between the 0Z and 6Z *2D Pressure Reduced to MSL @ msl* field for 2009-05-29 00:00:00Z.   Change the units to millibars and then change the range to match the new units. Save a JPG image of the difference. You may use bundle *<local path>*/**Gridded/Grid-Problem-Difference.mcvz** or real-time data to load the grids. If you are using real-time data, do not use the 2009 time, but choose one individual time to use or both model runs.
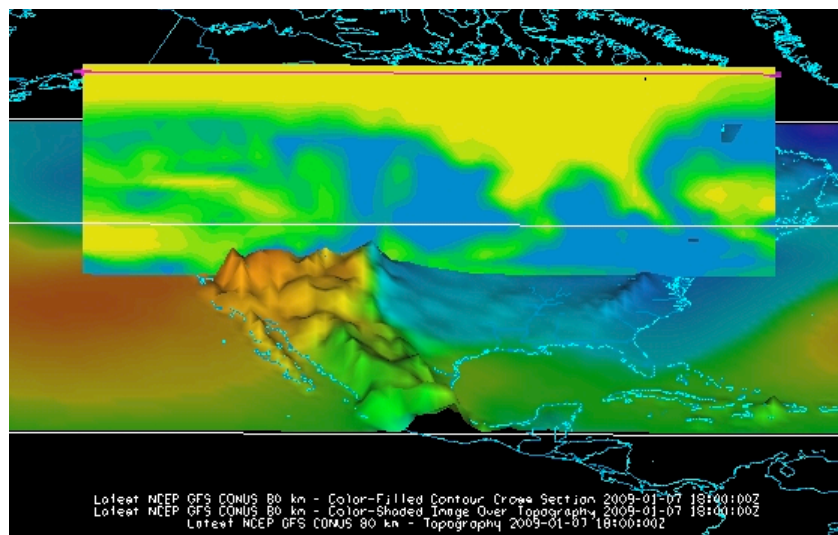
Problem Set #1 – Solution

Create a display of 2D Pressure as a 3D Color Shaded Image Over Topography display using the most recent time. Overlay Absolute Vorticity as an isosurface using the most recent time. Then, remove the Absolute Vorticity layer and add a cross section of Relative Humidity using the most recent time.

1. Remove all layers.

2. Create a new tab.

3. Add the first five times for 2D *Pressure reduced to MSL @ msl* and display it as a *3D Color-Shaded Image Over Topography* display. The 2D field will be displayed as topography.

    a. You will be prompted for the Topography field. Select the ***Latest NCEP GFS CONUS 80km -> Geopotential_height @ surface*** field from the selector, the earliest time, and press **OK**.

    b. Shade the colors, and use the zooming and rotating controls to see the display in 3D.

4. Reset the display projection.

5. Display the earliest *3D grid -> Absolute Vorticity @ isobaric* as a 3D isosurface.

6. Zoom in over the US and rotate the display to see the absolute vorticity isosurface over the continental US.

7. The **Isosurface Value** in the *Layer Controls* can be used to change the value of absolute vorticity displayed. Change the value to 5 x 1.0e-5 s-1.
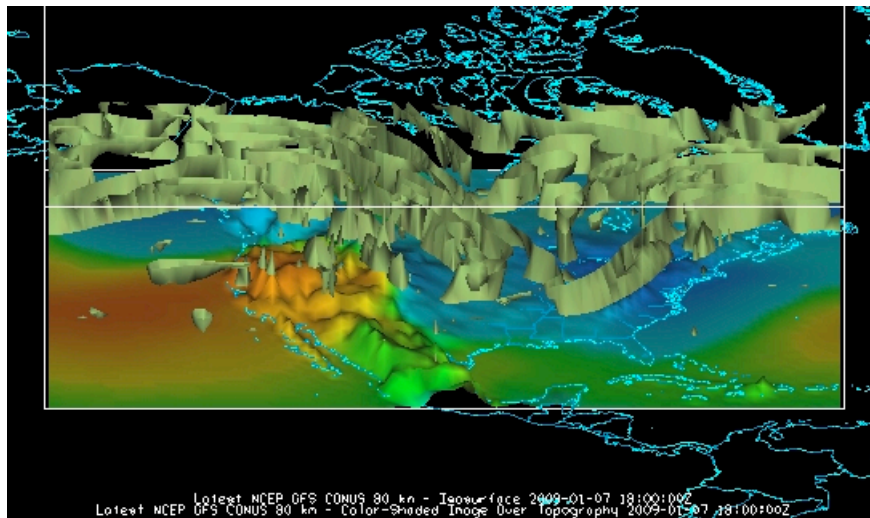

8. Remove the absolute vorticity isosurface layer from the display.

9. Add the earliest *3D Relative Humidity @ Isobaric* as a *Color-Filled Contour Cross Section*. Click **Create Display**. The cross section will be displayed in 3D in the **Main Display** window and in 2D in the *Layer Controls*.

