McIDAS-V Tutorial

Using and Creating Formulas

updated August 2009 (software version 1.0beta4)

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.

McIDAS-V is currently a beta version of the software, which means that the software may contain bugs and not always work as expected. If you encounter any errors, please send them to the McIDAS Help Desk at mug@ssec.wisc.edu . 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/** . 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.

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

Using and Creating Simple Formulas

1. Load the formulas data bundle.

   a. In the **Main Menu Bar** in the **Main Display** window of McIDAS-V, select **File** -> **Open File...**

   b. In the file brower, "Look In" the location where you downloaded the data files for this tutorial, select **Formula-Data.mcvz** and click **Open**.

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

   d. Under "Confirm Layer/Data Removal" uncheck the *Always Ask* box and click **Remove all layers/data**.

   e. When prompted, select *Replace Session* to replace the current window with the contents of the bundle and click OK.

   f. Select *Write to temporary directory*, check *Don't show this again*, and click **OK**.

2. Create a display using an existing formula.

   a. In the ***Field Selector*** tab, **left click** on the **Formulas** in the **Data Sources** panel.

      i. In the **Fields** panel, select **Grids -> Time Steps -> Time step difference D(T)=D(T)-D(T-1)**.

      ii. In the **Displays** panel, select **Plan Views->Contour Plan View**. Click **Create Display**.

b. When the Field Selector window pops up, select **form-model.nc -> 2D grid -> Pressure reduced to MSL** and then click **OK.**

c. Click on form-model.nc entry in the Legend to bring up the ***Layer Controls*** panel.

   i. In the **Edit->Change Display Unit,** change the unit to millibars.

   ii. Click **Change** and change the Contour Interval to 2.0, the base contour to 0, the minimum value to -15, the maximum value to 15, change the line width to 2, and click **OK**.

   iii. Right-click on the color table, select **Change Range** and change the values to -15 and 15.

   iv. Animate the display.

d. When finished, remove the layer.

3. Next, create a display using the "Derived" fields.

   a. Select the form-model.nc file in the **Data Sources** panel.

   b. In the **Fields** panel, select **3D grid -> Derived -> Sounding Data (with true winds)**.

      i. Click **Create Display**.

   c. In the main navigated display window, **left-click and drag** the color-filled box into the central US (to get the probe into the navigation of the grid).

   d. In the ***Layer Controls*** tab, do the following things:

      i. Use the Time Animation Controls.

      ii. Inspect the Hodograph (2D and 3D). Use **Ctrl+r** to reset the hodograph.

      iii. Zoom (mouse wheel) and pan (right button drag).

   e. When finished, remove the layer.

4. Making a formula – Subtracting two grids.

   a. In the ***Field Selector***, **right-click** on the **Formulas** Data Source and click **Create Formula**.

      i. In the "Formula Editor" window, enter the **Name** "subtract"

      ii. In the **Formula** field, type: **sub(one,two)**

      iii. Open the "Advanced" options by clicking on the double down arrow, and select the Settings panel.

iv. Under Displays, click the "Use selected" radio button.

v. Click the box next to Plan Views -> Color-Shaded Plan View. Click **Add Formula**.

b. In the ***Field Selector***, click on the **Formulas** Data source.

i. Click on the **subtract** formula – note the options for Displays only list Color-Shaded Plan View and the Omni Control, and click **Create Display**.

d. In the new ***Field Selector***, select the variables for your formula.

i. For Field: *one*: **form-model.nc -> 3D grid -> Geopotential Height at isobaric levels**.

1. Click the **Level** tab, and select 300 hectopascals (hPa).

ii. For Field *two*: **form-model.nc -> 3D grid -> Geopotential Height at isobaric levels**.

1. Click the **Level** tab, and select 850 hPa.

e. Click **OK** and get your display

f. Use the zooming and panning controls, as well as the time animation controls to investigate the image. When done, remove the layer.

Creating and Using More Complex Formulas

1. Viewing the Jython library.

a. Return to the ***Field Selector***, right click on the **Formulas** Data Source and click **Jython Library**.

b. In the Library Editor, click and explore the **System** routines for a while.

i. Note the plethora of available functions....with more to come!

ii. In particular, note the **Grid Diagnostics** routines – scroll down to the **sub(S1,S2)** method at line 51.

2. Make a Jython Routine and formula.

a. Click on **Local Jython -> User's Library**

i. In the editor panel, type:

```
def irmask(i, im):
    return i * mask(im, "<", 260.0)
```

Note: Your "return…" line must be indented below the "def irmask.." line.

ii. Click **Save**.

iii. Close the **Jython libraries** window.

b. Create a formula called "make mask".

i. In the ***Field Selector***, **right-click** on the Formulas data source and click **Create Formula**.

ii. Enter in this formula: irmask(img, imgmask)

iii. Set the Displays to only **Imagery -> Image Display**

iv. Click **Add Formula**.

c. Use the new formula.

i. In the ***Field Selector***, click **Formulas -> make mask**.

ii. Click **Create Display** and select the dataset **2612-IRComposite.area** for both the "img" and the "imgmask" -- **Click on the time (2009-05-26 11:45Z), <u>not</u> "All images"!!**

Note: If this data source had contained multiple times, the formula would have been more complex, because we would have to loop over "time" because the "mask()" function does not (yet) understand multiple times!

3. Use the Omni Control to inspect your data.

a. Remove all layers.

b. In the ***Field Selector***, Select the IR Composite image (2612-IRComposite.area -> All images)

i. In the Displays, select **General -> Omni Control**

ii. Click **Create Display**

iii. Click on the **Mappings** button in the Omni Control. In this display using "All Times," there are two functions. One has a domain (line/ele) pointing to range/value. This first domain is nested into time, which can get the object, and from the object can get line/ele and values.

c. Remove this control and repeat the display <u>except</u>

i. Select the **time** and <u>not</u> All Images in the ***Field Selector***.

ii. Use the Omni Control display again and bring up the Mappings information.

iii. Note the difference in Mappings.

iv. When you are done, remove the layers.

4. Using the Jython Shell

   a. Return to the ***Field Selector,*** **right-click** on Formulas, and select **Jython Shell**.

   b. In the text input field at the bottom, type: **a = selectData()** <Enter>

      i. In the pop-up window, choose the "GOES12 - 3.9um" data

      ii. Click **OK**.

   c. Again, in the text input field, type: **b = selectData()** <Enter>

      i. In the pop-up, choose the "GOES12 10.7 um" data

      ii. Click **OK**.

   d. Type: **c = (a – b) / (a + b)** <Enter>

   e. Then type: **createDisplay('imagedisplay', c)** <Enter>

   f. In the ***Layer Controls***, change the range of the color table to: **-0.1 to 0.1**.

   g. Back in the text input field in the Jython Shell, **right-click** and explore the various functions available