

# Science Software – v4.00 Training

GEM Mini-Workshop

June 26, 2008

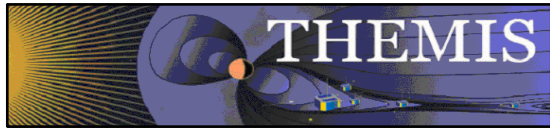


# THEMIS Agenda

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02:00	Introduction	V. Angelopoulos
02:10	THEMIS Web Site	D. King
02:20	V4.00 Science Software/Data Status Report	V. Angelopoulos
02:30	THEMIS Science Data Analysis Software	J. McTiernan / Pat Cruce
03:00	THEMIS Graphical User Interface (GUI)	D. King / J. McTiernan
03:15	THEMIS Ground Based Observatories (GBO)	J. McTiernan
03:30	Q&A's	All
03:45	Software Clinic	All

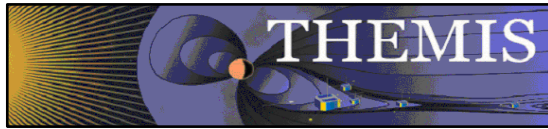


# Status Report



## V4.00 Science Software/Data Status Report

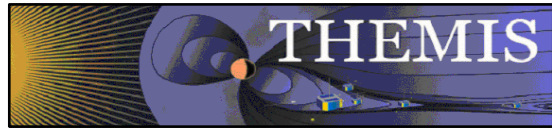
- General
  - Loads, introduces and calibrates all L1 quantities, all instruments
  - Loads calibrated L2 quantities
- FGM
  - L1, L2 data available since early March 2007
- SCM
  - L1 data available since early March 2007
  - L2 frequency spectrograms (FBK) available now
- EFI
  - All L1 data available from TH-C since May 2007, TH-D,E since Jun 7
- ESA
  - No L1 data, only L0 data – however, read-in is transparent to user
  - All data available since ESA turn-on, i.e., mid-March
  - L2 omnidirectional energy spectrograms, ground moments available now
- SST
  - L1 data available since SST turn-on, mid-March
  - L2 omnidirectional energy spectrograms available now



# THEMIS Data Analysis Software

<b>Organization</b>	<b>Contributors</b>
<b>UC Berkeley</b>	D Larson, H Frey, J Bonnell, J McFadden, A Keiling J McTiernan, J Lewis, D King
<b>UCLA</b>	V Angelopoulos, P Cruce, B Kerr, C Goethel, M Feuerstein, K Ramer, H Schwarzl
<b>SP Systems</b>	K Bromund
<b>NASA/GSFC</b>	V Kondratovich
<b>MPE</b>	E Georgescu
<b>TUBS</b>	U Auster
<b>CETP</b>	P Robert, O LeContel
<b>Calgary</b>	B Jackel, E Donovan






# Overview

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## Overview

- Software Objectives
  - Powerful, Flexible Command Line Interface
  - GUI to provide Easy Access to Key Features
- Software Installation
- Data Distribution
- Key Routines, crib sheets.
- Examples



# Software Objectives

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- Code is available to everyone, but not required to analyze data.
- IDL based (library of routines –but no main program!).
- Separates the tasks of:
  - Reading files.
  - Manipulating data
  - Plotting
- Platform independent. Works on:
  - Solaris
  - Linux
  - Windows
  - Mac OS X
- Self-Documenting
  - Auto-generated html help: `idl/_tdas_doc.html`
  - `IDL> DOC_LIBRARY, 'routine_name'`

# Software Design



## THEMIS-specific routines (idl/themis)

- Instrument-specific routines organized according to ground/spacecraft/state, fields/particles, instrument name.
  - Loading data
  - Calibrating data
- Transforming data
- Examples – crib sheets
- GUI – built on top of the command-line routines

## General routines (idl/ssl\_general)

- Library of generic routines useful for building mission-specific load routines
  - CDF reading/writing routines
  - File retrieval routines
  - Miscellaneous routines
- Plotting routines
  - Uses “tplot variables”: strings that associate data together with metadata and plotting parameters.
  - Routines to manipulate/plot tplot variables
- Data Export routines
- Data Processing routines

## External Libraries (idl/external)

- CDAWlib – from NASA SPDF, reads/plots CDF data
- IDL\_GEOPACK – Magnetic field modelling kit





# System Requirements

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Windows, Solaris, LINUX, PPC Mac or Intel Mac.

IDL 6.2 or higher required

IDL Patch Recommended

- [http://cdf.gsfc.nasa.gov/html/cdf\\_patch\\_for\\_idl6x\\_new.html](http://cdf.gsfc.nasa.gov/html/cdf_patch_for_idl6x_new.html)
- Required for IDL 6.2, (Strongly recommended for IDL 6.4 and 7.0)
- Required for Intel Mac, regardless of IDL version

For Mac, system configurations are required to run IDL

- X11 – may need to be installed.
- mouse click-through
  - one-time X11 configuration necessary for proper operation:  
`defaults write com.apple.x11 wm_click_through -bool true`

See THEMIS User's Guide for full information, available at:

<ftp://apollo.ssl.berkeley.edu/pub/THEMIS/>



# Installing/Configuring TDAS



For a new installation:

- Download and expand the latest TDAS release .zip file. The latest version is 4.00.  
[http://themis.ssl.berkeley.edu/socware/tdas\\_4\\_00/tdas\\_4\\_00.zip](http://themis.ssl.berkeley.edu/socware/tdas_4_00/tdas_4_00.zip)
- Create a directory called TDAS into which you will copy the latest software.
- Move the tdas\_x\_xx folder into the TDAS directory you created.
- Configure IDL to search the TDAS directory for IDL programs. Details on next slide.

For an upgrade of an existing installation of TDAS, installed as per the above 4 steps:

- Remove old tdas\_x\_xx from the TDAS directory.
- Download and expand the latest TDAS release .zip file.
- Copy the new tdas\_x\_xx directory into the pre-existing TDAS directory.
- Re-start IDL.



## Set up the IDL path

- Windows and IDLDE on any platform:
  - File->Preferences
  - Path Tab
  - Press Insert
  - Browse to find the TDAS folder you created.
  - Check the box preceding the path to 'search subdirectories'
- UNIX-like systems (Mac OS X, Linux, Solaris)
  - In `.cshrc`:  
`setenv IDL_PATH '<IDL_DEFAULT>:+/path/to/tdas'`
  - Or-
  - In `.bashrc` or `.bash_profile`:  
`export IDL_PATH='<IDL_DEFAULT>:+/path/to/tdas'`

## Path to Data Directory

- Data directory will be created automatically at
  - `C:/data/themis` (Windows)
  - `~/data/themis` (UNIX/LINUX/Max OS X)
- Run `thm_ui_config` from command line or THEMIS GUI if you need to change this.



# Data Definitions



The software operates on Level 1 and Level 2 data.

Data Level Definitions:

Level 0 Data –

- Raw files (\*.pkt) one per APID.
- Only used for loading ESA data.

Level 1 Data -

- CDF (Common Data Files) files (\*.cdf)
- Files contain raw, uncalibrated data. i.e. counts, DAC units.
- Requires TDAS software to interpret. Calibration is done by default when Level 1 data is input.

Level 2 Data -

- CDF files – contain physical quantities – TDAS software is not needed for interpretation.
- Files available for ESA, FBK, FIT, FGM, MOM, SST – can be downloaded from SPDF.



# Data / Directory structure

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- Data Directory structure is large!
  - Scores of files per day
  - ~3GB/day for all probes (L1 data)
- Directory hierarchy keeps directory sizes manageable
  - Software performs automatic file retrieval.
  - Software maintains directory hierarchy.
- Behavior of Automatic File Retrieval is configurable
  - 'No Download' mode for stand-alone operation.
  - 'No Update' mode to preserve local modifications.
  - Root directory of local copy of hierarchy is determined automatically, but configurable.
  - Available configuration methods:
    - thm\_ui\_config IDL widget
    - 'Config' button in the thm\_gui IDL widget.
    - Environment variables



# Primary Routines



## Load Routine Summary

Name	Description	L0	L1		L2
			raw	calibrated	
thm_load_asi	All-Sky Imager.		*	-	
thm_load_ask	All Sky Keogram		*	-	
thm_load_efi	Electric Fields Instrument waveforms		*	(*)	
thm_load_esa	ElectroStatic Analyzer				*
thm_load_esa_pkt	ElectroStatic Analyzer	*			
thm_load_fbk	Fields Filter Bank		*	*	*
thm_load_fft	On-board Fields Fast Fourier Transform.		*	*	
thm_load_fgm	Flux Gate Magnetometer waveforms		*	*	*
thm_load_fit	On-Board Fields Spin-Fit		*	*	-
thm_load_gmag	Ground Magnetometer				*
thm_load_hsk	Housekeeping		*		
thm_load_mom	On-board Particle Moments		*	(*)	
thm_load_scm	Search Coil Magnetometer waveform		*	(*)	
thm_load_sst	Solid State Telescope		*	-	*
thm_load_state	Orbit and Attitude		v2		

Notes:

- (\*) calibration routine available but still under development
- data reduction and analysis routines available: see crib sheet



# Primary Routines



## Usage Conventions:

Use keywords to determine functionality

level - Calibrated Level 1 data is the default (Except for SST and ESA data, which is handled differently).

datatype and probe keywords determine which data is loaded and/or created through calibration process

/get\_support\_data keyword is needed in thm\_load\_state to load data required by thm\_cal\* and thm\_cotrans routines.

To load uncalibrated data, set type = 'raw' (For all but SST, ESA)

Example from IDL Command Line:

```
timespan,'2007-07-07',1 ;choose a time range
```

```
thm_load_state, probe = 'a', /get_support_data
```

```
thm_load_fgm, probe='a', coord='gsm', datatype='fgl', level=1
```

# Variable Names



Probe specification. Example: tha

- a – can be one of [a-e] specifies probe

Particle data. Example: tha\_peif

- p – particles
- e – ESA, s – SST
- i – ions, e – electrons
- f – full, r – reduced, m – moments, b – burst

FGM data. Example: tha\_fgl

- l – low telemetry rate, h – high telemetry rate, e – engineering decimated high rate, s – spin fit.

Electric Fields and SCM. Example: tha\_efs

- ef - efi, sc – scm, fb – fbk, ff – fft
- s – spin fit, f – full orbit or fast survey, p – particle burst, w – waves burst.

Wildcards are accepted in names when plotting and data processing:

- th?\_fg?
- th[ab]\_fg[lh]
- th?\_state\*



## Crib Sheets for Loading, Processing and Plotting

**thm\_crib\_asi**

**thm\_crib\_dproc**

**thm\_crib\_efi**

**thm\_crib\_esa\_da**

**thm\_crib\_esa\_moments**

**thm\_crib\_export**

**thm\_crib\_fac**

**thm\_crib\_fbk**

**thm\_crib\_fft**

**thm\_crib\_fgm**

**thm\_crib\_fit**

**thm\_crib\_gmag**

**thm\_crib\_mom**

**thm\_crib\_mva**

**thm\_crib\_overplot**

**thm\_crib\_part\_getspec**

**thm\_crib\_scm**

**thm\_crib\_sst**

**thm\_crib\_state**

**thm\_crib\_tplot**

**thm\_crib\_tplotxy**

**thm\_crib\_twavpol**

**thm\_map\_examples**

**IDL>.run thm\_crib\_asi**

or cut and paste, or copy and modify

# THEMIS Coordinate Transformations



## Coordinate Transformations

- thm\_cotrans
  - transforms to/from any of the following coordinate systems in a single call
  - updates metadata in output.
  - knows coordinate system of input from metadata
- Currently Supported Geophysical Coordinate Systems
  - SPG Spinning Probe Geometric
  - SSL Spinning SunSensor L-vectorZ
  - DSL Despun SunSensor L-vectorZ
  - GEI Geocentric Equatorial Inertial
  - GSE Geocentric Solar Ecliptic
  - GSM Geocentric Solar Magnetospheric
  - SM Solar Magnetic
  - GEO Geographic Coordinate System
- Example
  - thm\_load\_state, /get\_support\_data
  - thm\_cotrans, 'th?\_fg?', out\_coord='geo', out\_suffix = 'geo'

# Plotting & Analysis Routines



## Plotting

- tplot
- tplotxy
- plotxy
- plotxyz
- tplot\_names
- tlimit
- get\_data
- store\_data

### Example:

```
tt89,'thc_state_pos',newname='model_field'
```

```
fac_matrix_make,'model_field',other_dim=  
'xgse', newname = 'fac_mat'
```

```
tvector_rotate, 'fac_mat', 'thc_peir_velocity',  
newname = 'ion_velocity_model_fa'
```

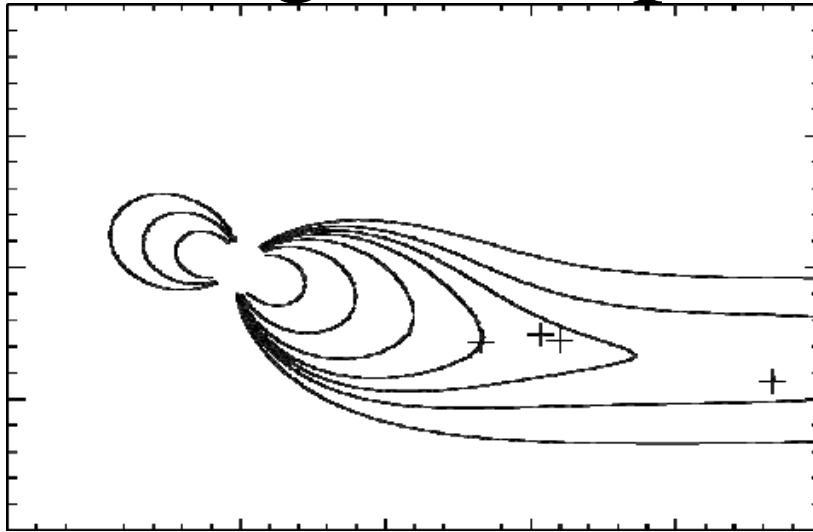
## Analytic Coordinate Transformations

- tvector\_rotate
- fac\_matrix\_make
- thm\_fac\_matrix\_make
- minvar\_matrix\_make

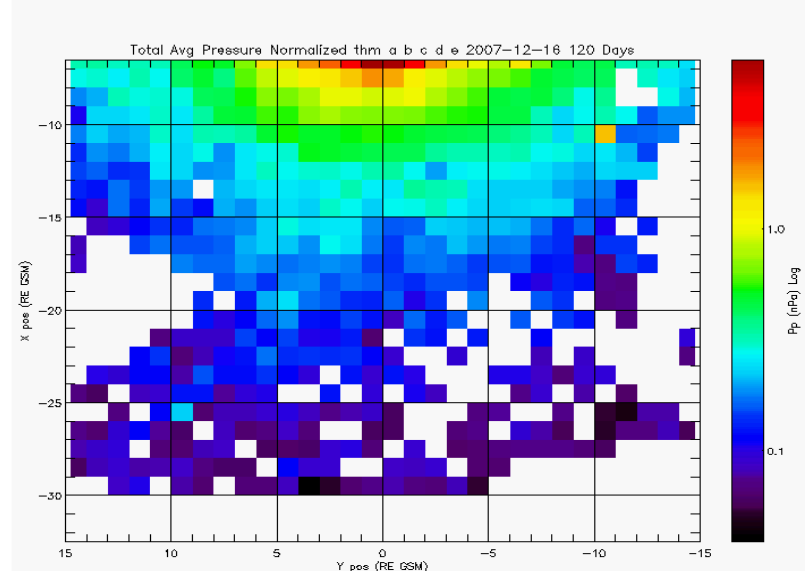
## Tsyganenko Model

- (t)trace2iono
- (t)trace2equator
- (t)t89
- (t)t96
- (t)t01
- (t)t04s

# Plotting Examples

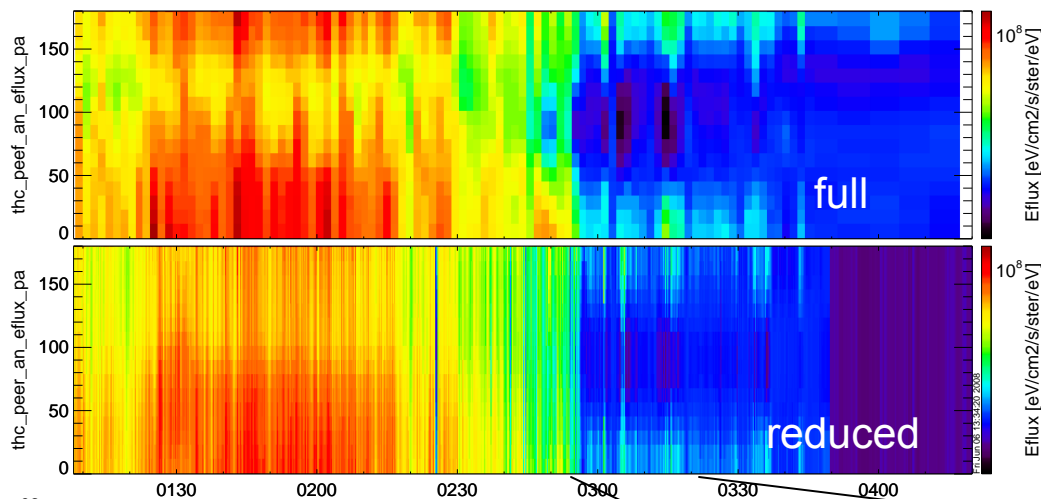


tplotxy can be used to plot isotropic position plots. Like plots of magnetic field models and spacecraft position



Plotxyz can be used to plot 3 dimensional isotropic data, with any axis.(Not restricted to time-series.)

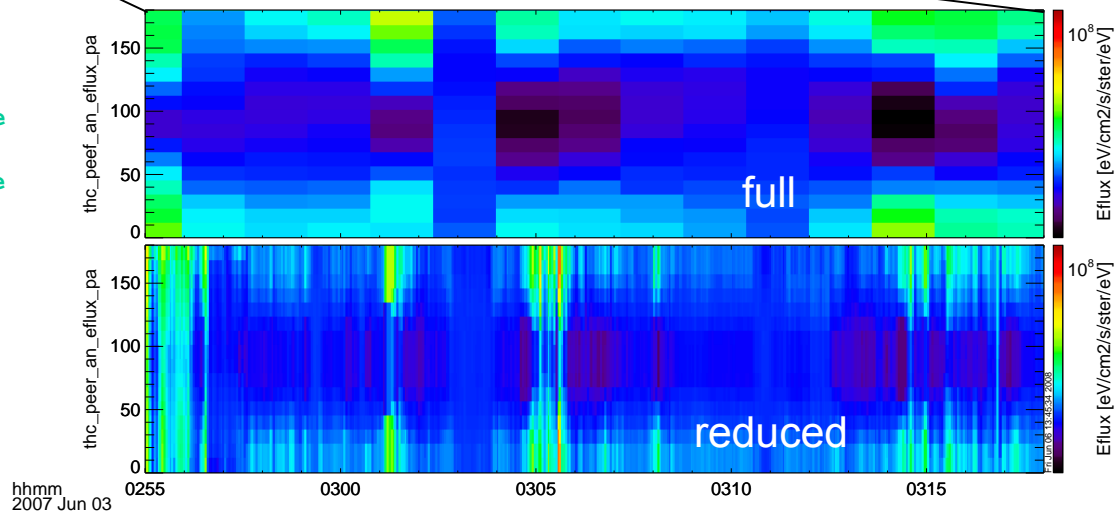
# Plotting Angular Spectra



hhmm  
2007 Jun 03

Pitch angle spectra for full and reduced mode electron ESA data. Plotted using tplot.

```
thm_part_getspec, $
probe=['c'], $ ;select probe
trange=['07-06-03/01:08', $ ;select timerange
        '07-06-03/04:20'], $
data_type=['peef','peer'], $ ;select data type
angle='pa', $ ;select pitch angle spectra
regrid=[32,16] ;set resolution of pitch/gyro
spectra
```

