SPEDAS Tutorial

GEM 2017, Portsmouth VA

Agenda

SPEDAS Tutorial

Opening remarks

SPEDAS development status
New features, plugins, and tools

Live demo: typical workflows, most used features

Q&A, discussion

Space Physics Environment Data Analysis Software (SPEDAS)

- Grass-roots data analysis software for Space Physics Community
- SPEDAS is an outgrowth of THEMIS / ARTEMIS code that has been extended to support multiple missions
- Standardizes retrieval of data from distributed repositories
- Science processing and graphics contain powerful set of legacy routines.
- The THEMIS mission is now served through the TDAS plugin

The SPEDAS framework:

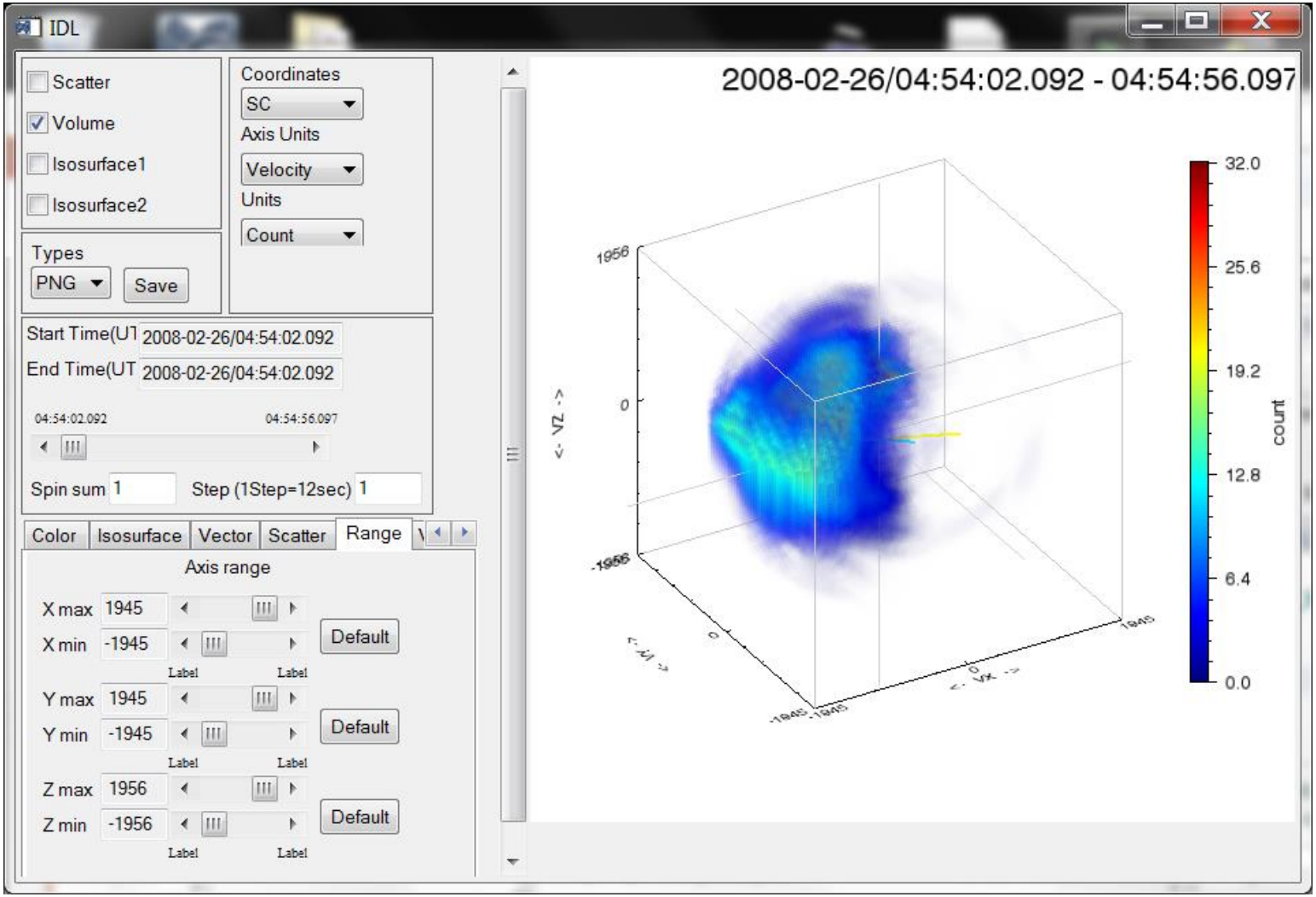
- Contains a GUI for ease of use (available through IDL VM freeware)
- Command line provides full access to IDL (paid license only)
- Works with Windows, Linux and Mac OS X.
- Is based on IDL, benefiting from platform independence and software maintenance services.

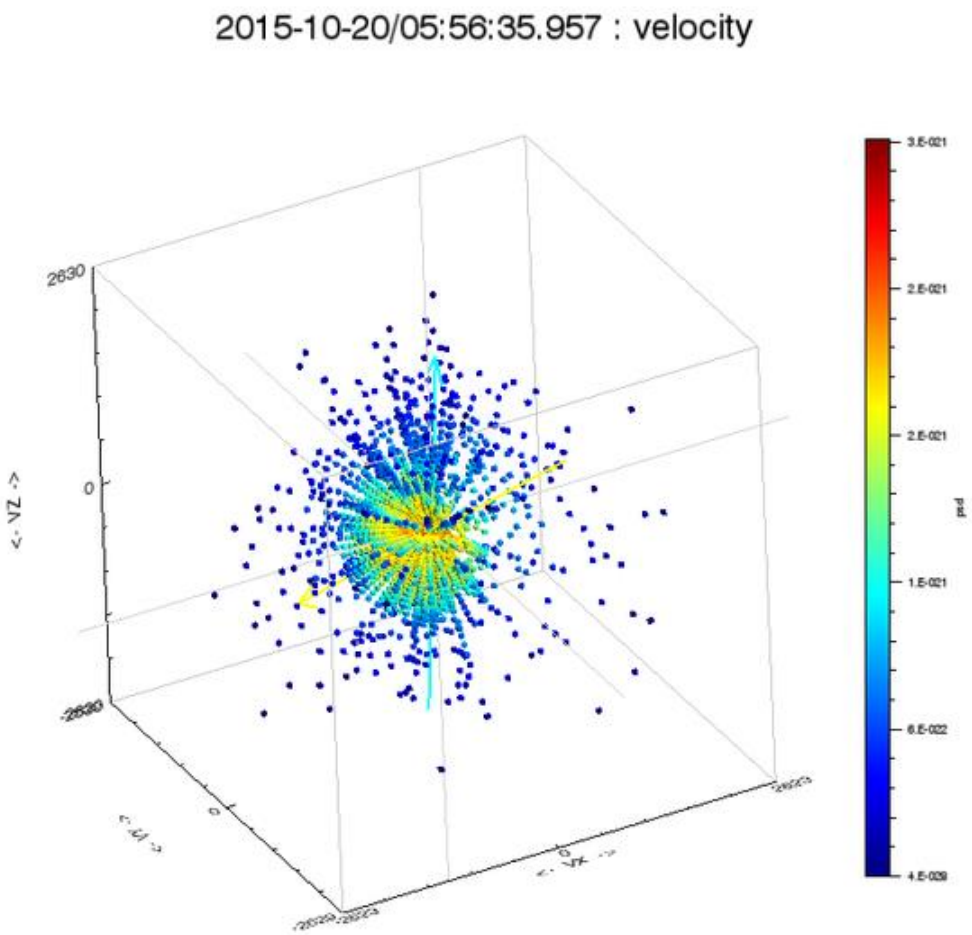
- What is the current status of SPEDAS development?
  - SPEDAS 2.00 (final) was released in June 2017
  - SPEDAS 2.00 includes the new ISEE 3D tool for visualizing particle distributions
  - SPEDAS 2.00 now supports the new Heliophysics API
  - Many load routines have been updated to work with data sources that enforce HTTPS-only downloads (e.g. CDAWeb, NOAA, LASP, etc)
  - The THEMIS, MMS, ERG, IUGONET, and BARREL plugins have been updated with the latest code from each development group.
  - SPEDAS 2.00 includes GUI tools for loading data for any mission supported by CDAWEB; support for loading various geomagnetic indices, and an interface to the GEOPACK magnetic field modelling library.

