ViSBARD Tutorial Examples

for Cross-Platform Release Version, August 2007

D. Aaron Roberts, NASA GSFC
aaron.roberts@nasa.gov
Ryan Boller, NASA GSFC

The following examples provide starting points for exploring ViSBARD's capabilities. Start ViSBARD by following the platform-specific instructions found in ViSBARD/ViSBARD_Quick_Start_Guide.txt. (There are many combinations of operating systems and graphics boards. Display problems may arise on older systems. We will only be able to offer limited help with these problems at this release level, but we are interested in feedback.)

Magnetospheric Spacecraft Orbits ("SSCWeb" orbits in CDF format)

1. Use the Properties Mapper panel ("MAP" in toolbar) from the toolbar to set max glyphs to 10. This reduces the number of data points displayed per dataset, and allows loading of more datasets at once.
2. Click on the Folder icon to open the Resource Toolkit.

Method using locally-stored files:
2a. Click on "Add Local File(s)..."
3. Locate the folder containing the sample data from the separately downloaded & extracted zip file and choose a few spacecraft orbit files. Try Wind, Polar, Geotail, and ACE, for example. Shift clicking in the open dialogue will select a range of files, and control-click allows the selection of multiple, noncontiguous files (for MS Windows, other operating systems have other (but similar) key combinations)
4. You may select an overall time range (min and max—shorter data sets will simply load what is available), ranges for particular data sets, or simply take the default, which gives the entire data sets.

Method using remotely-stored files:
2a. Click "Add Remote File(s)…"
3a. Change the selected Web Service to "SSCWeb.gsfc.nasa.gov" and press "Open Connection". Click and select a spacecraft of interest. Under MS Windows, you can select a range of S/C by shift-clicking, or several individual ones by control-clicking. Other operating systems have other, but similar, key-click combinations.
3b Enter a time range in the provided boxes. The default is the Bastille Day storm of 2000.
4a. Click "Retrieve Data" to get the data. Note that if data is not available for any of the specified S/C, it will be omitted in the confirmation dialog.
4b. Close the "Open Remote" dialog after the file transfer completes.

5. Click the "Load New" button. Various progress bars will indicate the sets are being loaded.

6. When the data are loaded, dismiss the Resource Toolkit with the X button in the upper right corner of the window. Make sure "static glyph coloring" is chosen in the Properties Mapper ("MAP") panel. You should see labels on the Range Controller that indicate which spacecraft is which color; if not, expand the Range Controller vertically.
7. Enable orbit plotting by clicking on the "Orbit" tab of the Properties Mapper ("MAP" on the toolbar), then clicking the "Enable" checkbox. The display should show the orbit path of each spacecraft for the time range selected. Experiment with scrolling in time. You may change the glyph size using the Properties Mapper panel to a small value to effectively remove the glyphs and show only the orbit plotting lines.
8. Rotate (left button), zoom (middle button) and pan (right button) to get the glyphs and magnetospheric surfaces in view. Shift-click on a glyph to make it the center of rotation. Home on the toolbar returns the view and rotation point to the original.
9. Use the Range Controller ("RNG" on the toolbar) to limit the time interval displayed to, say, about a month.
10. Add another spacecraft by using the Resource Toolkit and selecting, say, SOHO.
11. At this point, you should be able to select spacecraft and time intervals of interest to you to determine configurations useful for particular studies. Some fun things to do are to watch the highly unusual orbit of Wind using the Animation Panel ("ANIM" on the toolbar) for animation and the initial phase of the Cluster mission in which the four spacecraft gradually attain common orbits. The orbits of 27 spacecraft, including near Earth and geosynchronous, for April 2002 (during which a CDAW storm occurred) are also provided.
12. To obtain other SSC orbits manually (as opposed to using the built-in remote repository browsing capabilities), go to the "Locator Tabular" feature of the SSCWeb web site (http://sscweb.gsfc.nasa.gov). Choose a spacecraft and a time range, "CDF" from the optional output units/formatting settings, "GSE x,y,z" (column 1) and "Time" (last column) from the required output options settings, and then choose to download the data and wait for output. (No other settings matter for this purpose.) The file to be retrieved should eventually appear on your screen, but if not, go to /sscweb.gsfc.nasa.gov/query_output and check for the file according to the spacecraft name and download date. Download to your machine using the browser's "Download link to disk."
13. The magnetospheric bow shock and magnetopause are controlled using the Options Panel ("OPT" on the toolbar) and choosing the "Surfaces" tab. A parameter for the solar wind pressure (default around 2) controls the location of the surfaces. Fairly self-explanatory options are available to change the color and transparency of the surfaces.

"COHO" Interplanetary Hour-Averaged Data

All the hour-averaged data in a fairly recent version of the NSSDC's COHOWeb are available for download, along with many parameters from the OMNIWeb for 1AU data in the solar wind near Earth. The orbits and data may be viewed for many spacecraft at once. For details on some of the instructions, see the previous example.