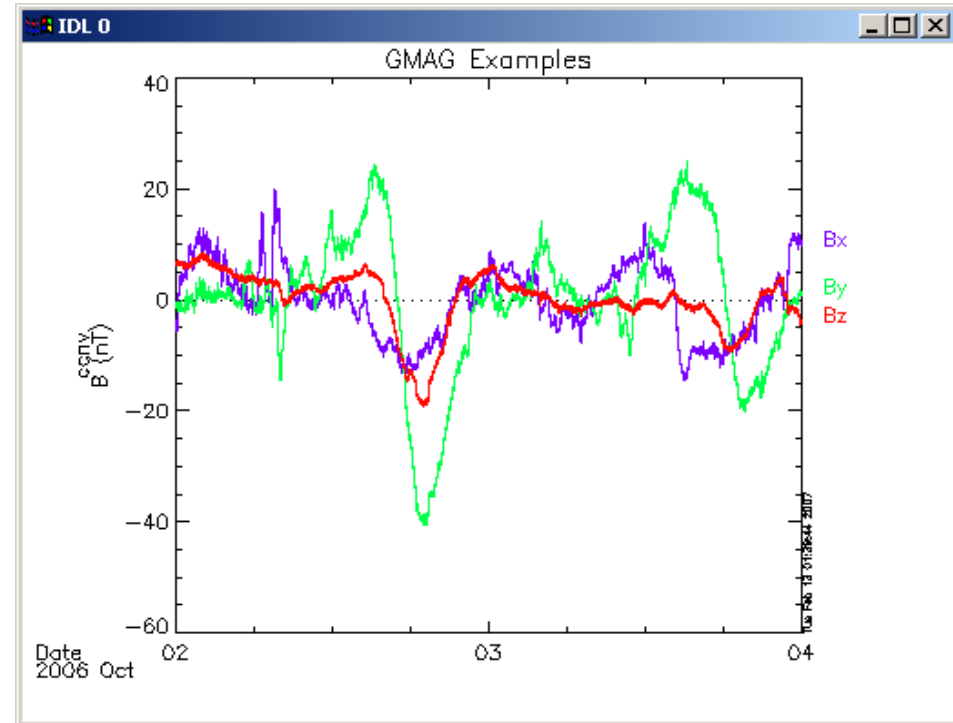


hhmm  
2007 Jun 03

# THEMIS Command Line Example 1



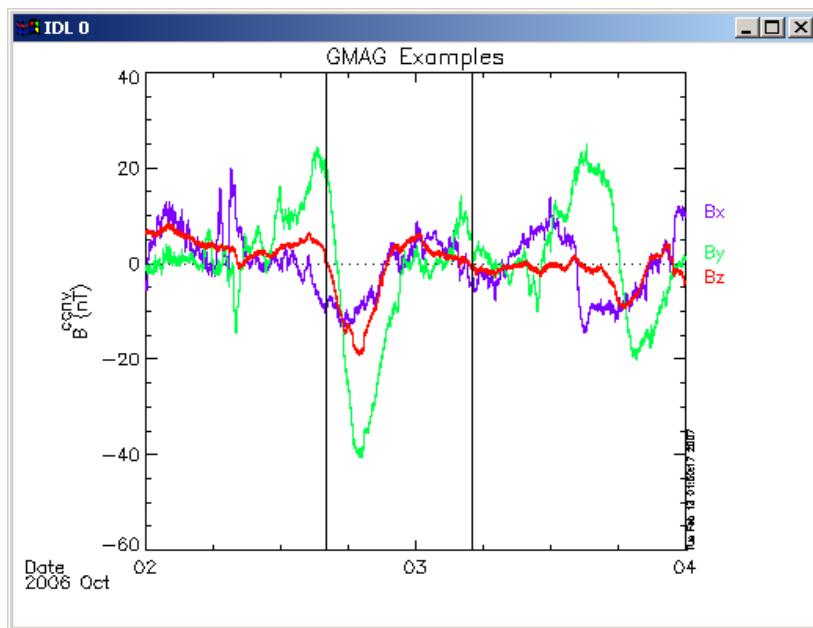
- To load data:
  - » `timespan,'6-10-2',2,/days`
  - » `thm_load_gmag,site='ccnv',$/`  
`subtract_average`
- To plot data:
  - » `options,'thg_mag_ccnv',$/`  
`labels=['Bx','By','Bz']`
  - » `tplot_options,'title',$/`  
`'GMAG Examples'`
  - » `tplot,'thg_mag_ccnv'`



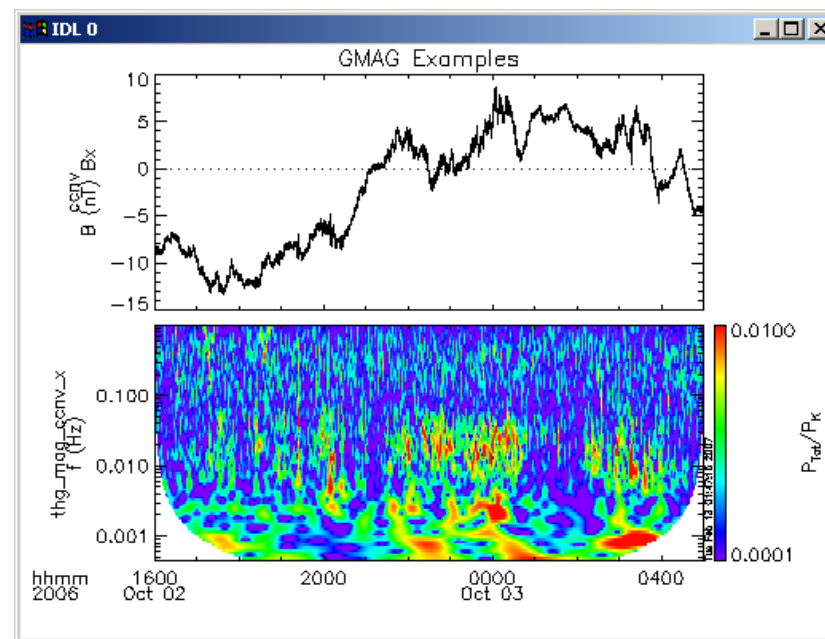
# Command Line Example 2



- Wavelet transform on an interval of interest
  - Define and display the interval
    - » `Tr = ['2006-10-2/16:00','2006-10-3/05']`
    - » `timebar,tr`



- Split the 3-vector into components:
  - » `split_vec,'thg_mag_ccnv'`
- Compute transform of one component
  - » `wav_data,'thg_mag_ccnv_x',/kol $ ,trange=tr ,maxpoints=241*3600*2`
- Set color limits (log scale)
  - » `zlim,'*pow',.0001,.01,1`
- Plot it.
  - » `tplot,'*ccnv_x*',trange=tr`







## Interface

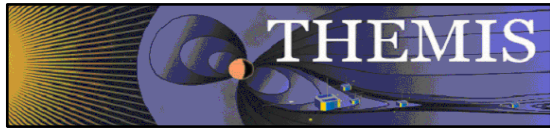
Called from IDL command line (thm\_gui).

**IDL> thm\_gui**

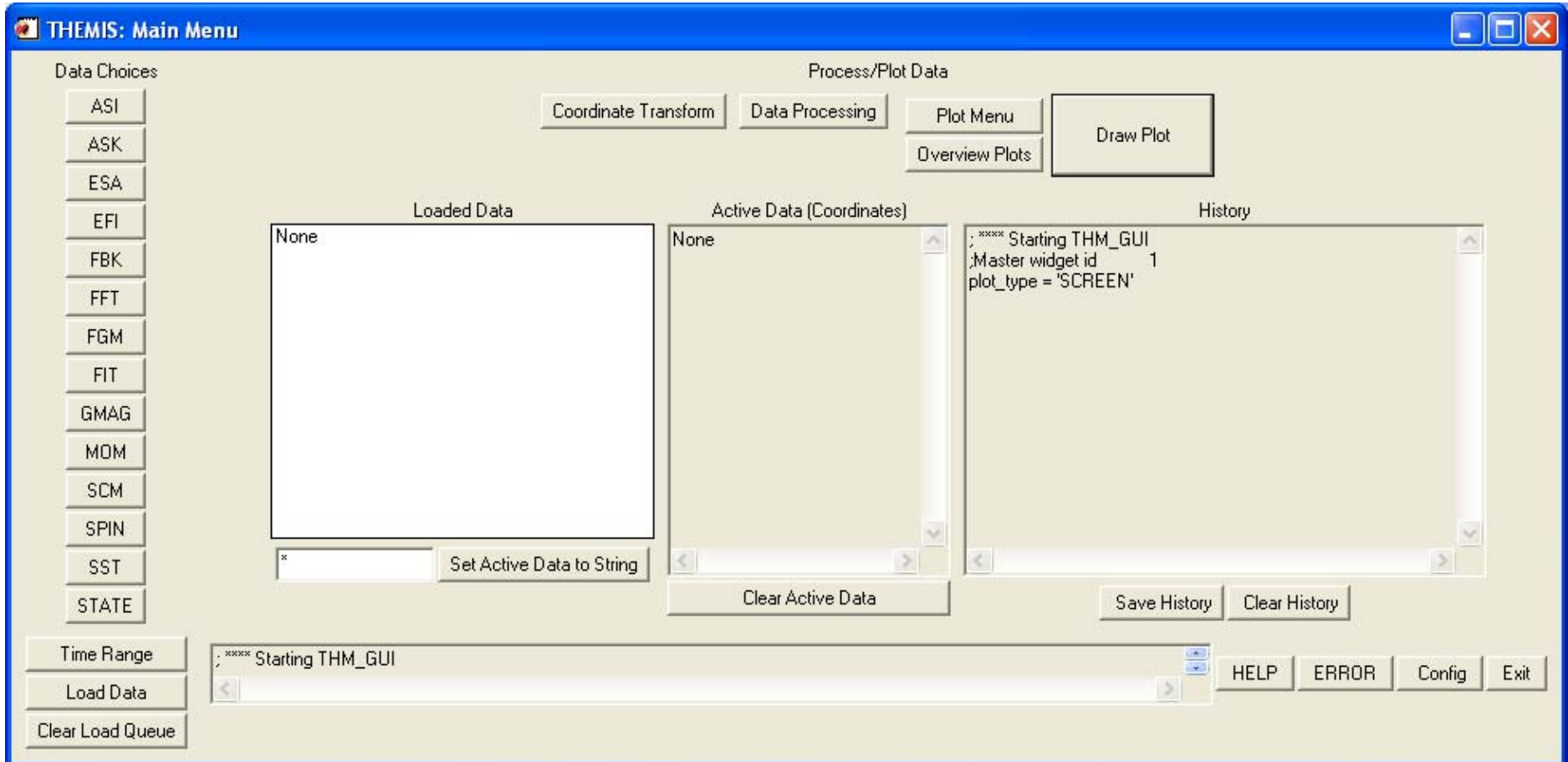
Gives the ability to load, calibrate, coordinate transformations, data manipulations and plot data.

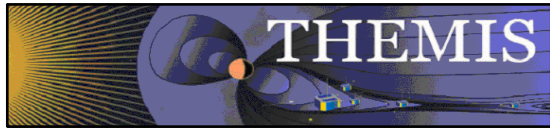
Calls various TPLOT routines

IDL functions are available from the command line when the main window is being displayed as well.



# Main Menu:



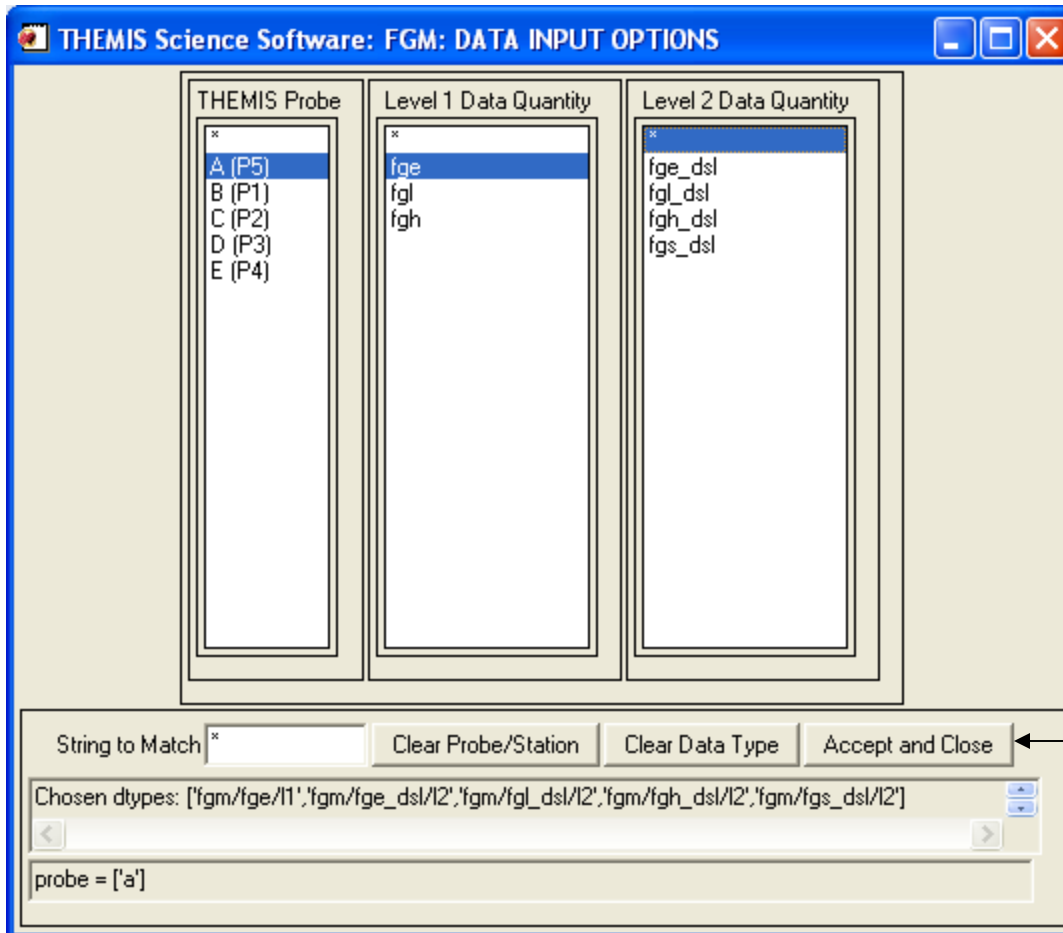


# Choose Data to Load:

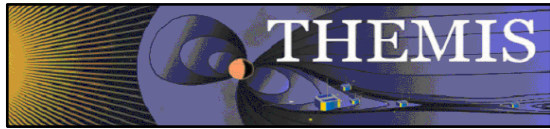
The screenshot shows the 'THEMIS: Main Menu' window. On the left, a vertical list of data types includes ASI, ASK, ESA, EFI, FBK, FFT, FGM, FIT, GMAG, MDM, SCM, SPIN, SST, and STATE. The 'FGM' button is highlighted with a mouse cursor. To the right, there are sections for 'Process/Plot Data' (Coordinate Transform, Data Processing, Plot Menu, Overview Plots, Draw Plot), 'Loaded Data' (None), 'Active Data (Coordinates)' (None), and 'History' (containing log text). At the bottom, there are buttons for 'Time Range', 'Load Data', 'Clear Load Queue', and a status bar with 'HELP', 'ERROR', 'Config', and 'Exit'.

Click here for FGM data

# Selecting Data:



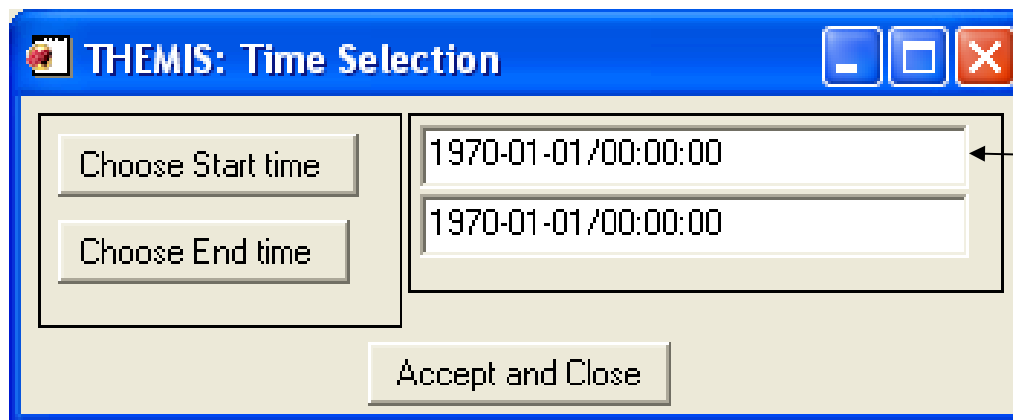
Nothing will happen until you click here



# Choose a Time Range:

Click here to choose times.

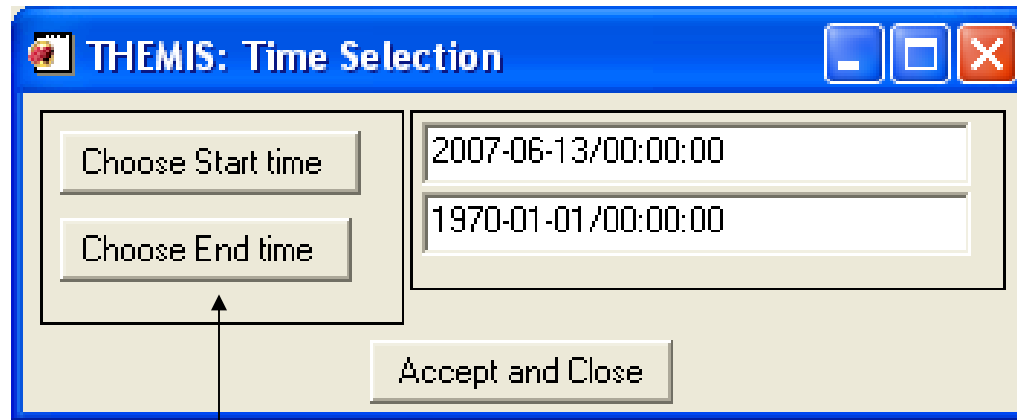
# Time Selection: Entering start time



← You can type here.  
For example: 2007-06-13

Initially times are set to 1970-01-01/00:00:00  
Times show up in history window as you type.

# Time Selection:



Click here for a time selection window



# Time Selection: Entering a stop time

THEMIS: Time Interval Selection

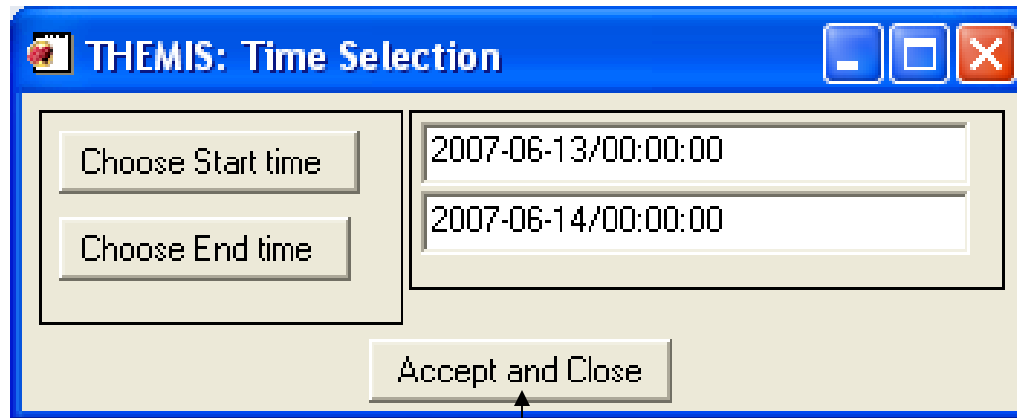
Choose Date and time

year	2005 2006 2007 2008 2009	month	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	day	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	hour	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	min	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	sec	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
------	--------------------------------------	-------	--	-----	---	------	--	-----	--	-----	--

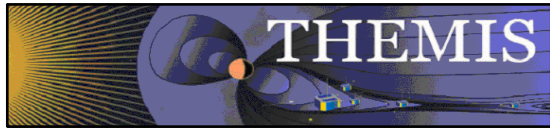
Accept and Close

Click here to accept selected time and close window

# Time Selection:



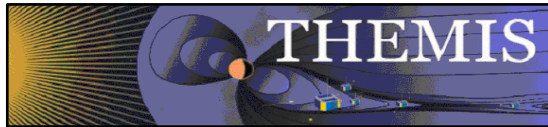
Click here to accept time range and close window



# Selection Displayed in History Window:

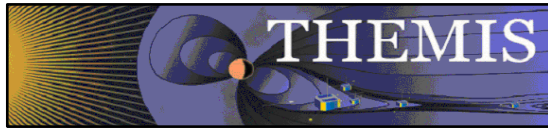
The screenshot shows the THEMIS: Main Menu interface. On the left is a 'Data Choices' panel with buttons for ASI, ASK, ESA, EFI, FBK, FFT, FGM, FIT, GMAG, MDM, SCM, SPIN, SST, and STATE. Below these are 'Time Range', 'Load Data', and 'Clear Load Queue' buttons. The 'Load Data' button is highlighted with an arrow. The main area is divided into three sections: 'Loaded Data' (containing 'None'), 'Active Data (Coordinates)' (containing 'None'), and 'History'. The 'History' window contains a log entry: `;**** Starting THM_GUI`, `;Master widget id 1`, `plot_type = 'SCREEN'`, `probe = ['a']`, `dtyp = ['fgm/fge/11','fgm/fge_dsl/12','fgm/fgl_dsl/12','fgm/fgh_dsl/12']`, `start_time = '2007-06-13 00:00:00'`, and `end_time = '2007-06-14/00:00:00'`. An arrow points from the 'Load Data' button to this log entry. At the top right, there are buttons for 'Coordinate Transform', 'Data Processing', 'Plot Menu', 'Overview Plots', and 'Draw Plot'. At the bottom right, there are 'Save History', 'Clear History', 'HELP', 'ERROR', 'Config', and 'Exit' buttons.

Now you can load data.



# After loading, All data is “active”

State data has been loaded automatically for FGM.

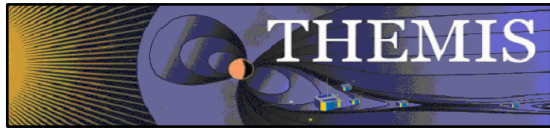


# Setting Active Data:

The screenshot shows the 'THEMIS: Main Menu' window. On the left, a vertical list of 'Data Choices' includes ASI, ASK, ESA, EFI, FBK, FFT, FGM, FIT, GMAG, MDM, SCM, SPIN, SST, and STATE. Below this are buttons for 'Time Range', 'Load Data', and 'Clear Load Queue'. The 'Load Data' button is highlighted. The main area is divided into three sections: 'Loaded Data', 'Active Data (Coordinates)', and 'History'. The 'Loaded Data' list contains various data series with time ranges. Below it is a text input field containing an asterisk (\*) and a 'Set Active Data to String' button. The 'Active Data (Coordinates)' list shows a selection of data series. Below it is a 'Clear Active Data' button. The 'History' window shows a log of operations, including 'Starting THM\_GUI' and 'Finished Loading data...'. At the bottom right, there are buttons for 'HELP', 'ERROR', 'Config', and 'Exit'. Three arrows point from the text below to the asterisk in the input field, the 'Set Active Data to String' button, and the 'Load Data' button.