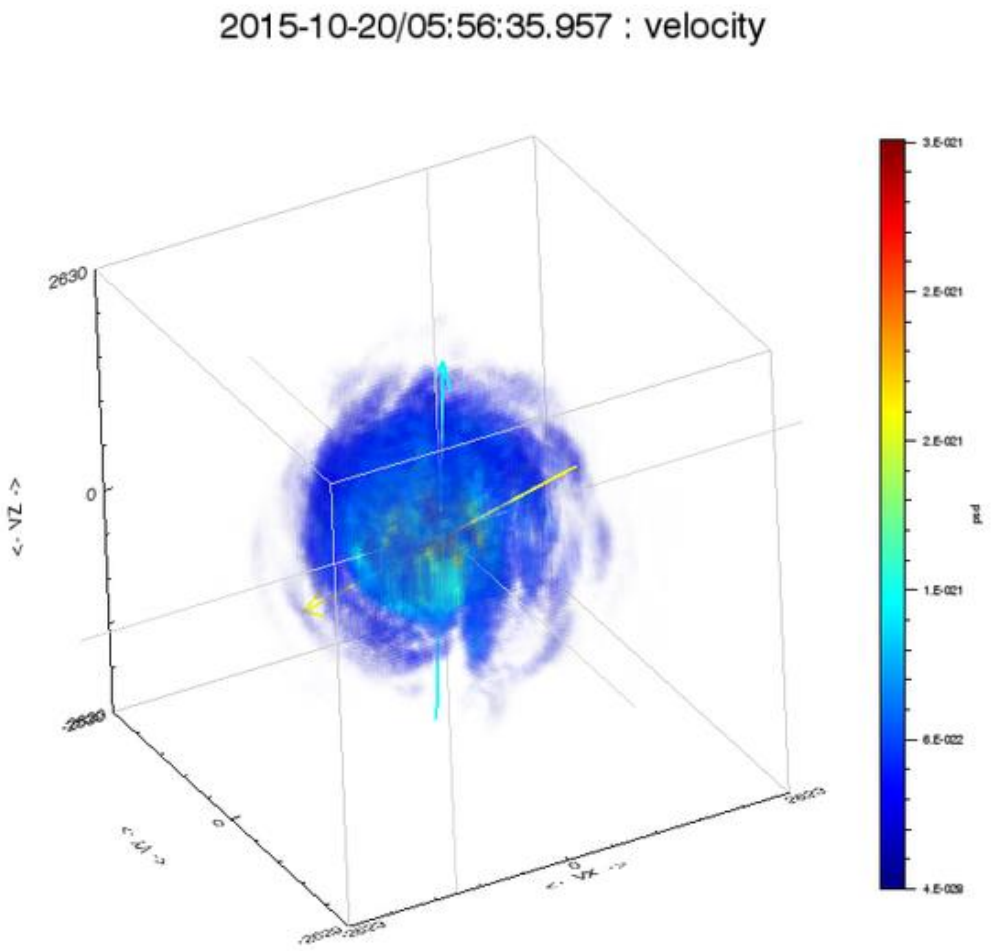
- The interface between plugins and the SPEDAS GUI has been simplified. Formerly, each feature (e.g. the “Load Data” panel, the “Configuration Settings” panel, the “Plugins” menu) required a separate configuration file, with information about all plugins that use that feature. So adding a new plugin required manual edits to several files, which doesn’t scale well as additional “hooks” are added to SPEDAS. The new system uses a single configuration file per plugin, so that installing a plugin is more of a “drag and drop” operation.

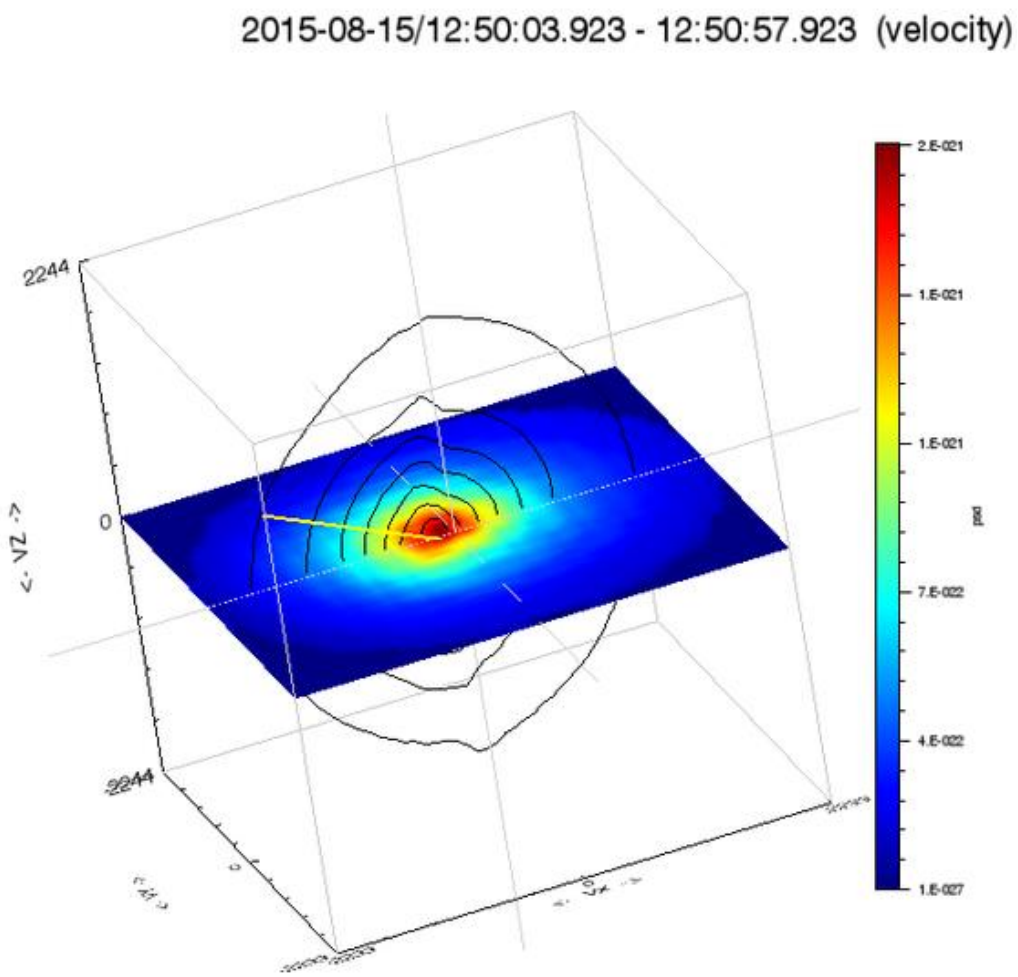
- Before SPEDAS 2.00, the “Data Analysis” panel was somewhat specific to THEMIS (especially regarding the set of coordinate transforms supported). We have generalized this panel so that each plugin can use this interface to expose their preferred set of coordinate transforms and other tools.

