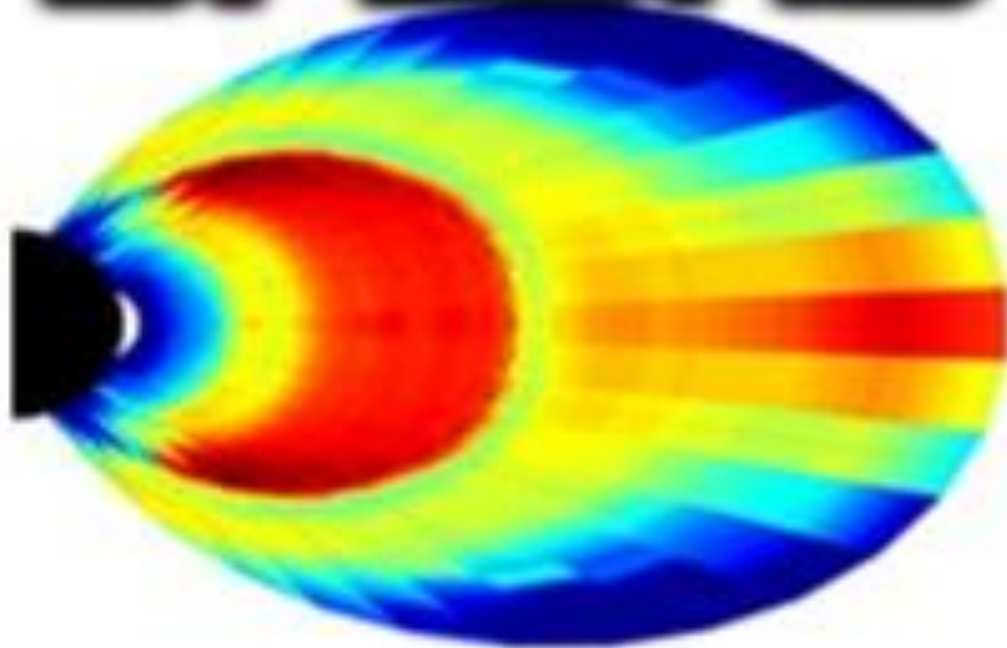


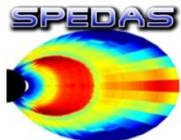


SPEEDAS



SPEEDAS Tutorial

Mini-GEM 2017, New Orleans LA



Agenda



SPEDAS Tutorial

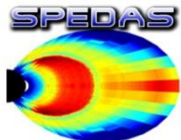
Opening remarks

SPEDAS development status

New features, plugins, and tools

Live demo: HAPI, new DSCOVN and SECS plugins, ISEE 3d tool

Q&A, discussion



What is SPEDAS?

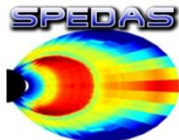


Space Physics Environment Data Analysis Software (SPEDAS)

- 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:

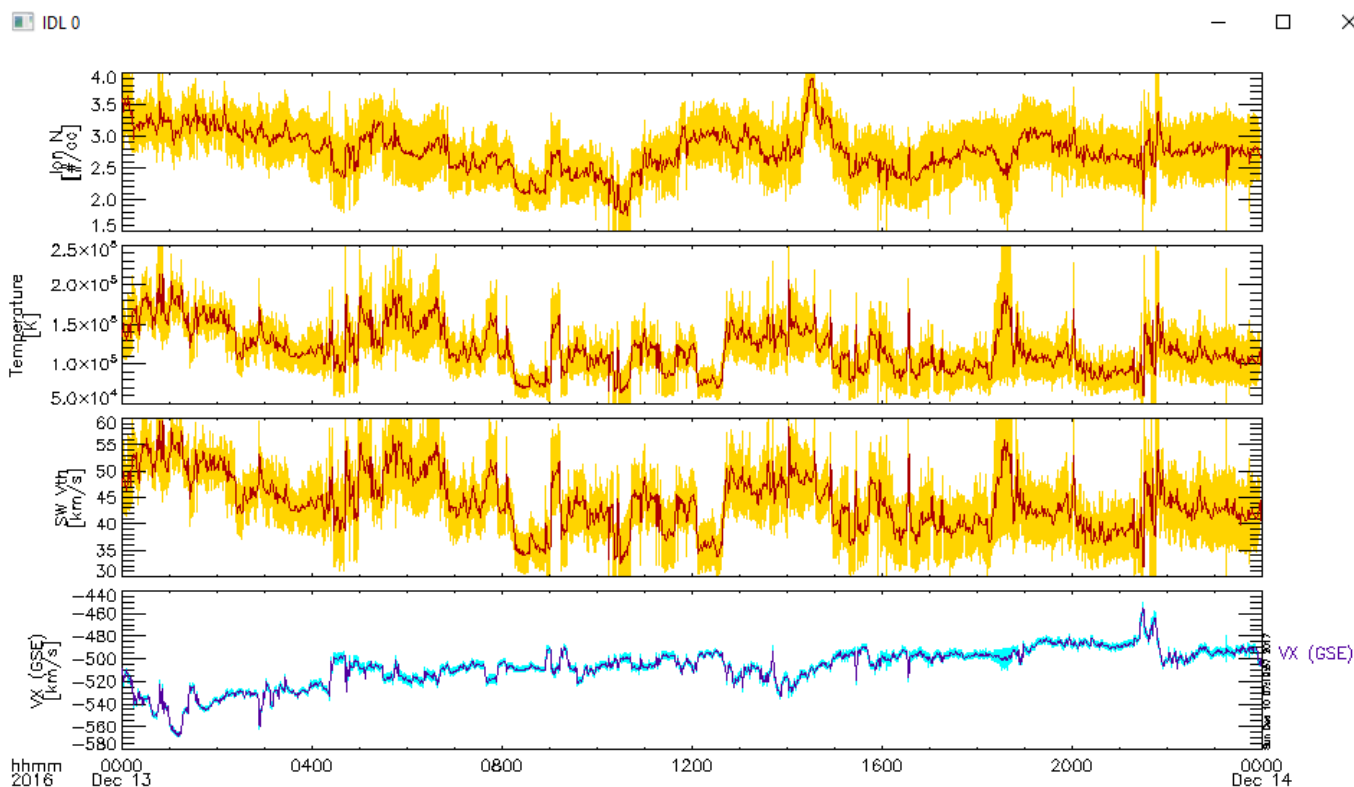
- Contains a GUI for ease of use (available through IDL VM freeware)
- Command line provides full access to IDL (paid license only)
- Works with Windows, Linux and Mac OS X.
- Is based on IDL, benefiting from platform independence and software maintenance services.



- What is the current status of SPEDAS development?
 - SPEDAS 2.1 is now undergoing QA testing, and should be released in late December 2017 or early January 2018.
 - New plugin for Spherical Elementary Currents System (SECS) allows loading of EICS (Equivalent Ionospheric Currents) and SECA (SEC amplitudes) data, as well as plotting over THEMIS ASI mosaic maps.
 - New plugin for DSCOVR mission, including data loading, overview plots, and line plots with shaded confidence intervals.
 - Updates to ERG, IUGONET, THEMIS, and MMS plugins
 - Improved HTTPS support for digest authentication, and significant performance improvements when creating large numbers of new TPLOTT variables.