10. To reposition the cross section in the main window, *left-click* on the plus or square to move the ends of the cross section, and the triangle to move the entire line.

Problem Set #2 – Solution

Create a 3D globe display of jet stream winds and 2D surface pressure from grids for the first three times. Use the bundle *<local path>*/**Gridded/Grid-Problem-Globe.mcvz** to load the grids. Create a movie of your display rotating and playing the loop. Note: This bundle is large, so it may take a minute to open the file.

1. Add a one panel globe display tab by selecting ***File -> New Display Tab -> Globe Display -> One Panel***.

2. Load bundle *<local path>*/***Gridded/Grid-Problem-Globe.mcvz*** via the ***File -> Open File…*** menu item in the **Main Display**. In the "Open Bundle" dialog box select the *Replace session* option and click **OK.** This is a large dataset, so it may take a minute to open the file.

3. Display the first three 2D *Temperature at Surface* grids as a *Color-Filled Contour Plan View*. Overlay it again as contours.

4. Next, display the *3D -> Momentum -> Derived -> Speed* grid as a 3D Isosurface for the same times.

5. In the ***Layer Controls***, change the following:

    a. Change **isosurface value** to 60 m/s for *Speed*.

    b. Change the default World Coastlines map color to RGB 0-153-204 and the default World Political Boundaries map color to RGB 0-255-255. This is done by going to the **Default Background Maps**, select the color square next to your desired map and navigating to the ***RGB*** tab.

6. Start the loop and turn on the **Auto-Rotate View** option (***View -> Viewpoint -> Auto-Rotate View*** from the **Main Display**). Use the Zooming and Panning controls to observe the data from different views. (Depending on preference, it might help to turn the **Auto-Rotate View** option off.)

7. Turn the looping on and make sure the **Auto-Rotate View** option is on.

8. Capture a movie of the rotating globe by selecting ***View -> Capture -> Movie…*** in the **Main Display**.

    a. In the **Movie Capture** window, change **Rate:** to 0.25 seconds.

    b. Move the **Main Window** and the **Movie Capture** window around so they do not overlap. (During the movie capture, if the view in the **Main Window** is obscured, the obscurities will be shown in the capture.)

    c. Start the movie capture by clicking **Automatically**.

    d. Once the globe has rotated 360°, click **Stop**. Click **Save Movie** to save it as a QuickTime movie.
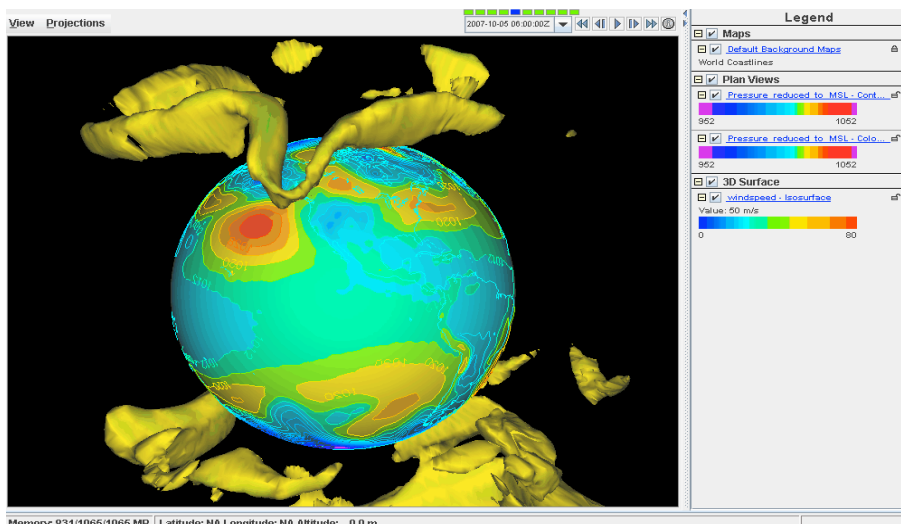
Problem Set #3 – Solution

