



THEMIS
Science Data Analysis
Software User's Guide
THM-SOC-120
July 2007

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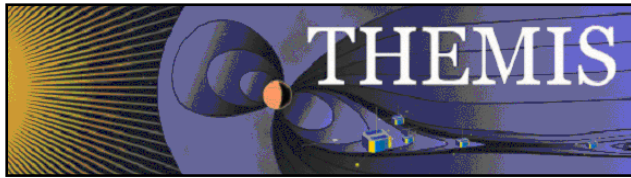
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Identifier	Description

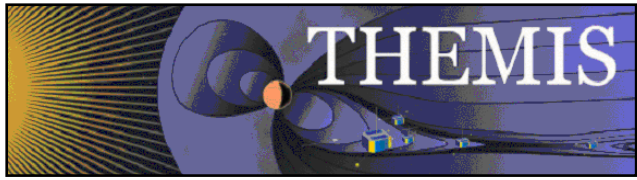
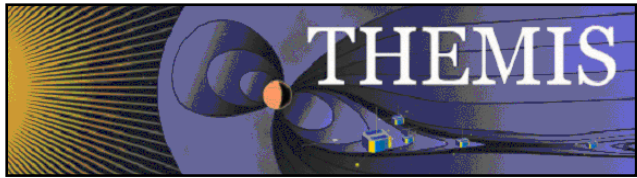
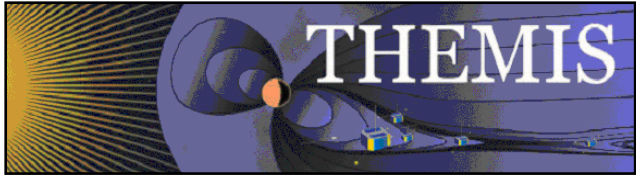


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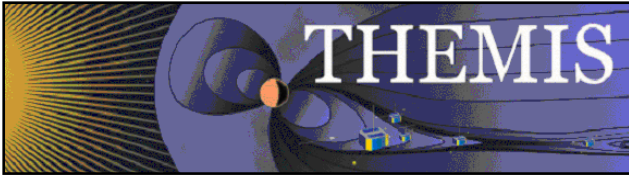
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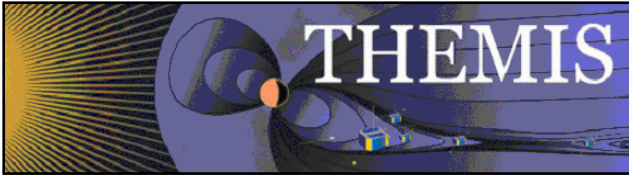
1. Introduction

1.1 Purpose and Scope.

The purpose of this document is to present to the worldwide scientific community what tools are available for viewing, downloading, processing, calibrating and plotting THEMIS data and how to use these tools.

1.2 Applicable Documents.

- | | |
|-------------------------------------------------------|--------------------------------------------|
| 1. THM_SYS_012_PDMP | THEMIS Project Data Management Plan |
| 2. THM_SOC_101_TIME | THEMIS TIME Definition |
| 3. THM_SOC_103_HKP_VARNAAMES | THEMIS Housekeeping L1 Variable Name Def's |
| 4. THM_SOC_105_FIELDS_VARNAAMES | THEMIS Fields Variable Names Definitions |
| 5. THM_SOC_108_GMAG_L1_VARNAAMES | THEMIS GMAG Variable Name Definitions |
| 6. THM_SOC_110_COORDINATES | THEMIS Coordinate Systems Definitions |
| 7. THM_SOC_111_SUNSENSPROC | THEMIS SUN SENSOR Science Processing |
| 8. THM_SOC_112_ATTPAIPROC | THEMIS Science ATT & Inertia Determ. |
| 9. THM_SOC_113_FGM_CALPROC | THEMIS FGM CAL File and Processing |
| 10. THM_SOC_114_SCM_CALPROC | THEMIS SCM CAL File and Processing |
| 11. THM_SOC_115_EFI_CALPROC | THEMIS EFI CAL File and Processing |
| 12. THM_SOC_116_ESA_CALPROC | THEMIS ESA CAL File and Processing |
| 13. THM_SOC_117_SST_CALPROC | THEMIS SST CAL File and Processing |
| 14. SAI-SPEC_1079A (Oct. 26, 2005) | THEMIS Coordinate Systems |
| 15. SAI-RPR-0722a (September, 2006) | Probe Alignment Report (MSSS data, p18) |
| 16. pturin e-mail on Faro alignment results (9/28/06) | FGM, SCM mag alignments |
| 17. THM-MB-005-Magnetometer clocking r7.pdf | MAG clocking angles |



2. THEMIS Web Page Interface

2.1 THEMIS Web Site - Home Page

The THEMIS Home Web Page can be displayed by using the following URL: <http://themis.ssl.berkeley.edu/>. Across the top portion of this web page are a series of drop down menus (Home, The Mission, Data, Software, Publications, News & Events, Contact Us and For the Public). In this document we will be discussing only the Data, Software and Contact Us Web Pages.