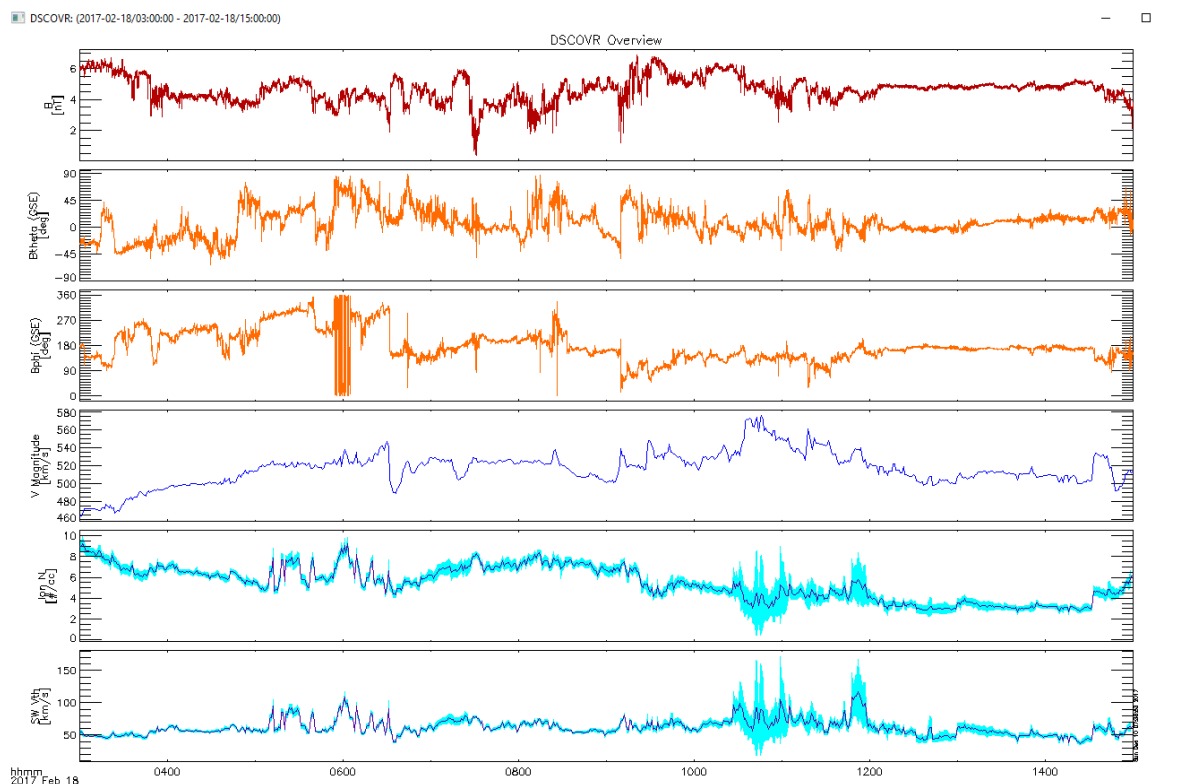
DSCOVr confidence interval plot, from projects/dscovr/examples/dsc_crib.pro:

```
tplot, ['dsc_h1_fc_Np', 'dsc_h1_fc_THERMAL_TEMP', 'dsc_h1_fc_THERMAL_SPD',
'dsc_h1_fc_V_GSE_x'] ;aka [25,26,24,27]
dsc_dyplot
```

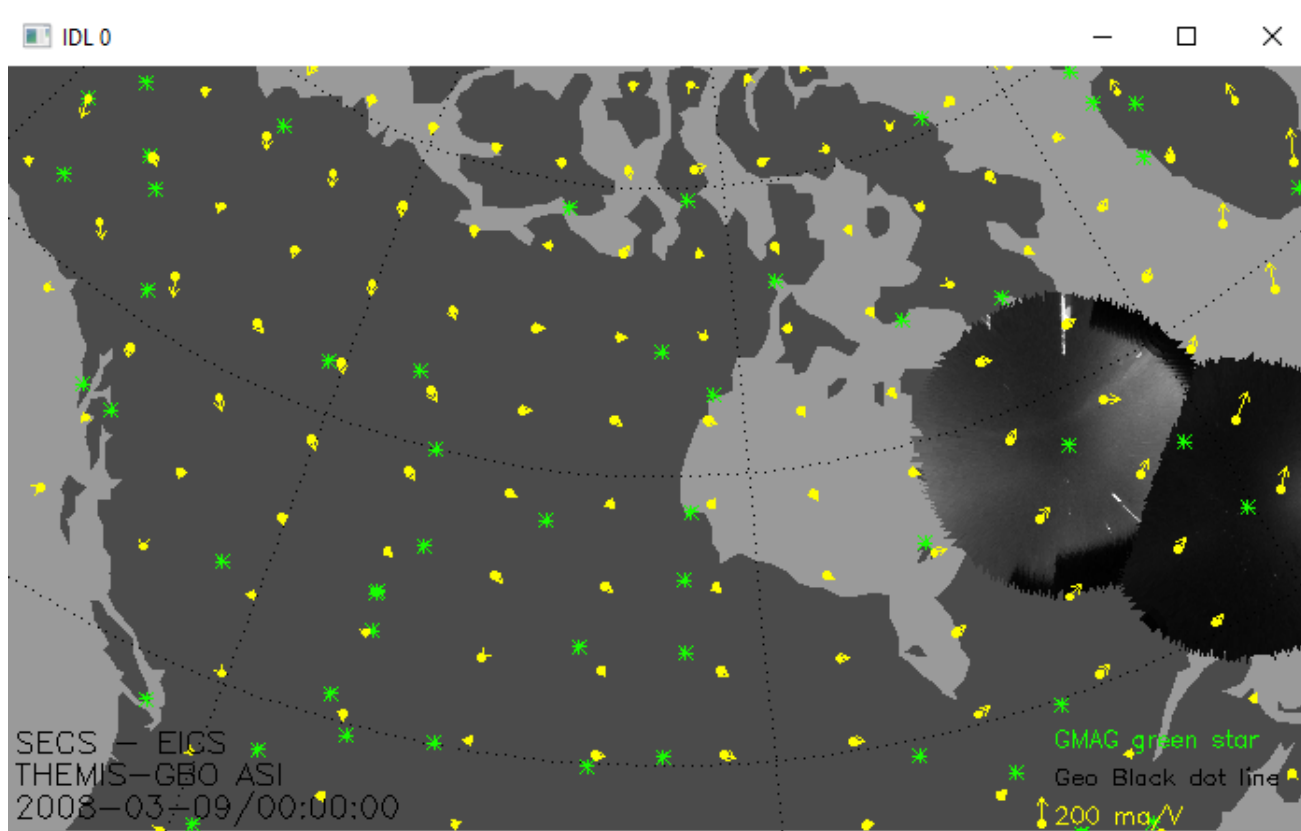


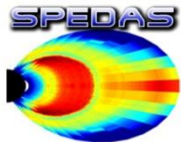
DSCOVr overview plot (dsc_crib.pro)

```
trg = timerange(['2017-02-18/03:00:00', '2017-02-18/15:00:00'])
dsc_overview, trange=trg           ; Overview for a given timerange
dsc_overview_mag, trange=trg       ; Overview of Magnetometer data
dsc_overview_fc, trange=trg        ; Overview of Faraday Cup data
```