ISEE 3D settings panel (using THEMIS data)




2015-10-20/05:56:35.957 : velocity
2630
0
-2630
<- VZ ->
<- VY ->
<- VX ->
3.E-021
2.E-021
2.E-021
1.E-021
6.E-022
4.E-039
psd


2015-10-20/05:56:35.957 : velocity
2630
0
-2630
<- VZ ->
<- VY ->
<- VX ->
3.E-021
2.E-021
2.E-021
1.E-021
6.E-022
4.E-029
psd

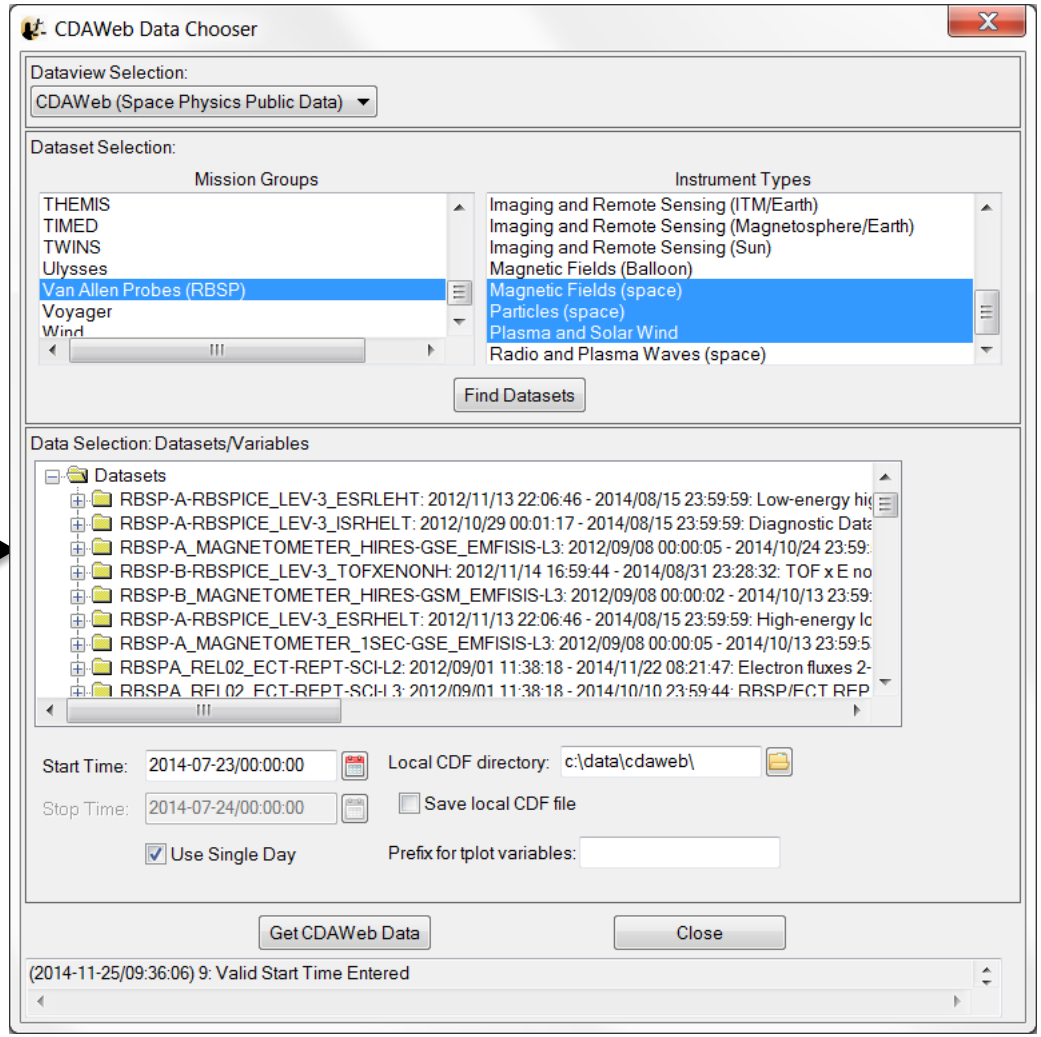

2015-08-15/12:50:03.923 - 12:50:57.923 (velocity)
2244
0
<- VZ ->
2244
0
<- VY ->
0
<- VX ->
2.E-021
1.E-021
1.E-021
7.E-022
4.E-022
1.E-027
[cm]

Loading CDAWeb Data

To Load **CDAWeb Data**:

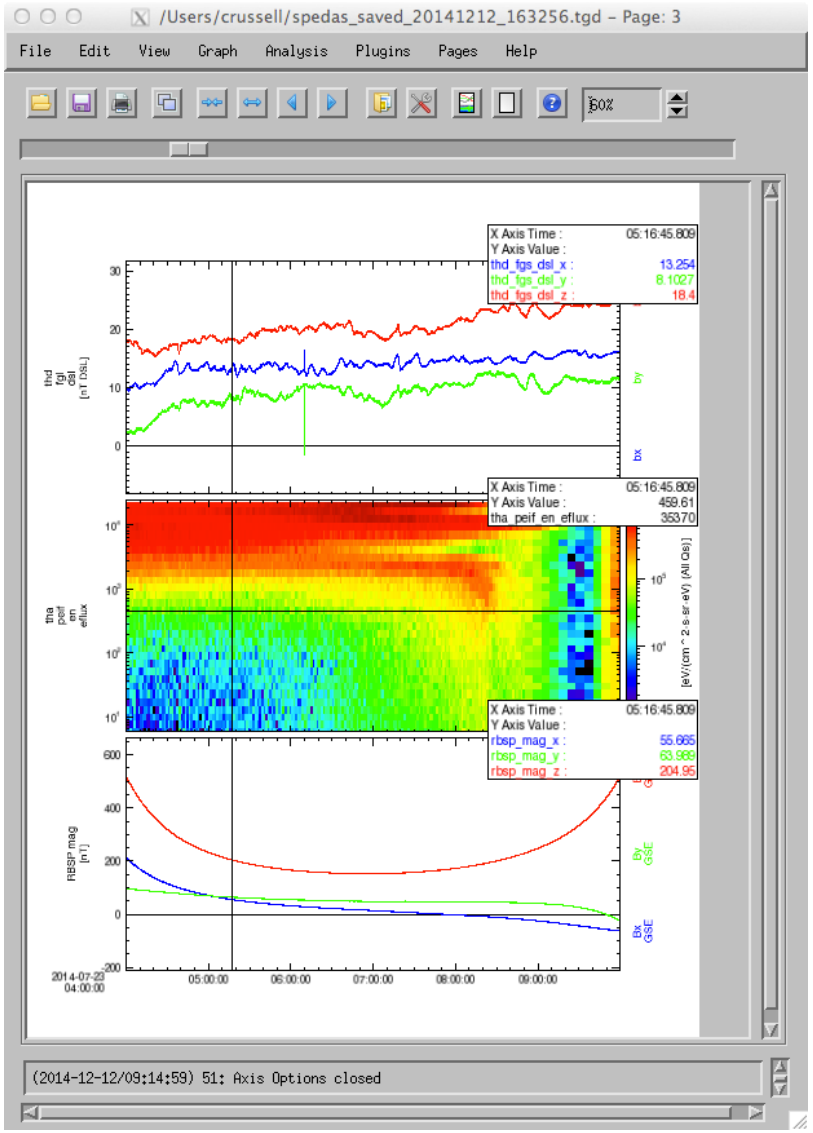
-Select 'Load Data using CDAWeb' under the File menu

- Select Mission Group (i.e., TWINS, Cluster, RBSP, etc.)
- Select the Instrument Type
- Click 'Find Datasets'
- Select variable or dataset to download
- Click 'Get CDAWeb Data'



THEMIS and RBSP Plots

- With a few clicks of the button the user can load, analyze, and plot data.
- Interactive Capabilities



SPEDAS Mini Language

- Simple scripting language has been written in IDL.
- This language allows access to some data analysis functionality in the IDL virtual machine and eases manipulations of time series (tplot) data
- This language allows composition of statements and functions with order of operations to give significant flexibility in statement construction

Examples:

1: Position to RE:

calc,'"tha_pos_re" = "tha_state_pos"/6374.4'

2: Natural log of total esa density:

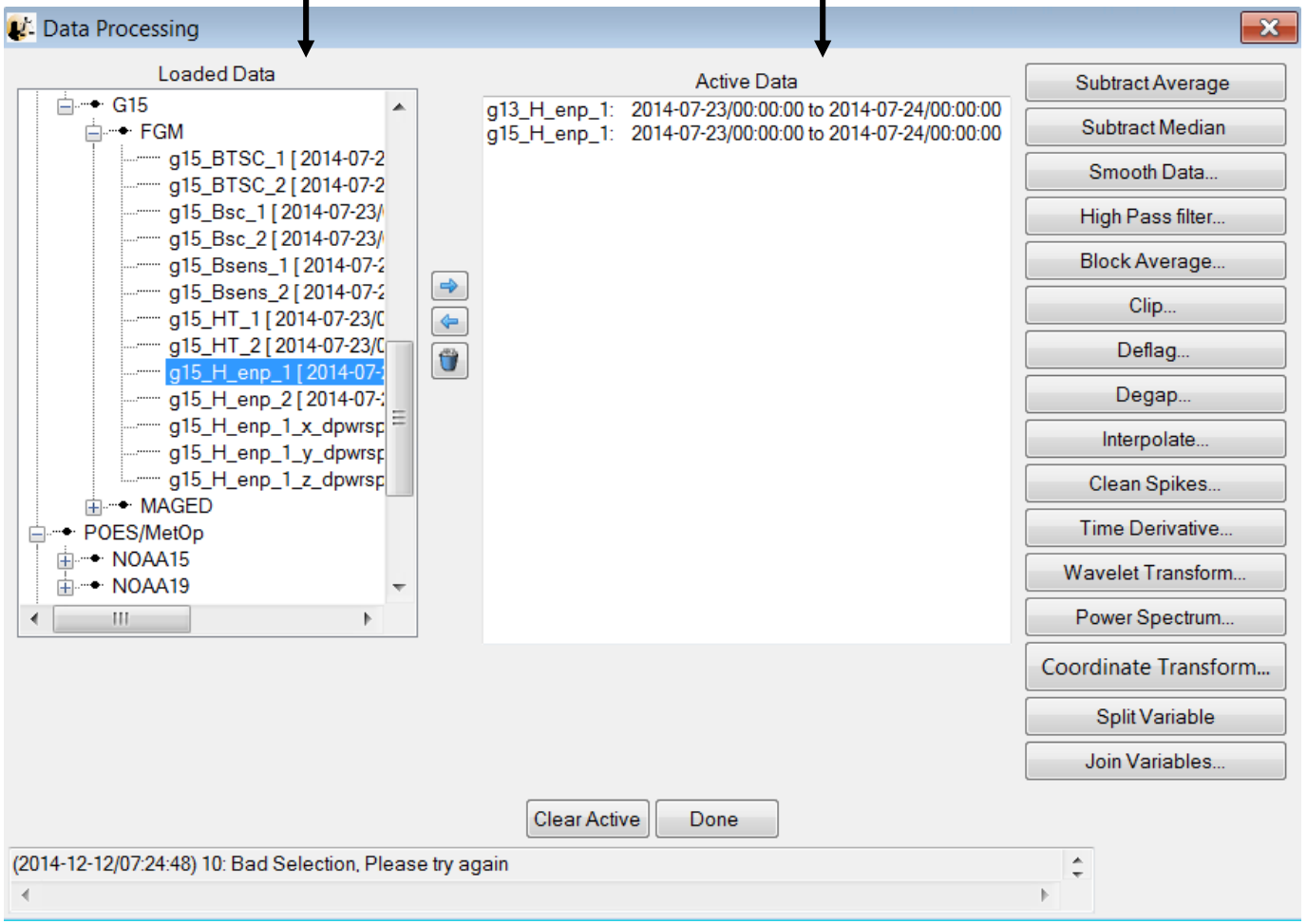
calc,'"tha_density_log"
=ln("tha_peir_density"+"tha_psif_density")

3: Average magnetic pressure:

calc,'Pb_avg = mean(0.01*total("tha_fgs_dsl"^2,2)/25.132741)'