The THEMIS Data Drop Down Menu allows you to select the following options: *Summary Plots*, *Orbits* or to *Download Data*. These options will be discussed in more detail in Section 2.2.

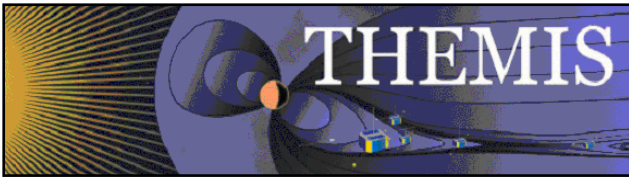
The THEMIS Software Drop Down Menu allows you to Select the following options: *Software*, *Developers* and *Documentation*. These options will be discussed in more detail in Section 2.3.

The THEMIS Contact Us will automatically link you to a web page that will allow you to send emails to the THEMIS PI or THEMIS Instrument Scientists or send a Help Request to the THEMIS Science Support Team with Comments, Observations, Problems or Questions concerning data, a document, download, GUI, Plot, Software, Web Interface or any other issue not listed.

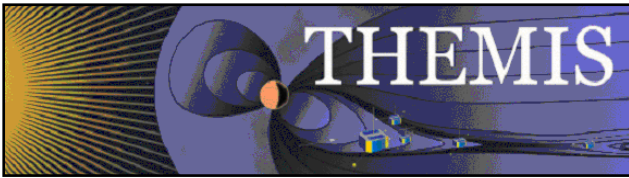
This Help Request option will be discussed in more detail in Section 2.4.

Please note: Differences between the screen displays presented in this document and what you may see online are due to Web Page Upgrades not yet reflected in this document. The screen displays incorporated into this document are to give the reader a sense of the functionality of the of the Web Interface to THEMIS Science Software.

Please see copy of the Themis Home Web Page on the Next Page.



THEMIS Web Site - Home Page




2.2 THEMIS Data Web Pages

The THEMIS Data Drop Down Menu has three Options. *Usage Rules* which will display the Rules for using the THEMIS Data (Rules of the Road). *Summary Plots* which will allow you to look at Summary Plots of one Probe, Multiple Probes, Ground Magnetometer, All Sky Imager or Orbits Data. *Download Data* to Download THEMIS Data. **Please note:** If using THEMIS Science Software Data Analysis Tools there is no need to use the Download Data option. Please see screen displays below.

The screenshot shows the THEMIS website interface. At the top left is the THEMIS logo with the tagline "Time History of Events and Macroscale Interactions During Substorms". A navigation bar includes links for Home, The Mission, Data, Software, Publications, News & Events, Contact Us, and For the Public >>. A dropdown menu is open under the "Data" link, showing "Usage Rules", "Summary Plots", and "Download Data". The main content area features a "Welcome to THEMIS" message, a "LATEST NEWS & EVENTS" section with a "Watch the launch Video >>" link, and a "View current orbital configuration >>" link. A sidebar on the left lists mission stages: Stage 5 (Dayside Science, 6/15/08-10/15/08), Stage 4 (Radiation Belt Science, 4/15/08-6/15/08), Stage 3 (Tail Science, 12/15/07-4/15/08), Stage 2 (Orbital Placement, 9/15/07-12/15/07), Stage 1 (Coast, 2/15/07-9/15/07), and Launch. A callout box on the right asks if the user is a member of the public and directs them to the Education and Public Outreach site.

THEMIS Data Dropdown Menu



 **THEMIS** Time History of Events and Macroscale Interactions During Substorms

Home The Mission **Data** Software Publications News & Events Contact Us For the Public >>