SECS ASI Mosaic plot (projects/secs/examples/secs_mosaic_plot_crib)

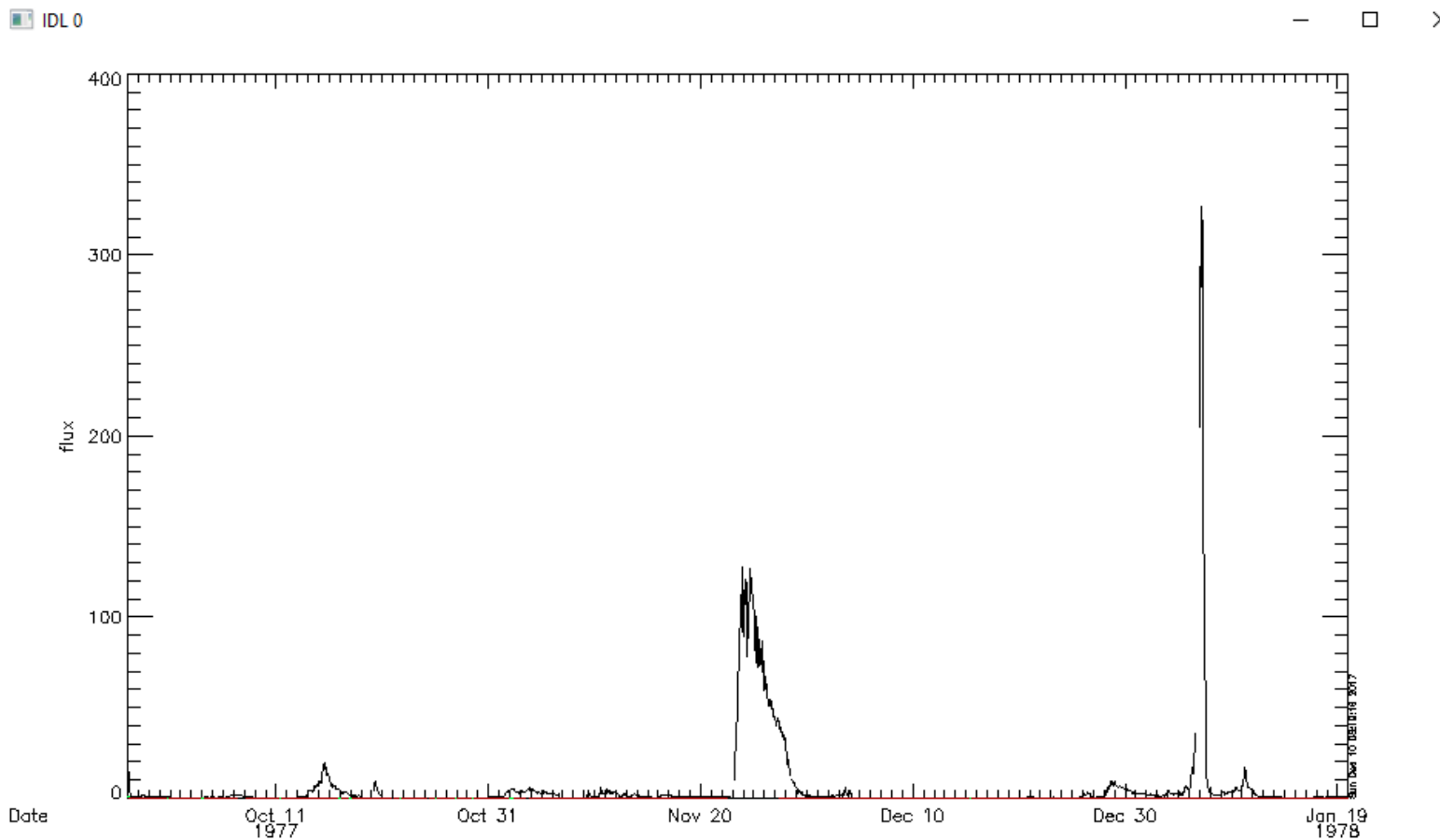




- SPEDAS 2.00 was released in June 2017:
 - SPEDAS 2.00 includes the new ISEE 3D tool for visualizing particle distributions
 - SPEDAS 2.00 supports the new Heliophysics API
 - Many load routines have been updated to work with data sources that enforce HTTPS-only downloads (e.g. CDAWeb, NOAA, LASP, etc)
- 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.