Type a string, or click to set data to “active”





# Active Data Window:

THEMIS: Main Menu

Data Choices

- ASI
- ASK
- ESA
- EFI
- FBK
- FFT
- FGM
- FIT
- GMAG
- MODM
- SCM
- SPIN
- SST
- STATE

Process/Plot Data

Coordinate Transform    Data Processing    Plot Menu    Draw Plot

Overview Plots

Loaded Data

```

tha_state_roi:2007-06-13/00:00:00 To 2007-01
tha_state_spinras:2007-06-13/00:00:00 To 20
tha_state_spindec:2007-06-13/00:00:00 To 20
tha_state_spinalpha:2007-06-13/00:00:00 To 2
tha_state_spinbeta:2007-06-13/00:00:00 To 20
tha_state_spinper:2007-06-13/00:00:00 To 20
tha_state_spinphase:2007-06-13/00:00:00 To
tha_fge:2007-06-13/21:53:59 To 2007-06-14/
tha_fge_hed:2007-06-13/21:53:59 To 2007-06-14/
tha_fge_dsl:2007-06-13/21:53:59 To 2007-06-14/
tha_fgl_dsl:2007-06-13/11:34:40 To 2007-06-14/
tha_fgh_dsl:2007-06-13/12:32:16 To 2007-06-14/
tha_fgs_dsl:2007-06-13/00:05:46 To 2007-06-14/

```

Active Data (Coordinates)

```

tha_fge_dsl (dsl)
tha_fgs_dsl (dsl)

```

History

```

; ***** Starting THM_GUI
;Master widget id      1
plot_type = 'SCREEN'
probe = ['a']
dtyp = ['fgm/fge/I1','fgm/fge_dsl/I2','fgm/fgl_dsl/I2','fgm/fgh_dsl/I2']
start_time = '2007-06-13 00:00:00'
end_time = '2007-06-14 00:00:00'
varnames = thm_ui_load_data_fr('2007-06-13/00:00:00', '2007-06-14/00:00:00')
;Finished Loading data...
varnames = ['tha_fge_dsl','tha_fgs_dsl']

```

Set Active Data to String

Clear Active Data

Save History    Clear History

Time Range    Finished Choosing Active Data Sets

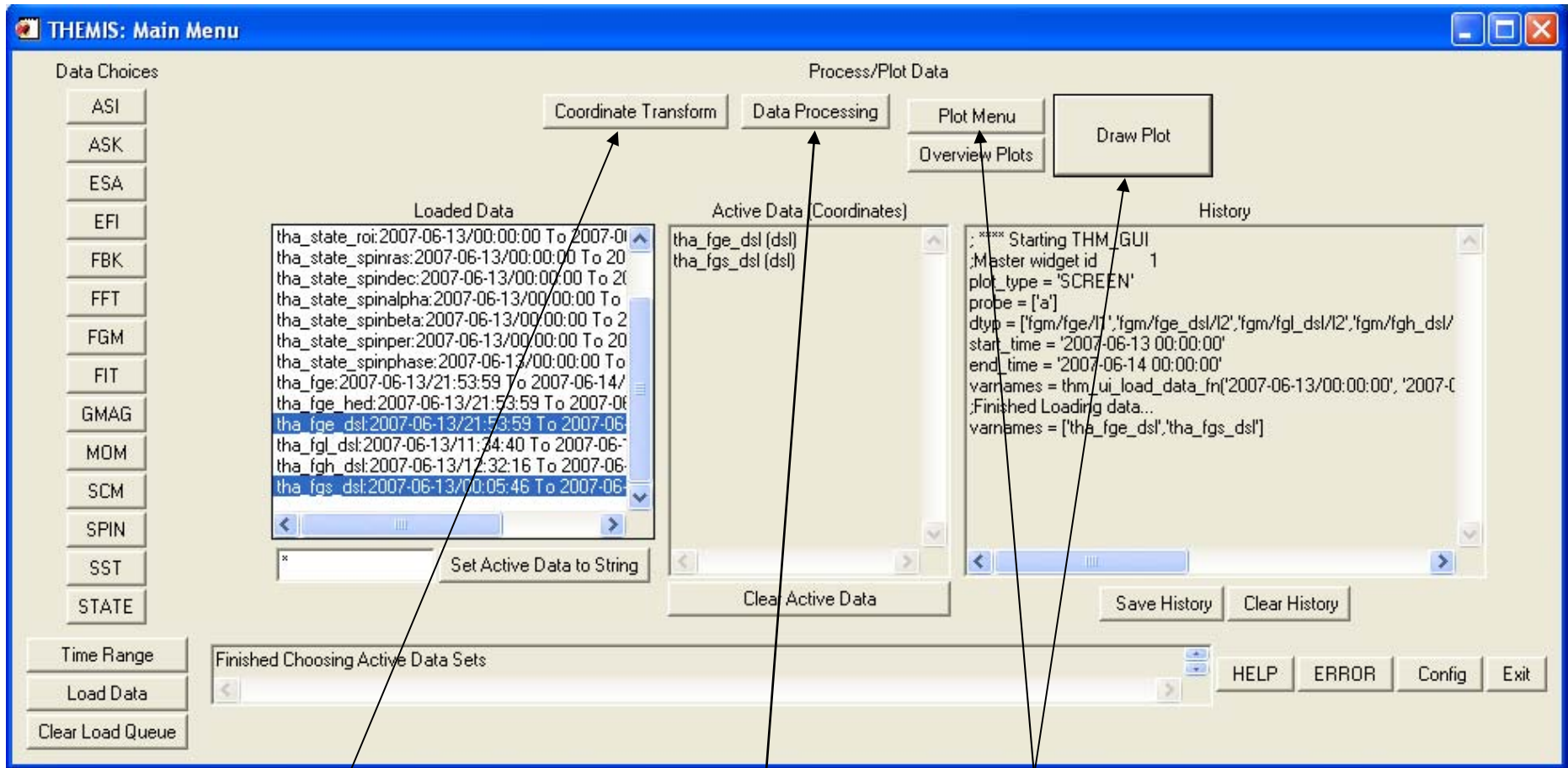
Load Data

Clear Load Queue

HELP    ERROR    Config    Exit

Selected data is now active

# What next?



**THEMIS: Main Menu**

**Data Choices**

- ASI
- ASK
- ESA
- EFI
- FBK
- FFT
- FGM
- FIT
- GMAG
- MOM
- SCM
- SPIN
- SST
- STATE

**Process/Plot Data**

- Coordinate Transform
- Data Processing
- Plot Menu
- Draw Plot
- Overview Plots

**Loaded Data**

```

tha_state_roi:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spinras:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spindec:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spinalpha:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spinbeta:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spinper:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_state_spinphase:2007-06-13/00:00:00 To 2007-06-13/00:00:00
tha_fge:2007-06-13/21:53:59 To 2007-06-14/00:00:00
tha_fge_hed:2007-06-13/21:53:59 To 2007-06-14/00:00:00
tha_fge_dsl:2007-06-13/21:53:59 To 2007-06-14/00:00:00
tha_fgl_dsl:2007-06-13/11:34:40 To 2007-06-13/12:32:16
tha_fgh_dsl:2007-06-13/12:32:16 To 2007-06-13/12:32:16
tha_fgs_dsl:2007-06-13/00:05:46 To 2007-06-13/00:05:46
    
```

**Active Data (Coordinates)**

```

tha_fge_dsl (dsl)
tha_fgs_dsl (dsl)
    
```

**History**

```

:**** Starting THM_GUI
;Master widget id = 1
plot_type = 'SCREEN'
probe = ['a']
dtyp = ['fgm/fge/1', 'fgm/fge_dsl/12', 'fgm/fgl_dsl/12', 'fgm/figh_dsl/12']
start_time = '2007-06-13 00:00:00'
end_time = '2007-06-14 00:00:00'
varnames = thm_ui_load_data_fn('2007-06-13/00:00:00', '2007-06-14/00:00:00')
;Finished Loading data...
varnames = ['tha_fge_dsl', 'tha_fgs_dsl']
    
```

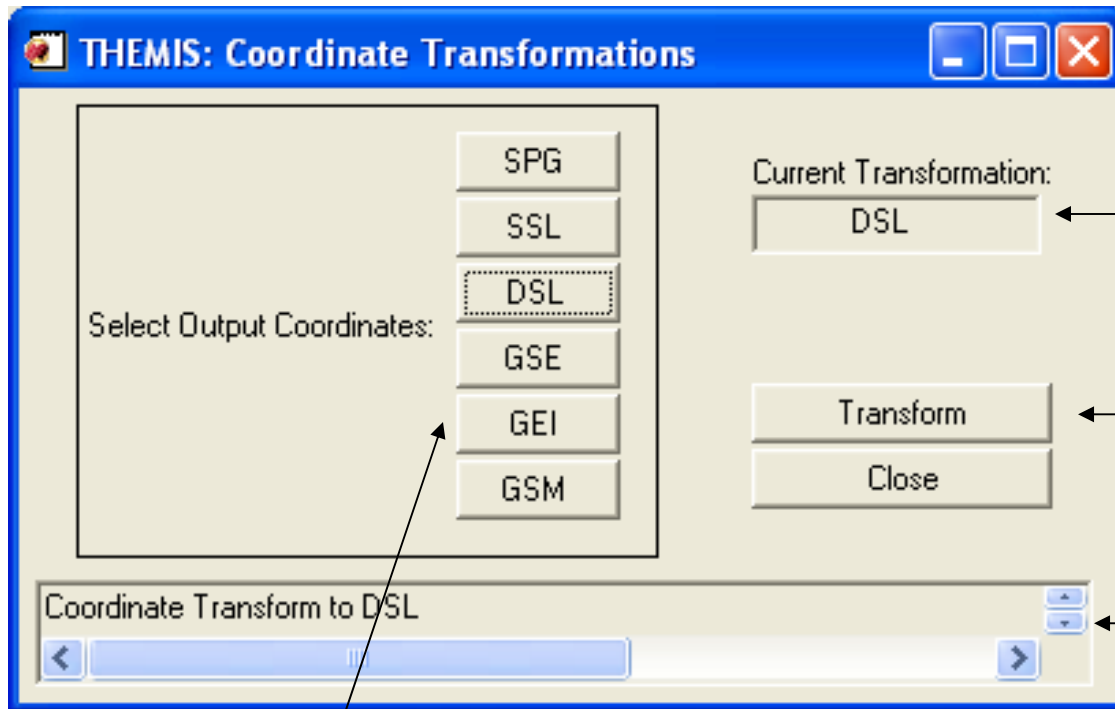
**Coordinate transform**

**Data Processing**

**Plotting**



# Coordinate Transform:



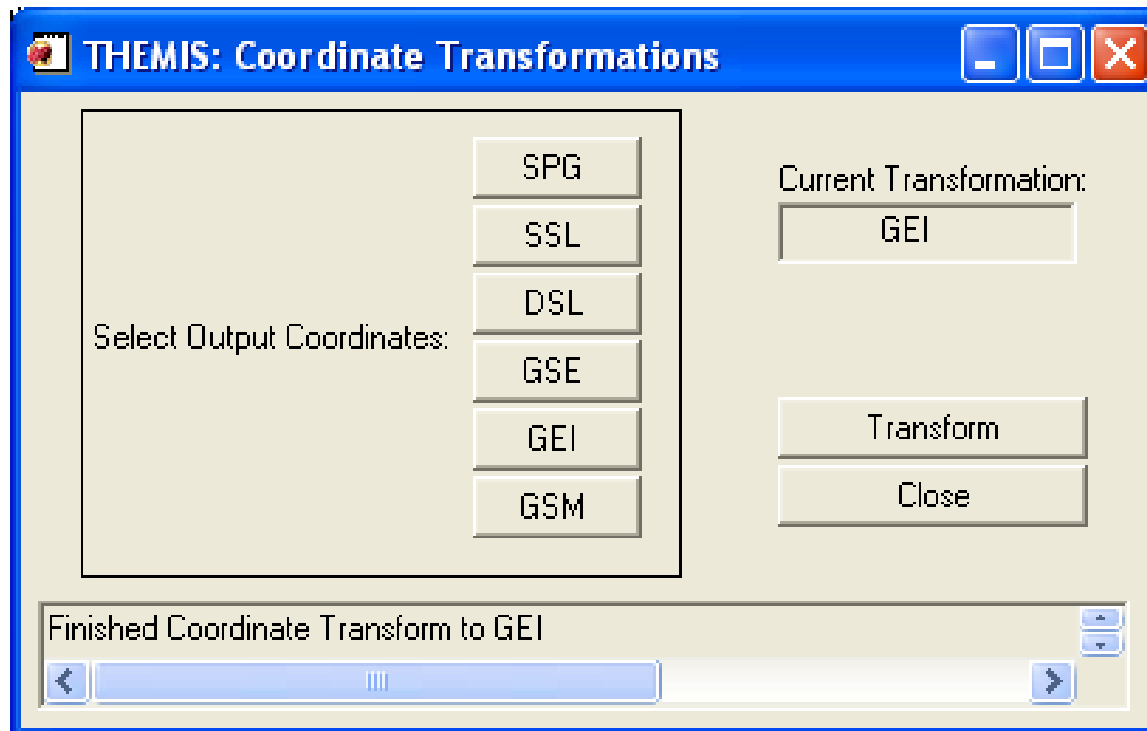
Shows current transform

Click here to perform the transformation

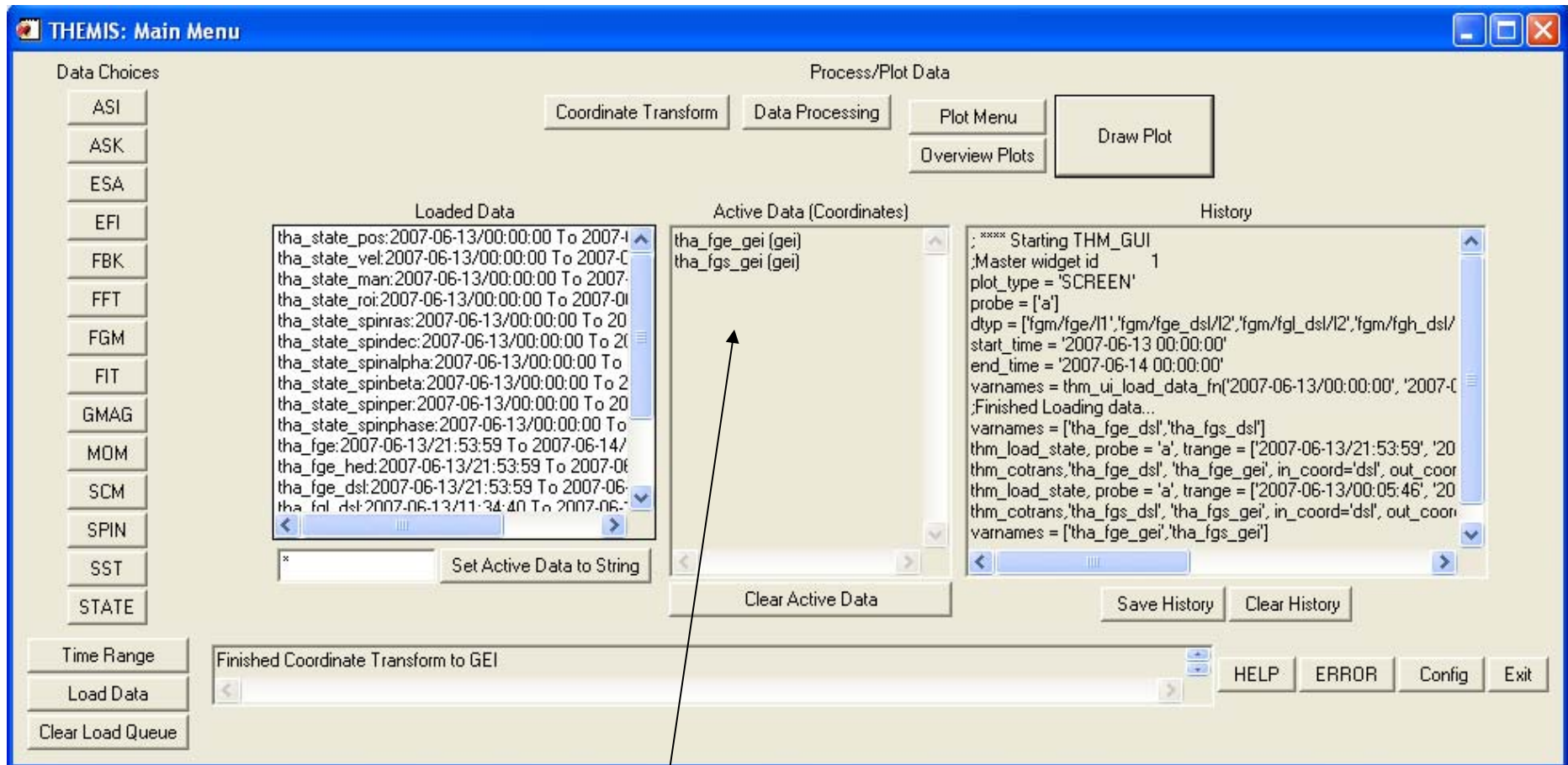
Message window will show warnings, errors, and progress

