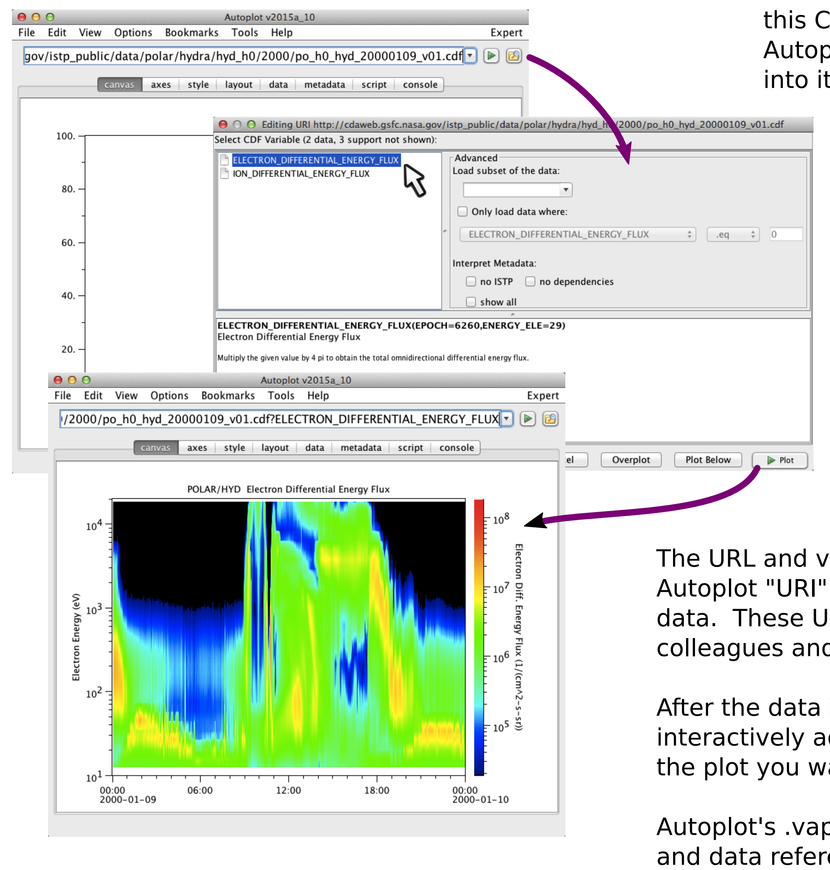
Abstract

Autoplot was introduced in 2008 as an easy-to-use plotting tool for the space physics community. The idea was that data sources would be identified with URIs, and data from these sources would be loaded in and a reasonable rendering of the data would be shown automatically. The scientist could then easily adjust plot axes and navigate the data. URIs would point to data files served on web sites, and Autoplot manages the download and freshness of the files. Data from different sources is easily integrated onto one page, and configurations are saved as ".vap" files. The scientist can then easily communicate with others by sending URIs and attaching .vap files.

Autoplot is used widely on many missions, and its set of features has grown as well. Autoplot's scripting is used by many students and workgroups to provide an alternate to IDL and Matlab which makes loading data and producing graphics trivial, and allowing the scientists to focus on the data. Autoplot has plug-ins that allow it to grab data directly from the CDAWeb and from the PDS/PPI Node, providing a more abstract facility for discovering data. Last, Autoplot has been used widely on the Van Allen Probes and Juno missions, and its use there is shown.