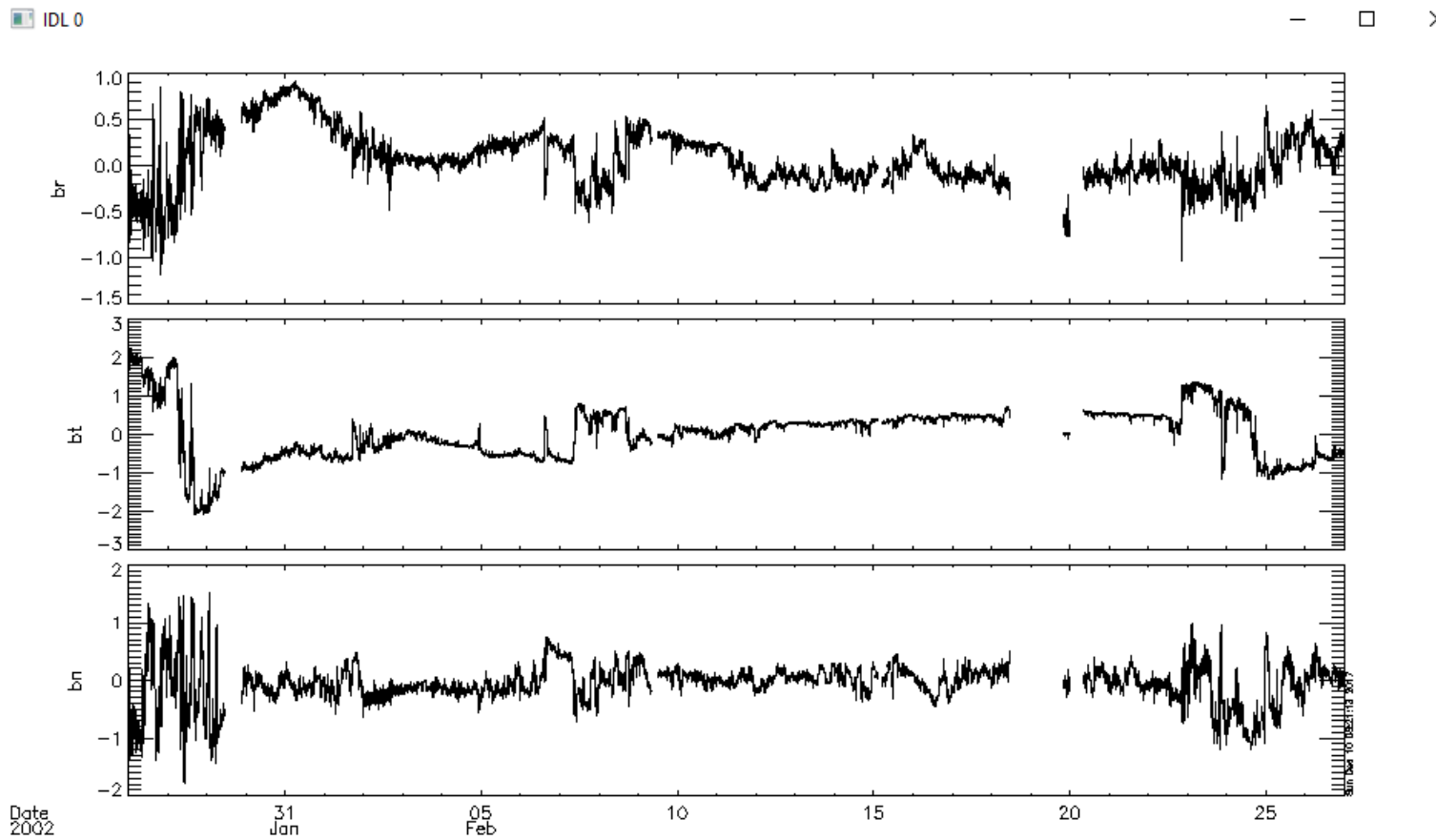


Voyager 1 proton flux via Heliophysics API (HAPI), from idl/general/crib_hapi.pro:



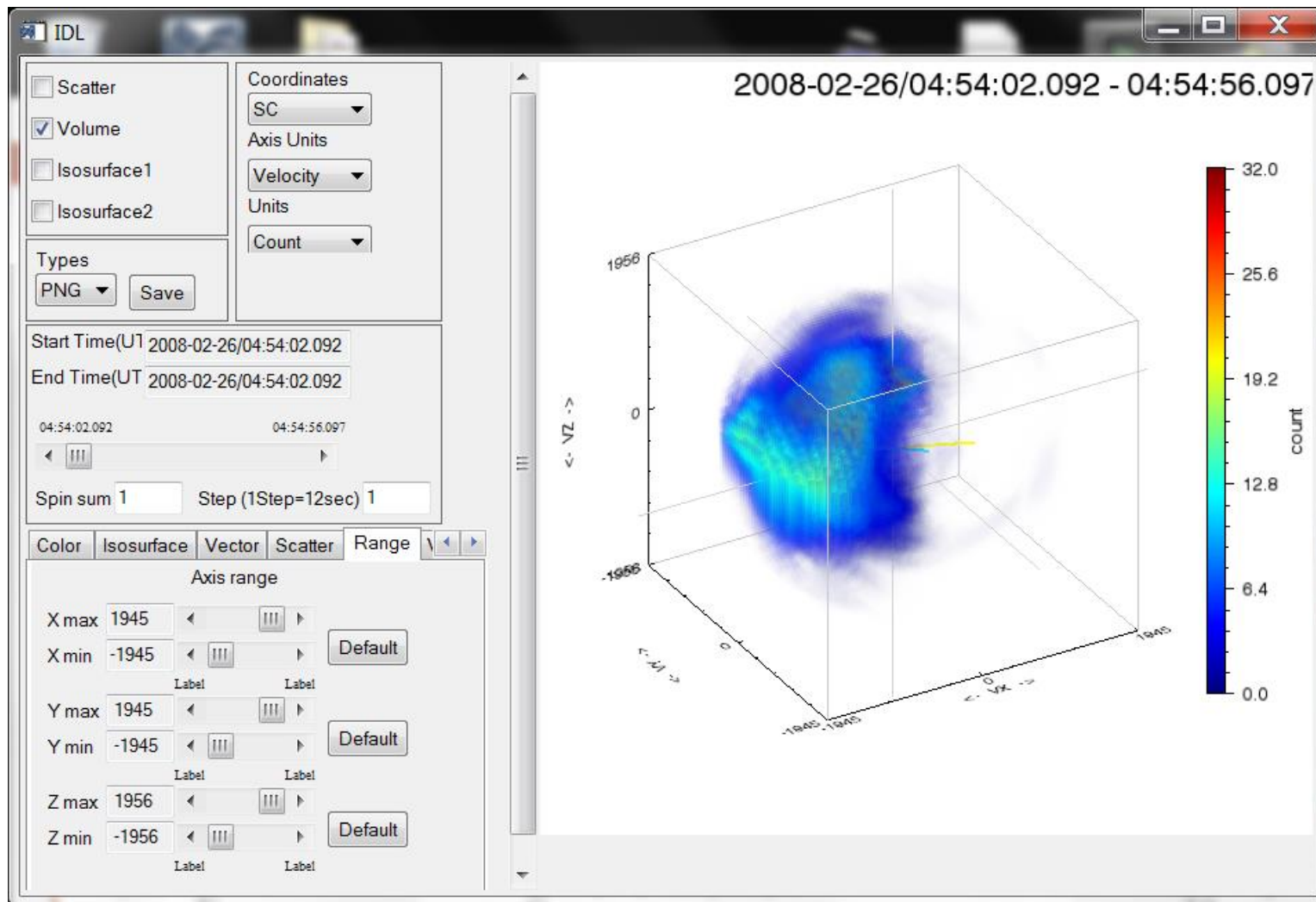


Cassini mag data via Heliophysics API (HAPI), from idl/general/crib_hapi.pro:





ISEE 3D settings panel (using THEMIS data)