Click one of these to choose output coordinates

## Clicked on GEI, and Transform Button:

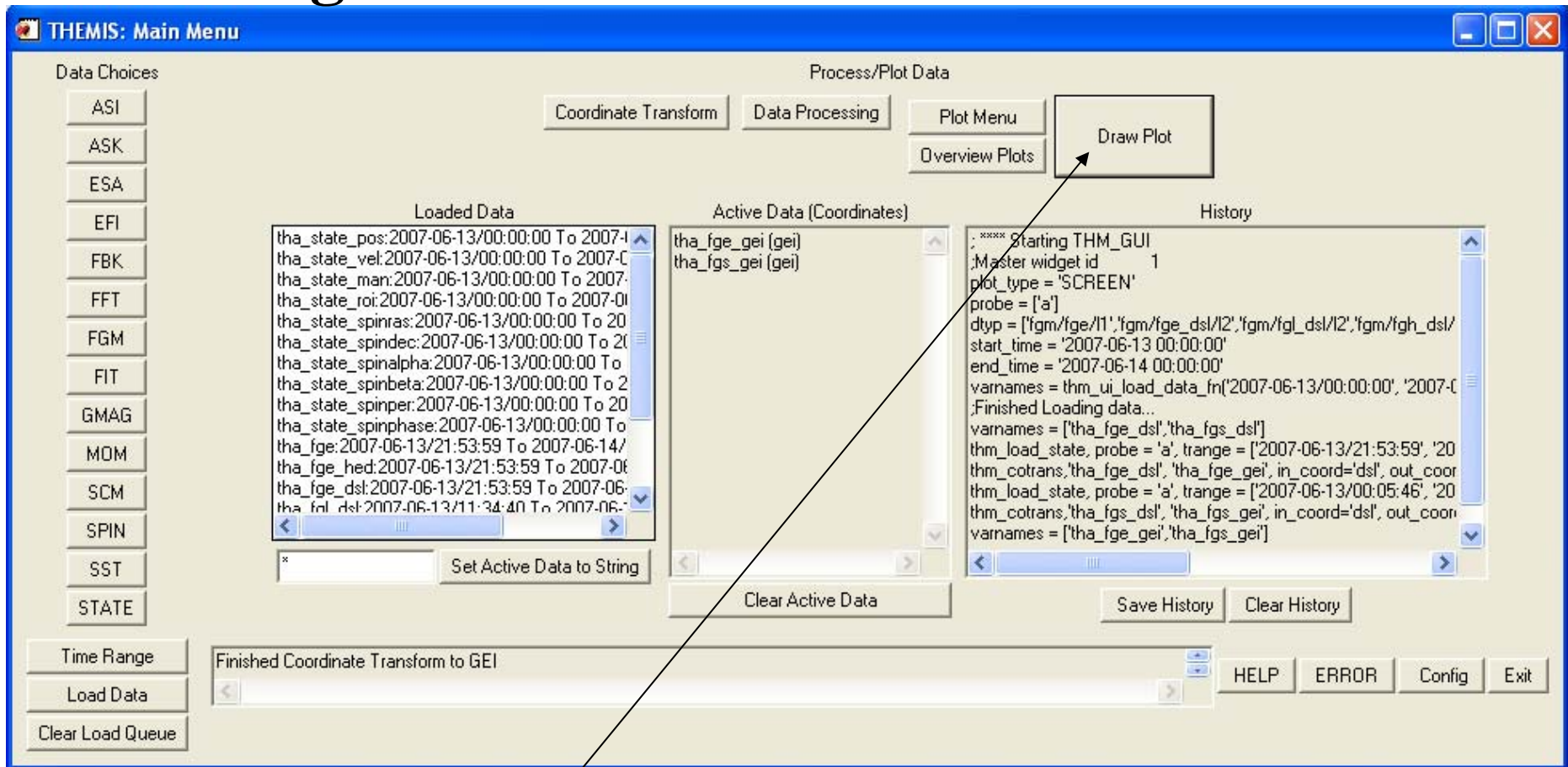


# Back on the Main Menu:



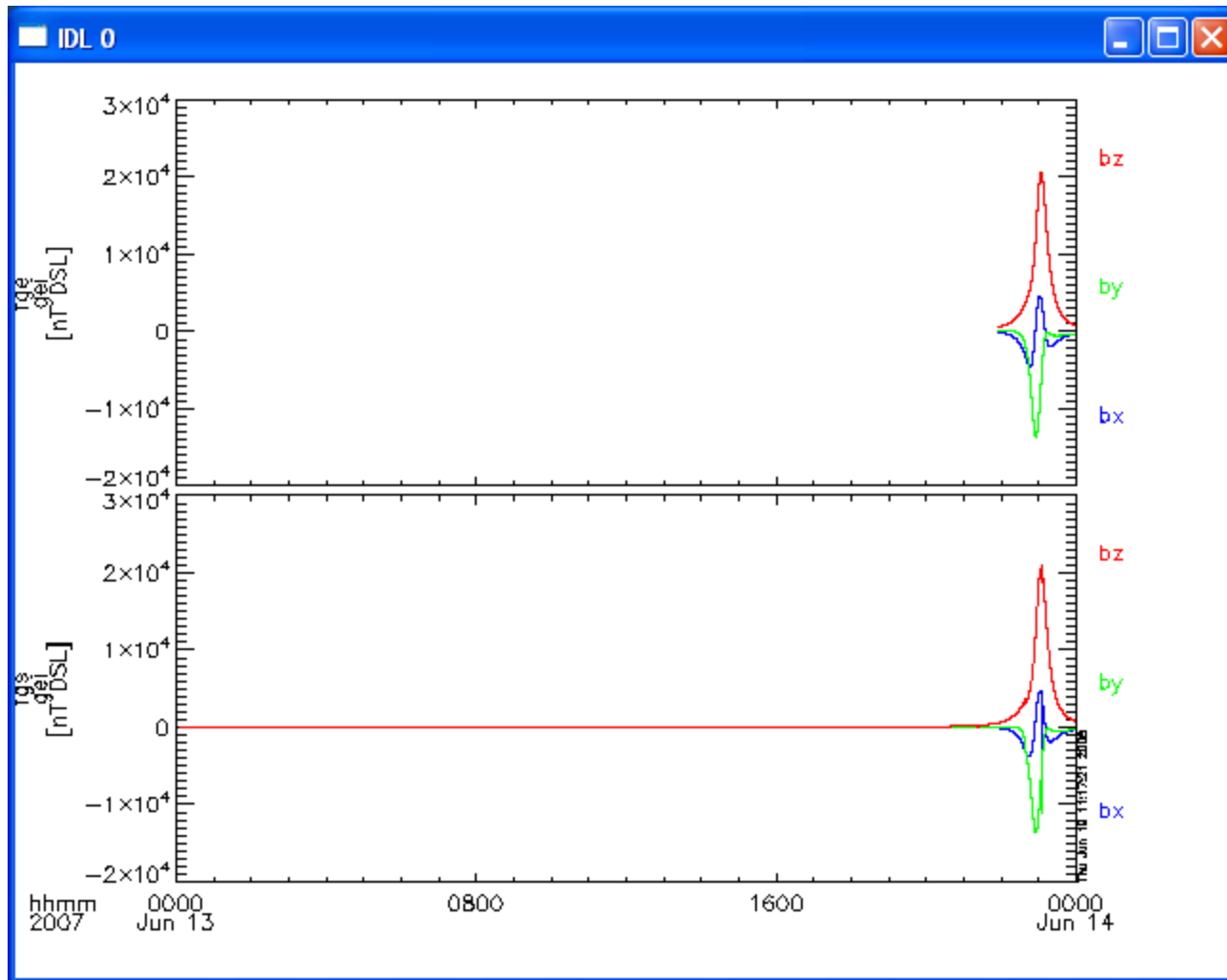
New “active” data. Remember – only active data is processed.

# Plotting:

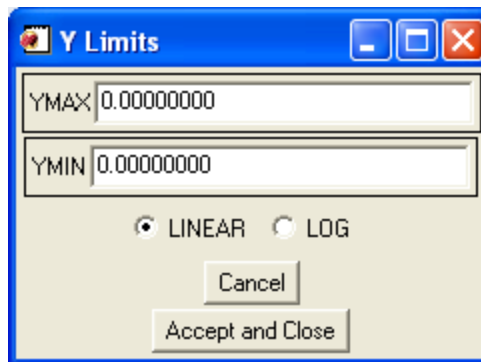
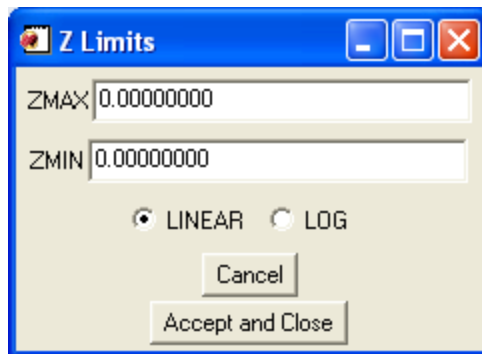
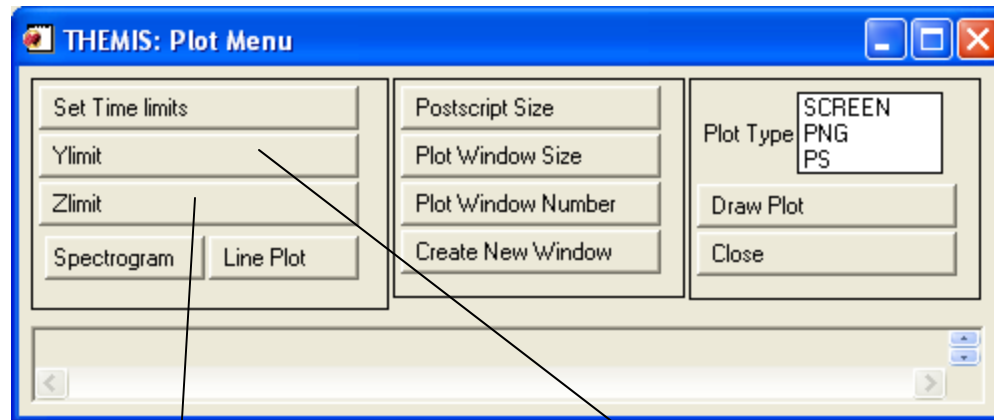


Click the “Draw Plot” button. Active data is plotted.

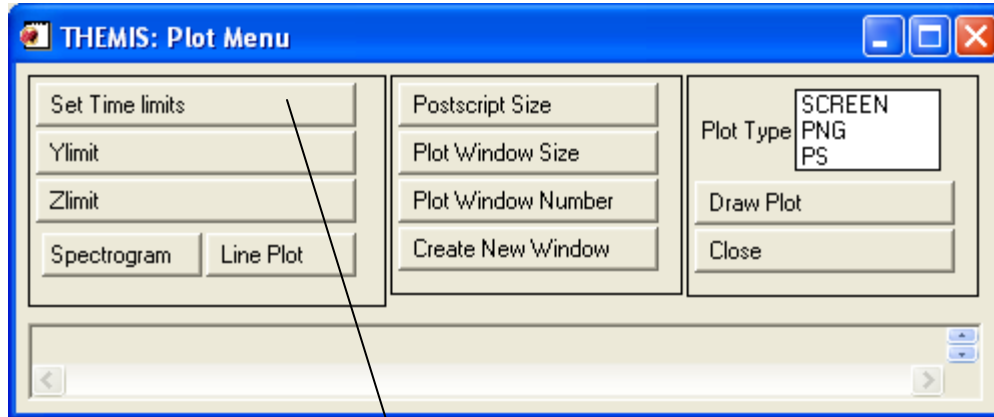
# Plot:



# Plot Menu:



# Plot Menu: Rescale Active Data



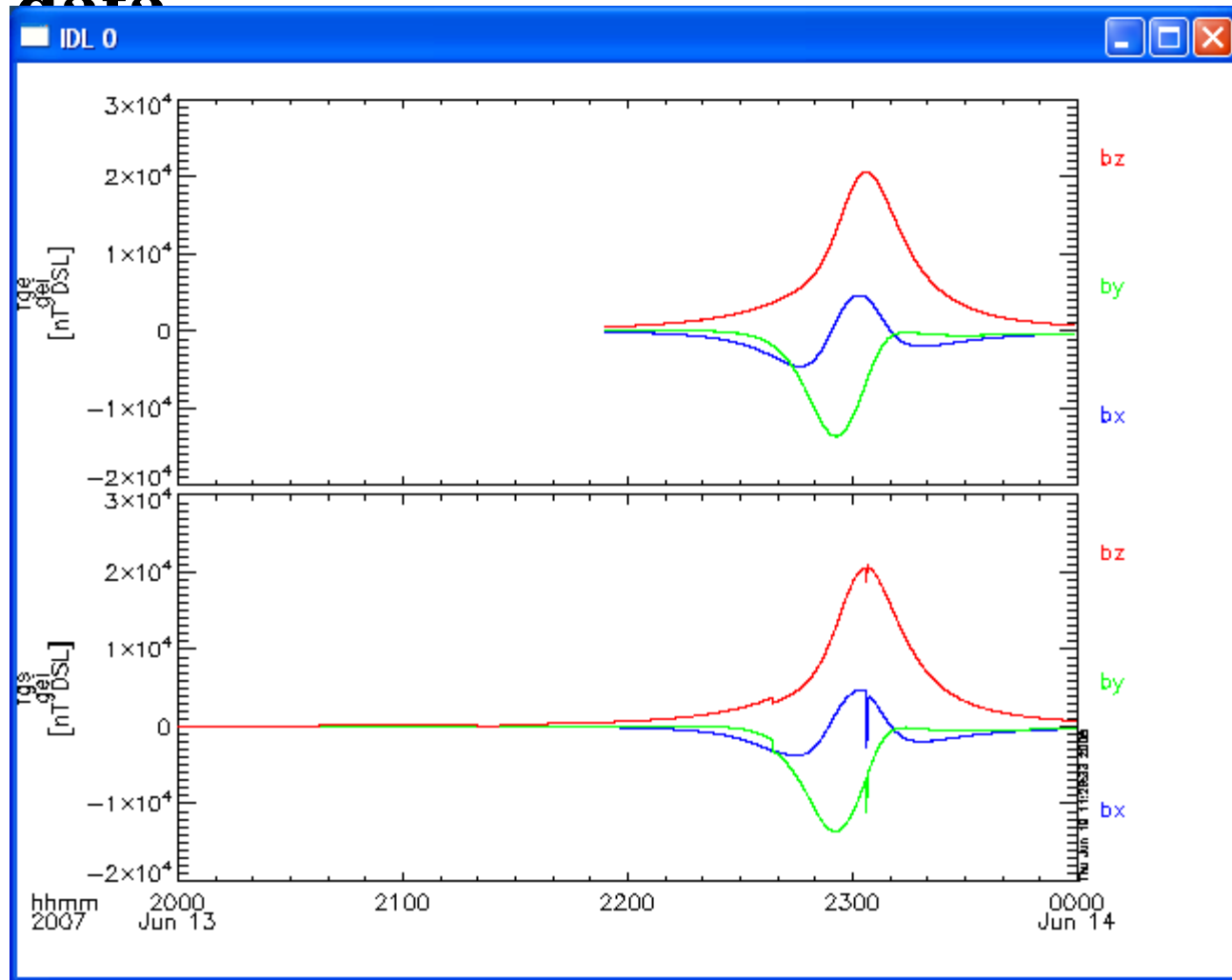
Enter new start time



You must click here, in order to accept the new start time.

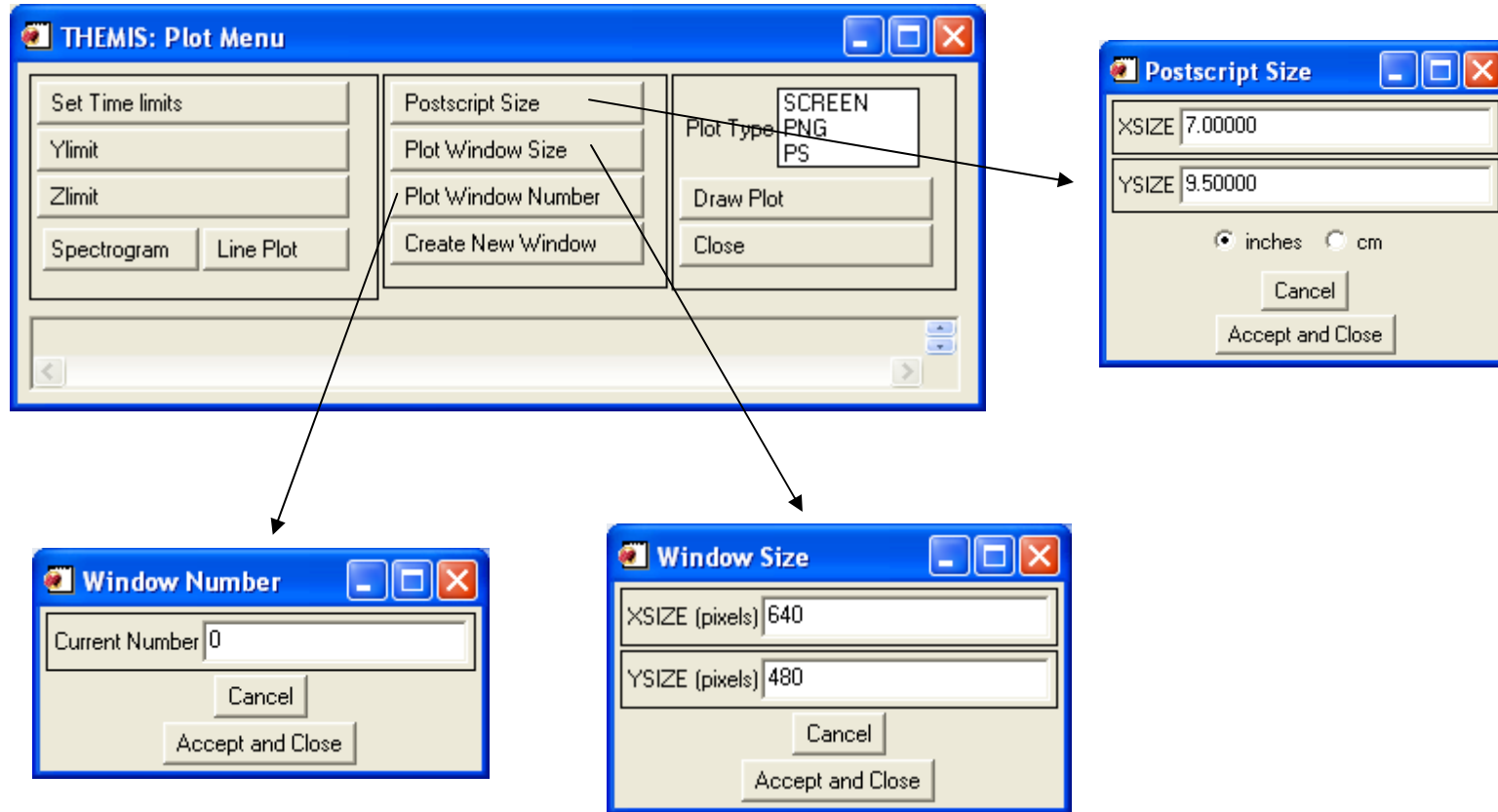


# Plot Menu: New time limits automatically plots new data

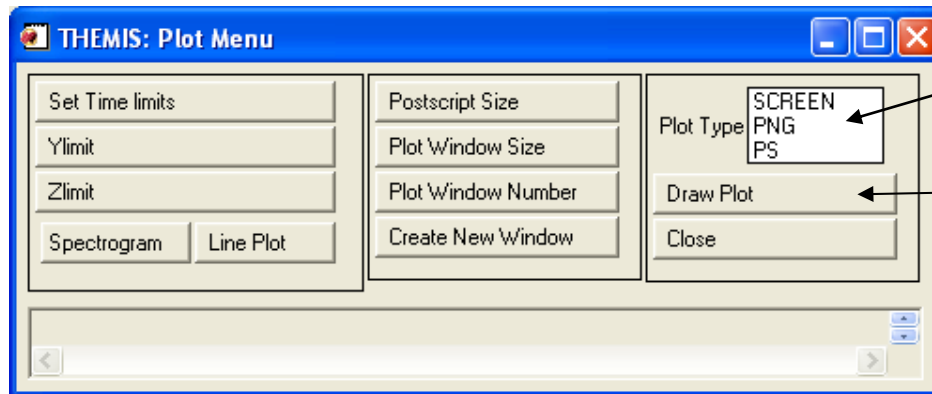




# Plot Menu: Setting Size and Window options.



# Plot Menu: Setting “PNG” or “PS”



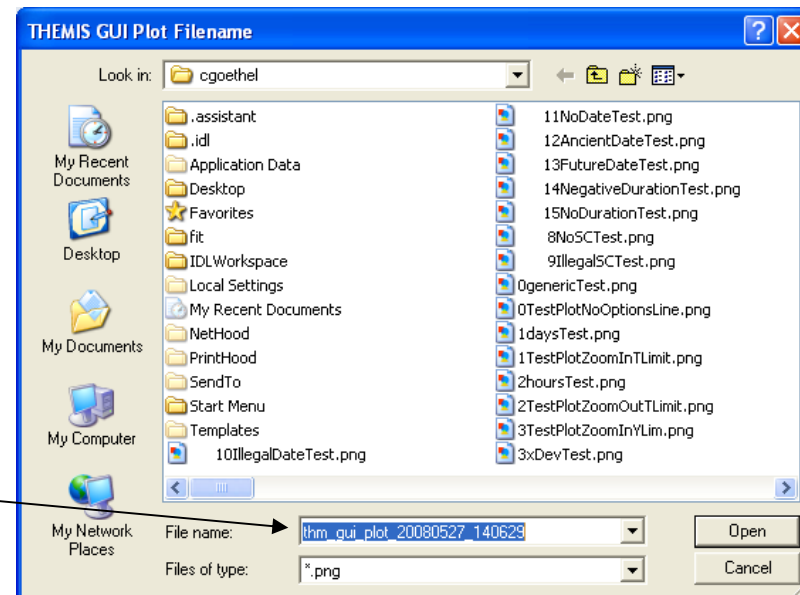
Click here to select output mode

Plots will not be made until you click here.

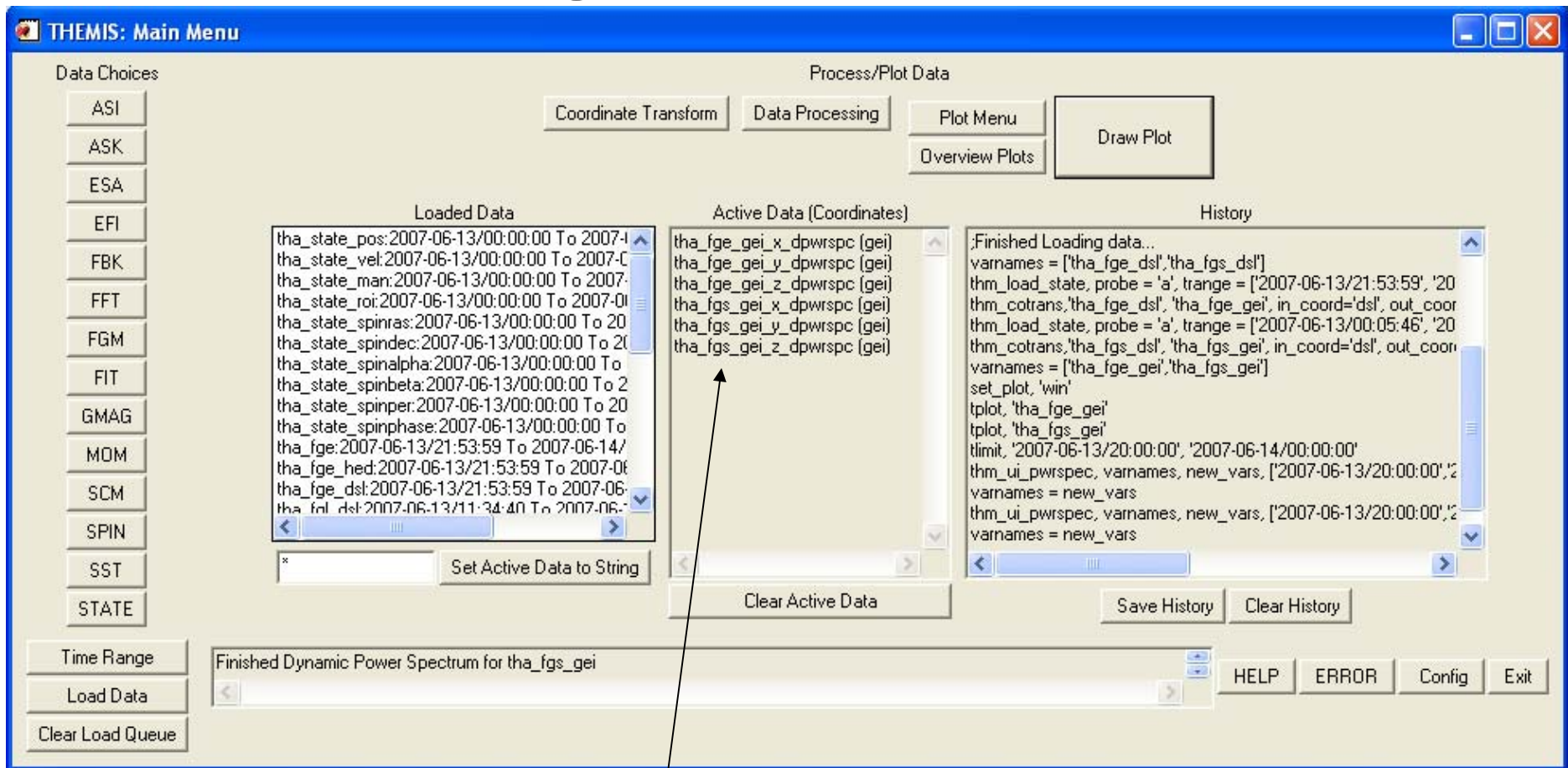
If a PNG or PS plot type was selected, a file selection window is displayed.