Looking at a CDF file, the basic idea

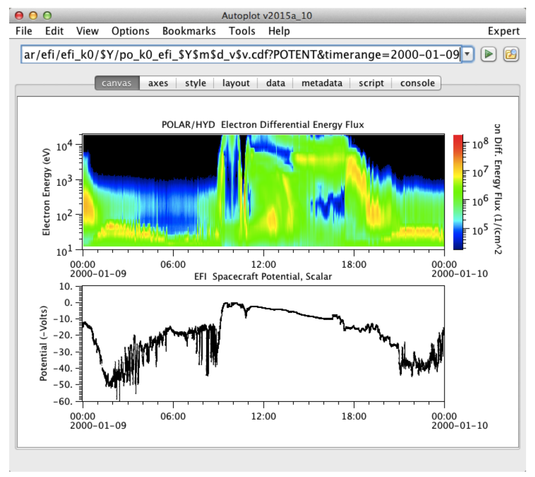


A CDF file name is entered, and an editor pops up to get the needed variable name. Note this CDF file name is a URL, and Autoplot will download the file into its cache automatically.

The URL and variable name form an Autoplot "URI" which refers to specific data. These URIs can be shared with colleagues and used in software.

After the data is loaded, you can interactively adjust axes and labels to get the plot you want.

Autoplot's .vap files store canvas layout and data references.



A URI can be an "aggregation" as well, which is a template for generating file names, using $Y for year, $m for month, etc. $v will use the best file version found.

This means:
- old datasets are accessible without new code
- anyone can publish data without a special server

See http://tsds.org/uri_templates for a full description of templates supported.

The button "Plot Below" is used to build stacks of plots, and the layout tab is used to more finely control the plot layout.

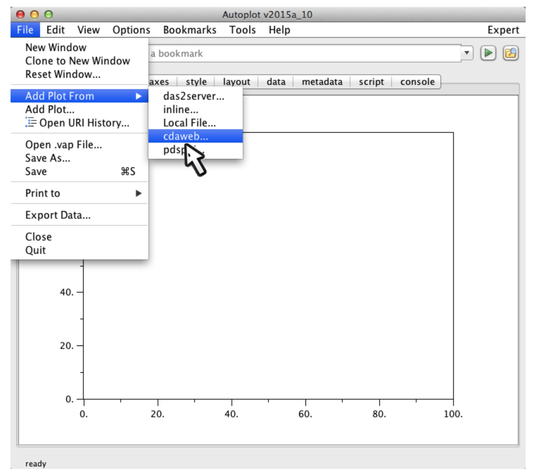
Autoplot reads data from many file formats:
- ASCII files, with full support for CSV files
- CDF files, the Common Data Format used in terrestrial space physics
- HDF5 and NetCDF files, used in earth sciences
- Binary tables, FITS files, Excel, .wav files, Cluster Exchange Format

Autoplot was designed with plug-in software modules and a mature and proven uniform data model, QDataSet.

Note CDF files carry all sorts of useful metadata along with the data, so Autoplot can effectively label axes, report units, describe caveats, and identify data providers.

Getting data from the CDAWeb

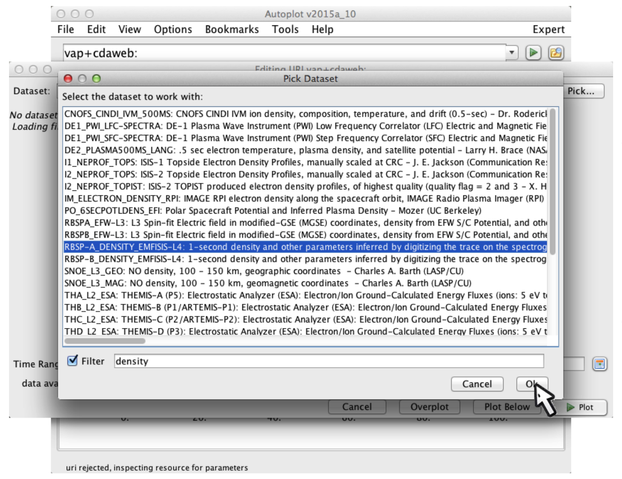
Though Autoplot can pick up a file and use it, it can also communicate with data servers, like the CDAWeb at NASA/Goddard. These sources allow data to be "discovered."



File→Add Plot From... shows the data sources that allow discovery.

das2server is a homebrew server at U. Iowa; inline allows short code snippets for data "mashing"; pdsppi is described later.