Usage Rules >>
Summary Plots
Download Data

Rules of the Road for Data Use

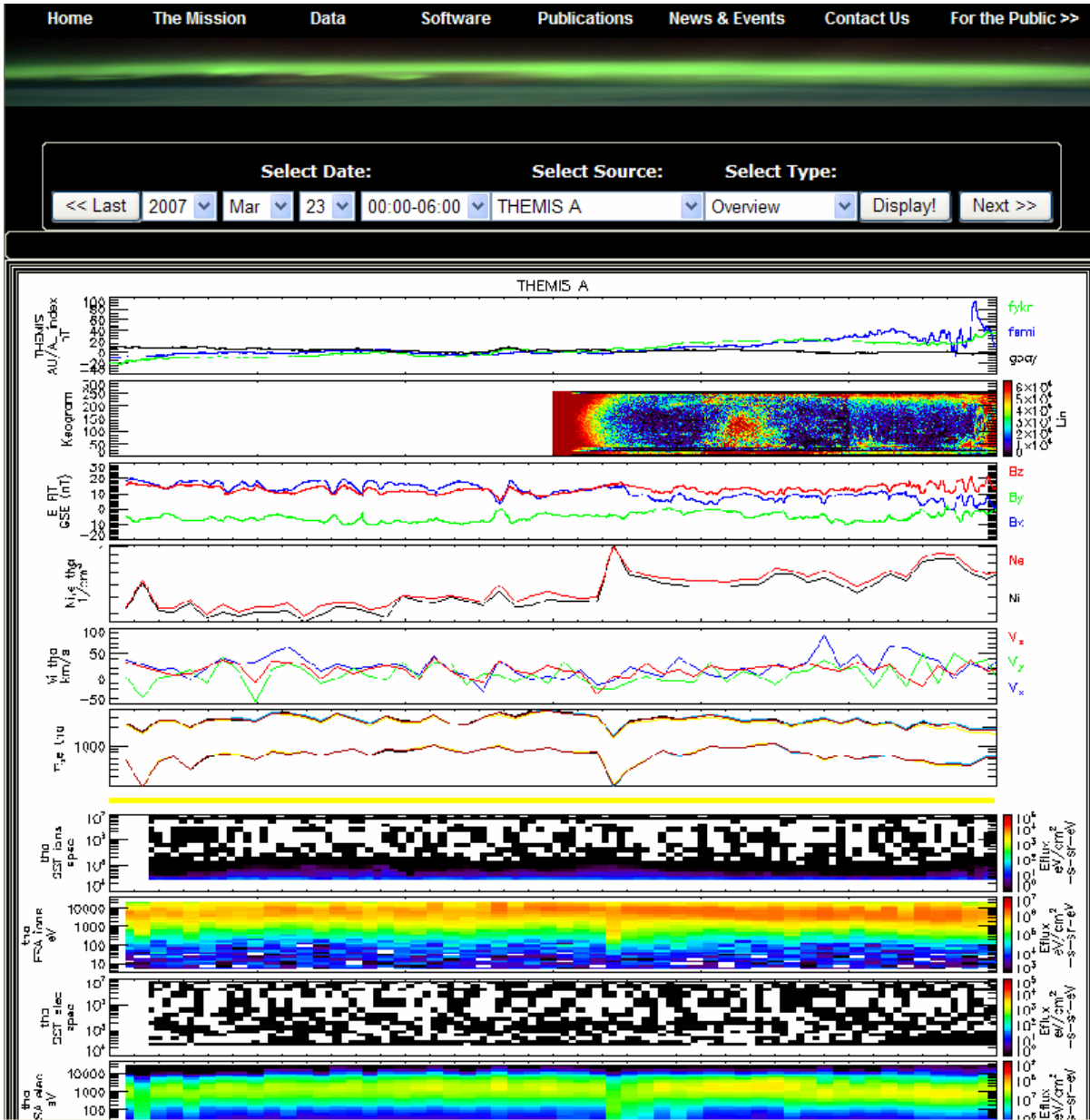
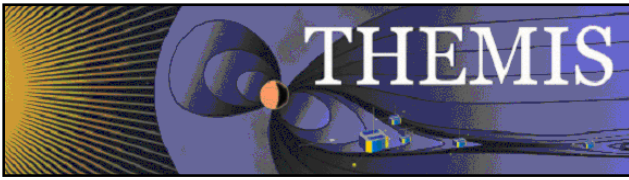
1. Data are free for scientific publications.
2. Register your submitted and accepted paper in the on-line form: <http://themis.ssl.berkeley.edu/publications>
3. We strongly recommend working directly or checking with the PI and instrument coIs regarding data interpretation, especially in the initial phase of the project, and well in advance to submitting a talk/publication, in order to be informed of the nuances (and accuracy) of the THEMIS dataset.
4. If PI/coIs are not part of the publication list, then Credit/Acknowledge the THEMIS team and NASA as follows:

" We acknowledge NASA contract NAS5-02099 and V. Angelopoulos for use of data from the THEMIS Mission. Specifically:"