\* Remember to click the Screen option to return to screen plots.

Click here to enter a file name



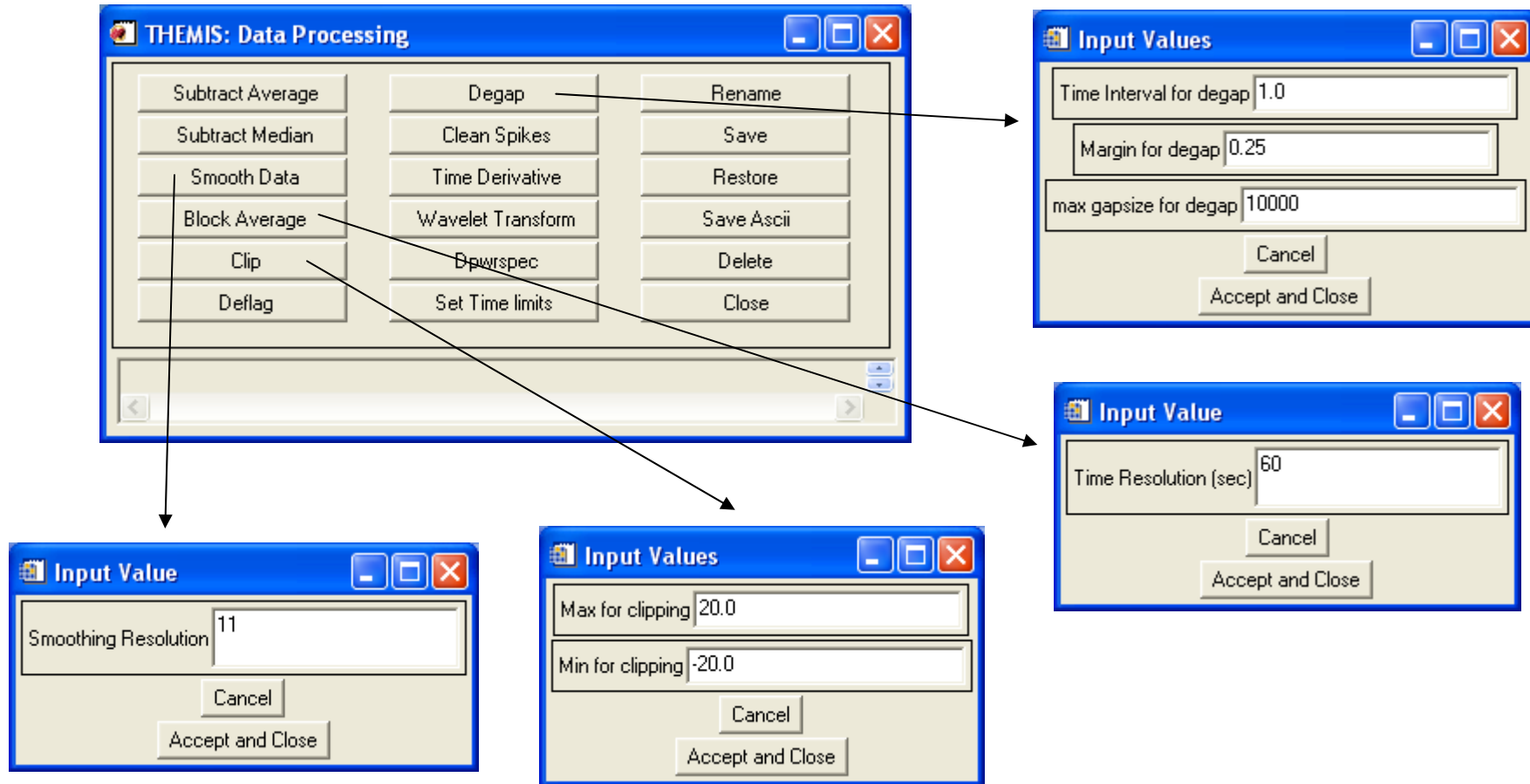
# Data Processing Resets Active Data:



The screenshot shows the THEMIS: Main Menu interface. On the left, there is a 'Data Choices' panel with buttons for ASI, ASK, ESA, EFI, FBK, FFT, FGM, FIT, GMAG, MOM, SCM, SPIN, SST, and STATE. Below these are 'Time Range', 'Load Data', and 'Clear Load Queue' buttons. The main area is titled 'Process/Plot Data' and contains buttons for 'Coordinate Transform', 'Data Processing', 'Plot Menu', 'Overview Plots', and 'Draw Plot'. There are three main panels: 'Loaded Data', 'Active Data (Coordinates)', and 'History'. The 'Loaded Data' panel lists various data files with their time ranges. The 'Active Data (Coordinates)' panel lists the currently active data variables. The 'History' panel shows a log of operations. At the bottom, there are buttons for 'Set Active Data to String', 'Clear Active Data', 'Save History', 'Clear History', 'HELP', 'ERROR', 'Config', and 'Exit'. A black arrow points from the text below to the 'Clear Active Data' button.

These processes reset the “active” data.

# Data Processing Menu:

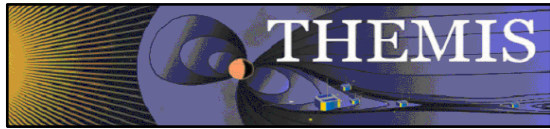


The main window, titled "THEMIS: Data Processing", contains a grid of buttons for various operations:

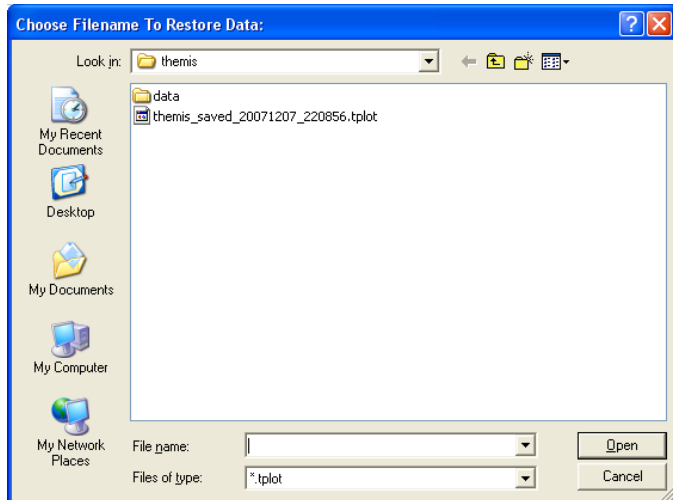
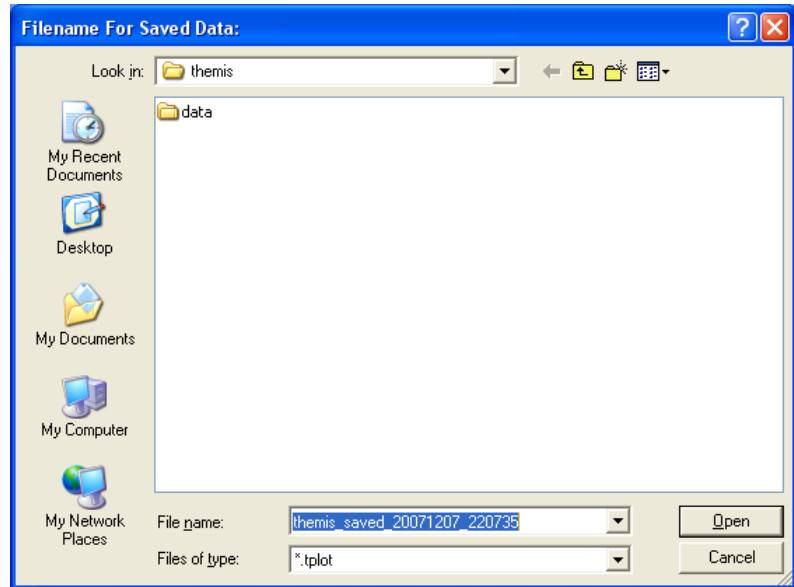
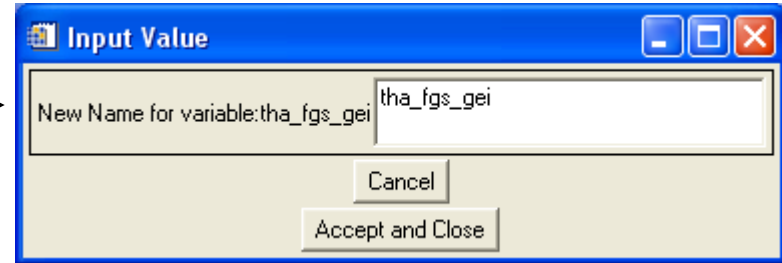
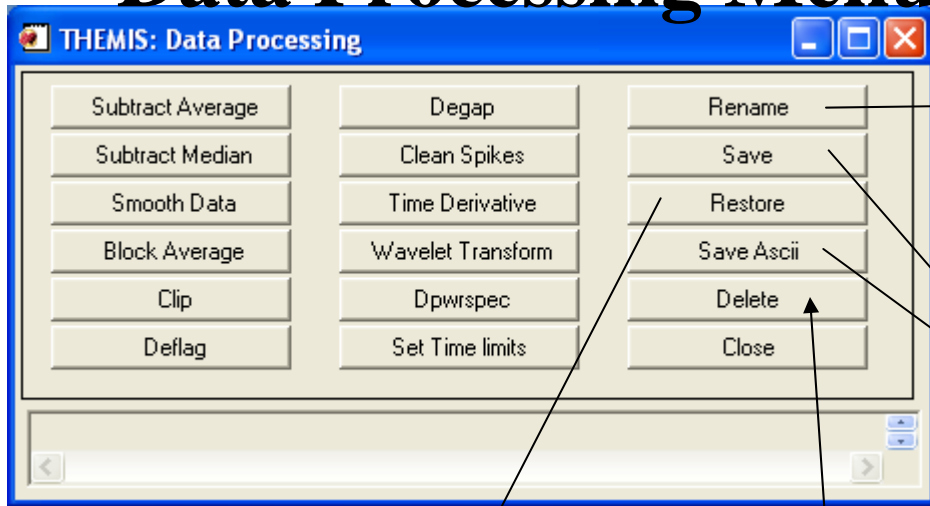
Subtract Average	Degap	Rename
Subtract Median	Clean Spikes	Save
Smooth Data	Time Derivative	Restore
Block Average	Wavelet Transform	Save Ascii
Clip	Downspec	Delete
Deflag	Set Time limits	Close

Four dialog boxes are shown, each linked to a specific button in the main menu:

- Input Values** (linked to "Degap"): Contains fields for "Time Interval for degap" (1.0), "Margin for degap" (0.25), and "max gapsize for degap" (10000). Buttons: "Cancel", "Accept and Close".
- Input Value** (linked to "Smooth Data"): Contains a field for "Smoothing Resolution" (11). Buttons: "Cancel", "Accept and Close".
- Input Values** (linked to "Clip"): Contains fields for "Max for clipping" (20.0) and "Min for clipping" (-20.0). Buttons: "Cancel", "Accept and Close".
- Input Value** (linked to "Block Average"): Contains a field for "Time Resolution (sec)" (60). Buttons: "Cancel", "Accept and Close".



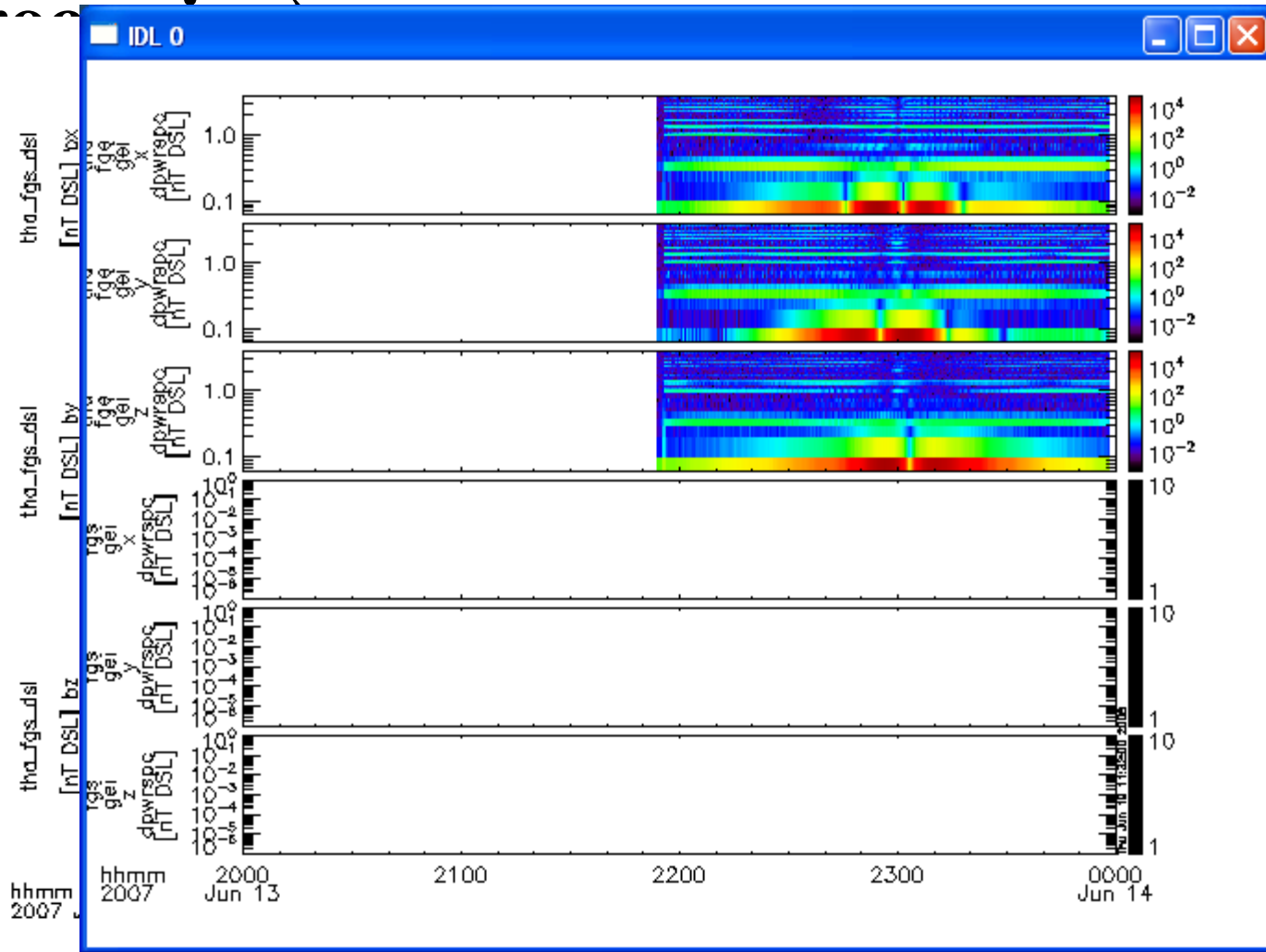
# Data Processing Menu:



Deletes Active Data.

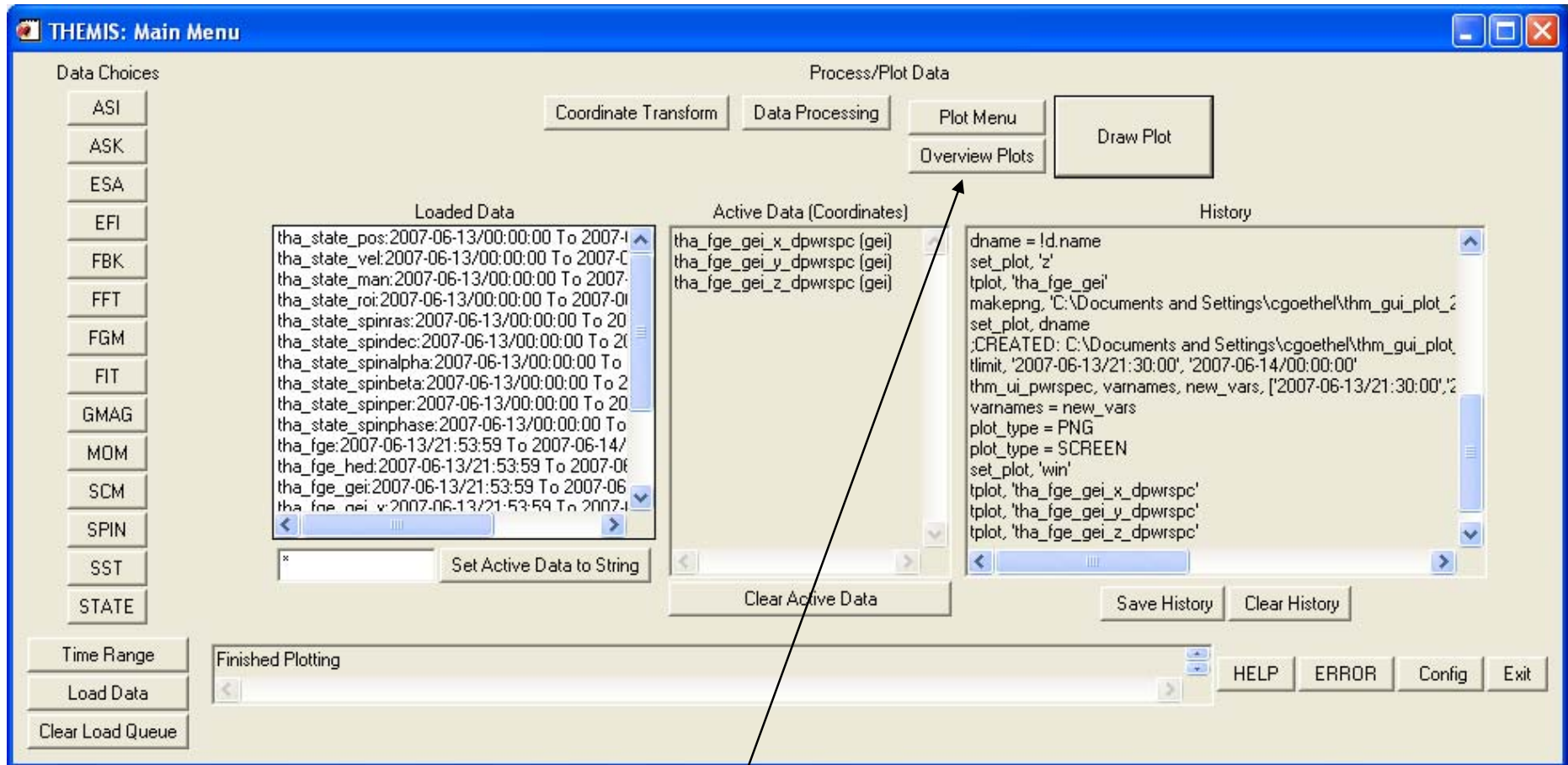


# Plot of New Processed Data: (after dpwrspc pr





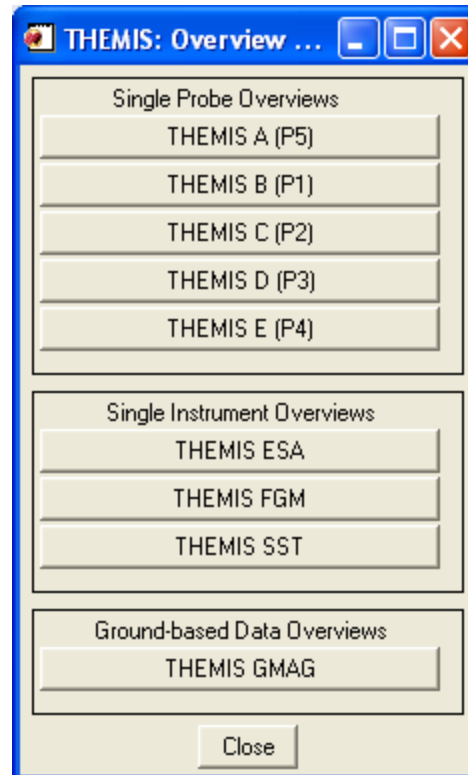
# Overview Plots:



Click here for an overview plot:

# Overview Plot Menu:

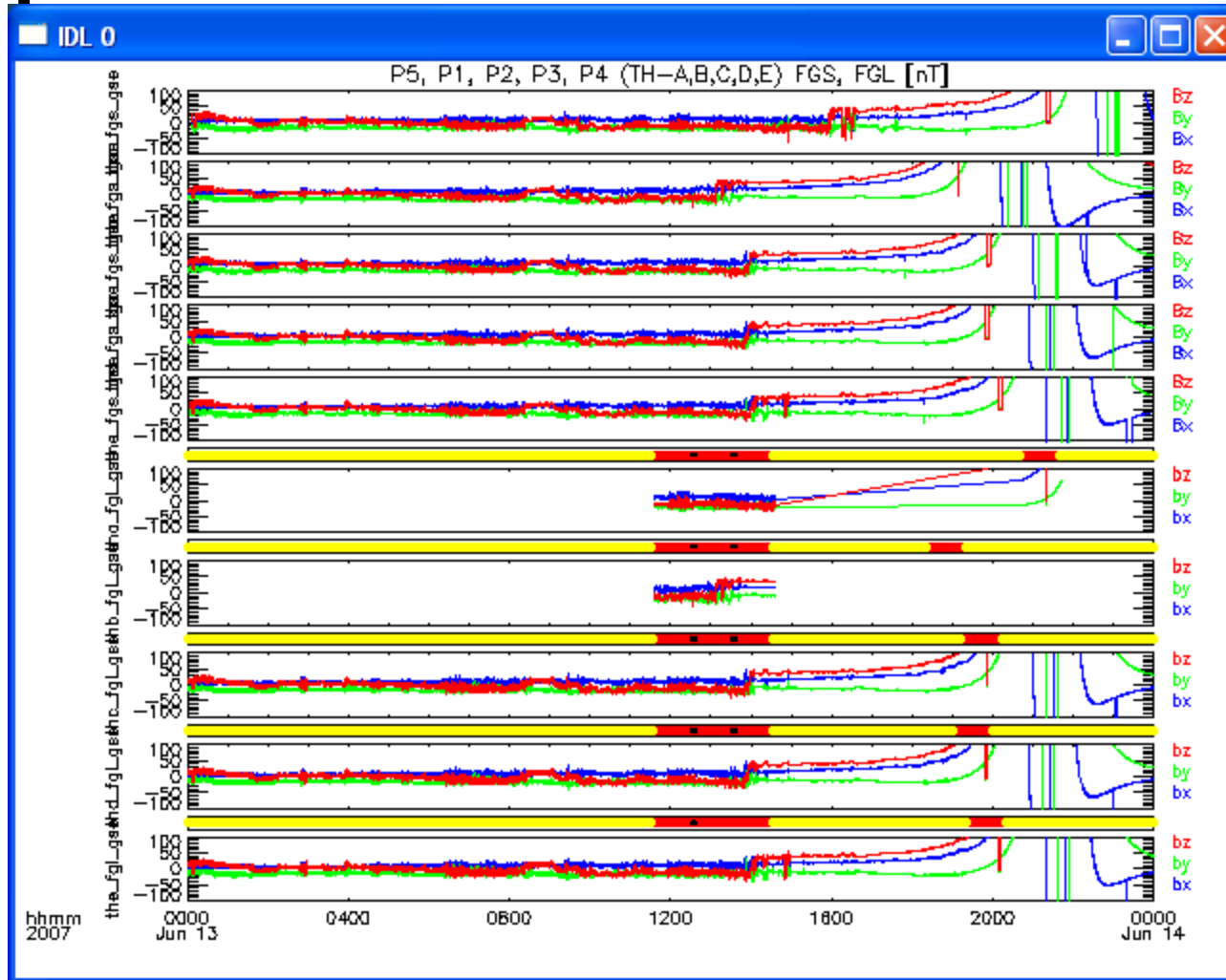
\* Warning - this process might take awhile

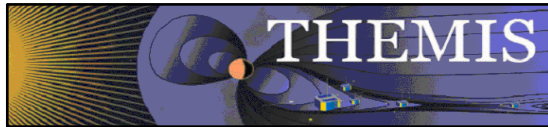






# Sample Overview Plot:





# History Window:

The screenshot shows the THEMIS: Main Menu software interface. The History window is open, displaying the following IDL commands:

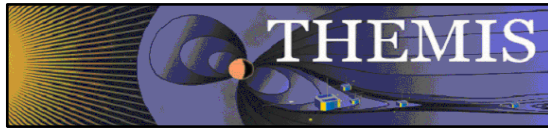
```

dtyp = ['fgm/fge/11','fgm/fge_dsl/12','fgm/fgl_dsl/12','fgm/fgh_dsl/
start_time = '2007-06-13 00:00:00'
end_time = '2007-06-14 00:00:00'
varnames = thm_ui_load_data_fr('2007-06-13/00:00:00', '2007-0
;Finished Loading data...
varnames = ['tha_fge_dsl','tha_fgs_dsl']
thm_load_state, probe = 'a', trange = ['2007-06-13/21:53:59', '20
thm_cotrans,'tha_fge_dsl', 'tha_fge_gei', in_coord='dsl', out_coor
thm_load_state, probe = 'a', trange = ['2007-06-13/00:05:46', '20
thm_cotrans,'tha_fgs_dsl', 'tha_fgs_gei', in_coord='dsl', out_coor
varnames = ['tha_fge_gei','tha_fgs_gei']
set_plot, 'win'
tplot, 'tha_fge_gei'
tplot, 'tha_fgs_gei'
tlimit, '2007-06-13/20:00:00', '2007-06-14/00:00:00'

```

Two arrows point from the text below to the History window, indicating that these are the IDL commands used.

These are the IDL commands used.



# Save History:

THEMIS: Main Menu

Data Choices

- ASI
- ASK
- ESA
- EFI
- FBK
- FFT
- FGM
- FIT
- GMAG
- MDM
- SCM
- SPIN
- SST
- STATE

Process/Plot Data

Coordinate Transform | Data Processing | Plot Menu | Draw Plot

Overview Plots

Loaded Data

```
tha_state_pos:2007-06-13/00:00:00 To 2007-1
tha_state_vel:2007-06-13/00:00:00 To 2007-C
tha_state_man:2007-06-13/00:00:00 To 2007-
tha_state_rot:2007-06-13/00:00:00 To 2007-0
tha_state_spinras:2007-06-13/00:00:00 To 20
tha_state_spindec:2007-06-13/00:00:00 To 2
tha_state_spinalpha:2007-06-13/00:00:00 To
tha_state_spinbeta:2007-06-13/00:00:00 To 2
tha_state_spinper:2007-06-13/00:00:00 To 20
tha_state_spinphase:2007-06-13/00:00:00 To
tha_fge:2007-06-13/21:53:59 To 2007-06-14/
tha_fge_hed:2007-06-13/21:53:59 To 2007-0
tha_fge_dsl:2007-06-13/21:53:59 To 2007-06-
tha_fgl_dsl:2007-06-13/11:34:40 To 2007-06-
```

Active Data (Coordinates)

```
tha_fgs_gse (gse)
sample_rate_a (unknown)
tha_fgl_gse (gse)
sample_rate_b (unknown)
thb_fgl_gse (gse)
thb_fgs_gse (gse)
sample_rate_c (unknown)
thc_fgl_gse (gse)
thc_fgs_gse (gse)
sample_rate_d (unknown)
thd_fgl_gse (gse)
thd_fgs_gse (gse)
sample_rate_e (unknown)
the_fgl_gse (gse)
the_fgs_gse (gse)
```

History

```
tplot, 'tha_fgs_gei'
tlimit, '2007-06-13/20:00:00', '2007-06-14/00:00:00'
thm_ui_pwrspc, varnames, new_vars, ['2007-06-13/20:00:00','2
varnames = new_vars
thm_ui_pwrspc, varnames, new_vars, ['2007-06-13/20:00:00','2
varnames = new_vars
set_plot, 'win'
tplot, 'tha_fge_gei_x_dpwrspc'
tplot, 'tha_fge_gei_y_dpwrspc'
tplot, 'tha_fge_gei_z_dpwrspc'
tplot, 'tha_fgs_gei_x_dpwrspc'
tplot, 'tha_fgs_gei_y_dpwrspc'
tplot, 'tha_fgs_gei_z_dpwrspc'
thm_gen_overplot, probe='a', date='2007-06-13/00:00:00', dur =
set_plot, 'win'
```

Clear Active Data

Save History | Clear History

Time Range: Finished Overview Plot, Instrument: fgm

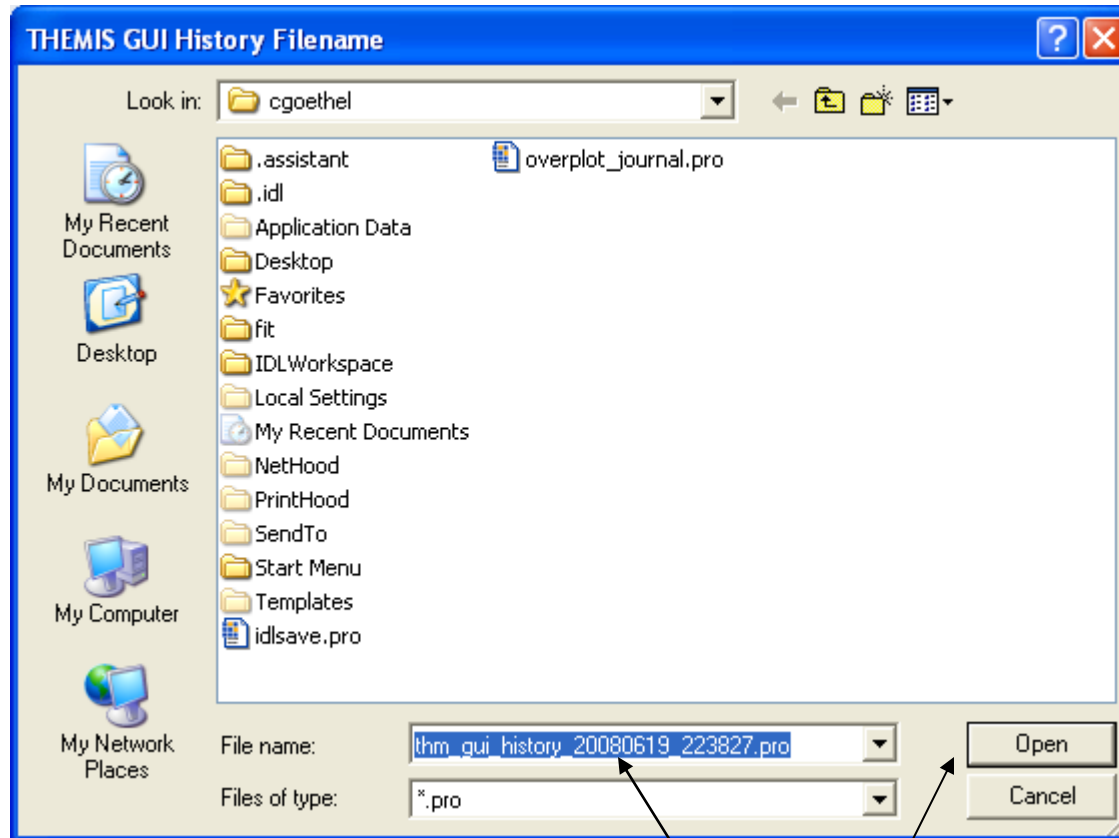
Load Data

Clear Load Queue

HELP | ERROR | Config | Exit

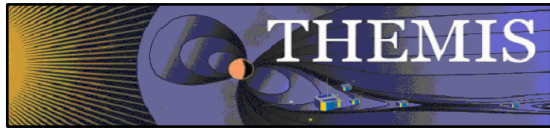
Click here to save history. Use when sending help request.

# History File Selection Window:



Select file name and save.





# Clear History Window:

THEMIS: Main Menu

Data Choices

ASI  
ASK  
ESA  
EFI  
FBK  
FFT  
FGM  
FIT  
GMAG  
MDM  
SCM  
SPIN  
SST  
STATE

Time Range  
Load Data  
Clear Load Queue

Process/Plot Data

Coordinate Transform Data Processing Plot Menu Draw Plot  
Overview Plots

Loaded Data

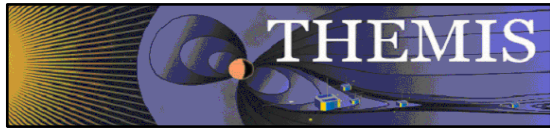
Active Data (Coordinates)

History

Clear Active Data Save History Clear History

HELP ERROR Config Exit

Click here to clear the window.



# Clear History Window:

The screenshot shows the THEMIS: Main Menu software interface. On the left is a vertical list of 'Data Choices' including ASI, ASK, ESA, EFI, FBK, FFT, FGM, FIT, GMAG, MQM, SCM, SPIN, SST, and STATE. Below this are buttons for 'Time Range', 'Load Data', and 'Clear Load Queue'. The main area is divided into sections: 'Process/Plot Data' with buttons for 'Coordinate Transform', 'Data Processing', 'Plot Menu', 'Overview Plots', and 'Draw Plot'; 'Loaded Data' with a list of data files and a 'Set Active Data to String' button; 'Active Data (Coordinates)' with a list of parameters and a 'Clear Active Data' button; and 'History' with 'Save History' and 'Clear History' buttons. A message box at the bottom left displays 'Finished Clearing History'. A black arrow points from the text 'History has been cleared' below to the 'Clear History' button in the interface.

History has been cleared



# Help, Error, and Config Buttons:

THEMIS: Main Menu

Data Choices

- ASI
- ASK
- ESA
- EFI
- FBK
- FFT
- FGM
- FIT
- GMAG
- MQM
- SCM
- SPIN
- SST
- STATE

Process/Plot Data

- Coordinate Transform
- Data Processing
- Plot Menu
- Draw Plot
- Overview Plots

Loaded Data

Active Data (Coordinates)

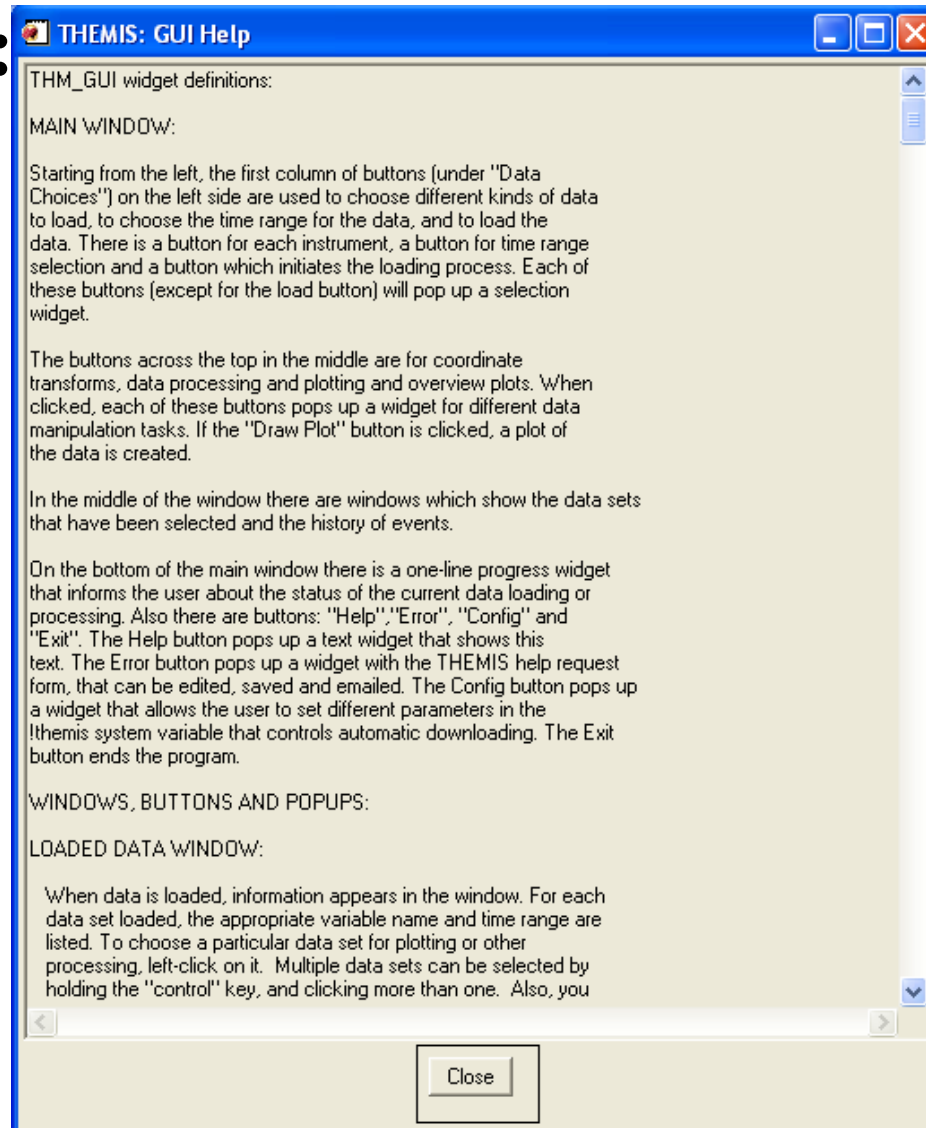
History

HELP ERROR Config Exit

Help, Error, and Config buttons

# Help Window:

This has descriptions of all of the buttons and windows in the GUI.







# Error Window:

This should pop up automatically if there is a crash. Also you can get this by clicking the ERROR button on the main window.

You can edit this form, and please save this and email it to:

[THEMIS\\_Science\\_Support@ssl.berkeley.edu](mailto:THEMIS_Science_Support@ssl.berkeley.edu)

Also email a saved history file and any other pertinent information that can be cut and pasted from the IDL window.

THEMIS: Help Request Form

THEMIS Science Help Request Form

thm\_sci\_help\_request\_XXXX (XXXX number will be sent back to you)

Date Submitted: \_\_\_\_\_

Request Type: \_\_ (C-Comment, O-Observation, P-Problem, Q-Question)

Category: \_\_\_\_\_ (Data, Document, Download, Gui, Instrument, Plot, Software, Web Content, Other, Not Sure)

Title: \_\_\_\_\_

Requestor Info:  
Name: \_\_\_\_\_ Office Phone: \_\_\_\_\_  
Email: \_\_\_\_\_

Help Request Details (fill in as much as you can):

If a Problem or Observation:  
Date Occurred: \_\_\_\_\_  
Operating System \_\_\_\_\_ (e.g. Linux, Unix, Windows)  
CDF Version \_\_\_\_\_ Version of Software \_\_\_\_\_ Version of IDL \_\_\_\_\_

Detail Description of Comment, Observation, Problem or Question:  
(if applicable, please include IDL error messages, crib sheet or lines of code used to run and if using the GUI the History File)

\_\_\_\_\_

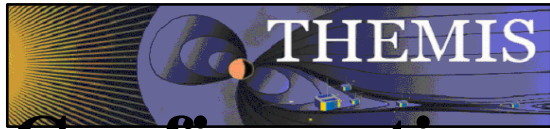
\_\_\_\_\_

\_\_\_\_\_

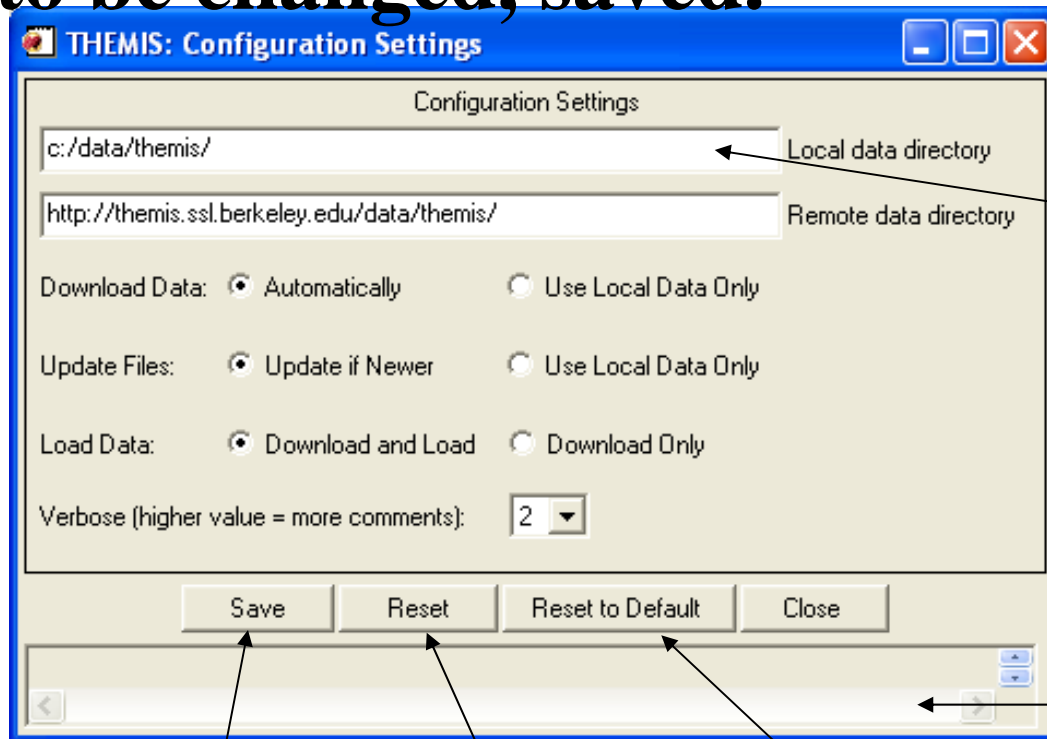
Please email any supportive materials that would help in researching your request to: THEMIS\_Science\_Support@ssl.berkeley.edu with the Help Request Title above in the subject line.