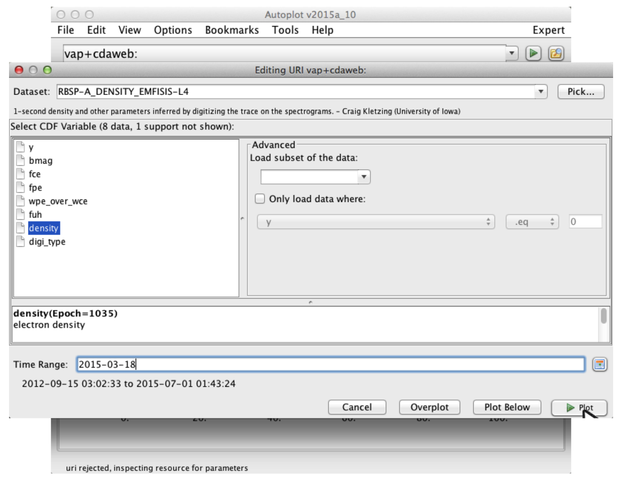
CDAWeb brings up the CDAWeb editor panel.



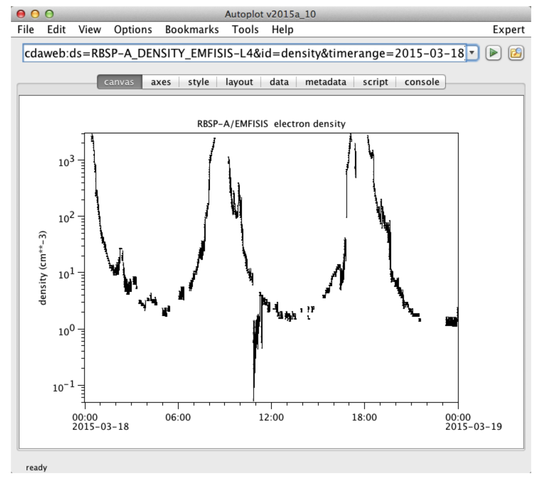
The panel shows a list of the data sets available. Each of these represent one type of CDF file.

A filter is provided to search on mission, PI name, or free text.

Here "density" constrains the search and we find the density product for RBSP-A (a.k.a. Van Allen Probes)



One of the files is downloaded, and the parameters found within the file are displayed.



The CDF file for the time requested is downloaded, and parameter displayed. Additional data will be loaded as the time axis is adjusted.

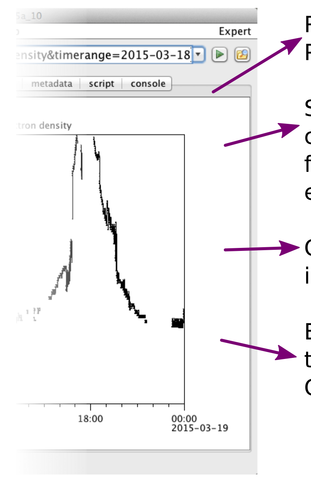
You can re-enter the editor panel with the inspect-folder icon, and add additional parameters below.

Starting Autoplot

Autoplot is a Java application that uses Oracle's Java Webstart to provide click-to-launch functionality. Many people have found it easier to just download a single .jar file and launch that instead. Go to autoplot.org to get new releases. Autoplot is free and GPL)