1. Set the "max glyphs" in the Properties Mapper ("MAP" on toolbar) panel to 200.

2. Use the Resource Toolkit (Folder button on the toolbar) to add a local file. ("Remove all" other datasets if any are loaded). A nice example to start with is Ulysses, so choose it from the Heliospheric folder (if downloaded), accept the default time range, and populate new resources.

Note: it is now possible to retrieve files from remote repositories from within ViSBARD. See "Accessing Remote Repositories" below.

3. Pan, scroll, and zoom; you should be able to see the entire Ulysses orbit out to Jupiter and around the solar poles.
4. You will want to scale the variables in two ways. First, choose the "2-D" tab to the left in the visualization window to see plots of time series. Use the Scaling Panel ("SCAL" on the toolbar) to optimize the range of each variable, making it fit in the full range of the 2-D view. This will optimize the range for colors and sizes in the 3-D view. The 2-D view is also useful for deciding on the range of data to display since it scrolls with the Range Controller. Change back to the 3-D view, and use the Properties Mapper ("MAP" on the toolbar) to scale the overall sizes of the vectors and glyphs. Large glyphs are easy to see, but obscure other things.
5. Change the Range Controller to obtain an interesting interval (e.g., half a year), and scroll in time to watch the changes in the character of the flow and magnetic structure.
6. Choose an interval just past Jupiter (this is not essential) of about 4 days in duration. To obtain a "spatial view" by kinematic projection according to the measured speed and the time interval from the center of the displayed range; use "Apply Projection" from the Scaling Panel ("SCAL" on the toolbar). It can be useful to suppress the velocity (displayed as an arrow by default) by selecting the "Arrow 1" tab in the Properties Mapper ("MAP" on the toolbar) window and setting its "Scale" value to a small size. You can also use this panel to display "Velocity" as color or size of the glyph. It is very useful to use shift-click to change the center of rotation to the region of interest. Increase the resolution by increasing max glyphs or decreasing the range. The displayed and underlying resolution are available by double clicking a point and examining the Information Panel ("PICK" in the toolbar), which also displays specific data. Note that the vector components displayed at present are (x,y,z), but the more useful (R,T,N) will be used in a subsequent version.
7. Choose a max glyphs of about 50, unload the Ulysses data set using the Resource Toolkit, and load two Helios and the OMNI data sets. (You may want to restrict the time interval for OMNI to something like that for Helios.) Select an interval of two or three days, and use the projection to obtain a spatial view. Scroll in time to view the evolution of the spatial structure.

CDAWeb Magnetospheric Examples

CDAWeb data provides physical quantities for a large number of magnetospheric and upstream spacecraft. ViSBARD can read virtually all of these files. It imports them according to a "Resource Description File" (RDF) for each file type. A base set of RDFs are included in the ViSBARD distribution. However, if a file is loaded that an RDF does not exist for, ViSBARD will prompt you to generate a new one. The wizard that follows

allows you to select which variables to import, which units to use, etc. After this is complete, an RDF will be generated and placed in your ViSBARD/settings directory, so that this file type will be recognized in the future.

After the file is loaded, the procedure for displaying data from these files is essentially the same as for COHO files, though there is now the option to directly access CDAWeb from within ViSBARD. See "*Accessing Remote Repositories"* below for more information. Either way, the same procedure of setting max glyphs, adding resources, populating the datasets, scaling and changing the representation, and saving ASCII sets remains the same as before. The background will now, however, be that of the Earth and the reference magnetospheric surfaces. We have added many of the RDFs very recently, and will work to add more (see below). We have included data for a number of spacecraft from around the time of the "Bastille Day" event in the Magnetospheric set of files; not all the datasets we had hoped were available, but there should be enough to give you the idea of what can be done. The "Combine" feature was used to make an integrated plasma/magnetic field dataset, recognizable by its .vba extension, for each case in which this was possible. This may be loaded as a single file resource. You may retrieve CDF files of the same sorts as those found here from the NSSDC (http://cdaweb.gsfc.nasa.gov) to view other intervals.

Accessing Remote Repositories

As mentioned above, ViSBARD can now access remote repositories directly. At the time of this writing, CDAWeb, SSCWeb, and the VSPO are accessible.

To access this functionality, open the "Resource Loading Toolkit" (tan folder on the toolbar), and click "Add Remote File(s)…" Select the web service of interest. For this example, let's choose "CDAWeb.gsfc.nasa.gov" and click "Open Connection." A list of available spacecraft should show up on the left side; green ones are recognized by an RDF, red ones are not. To show only the S/C that ViSBARD recognizes, click the "Show Recognized" button. This is somewhat moot, as a new feature now exists to import data with relative ease that is not recognized.

From there, you can click on the satellite of interest, which will then bring up a list of its available instruments. Select the one of interest, then enter the desired time range in the format given.