Thanks so much,  
THEMIS Science Support Team

Save Close



# Configuration Settings: Allows configuration to be changed, saved.



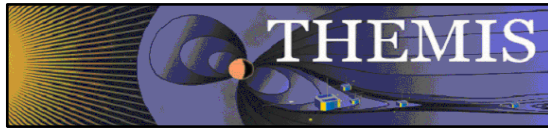
You need to be able to write to this directory if you download data.

Messages

Saves in a file. Input into every session

Resets to initial state.

Resets to default state in distribution, deletes any saved files.



# Exit Button:

THEMIS: Main Menu

Data Choices

- ASI
- ASK
- ESA
- EFI
- FBK
- FFT
- FGM
- FIT
- GMAG
- MDM
- SCM
- SPIN
- SST
- STATE

Process/Plot Data

Coordinate Transform Data Processing Plot Menu Draw Plot

Overview Plots

Loaded Data

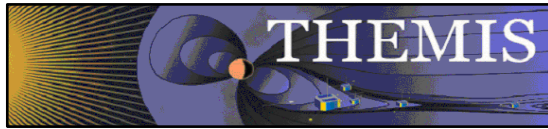
Active Data (Coordinates)

History

Finished Overview Plot, Instrument: fgm

HELP ERROR Config Exit

Click here to exit GUI. Popups are dismissed, except for Help, Error or Config and plot windows. Loaded data is not deleted and will show up in Loaded Data window on restart.



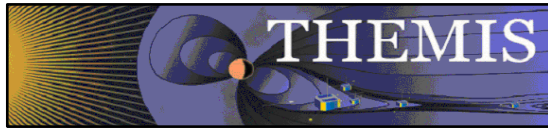
## THM\_GUI Tips:

Remember to save and email your history file if you have a bug. Also feel free to include any other output messages that show up in the IDL command line.

Always choose a time range before loading data. Don't load more than a couple of days at a time, or a couple of hours if you are loading full resolution all-sky imager (asf) data. If you try to load a relatively long time period, you will get a pop-up window that will ask you if you really want to do that.

The choice of "probe" in the data loading window is global, that is, all of the selected data will be loaded for the probe(s) chosen most recently. If, for example, you want to load EFI data from probe "A" and FGM data from probe "B", you will need to load these separately. When choosing multiple probes, data types, or whatever, hold the "control" key, and click more than one. Also, you can click on an option, then hold "shift" and the left mouse button, and drag the cursor over the others.

The data names are kind of cryptic, there is a table in the User's Guide and also at the end of the text in the help window for guidance.



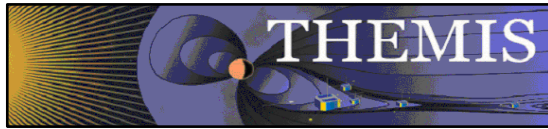
## THM\_GUI Tips:

Once you've chosen data, hit the "Clear Load Queue" to clear it out if you don't want to load it. If a load fails (for a reason other than "the data isn't there"), then the data are still waiting to be loaded. Clear the load queue.

Remember that all loaded data are set to "active" immediately upon loading. If you don't want all of that data to be active, then click on what you want in the Loaded Data window.

If you want to delete all data, type "\*" window below the Loaded Data window, click "Set Active Data to String", call up the Data Processing window, and click "Delete".

For coordinate transforms, data that have "Unknown" for a coordinate system will not be transformed. Multiple data sets with different input coordinates \*can\* be transformed. Data Processing and Plotting tasks are only possible when there is "active" data.

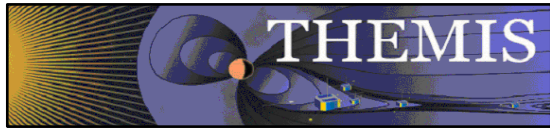


## THM\_GUI Tips:

When typing in strings for numerical input -- be careful. Strings that aren't numbers are interpreted as 0 by IDL, but strings that aren't numbers, but start with a number are set to the number, e.g., 'a14' is set to 0, but '1a4' is set to 1. When in doubt, look in the History to see what you've typed.

Sometimes data is inappropriate for a given operation (especially wavelet transforms, and power spectra). We have tried to catch as many of these situations as we can, but there probably will be more as more types of data are imported. If something looks weird, save your history, and email us.

Some processes can take a while (e.g., calibrating SCM data, wavelet transforms of whole days). Currently there is no good way to stop a process except for the standard IDL "control-C" on the IDL window. This doesn't always work...



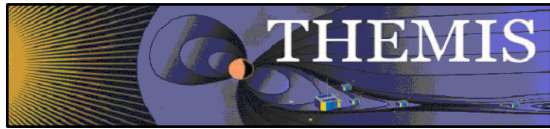
## THM\_GUI Tips:

The Plot Menu button may first issue a "tplot" call when the window pops up.

If you create a "PNG" plot, remember to reset to "SCREEN" for screen plotting.

Don't try to plot more than about 10 quantities at a time, if there is spectrogram data, there will be a crash.

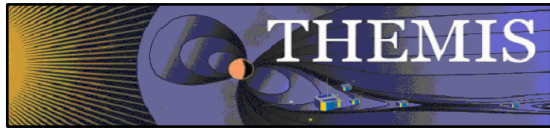
There will undoubtedly be more of these...



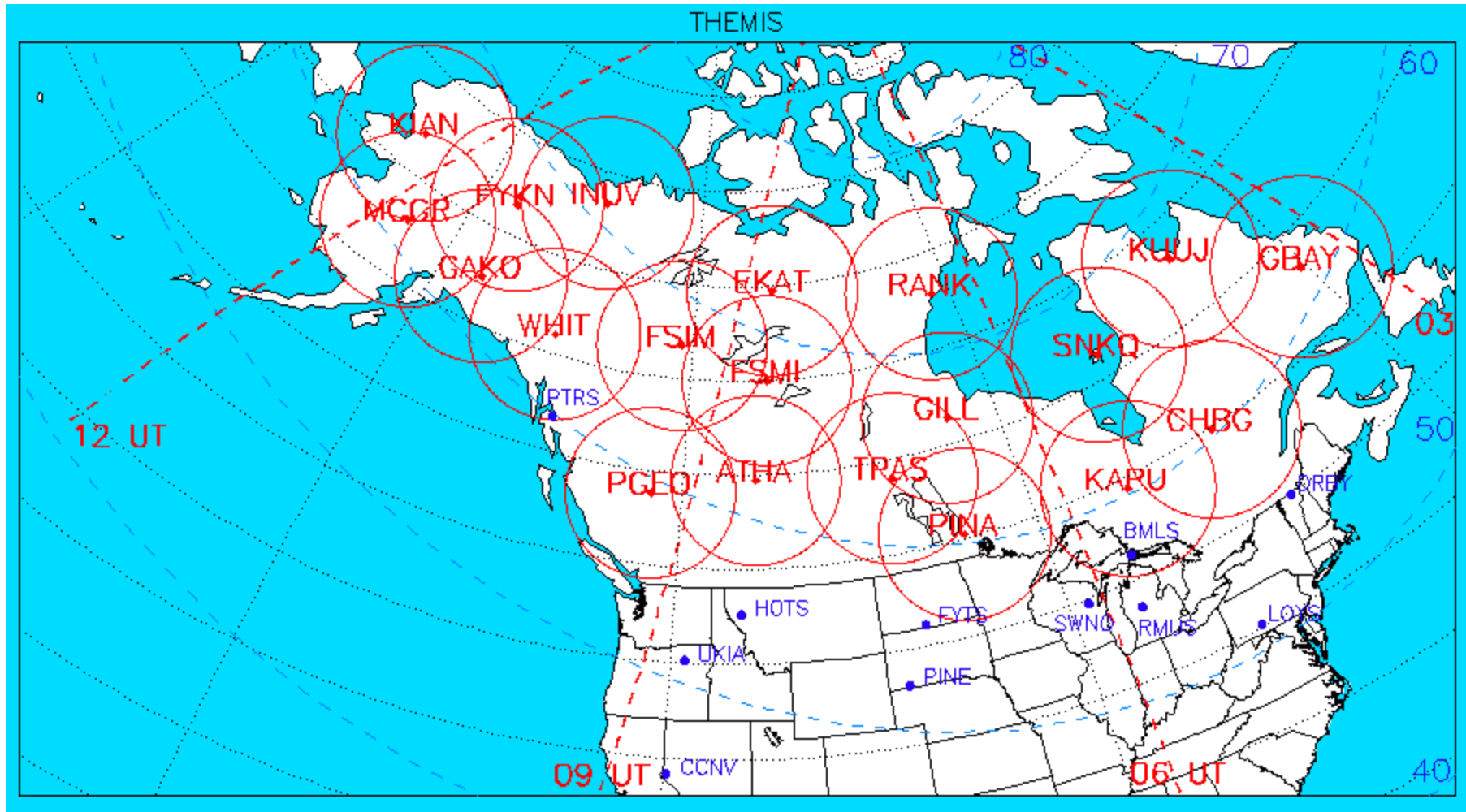
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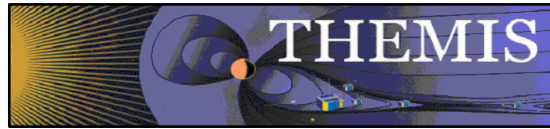
THEMIS software for GBO all-sky imager  
Thm\_crib\_asi.pro  
Harald U. Frey



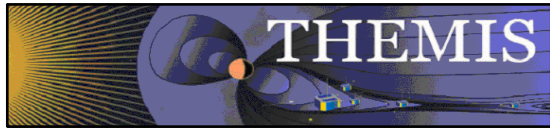


# THEMIS GBO network

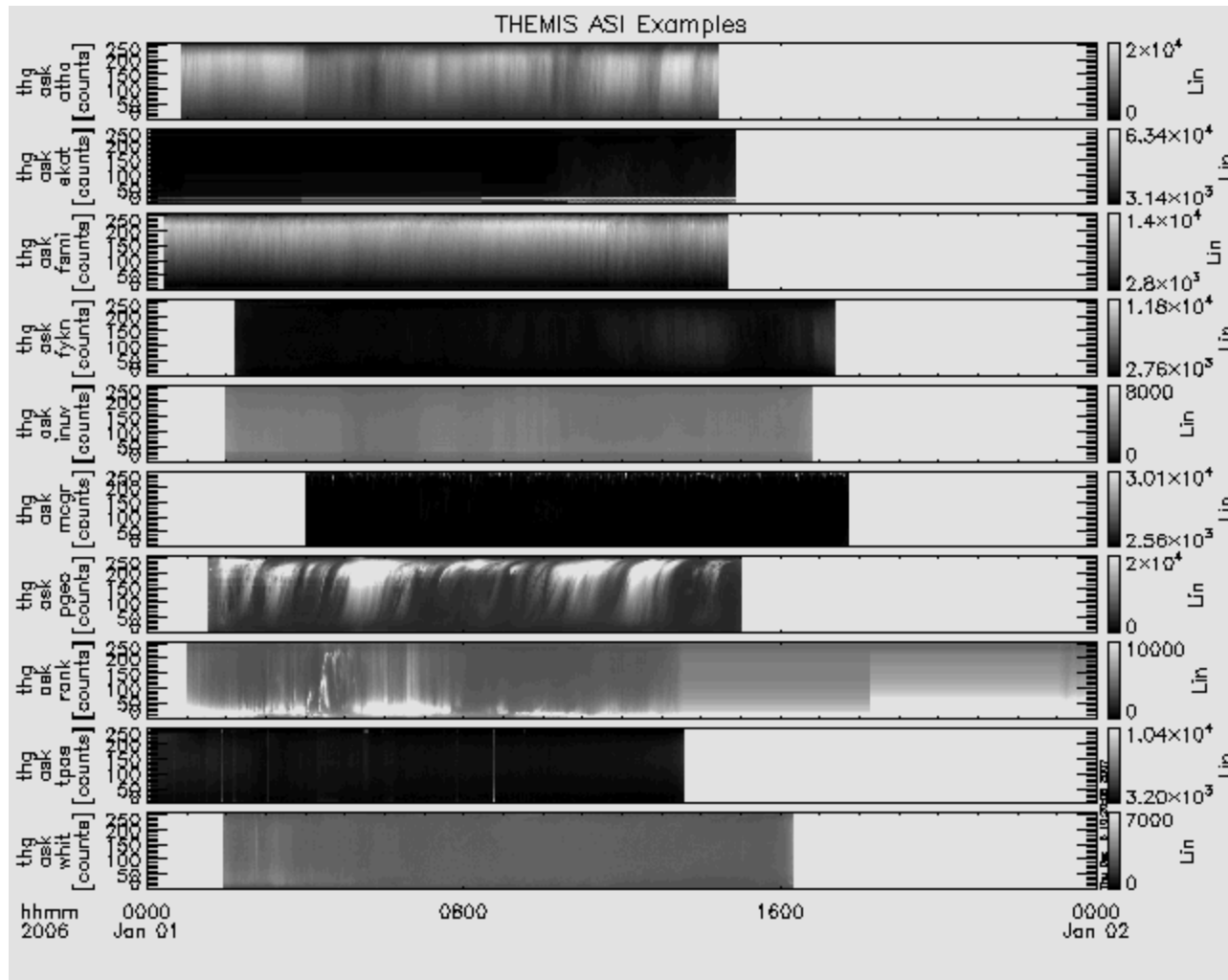


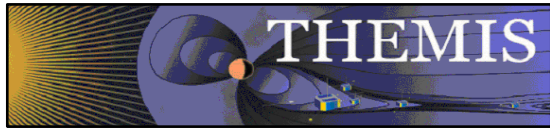


1. Keograms along local magnetic meridian
  - Delivered daily jpeg-compressed
  - Reprocessed  $\frac{1}{2}$  year later with full resolution images
2. Geomagnetically mapped thumbnail images
  - Delivered daily square-root intensity compression
  - 1024 pixels within  $\pm 8^\circ$  magnetic Latitude and  $\sim \pm 12^\circ$  Longitude
  - 3 seconds temporal resolution
3. Full resolution images
  - 256x256 pixels covering about 600 km radius around station
  - Delivered about  $\frac{1}{2}$  year later
  - 3 seconds temporal resolution
  - Full 16 bit intensity scale

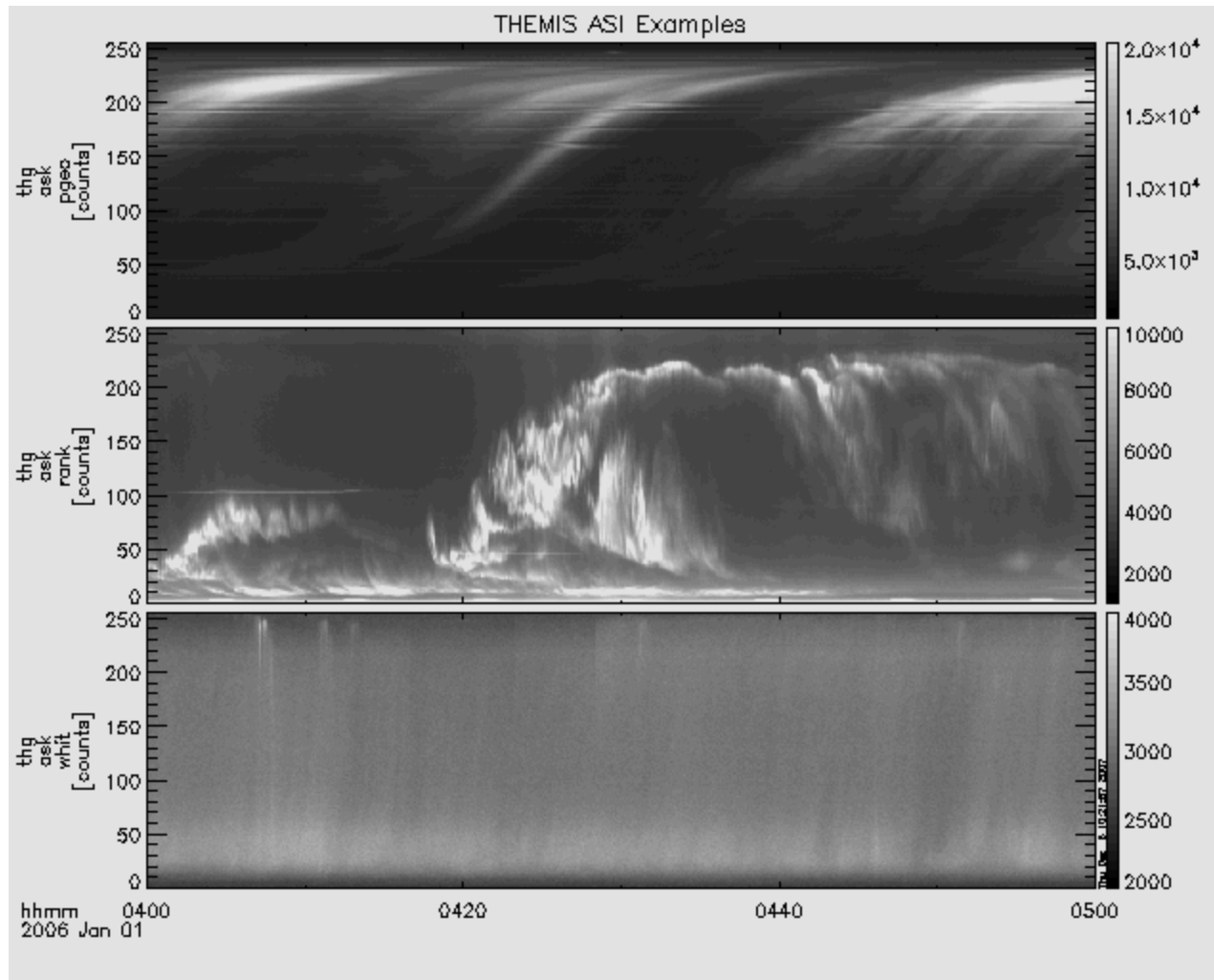


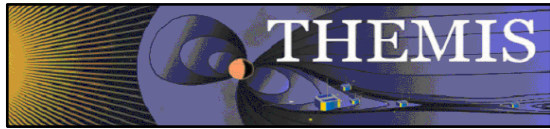
# Daily overview of available keograms



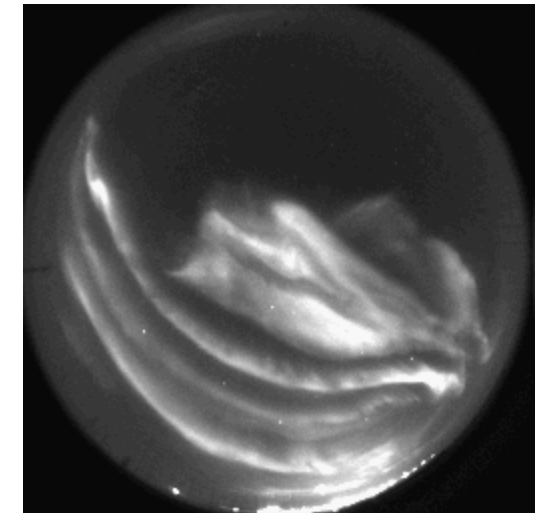
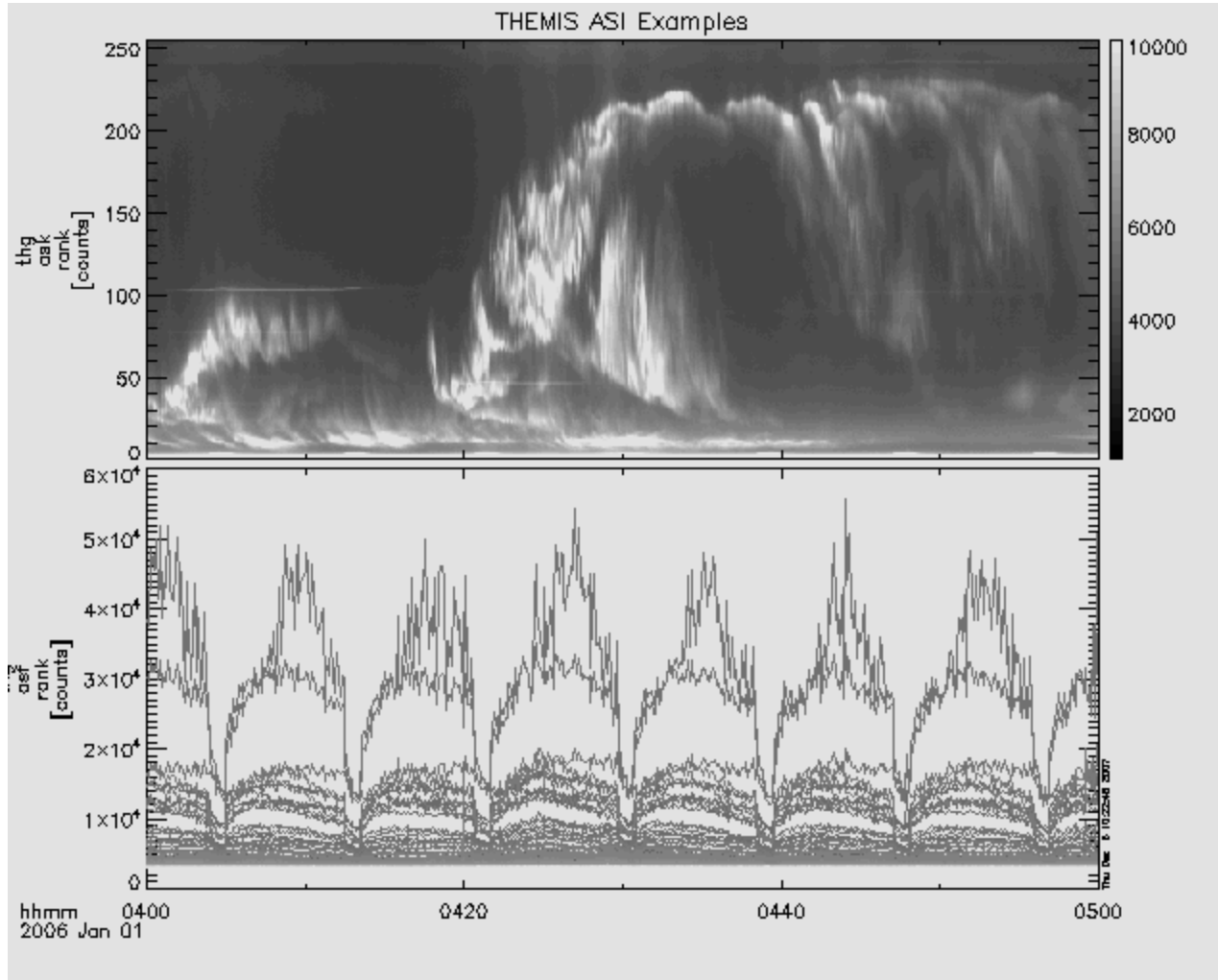