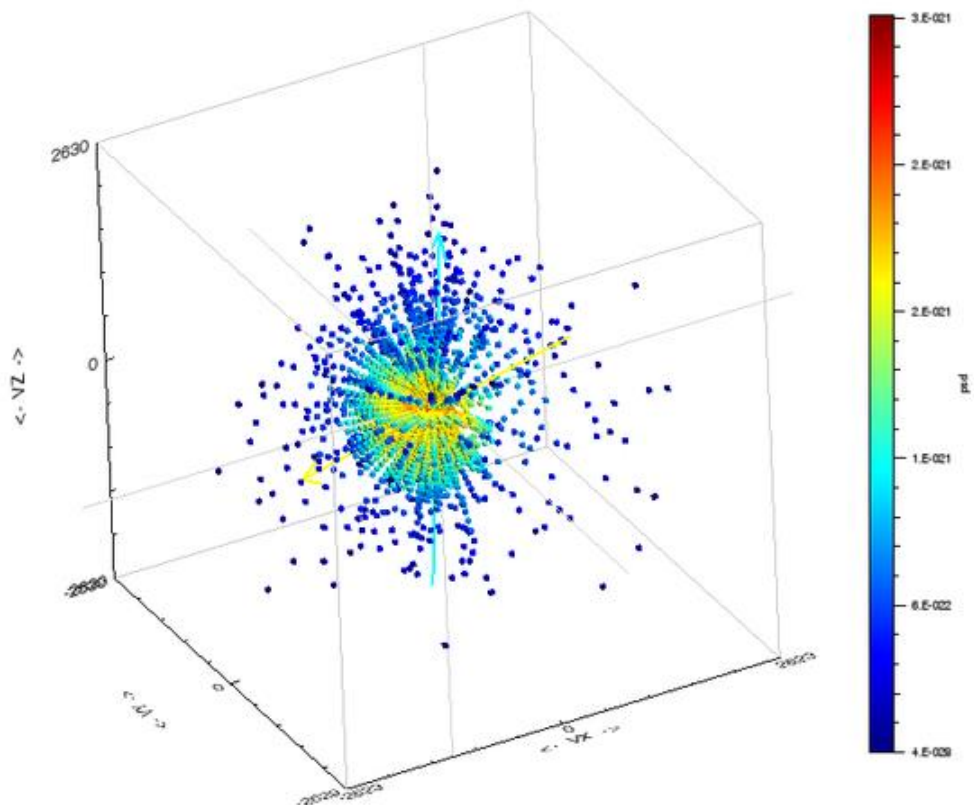




ISEE 3D: MMS FPI ion scatter plot



2015-10-20/05:56:35.957 : velocity

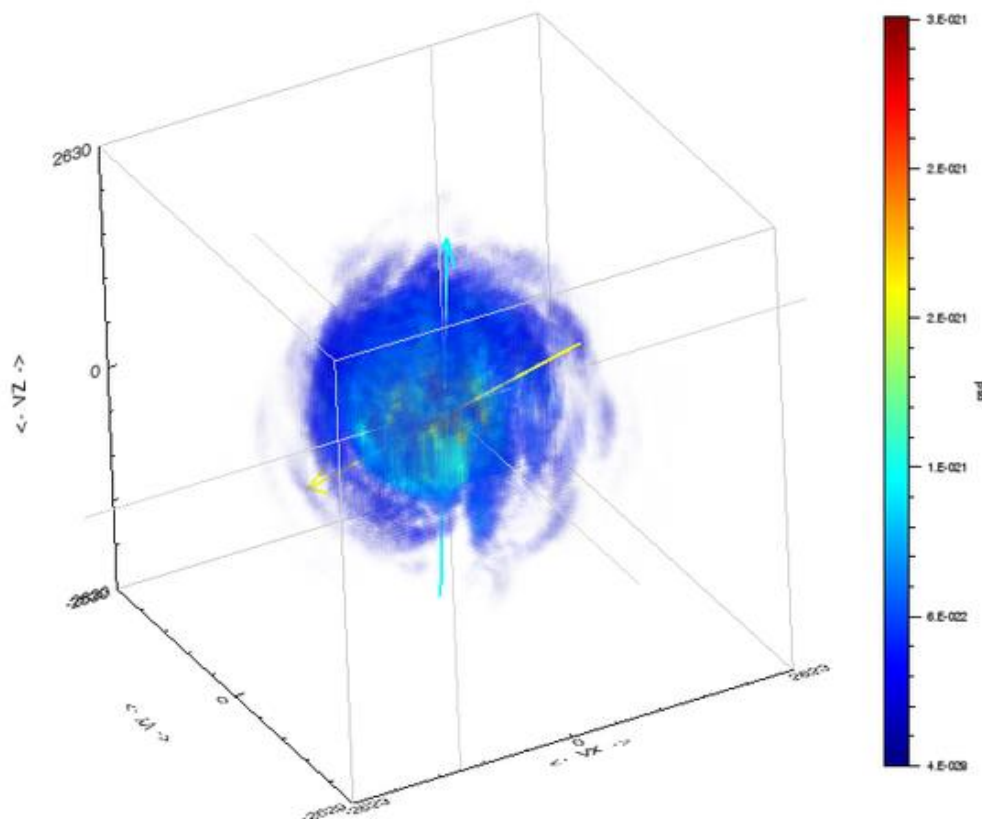




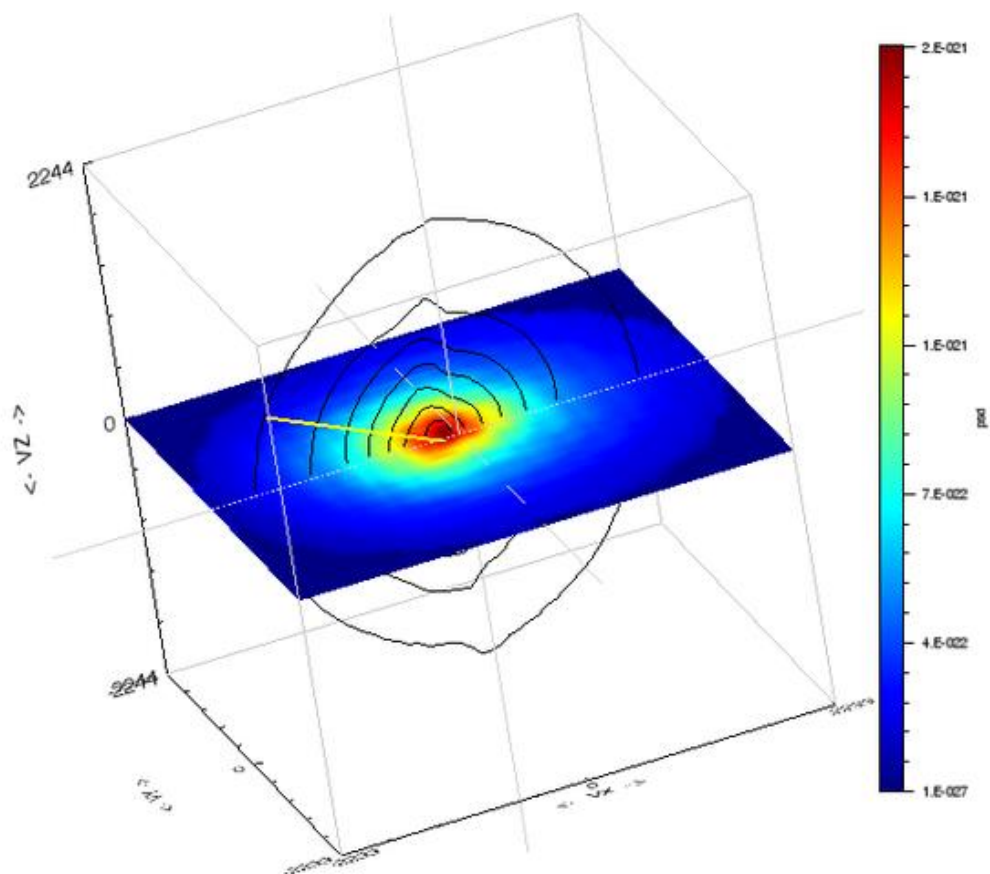
ISEE 3D: MMS FPI ion volume plot

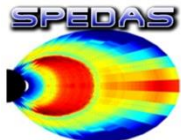


2015-10-20/05:56:35.957 : velocity



2015-08-15/12:50:03.923 - 12:50:57.923 (velocity)





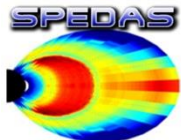
Loading CDAWeb Data



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'