Output from Autoplot

Data can be output in many ways



Render canvas to SVG, PNG and PDF

Save canvas configuration to a .vap file, data can be embedded within

Copy and Paste image into email or PowerPoint

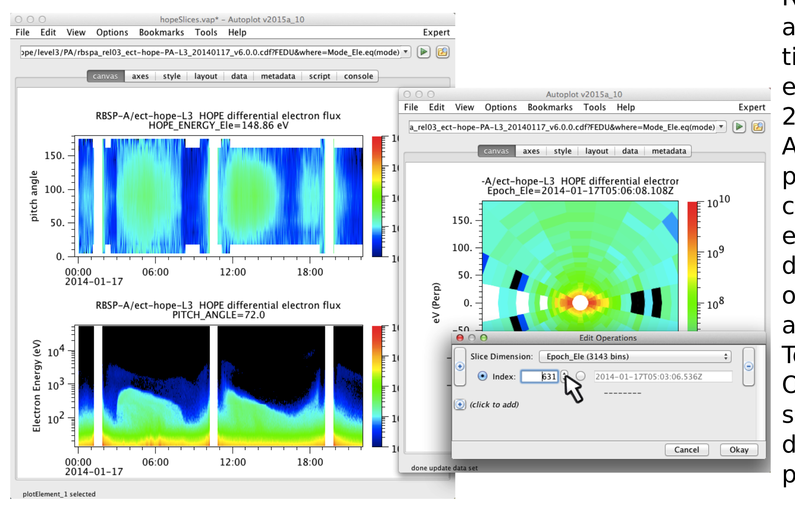
Export Data to ASCII table, Excel Spreadsheet, CDF files

Autoplot works on Java web servers like Tomcat for server-side rendering to thin clients, and an example server is available.

Reading data into Matlab or IDL

Plotting from IDL

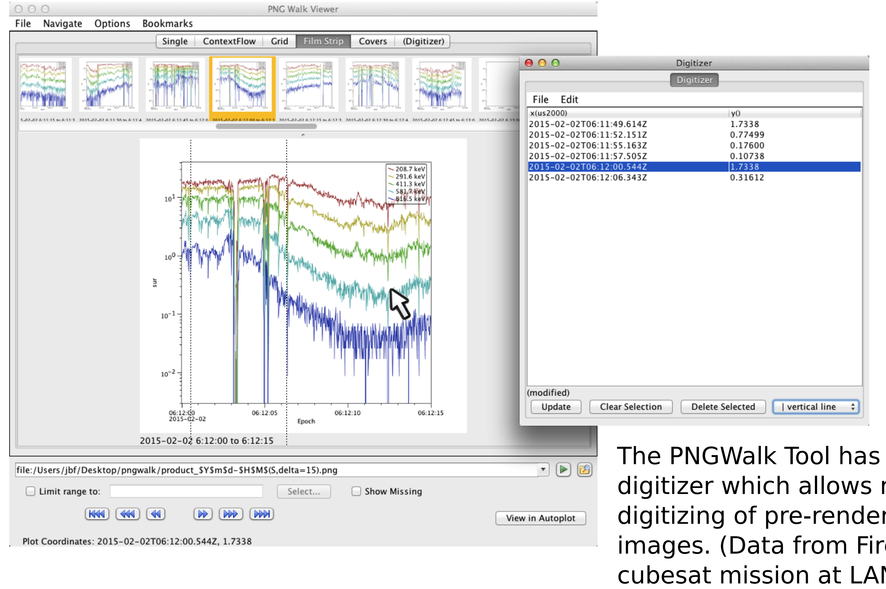
Slicing and Dicing data



RBSP/ECT HOPE data is a "qube" of data in time, pitch angle, and energy. Autoplot shows 2-D slices of the data. A user interface is provides interactive controls to allow exploration of the data. Other data operations are available as well (via Tools→Additional Operations), such as smoothing and detrending data, and performing FFTs.