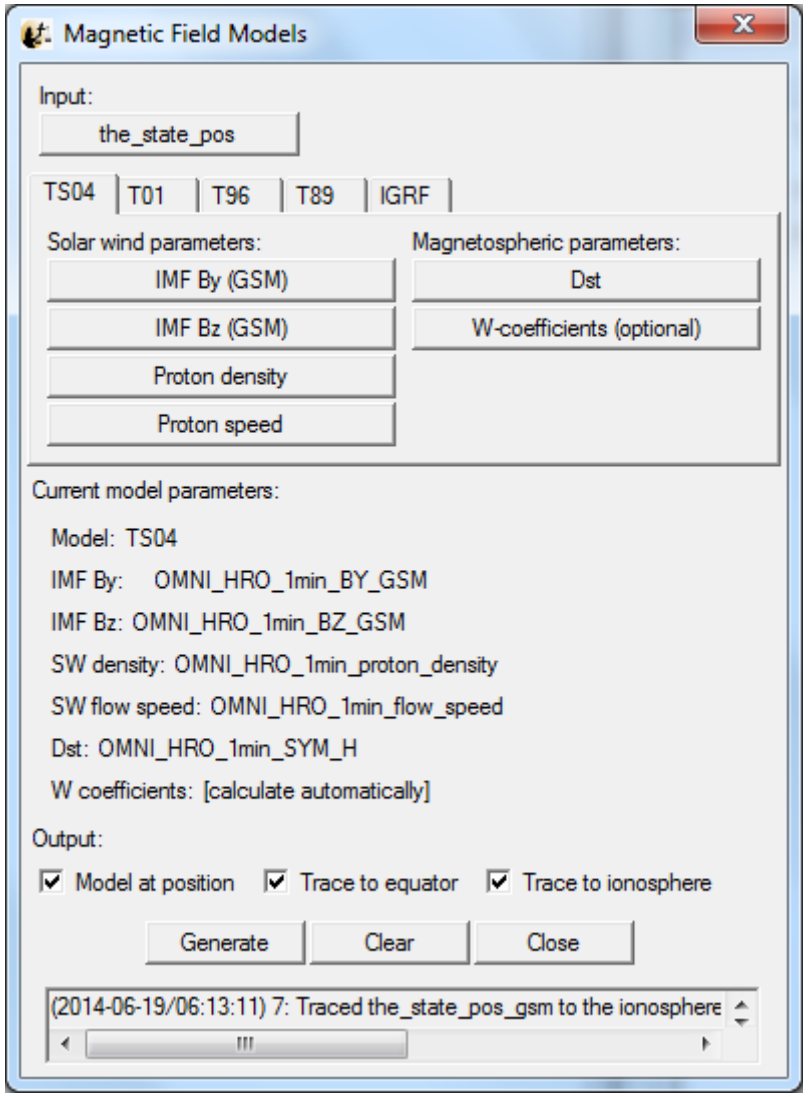
Additional examples can be found in general/examples/crib_calc.pro