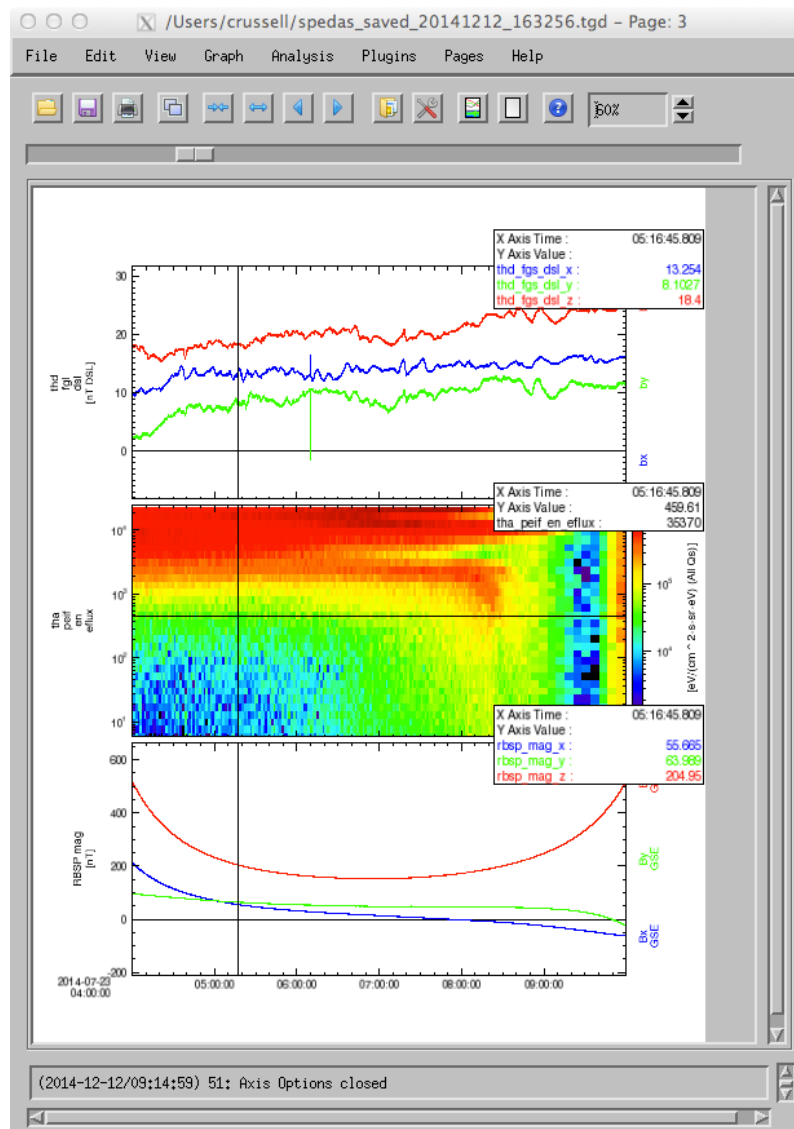


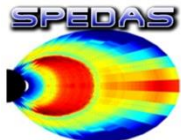


THEMIS and RBSP Plots



- 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'
```

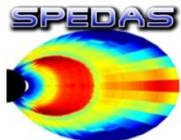
2: Natural log of total esa density:

```
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



Available Data

Active Data

Loaded Data

- G15
 - FGM
 - g15_BTSC_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_BTSC_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsc_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsc_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsens_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsens_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_HT_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_HT_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_x_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_y_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_z_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - MAGED
 - POES/MetOp
 - NOAA15
 - NOAA19

Active Data

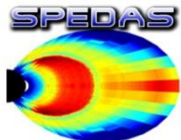
g13_H_enp_1: 2014-07-23/00:00:00 to 2014-07-24/00:00:00
g15_H_enp_1: 2014-07-23/00:00:00 to 2014-07-24/00:00:00

Common Functions

- Subtract Average
- Subtract Median
- Smooth Data...
- High Pass filter...
- Block Average...
- Clip...
- Deflag...
- Degap...
- Interpolate...
- Clean Spikes...
- Time Derivative...
- Wavelet Transform...
- Power Spectrum...
- Coordinate Transform...
- Split Variable
- Join Variables...

Clear Active Done

(2014-12-12/07:24:48) 10: Bad Selection, Please try again

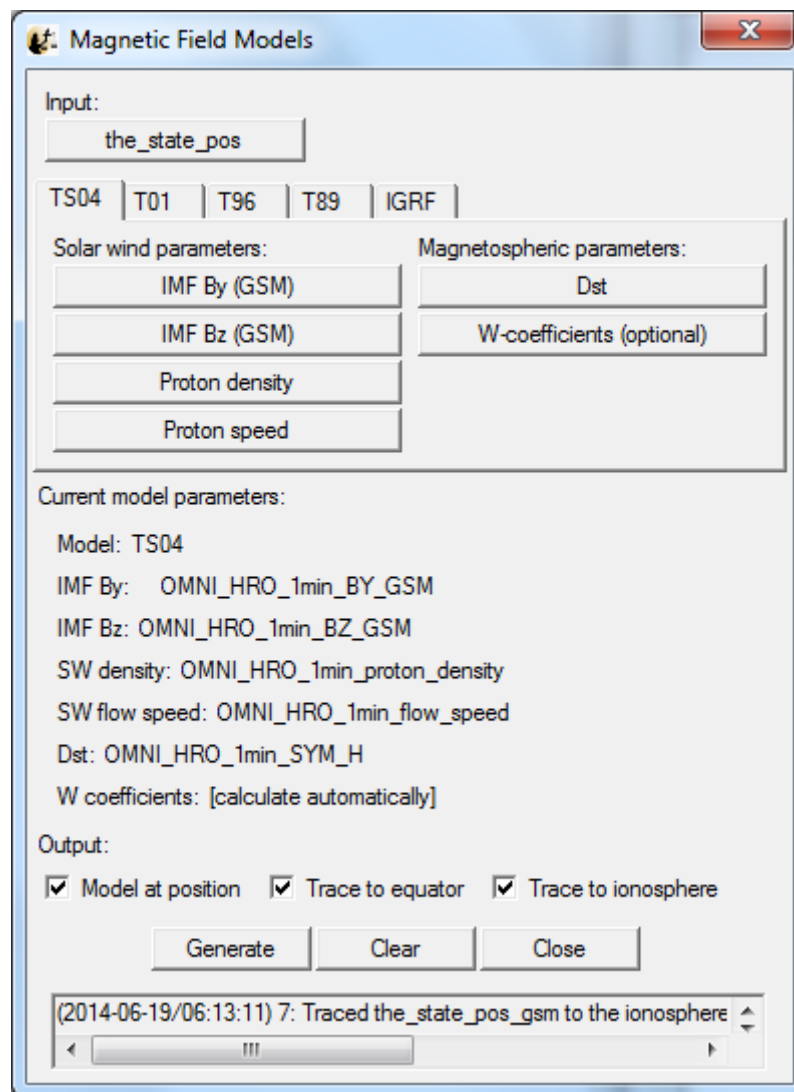


Magnetic Field Models



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)



MMS

POES THEMIS THEMIS Derived Products WIND

ACE BARREL ELFIN Lomo FAST GOES Geomagnetic Indices IUGONET MAVEN_PFP MMS OMNI

MMS Data Selection:

Start Time: 2007-03-23/00:00:00

Stop Time: 2007-03-24/00:00:00

Use Single Day

Instrument Type: FGM

Probe:	Data Rate:	Level:	Data Type:
MMS 1	svvy	L2	
MMS 2	brst		
MMS 3			
MMS 4			

Clear Probe Clear Rate Clear Levels Clear Type

Data Loaded:

- Geomagnetic Indices
 - Kyoto
 - WDC
 - kyoto_dst [2007-03-23/00:00:00 to 2007-03-24/00:00:00]

Delete All Data

Done

0: Status information is displayed here.