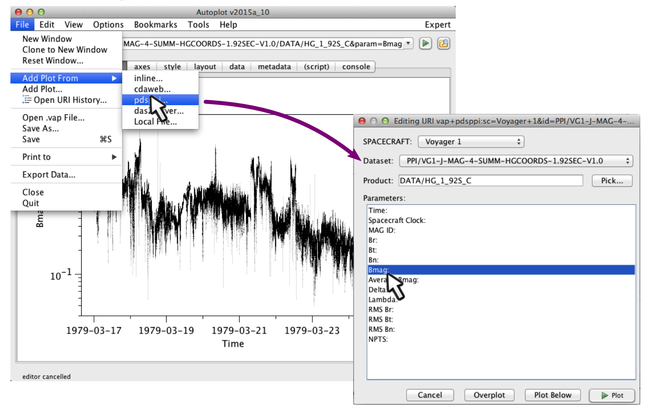
PNG Walks

The PNGWalk tool lets you quickly browse pre-generated PNG walks of your data. Autoplot easily generates PNG walks as well, and inserts "Rich PNG" metadata so axis labels and plot cordinates are available later. http://autoplot.org/richPng talks about this more, and the hope is more data systems will adopt this metadata in thier output.



The PNGWalk Tool has a built-in digitizer which allows rapid digitizing of pre-rendered png images. (Data from Firebird cubesat mission at LANL)

Getting data from PDS/PPI

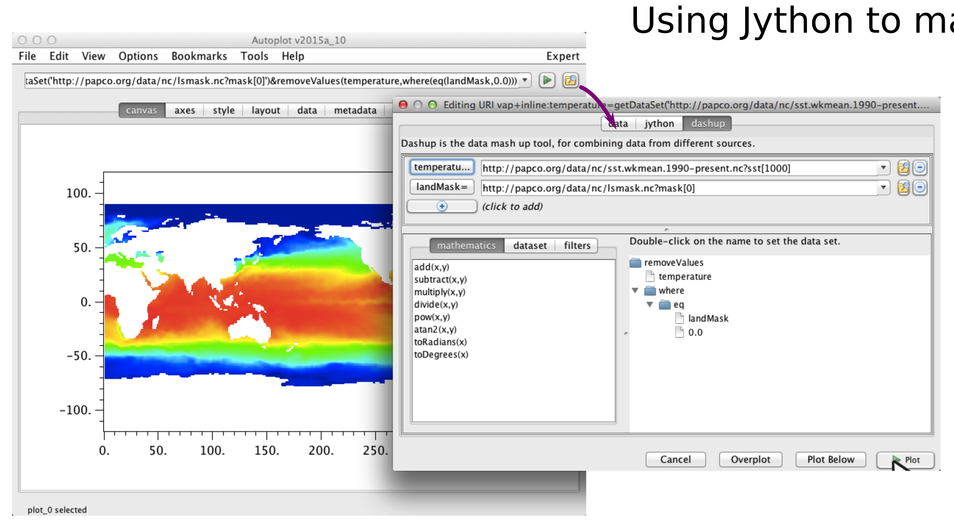


This uses the DITDOS web interface to browse and retrieve data. Data is sent over in VOSPASE tables.

This makes for a nice study of PDS and CDF, and shows where CDF's more rigid structure allows systems like Autoplot to better access to the data.

Still a work in progress, but it will be able to read data and provide the same functionality as other data sources.

Using Jython to mash data



Coming soon is a data mashup GUI (above), where Autoplot can load data from several sources and combine them using any of the scripting functions. Presently an Autoplot script (a text file containing Python code) is used for this:

```
script
Execute  Stop  Save As...  Open...  New  Data Source Context
1 temperature=getDataSet('http://papco.org/data/nc/sst.wkmean.1990-present.nc?sst[1000]')
2 landMask=getDataSet('http://papco.org/data/nc/lsmask.nc?mask[0]')
3 result= removeValues(temperature,where(eq(landMask,0.0)))
4
/home/jbf/public_html/autoplot/agu2015/mash.jyds
4,1
```

George's script to do science analysis

Autoplot is intended to be a simple tool providing easy access to data. As it has matured with RBSP (Van Allen Probes) and other missions, more advanced features like scripting are being used for other business functions needed in research. These are quickly maturing, and should be useful to many in the coming years.

More information about Autoplot at http://autoplot.org.

Also a community discussion group answering questions and announcing new releases and functionality is at https://groups.google.com/forum/#!forum/autoplot