Data Analysis

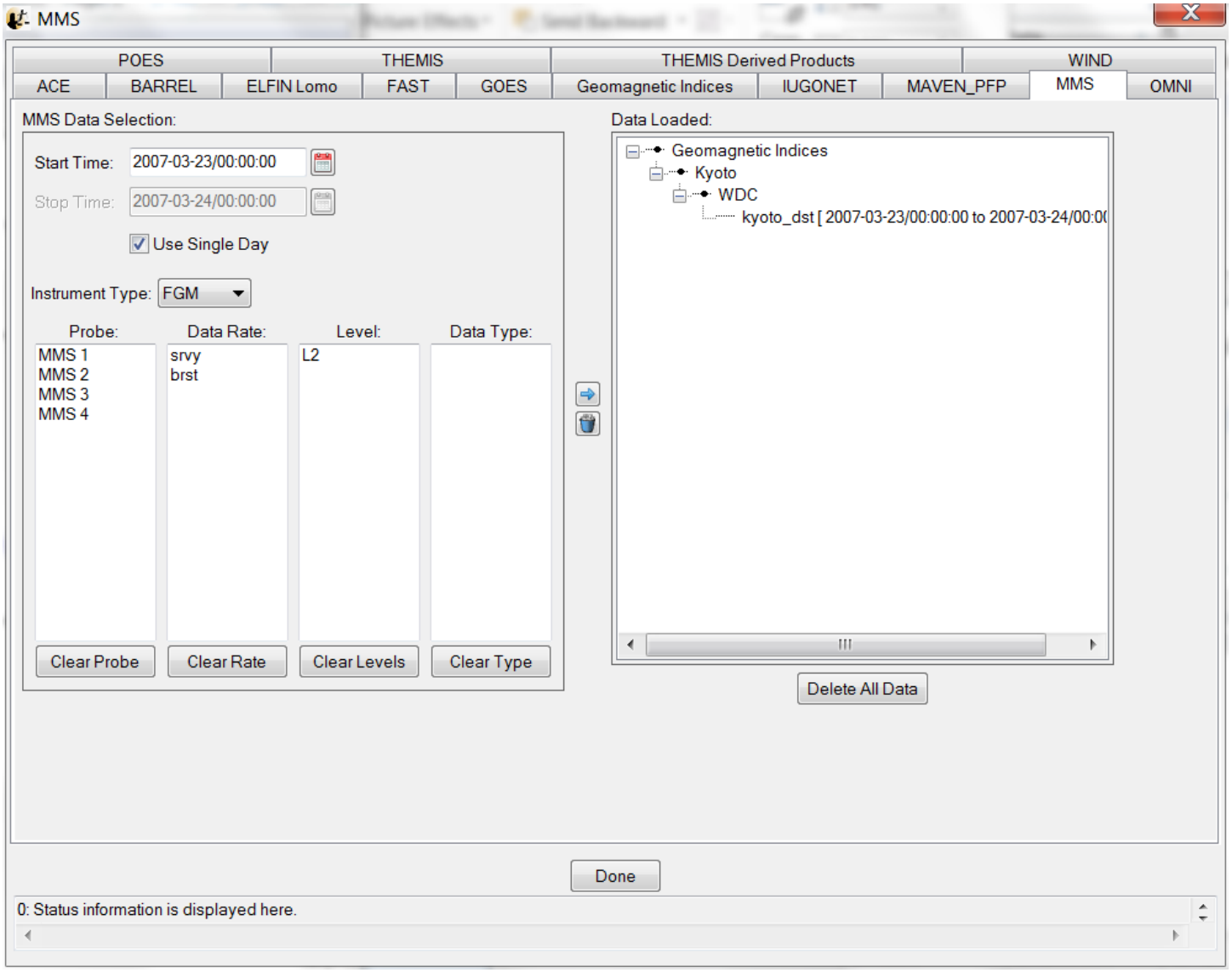


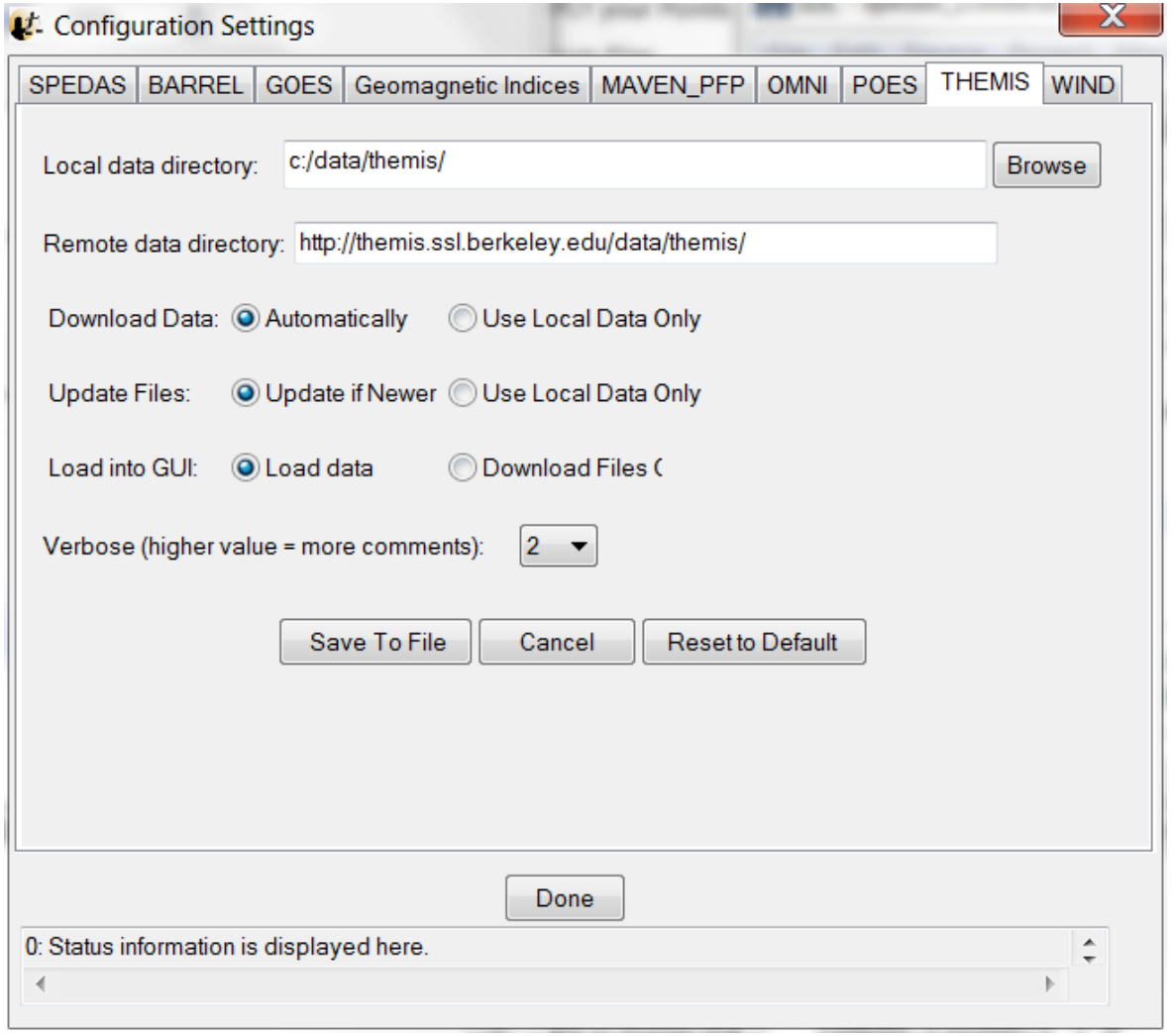
Magnetic Field Models

The GUI is now able to:
- Model the field at the spacecraft position
- Trace field from position to the ionosphere and equator



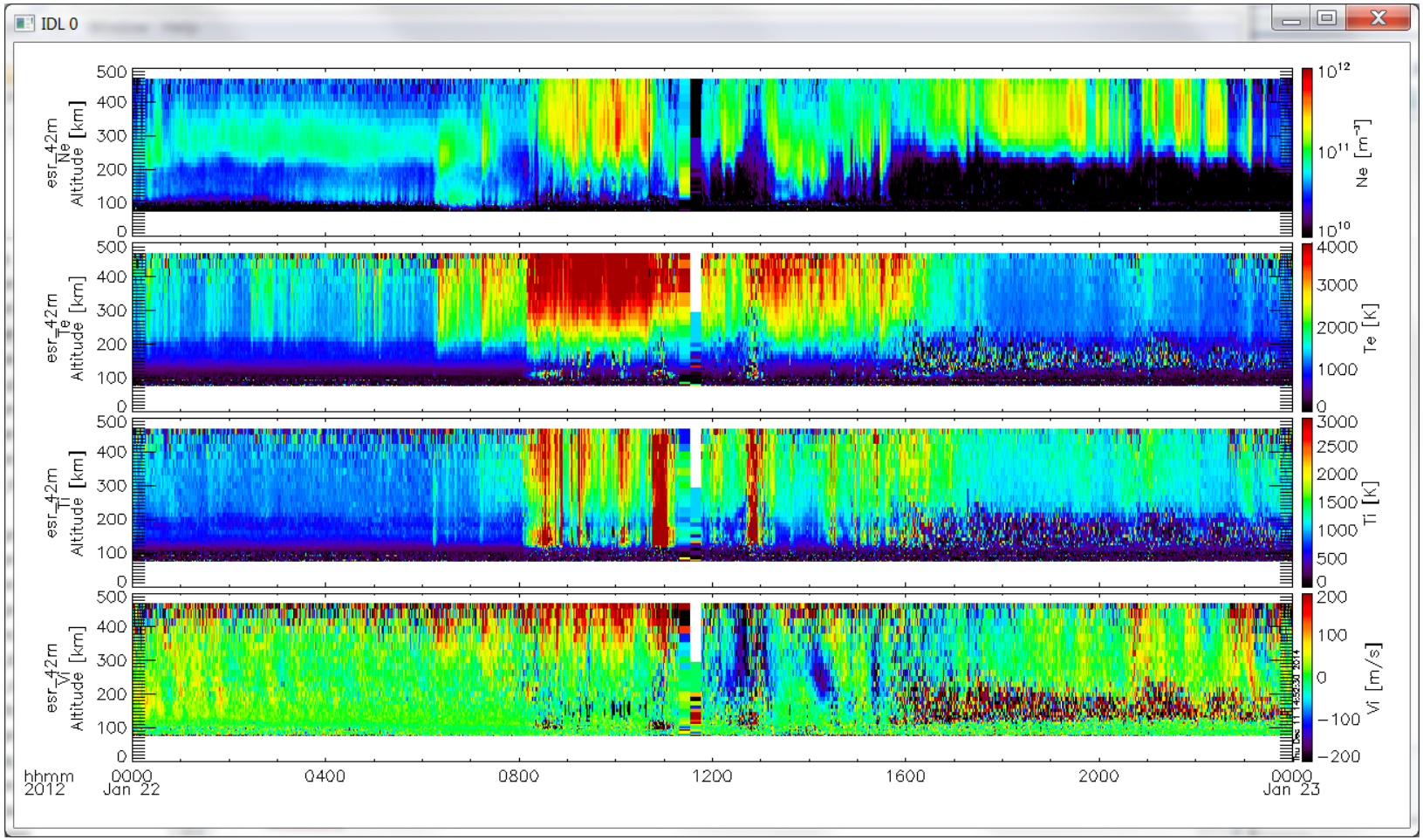
Load Data panel (MMS plugin tab)




Configuration Settings
SPEDAS
BARREL
GOES
Geomagnetic Indices
MAVEN_PFP
OMNI
POES
THEMIS
WIND
Local data directory:
c:/data/themis/
Browse
Remote data directory:
http://themis.ssl.berkeley.edu/data/themis/
Download Data:
Automatically
Use Local Data Only
Update Files:
Update if Newer
Use Local Data Only
Load into GUI:
Load data
Download Files (
Verbose (higher value = more comments):
2
Save To File
Cancel
Reset to Default
Done
0: Status information is displayed here.