Configuration settings panel (THEMIS plugin tab)



Configuration Settings

SPEEDAS | BARREL | GOES | Geomagnetic Indices | MAVEN_PFP | OMNI | POES | **THEMIS** | WIND

Local data directory:

Remote data directory:

Download Data: Automatically Use Local Data Only

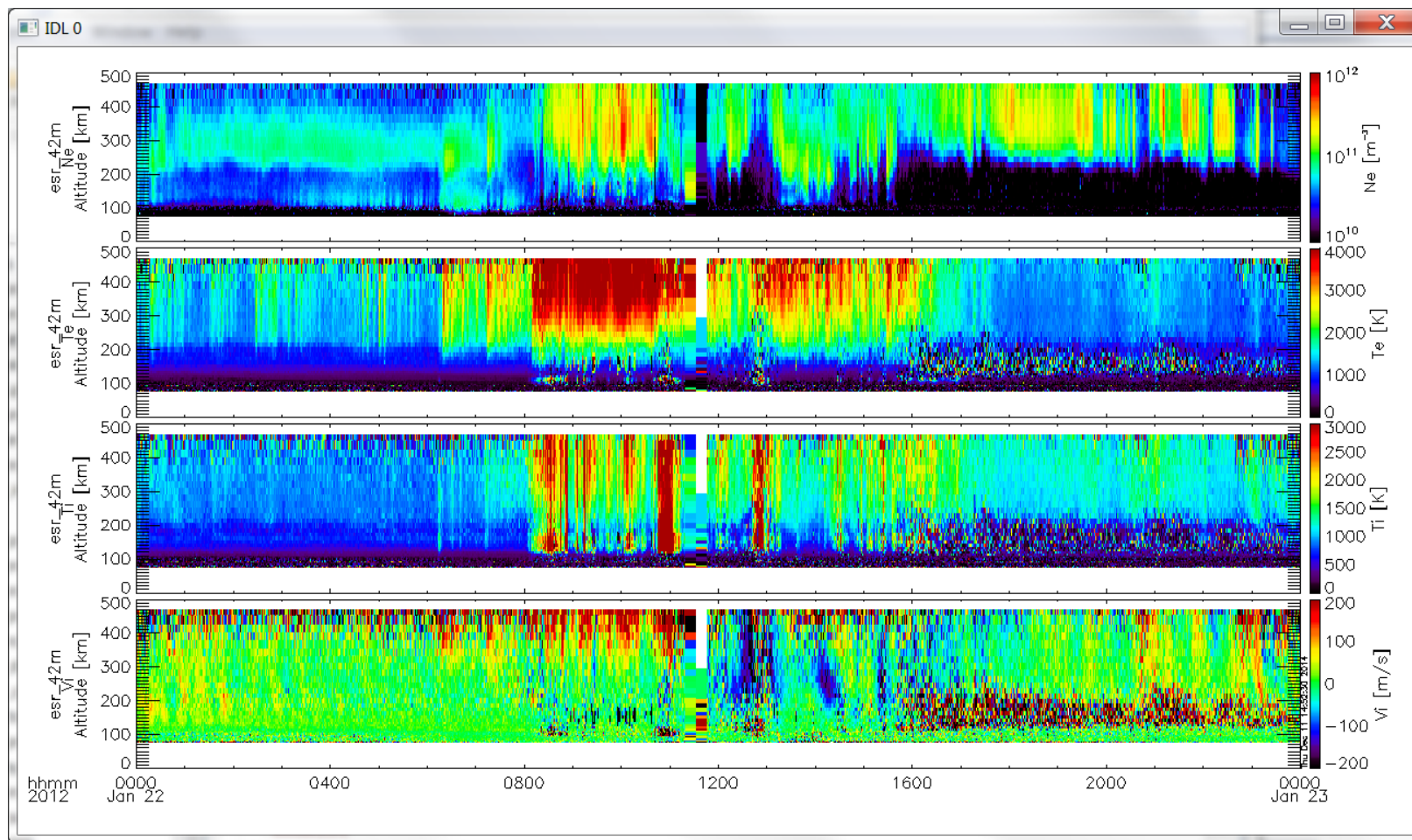
Update Files: Update if Newer Use Local Data Only

Load into GUI: Load data Download Files C

Verbose (higher value = more comments): ▼

0: Status information is displayed here.