Once this is done, click "Retrieve Data" to query the server and look for the data. It will give you an error message if the given time is not found. Otherwise, it will provide you with a list of proposed files to download, which you may accept or decline. By default, these files are placed in a temporary directory on your system, but can be manually specified from within the Options Panel (OPT) under "Local Dir for Remote Files." Don't forget to File|Save Settings after you change this so that ViSBARD remembers your preferences the next time you start it.

You may then close the "Open Remote File(s)" panel, and finally load the data into ViSBARD's active state by clicking "Load New."

Close the Resource Toolkit and -- Voila! The data should now be available for your analysis and is treated like locally stored data.

Resource Description Files

You can use your own data in ViSBARD stored in ASCII or CDF files. We have included "Resource Description Files" or RDFs (plain text XML files located in the Settings folder) for some instruments on a number of spacecraft. These tell ViSBARD how to interpret files of a particular kind. Earlier versions of ViSBARD required that a user create his/her own RDF for unknown data types, but a recent feature addition automates this process for CDF files to a large degree. An auto-RDF-generation wizard appears when an unrecognized file is loaded. If this completes successfully, an RDF is added to the ViSBARD/settings folder, so that the CDF file type will be recognized from that point forward.

Therefore, it should not be necessary to examine or modify the RDF contents (for CDF files, at least), but you may do so if desired. The structure of the file is fairly self-explanatory. The proper RDF is determined first by its extension (.dat for ASCII, .cdf for CDF, and .vba for ViSBARD ASCII) and then by particular keywords that identify, e.g., a unique type of CDF file. The RDFs specify which variables from the file are to be loaded, which variables are in each column for .dat files; .vba (ViSBARD ASCII) files contain simple metadata in the structured header. To see the structure, export a data file ("Output" button in Resource Toolkit) and examine the resulting file in a text editor. The above examples use our prepared RDFs; you may wish to make your own later.

Procedure for finding, saving, and converting spacecraft data for use in ViSBARD

This section describes how to load CDF data, select variables of interest, and export them into ViSBARD ASCII (VBA) files. If you would simply like to load data to browse, see the above sections.

1. Retrieve CDAWeb data from within ViSBARD using procedure listed in above section entitled, "Accessing Remote Repositories."

2. Alternatively, go to CDAWeb (http://cdaweb.gsfc.nasa.gov/), choose wanted mission data
    a. Choose wanted spacecraft from Source selector
    b. Choose wanted data from Instrument types
    c. Select which data sets wanted;
    d. Choose wanted time range for data (choose from predefined solar events or submit your own start and stop times)

e. Choose “Download Daily CDFs” under “Select an Activity”, and then “Submit”
f. If desired data is available and displayed on next page, scroll to bottom and click on “Combined CDFs”
g. When the “File Download” window pops up, choose the “Save” option.
h. Leave the “.tar.gz” extension and name the file something understandable for future reference such as “combined_[date]…”; save
i. Once file transfer is done, extract the contents of the tarball to your desired data directory
j. Launch ViSBARD
k. Go to the resource loading toolkit. (File | Resource Loading Toolkit)
l. On the bottom left, select “Add Local File(s)…”
m. Select all like files. For example, go to the folder where you stored your data and select all of the ac_h0_mfi_... files. Make sure that the “Concatenate files into one resource” checkbox is selected. This allows a time series of data that’s stored in separate files to be treated as one resource.
n. Repeat this process with all of your desired data.
o. Once all of your desired data is displayed, choose “Combine Added Resources”
p. Name your new resource something that you will understand later, for example, if you are combining the ACE files, name it “ACE_[date]”
q. Under the time section, click on the gray textbox next to “Data variable”. Select which variable you want to use for time. Usually, choosing the time from the spacecraft’s Magnetic Field (mfi/mag) data turns out to be best, but you can choose differently.
r. Under the location section, click on the gray textbox next to “Variable”. Select which variable you want to use for location. Again, choosing the location from the spacecraft’s Magnetic Field data turns out to be best, but you can choose differently.
s. Add your desired data variables with the “Add” button in the “Data variables” section. Be sure to be consistent with your data variables. In other words, do not add a WIND instrument to an ACE combined file.
t. Click “Create” to finish the process for this S/C.
u. Repeat steps o-t with all desired spacecraft/data

3. Remove all non-combined files by selecting each in the “New Resources (Not Loaded)” section and clicking on “Remove”
4. Select a combined file to output. Select the file and click on “Output to File…”
5. Click on the gray textbox next to “Output file”. Name your file something that you will understand later and be sure to save it into the folder from which all the CDF files came so you can find it later. A recommendation for naming is “[spacecraft name]_[date].vba”. Be sure to add the “.vba” extension manually because your file will not automatically save as a ViSBARD ASCII file.
6. Repeat steps 4-5 with all combined files.
7. Choose “Load new”