IUGONET, OMNI, Field Data

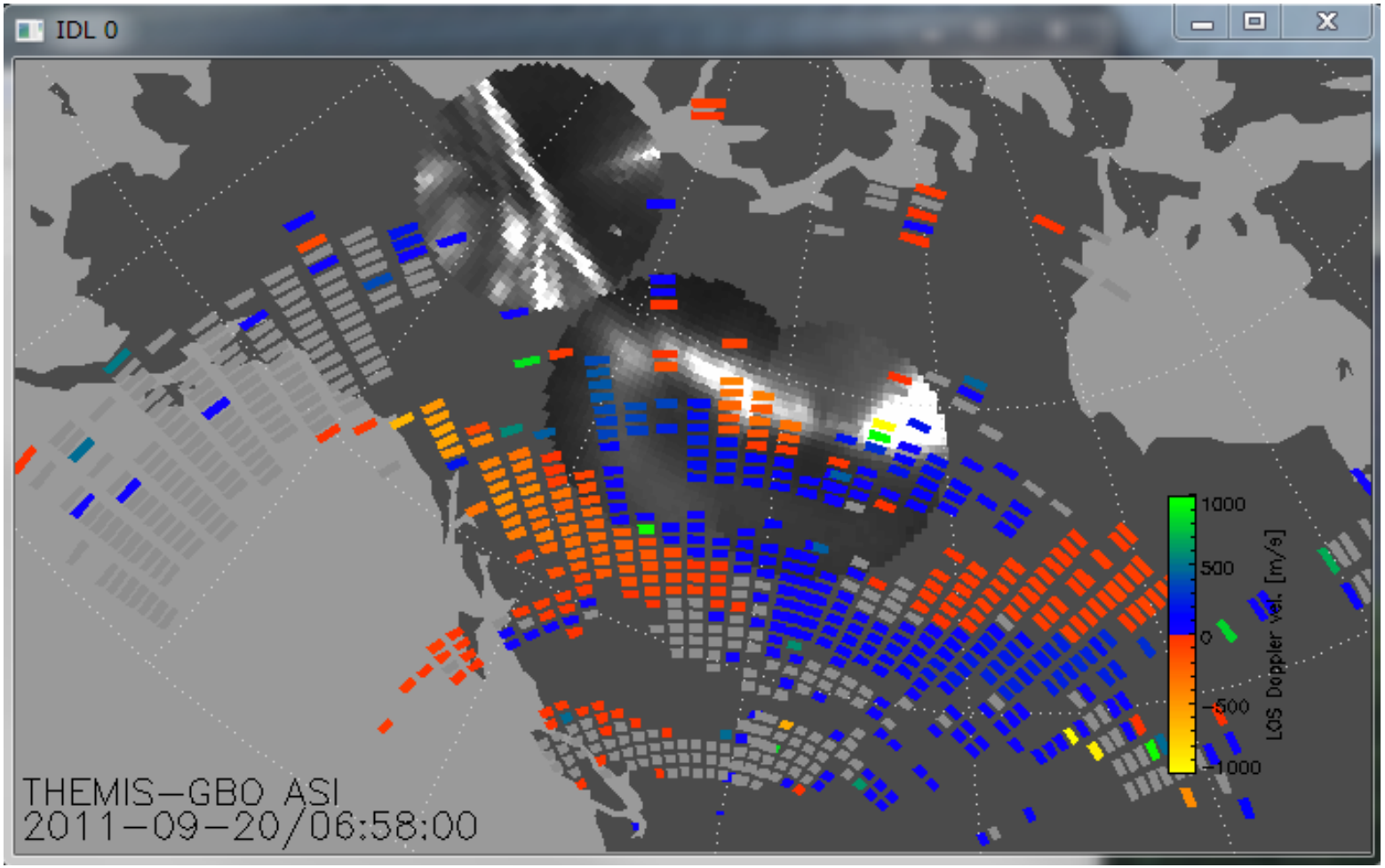
crib_iugonet_20120122sc.pro



Yoshimasa Tanaka

THEMIS ASI / SuperDarn Radar

→ erg-sc_crib_thmasi_sd_sample



Tomo Hori

- SPEDAS Development Roadmap
  - SPEDAS 2.00 was released in June 2017
  - It includes the latest versions of the THEMIS, MMS, IUGONET, ERG, and BARREL plugins.
  - Future SPEDAS versions will include expanded support (including a GUI panel) for downloading via the new Heliophysics API
  - Our QA procedures, release schedule, and set of deliverables need a bit more flexibility to keep up with new plugins as they are released or updated.
  - In future releases, we hope to expand the scope of some mission-specific tools (for example, particle moments, 2-D and 3-D visualization tools, spectrograms, pitch angle distributions) to more generic solutions that can be applied to multiple missions.
  - We continue to work closely with other projects, to support integrating their software tools into SPEDAS as plugins or core capabilities.
  - We plan to include support for additional missions and data sets: ICON, GOLD, DSCOVR, LANL-GEO
  - We are looking into the possibility of porting some SPEDAS capabilities to Python

- SPEDAS Development Roadmap
  - Currently, all crash reports and help requests are routed to the THEMIS science support address, even if the crash or problem occurs in some other plugin. Future releases should allow each plugin to define its own error handlers and reporting policy.
  - We have conducted several WebEx tutorial sessions covering various capabilities of the SPEDAS software and plugins. These sessions allow us to go into far greater detail into the nuts and bolts of using SPEDAS for realistic data processing tasks.
  - We will be looking into implementing more tools to support exporting data as CDFs with standard metadata (ISTP, SPASE).