→ `crib_iugonet_20120122sc.pro`



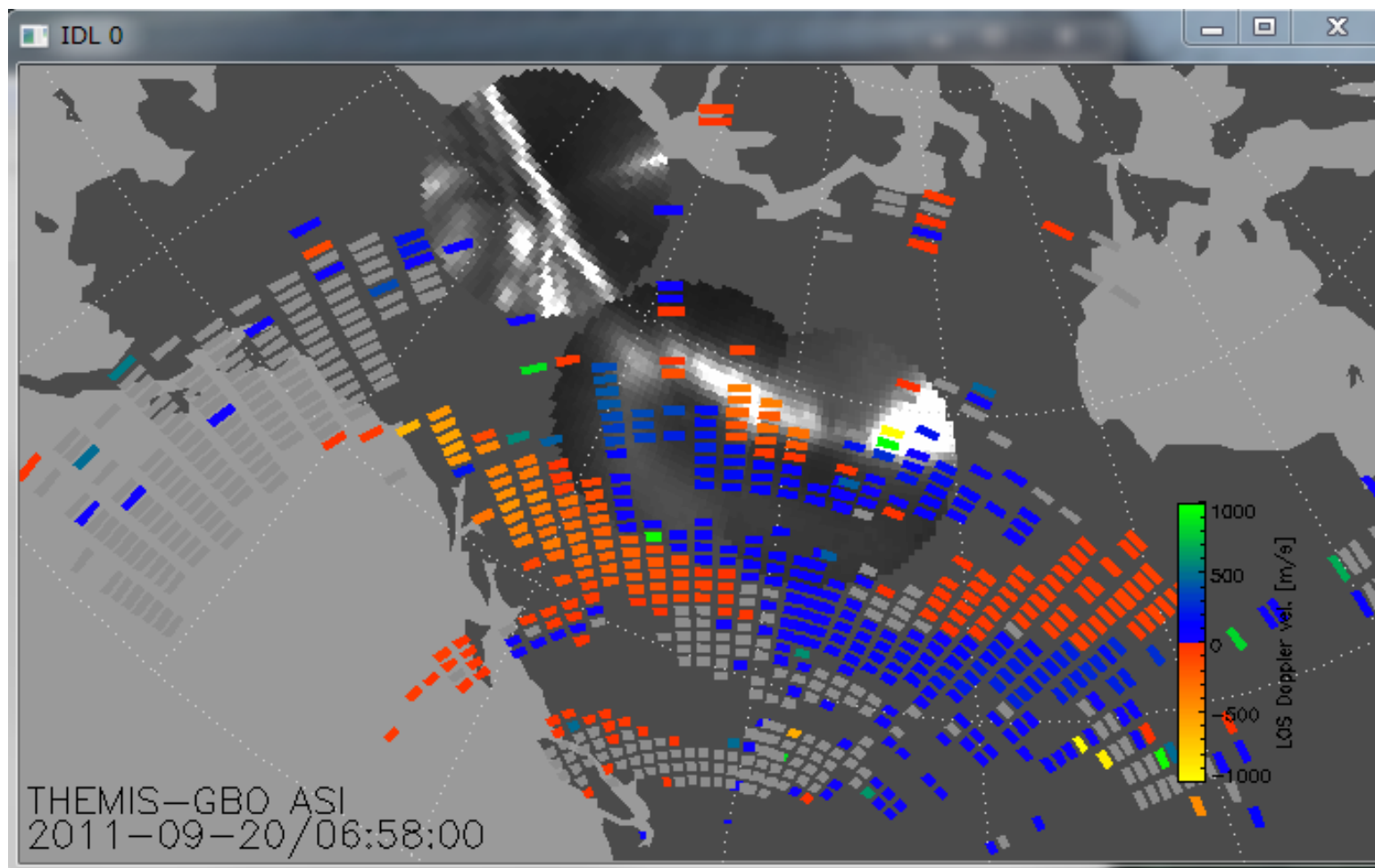
Yoshimasa Tanaka



THEMIS ASI / SuperDarn Radar



→ erg-sc_crib_thmasi_sd_sample

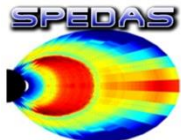


Tomo Hori



• SPEDAS Development Roadmap

- SPEDAS 2.00 was released in June 2017; SPEDAS 2.1 expected in late December 2017 or early January 2018
- 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 are looking into the possibility of porting some SPEDAS capabilities to Python
- We intend to develop some tools that would allow for exporting and importing data and metadata between SPEDAS and Autoplot



• 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

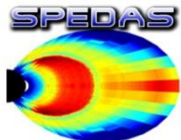
Documentation wiki

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

File Edit View History Bookmarks Tools Help

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Main Page

Contents [hide]

- 1 Welcome to SPEDAS
 - 1.1 Introduction
 - 1.2 Downloads
 - 1.3 Missions
 - 1.4 Documentation
 - 1.5 External Resources

Welcome to SPEDAS

Here you can find information and documentation for the Space Physics Environment Data Analysis Software (SPEDAS) framework. SPEDAS version 1.00, including version 9.0 of the THEMIS Data Analysis Software (TDAS), and updated versions of several other plugins, was released on Aug 29, 2014.

SPEDAS is a grass-roots data analysis software for the Space Physics community. It supports multi-mission data ingestion, analysis and visualization. It standardizes the retrieval of data from distributed repositories, the scientific processing with a powerful set of legacy routines, the quick visualization with full output control and the graph creation for use in papers and presentations.

The SPEDAS framework:

- Contains a Graphical User Interface for ease of use by novice users.
- Works with Windows, Linux and Mac OS X.
- Is based on IDL, benefiting from platform independence and software maintenance services.
- Can be used with or without an IDL license.

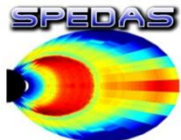
SPEDAS supports plugin modules for multiple projects (THEMIS, GOES, WIND, ERG, etc) and provides interfaces for software modules developed by the individual teams of those missions.

SPEDAS is concerned mostly with establishing developers' guidelines, communicating best practices, and providing peer review of new products to like-minded colleagues, towards an efficient space environment data analysis suite of software code.

Introduction

- * [SPEDAS Youtube Channel](#) - SPEDAS introductory videos
- * [Starting with SPEDAS](#) - Video: how to download and install SPEDAS
- * [SPEDAS Screenshots](#) - SPEDAS screenshots
- * [Introductory Examples](#) - Examples for first-time users

spedas.org/wiki



SPEDAS Downloads



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

Most Visited Z Zimbra Y Yahoo Maps THEMIS GMAG UCLA Bank Dictionary BBB Travelocity Spanish Weather Gmail AmEx Google Calendar GMAT User Guide

Version 1.00, August 2014

1. **Source code.** This is a zip file with all the SPEDAS IDL source code. To use it you need to have IDL installed. This is the only distribution that provides full access to the command line tools. If you have used TDAS in the past, this is probably the option you should use.

* [Download SPEDAS 1.00 source code \(13 MB\)](#)

2. **Save file.** This is suitable for users without an IDL license. It requires the IDL Virtual Machine (VM) which has to be downloaded for free from Exelis. There are limitations using the VM compared to the full IDL. This distribution only provides access to the GUI, and not the command line tools.

* [Download the SPEDAS 1.00 savefile \(14 MB\)](#)

3. **Executable files.** These zip files contain executable files that can be run directly without installing anything else. They include a Virtual Machine (VM) version of IDL and they open the SPEDAS GUI but they do not include a command line tool, nor the SPEDAS IDL source code. They also include Geopack. (Note: If you have downloaded a zip file before Dec 5th, 2014, then you should download it again. The new version contains small fixes.)

IDL 8.3

- * [Download SPEDAS 1.0 Executable, Windows 64bit, IDL 8.3, Geopack 9.3 \(52 MB\)](#)
- * [Download SPEDAS 1.0 Executable, MacOS 64bit, IDL 8.3, Geopack 9.3 \(60 MB\)](#)
- * [Download SPEDAS 1.0 Executable, Linux 64bit, IDL 8.3, Geopack 9.3 \(70 MB\)](#)
- * [Download SPEDAS 1.0 Executable, Linux 64bit, IDL 8.3, Geopack 7.6 \(70 MB\)](#)

IDL 7.1

- * [Download SPEDAS 1.0 Executable, Windows 64bit, IDL 7.1, Geopack 9.3 \(34 MB\)](#)
- * [Download SPEDAS 1.0 Executable, MacOS 64bit, IDL 7.1, Geopack 9.3 \(48 MB\)](#)
- * [Download SPEDAS 1.0 Executable, Linux 64bit, IDL 7.1, Geopack 9.3 \(53 MB\)](#)
- * [Download SPEDAS 1.0 Executable, Linux 64bit, IDL 7.1, Geopack 7.6 \(53 MB\)](#)

The Enhancement Lists for SPEDAS Version 1.00 can be found [here](#).

Installation on a Mac

Newer Mac OS X versions do not include the Y11 libraries. YQuartz (Y11) has to be downloaded and installed, or IDL will not work.

Firefox automatically sends some data to Mozilla so that we can improve your experience. [Choose What I Share](#)

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