Create a display showing the difference between the 0Z and 6Z *2D Pressure Reduced to MSL @ msl* field for 2009-05-29 00:00:00Z.   Change the units to millibars and then change the range to match the new units. Save a JPG image of the difference. You may load the grids using real- time data or bundle *<local path>*/**Gridded/Grid-Problem-Difference.mcvz**. If you are using real-time data, do not use the 2009 time, but choose one individual time to use on both model runs.

1. Open a new tab, and close the globe display tab.

2. If you are using real-time data, skip to step 3. Otherwise, load the data bundle **Grid-Problem-Difference.mcvz**. In the "Open Bundle" dialog box select the *Replace session* option and click **OK.**

3. If you are using real-time data, follow the instructions below.

    a. Remove all layers and data sources.

    b. Return to the ***Data Sources*** tab, and load the 0Z and 6Z GFS *Global 1°* grids (***NCEP Model Data -> Global Forecast System Model -> NCEP GFS Global 1 degree -> GFS_Global_onedeg_YYYYMMDD_0000.grib2 (0600.grib2)***) for today into the ***Field Selector***.

4. Choose *Formulas* in the **Field Selector**, and select ***Miscellaneous -> Simple difference a-b***.

5. In the **Displays** tab select *Plan Views -> Color-Shaded Plan View* and click **Create Display**. A **Field Selector** window will pop up prompting you for the two fields to subtract. You may need to expand the window to see the full descriptions.

    a. On the left, select the 0Z run *Pressure Reduced to MSL @ msl* field and 2009-05-29 00:00:00Z.

    b. On the right, select the 6Z run *Pressure Reduced to MSL @ msl* field and 2009-05-29 00:00:00Z in the ***Times*** tab. Click **OK**.

6. The resulting plot will show the difference between the two grids in Pascals. Change this to millibars.

    a. In the ***Layer Controls***, select ***Edit -> Change Display Unit…***

    b. Select *millibar* from the dropdown list and click **OK**. To change the range of data values with the new units, *right*-click on the color bar in the **Legend** and select **Change Range**. Click on *Use Predefined -> From All Data* and click **OK**. Positive values indicate the 0Z forecast predicted a higher pressure than the 6Z, and negative values indicate the opposite.

7. Save the **Main Display** window as an image. Select *View -> Capture -> Image…* from the **Main Display**.

    a. Under "Capture What", change the radio button to *Full Window*.