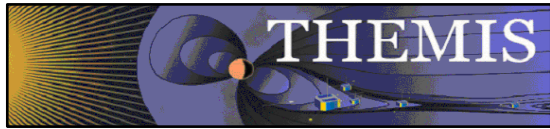
# Zoom into interesting time



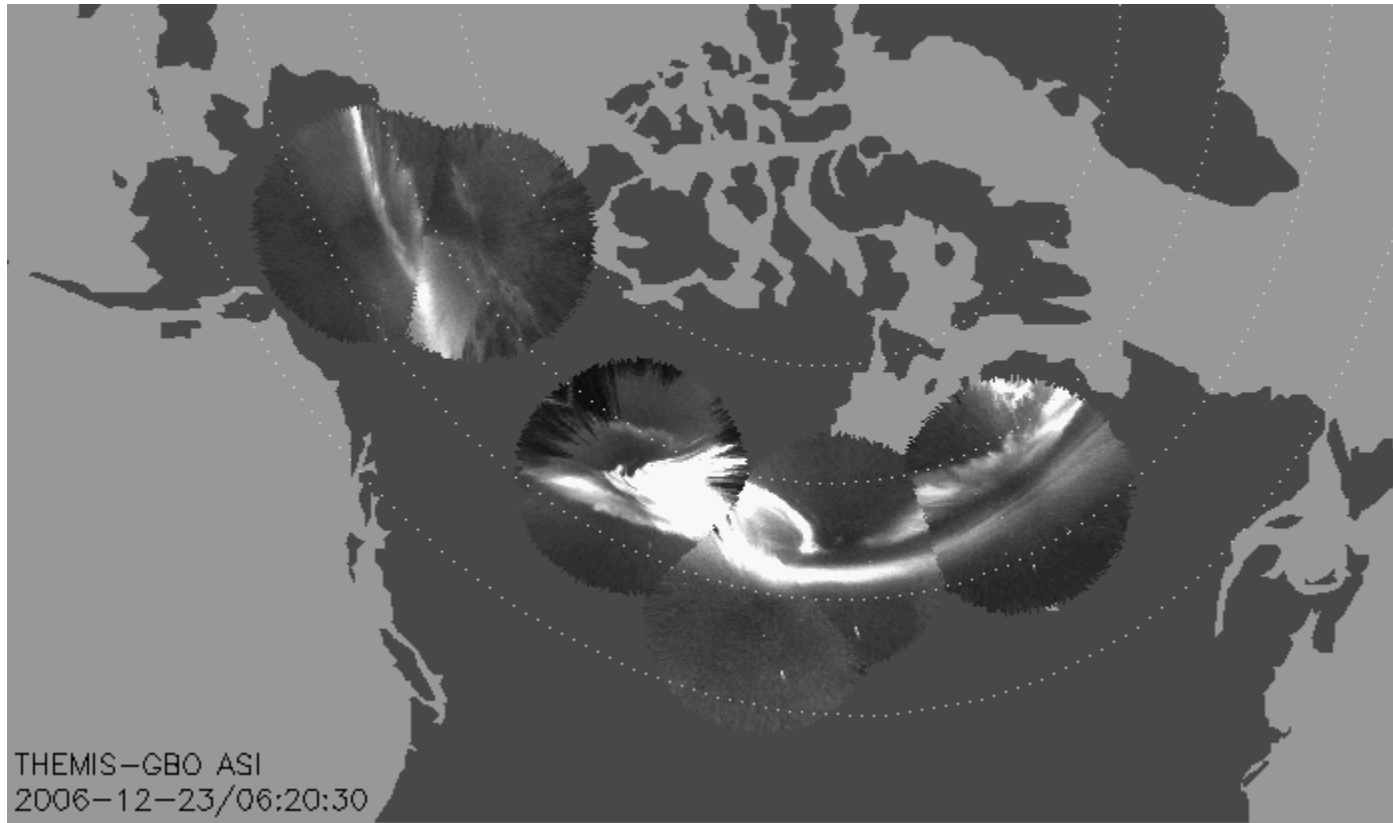


# Watch “movie” of single station



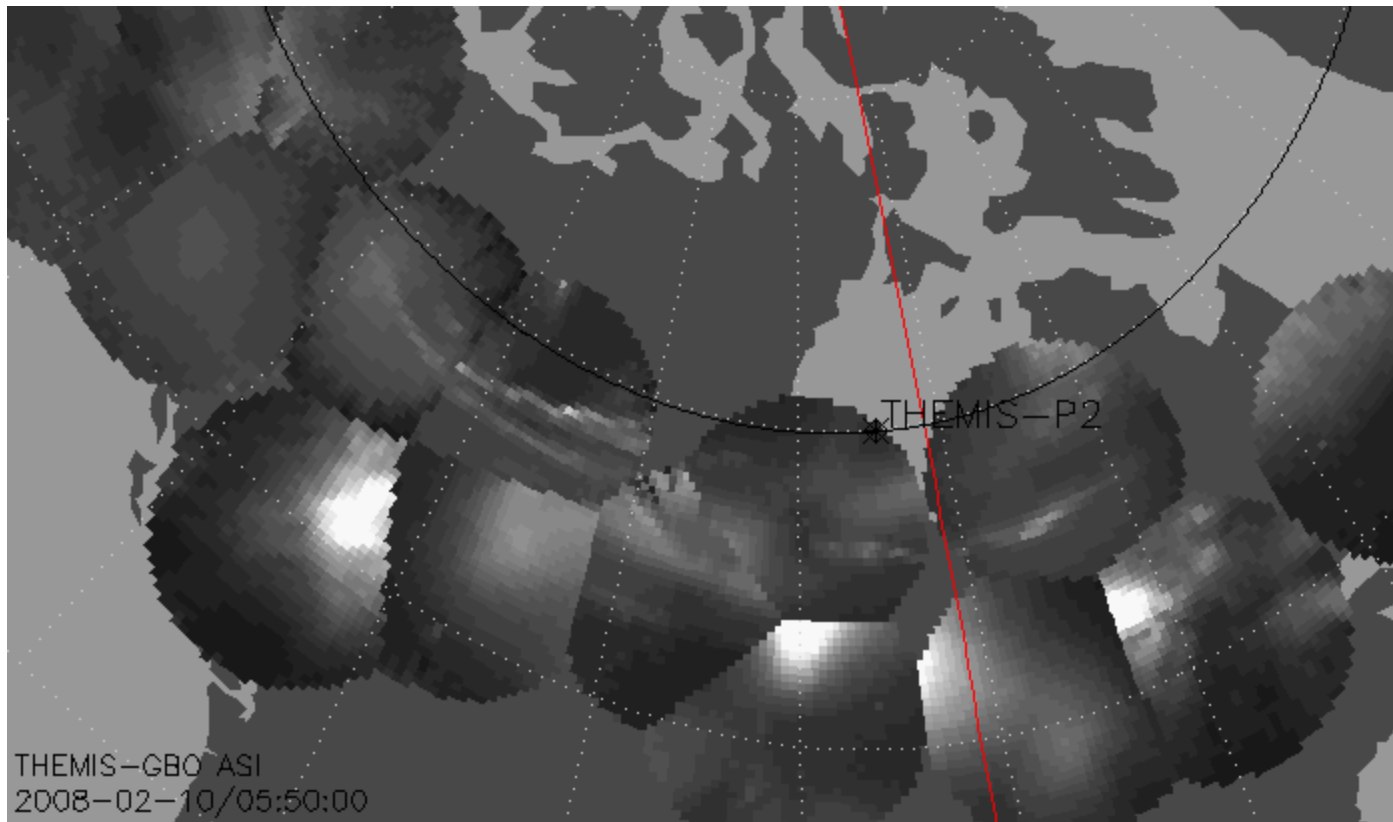


# Mosaic of whole GBO array from full resolution images

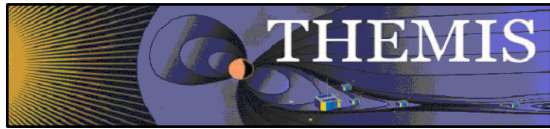




## Mosaic with S/C footprint From thumbnail images



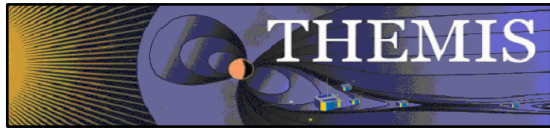
Black line marks footprint of THEMIS-P2 during whole night  
Asterisk marks location at time of mosaic



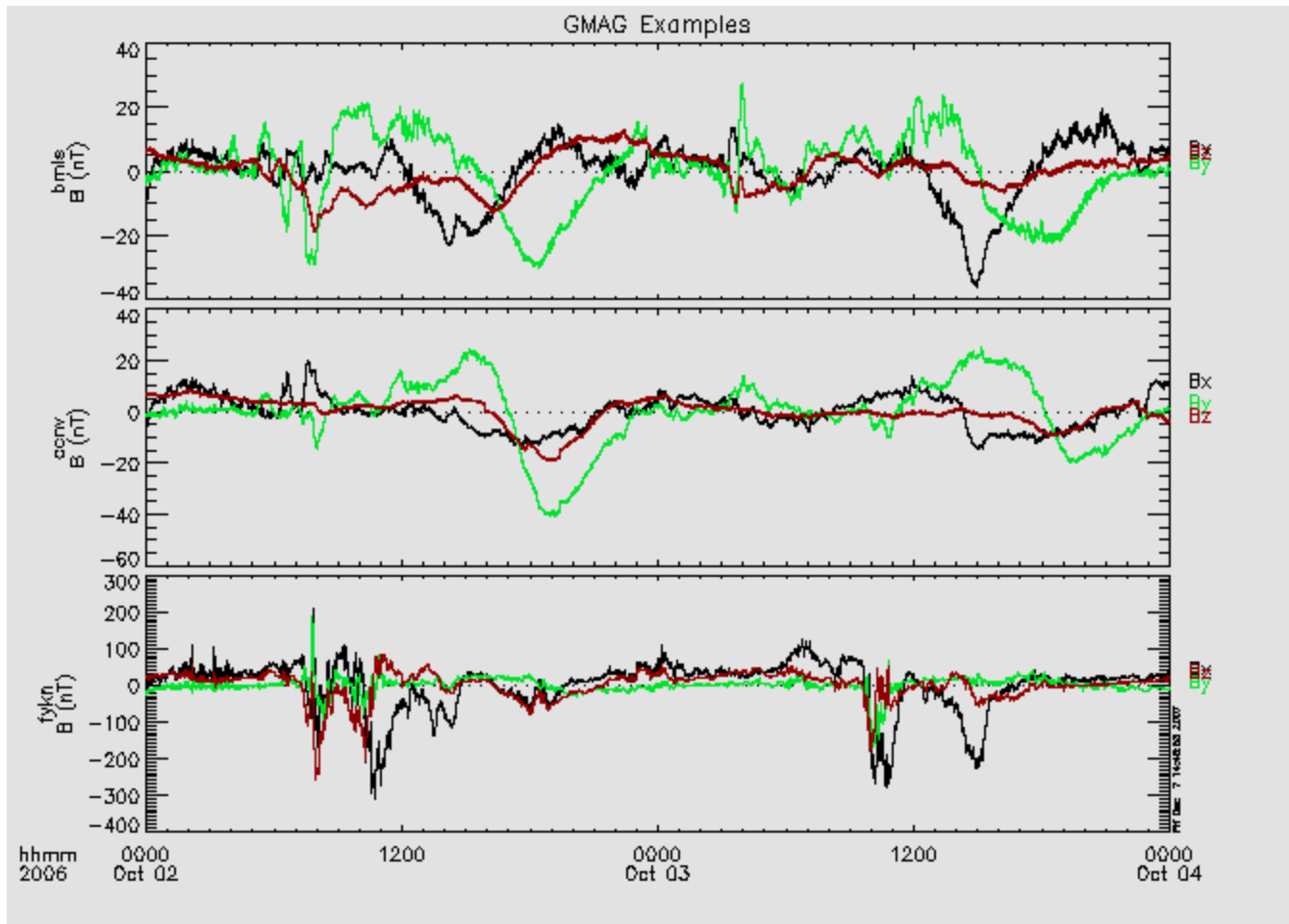
# Ground magnetometer Examples

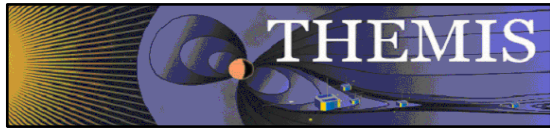
## Thm\_crib\_gmag.pro



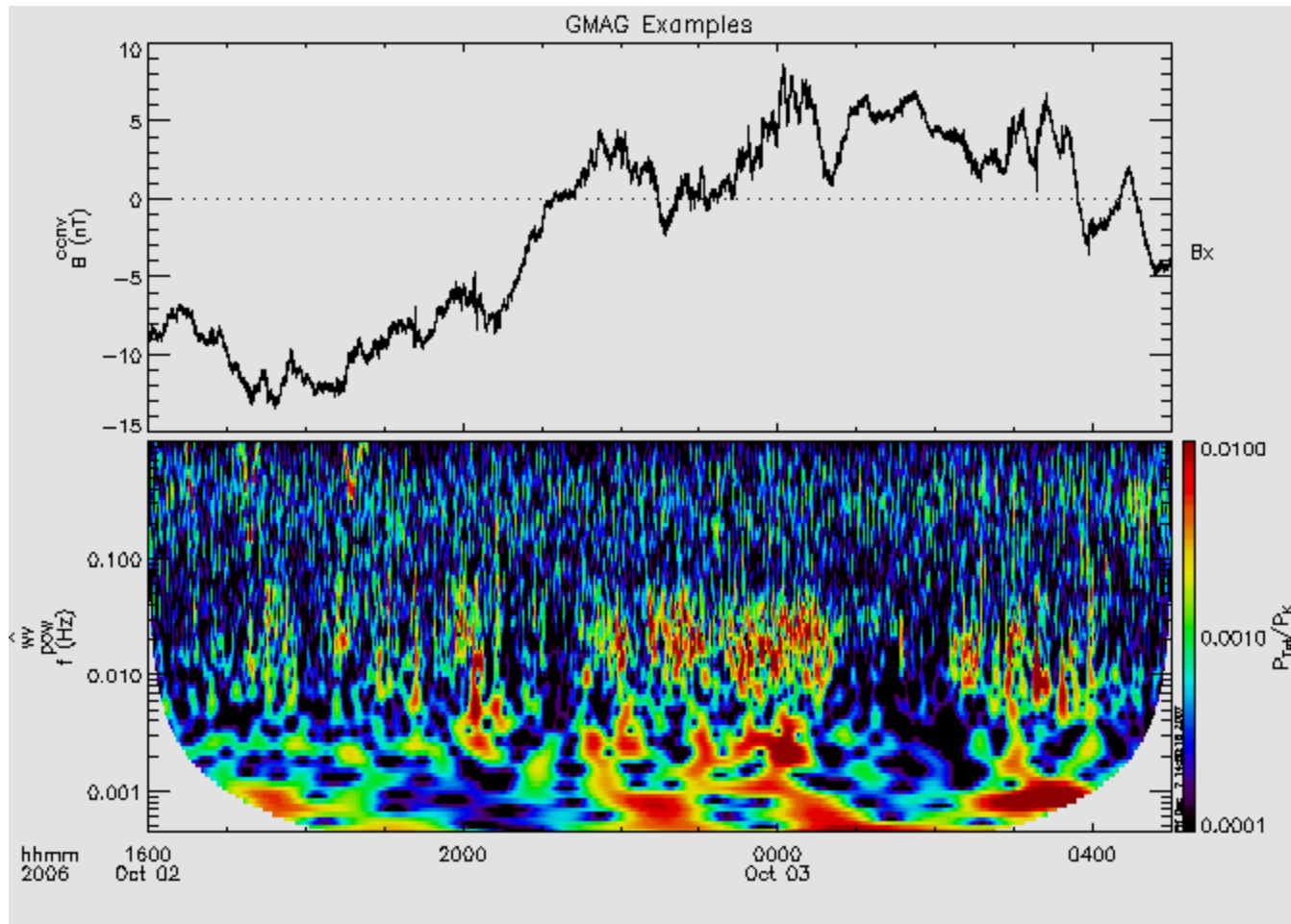


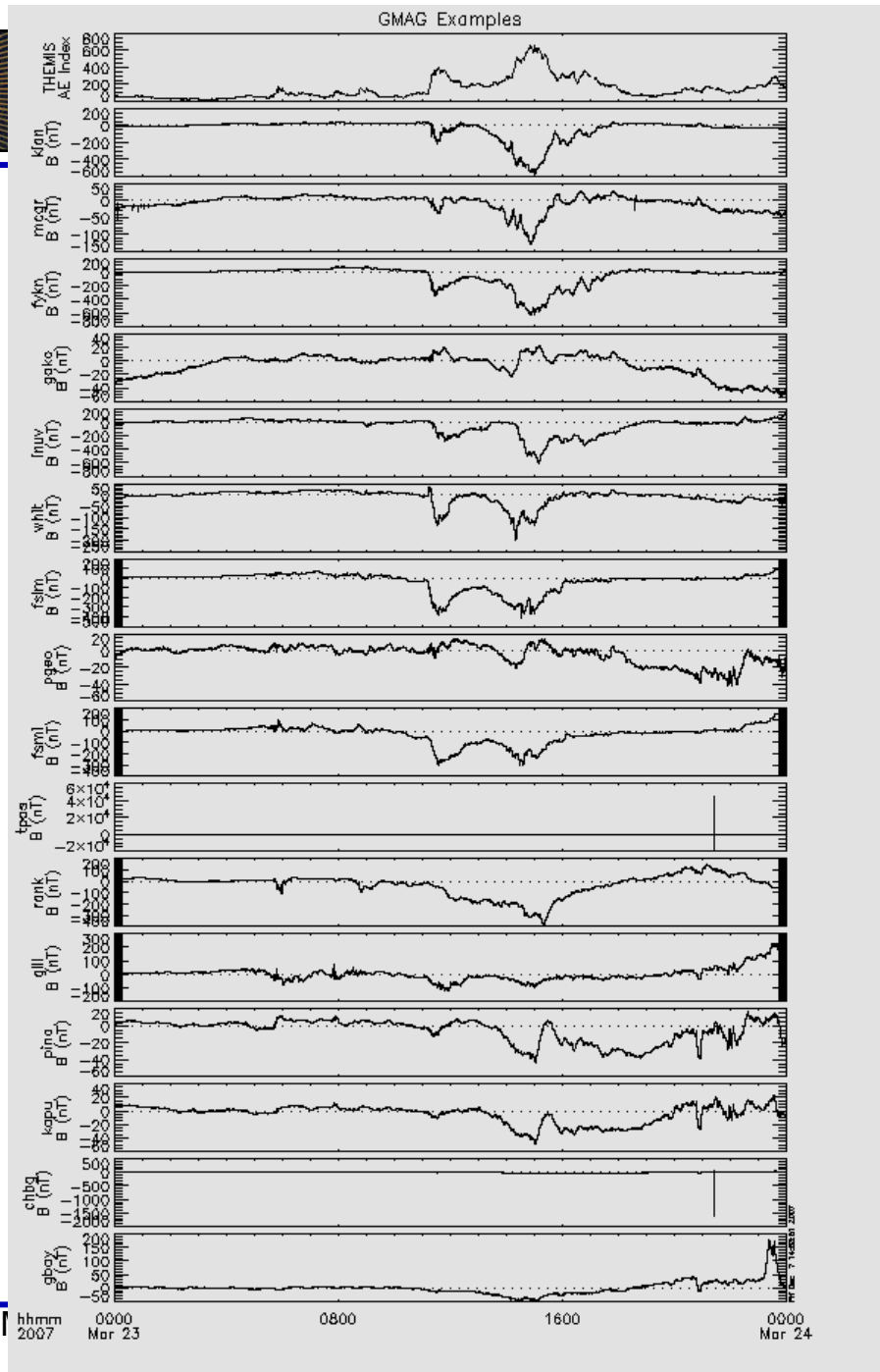
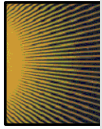
# Three station example





# Wavelet transform example





## Pseudo-AE of network