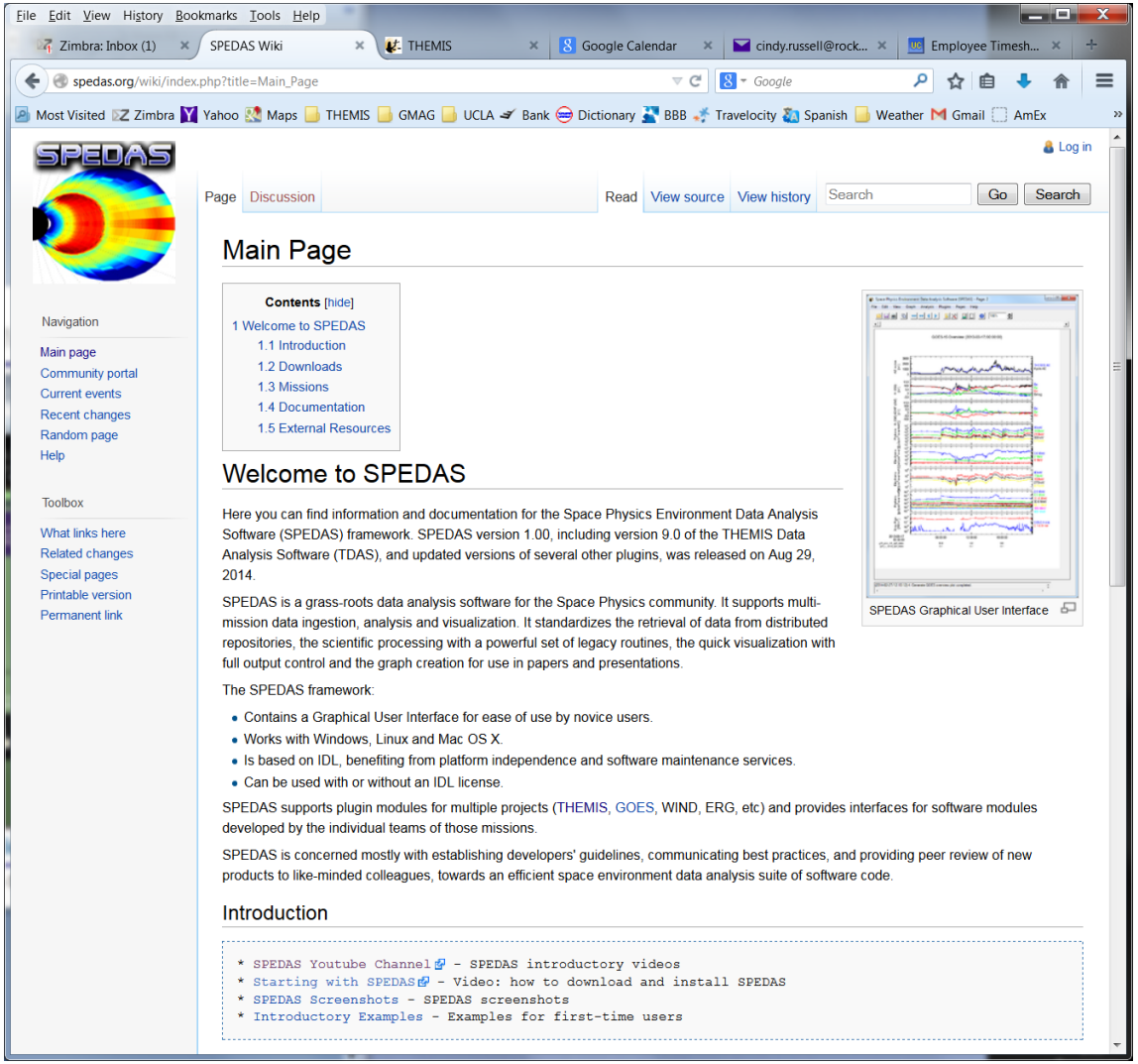
Spedas.org is now live!

- SPEDAS and plugin downloads
- Documentation wiki
- Mailing list
- Blog
- Google group (https://groups.google.com/forum/#!forum/spedas)

We welcome plugin developers to contribute content and participate in discussions on the SPEDAS site! (Registration required for wiki and blog edit privileges; please contact Jim Lewis (jwl@ssl.Berkeley.edu) to gain access).

SPEDAS Wiki

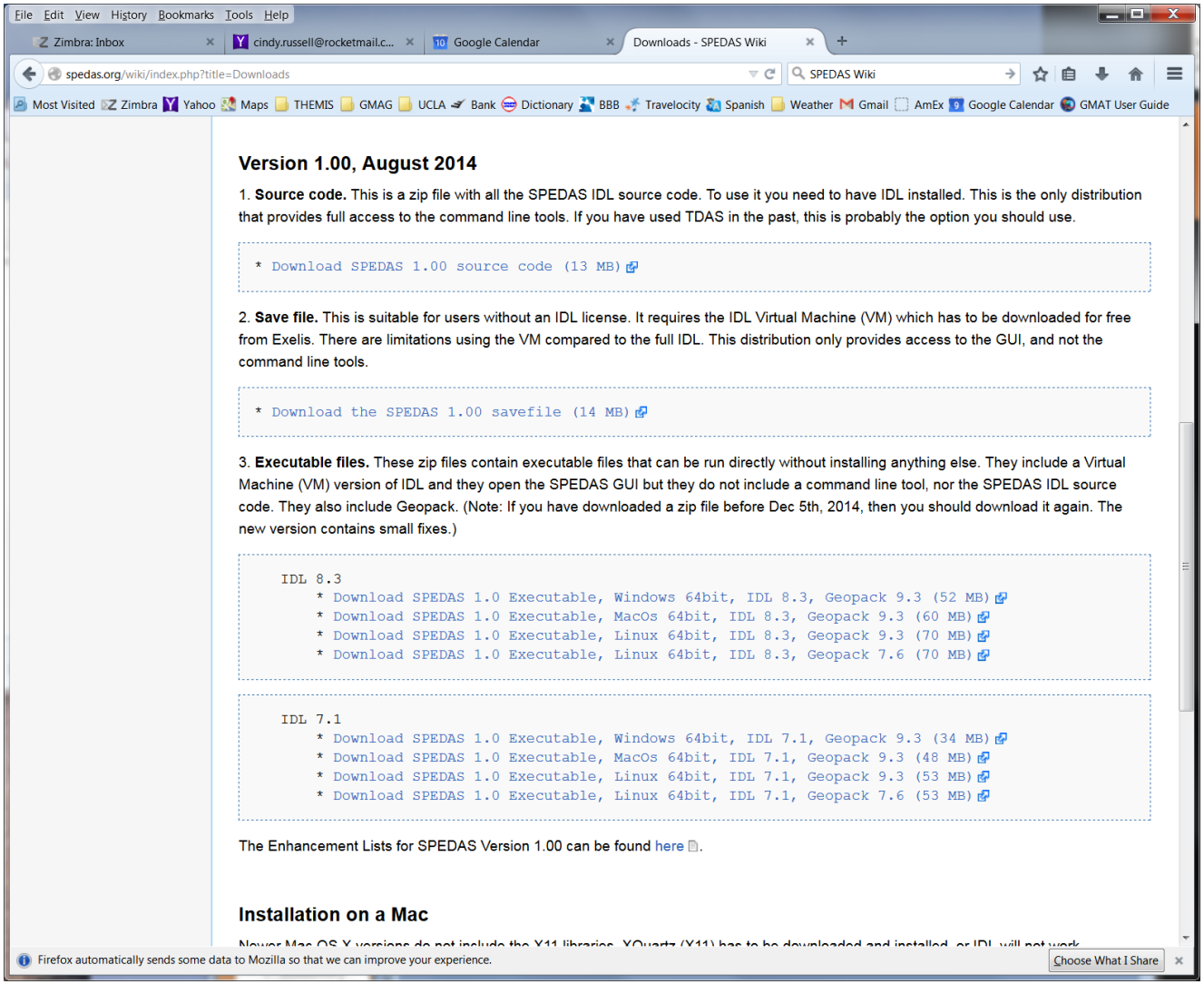
Introduction:
- You Tube Channel
- SPEDAS video
- Introductory Examples
- Screen shots



spedas.org/wiki

SPEDAS Downloads

Select:
1.2 Downloads From Main Page



spedas.org/wiki/index.php?title=Downloads