    b. Enter in a name, followed by the ".jpg" extension and click **Save**.
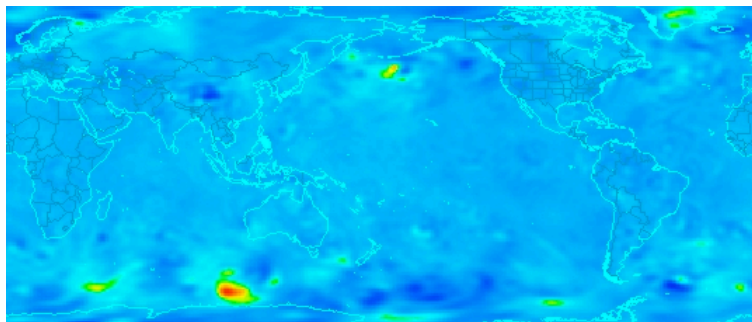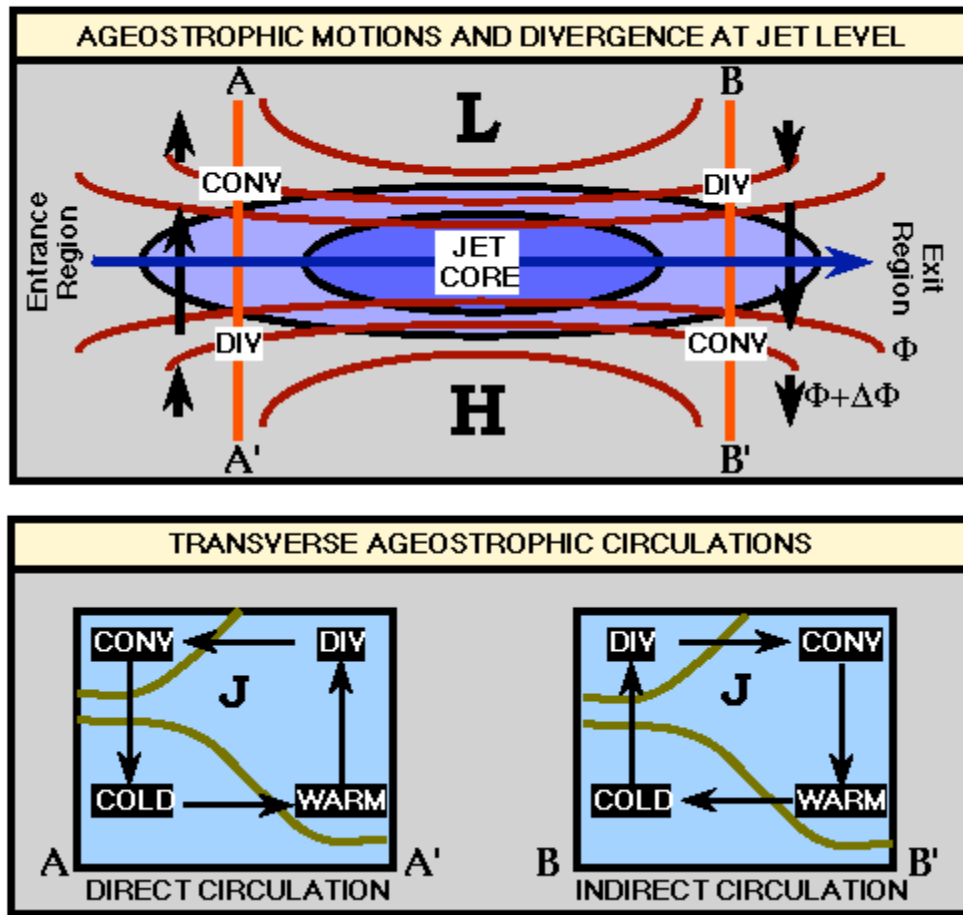
Challenge

The bundle *<local path>*/**Gridded/Grid-Problem-Challenge.mcvz** contains 3D u and v data. Use the available data and display options to look for a jet entrance or exit region.

For a reminder of jet entrance and exit regions, see the graphic below from:
http://www4.ncsu.edu/~nwsfo/storage/training/jets/JETS.gifs/JET.4Cell.A.gif

THE FOUR QUADRANT STRAIGHT JET MODEL

AGEOSTROPHIC MOTIONS AND DIVERGENCE AT JET LEVEL

A   L   B

Entrance Region

CONV   DIV

JET CORE

Exit Region

DIV   CONV Φ

A'   H   B' $\Phi+\Delta\Phi$

TRANSVERSE AGEOSTROPHIC CIRCULATIONS

CONV ← DIV
J
COLD → WARM

A   A'
DIRECT CIRCULATION

DIV → CONV
J
COLD ← WARM

B   B'
INDIRECT CIRCULATION

Zooming, Panning, and Rotating Controls

Zooming	Panning	Rotating
Mouse		
Shift-Left Drag: Select a region by pressing the ***Shift*** key and dragging the left mouse button. **Shift-Right Drag:** Hold ***Shift*** key and drag the right mouse button. Moving up zooms in, moving down zooms out.	**Control-Right Mouse Drag:** Hold ***Control*** key and drag right mouse to pan.	**Right Mouse Drag:** Drag right mouse to rotate.
Scroll Wheel		
Scroll Wheel-Up: Zoom Out. **Scroll Wheel-Down:** Zoom In.		**Control-Scroll Wheel-Up/Down:** Rotate clockwise/counter clockwise. **Shift-Scroll Wheel-Up/Down:** Rotate forward/backward clockwise.
Arrow Keys		
Shift-Up: Zoom In. **Shift-Down:** Zoom Out.	**Control-Up arrow:** Pan Down. **Control-Down arrow:** Pan Up. **Control-Right arrow:** Pan Left. **Control-Left arrow**: Pan Right.	**Left/Right arrow:** Rotate around vertical axis. **Up/Down arrow:** Rotate around horizontal axis. **Shift-Left/Right arrow:** Rotate Clockwise/Counterclockwise.