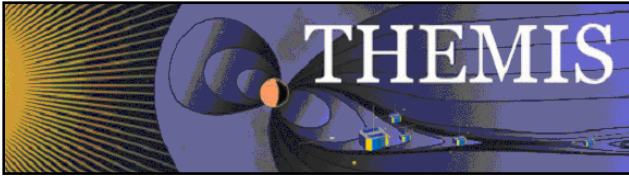
and for specific instruments the following additions:

for EFI: " J. W. Bonnell and F. S. Mozer for use of EFI data"
for SST: " D. Larson and R. P. Lin for use of SST data"
for ESA: " C. W. Carlson and J. P. McFadden for use of ESA data"
for SCM: " A. Roux and O. LeContel for use of SCM data"
for FGM: " K. H. Glassmeier, U. Auster and W. Baumjohann for the use of FGM data provided under the lead of the Technical University of Braunschweig and with financial support through the German Ministry for Economy and Technology and the German Center for Aviation and Space (DLR) under contract 50 OC 0302"
for GBO/ASIs: "S. Mende and E. Donovan for use of the ASI data, and the CSA for logistical support in fielding and data retrieval from the GBO stations"
for GBO/GMAGs (UCLA magnetometers): "S. Mende and C. T. Russell for use of the GMAG data"
for GBO/GMAGs (Alberta magnetometers): "I. Mann for use of the GMAG data, and the CSA for support of the CARISMA network"
5. Please review the [Heliophysics Data Policy](#)

THEMIS Data Usage Rules Web Page



THEMIS Data Summary Plot Web Page



THEMIS
Time History of Events and Macroscale Interactions During Substorms

Home The Mission Data Software Publications News & Events Contact Us For the Public >>

Usage Rules
Summary Plots
Download Data >>

Download THEMIS Data

Reminder: If you are using the Themis Science Software there is no need to use this downloader.

Direct access to the data FTP Site [here](#)

Data Selection Criteria (please limit to 10 days):

Segment	Probe/GBO	Instrument	Product
Space	THEMIS E	Solid State Telescope	Level 1 CDF

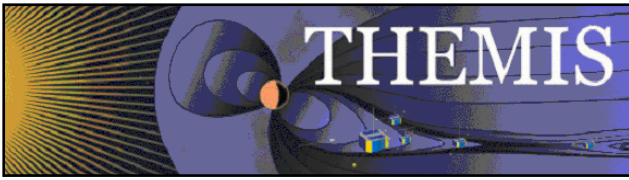
From To [Download Data](#)

Check Data Availability

	Level 1 CDF	Level 2 CDF
Space Probe	YES	YES
Ground ASI	YES	NO
Ground MAG	NO	YES

Data FAQ
L1 data is raw, uncalibrated data in CDF format.
L2 data is calibrated data in physical units, also in CDF format.

THEMIS Download Data Web Page

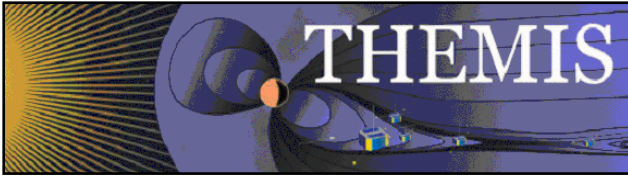



2.3 THEMIS Science Software Web Page

The THEMIS Science Software Drop Down Menu has three options. *Software* which displays a web page for downloading the latest release of the THEMIS Science Software Data Analysis Tools, Documentation, Registering to be notified of Future Releases of the Software, Download not yet released Software and Contacting the THEMIS Science Support Team with Help Requests. *Developers*, options to read about how to develop and contribute Software to THEMIS Science Software. *Documentation* which provides a link to the THEMIS Science Software Documentation ftp site. **Please note:** If you download the not yet released Software, this Software may not have been tested (you are on your own). Please see screen displays below.

The screenshot shows the THEMIS website interface. At the top left is the THEMIS logo with the tagline "Time History of Events and Macroscale Interactions During Substorms". The navigation menu includes: Home, The Mission, Data, Software, Publications, News & Events, Contact Us, and For the Public >>. The "Software" menu is expanded, showing options for Software, Developers, and Documentation. On the left side, there is a vertical timeline of mission stages: Stage 5 (Dayside Science, 6/15/08-10/15/08), Stage 4 (Radiation Belt Science, 4/15/08-6/15/08), Stage 3 (Tail Science, 12/15/07-4/15/08), Stage 2 (Orbital Placement, 9/15/07-12/15/07), Stage 1 (Coast, 2/15/07-9/15/07), and Launch. The main content area features a "Welcome to THEMIS" message, a "LATEST NEWS & EVENTS" section with a "Watch the launch Video >>" link, and a "View current orbital configuration >>" link. There is also a call to action for public members to visit the Education and Public Outreach site.

THEMIS Science Software Drop Down Menu






THEMIS

Time History of Events and Macroscale Interactions During Substorms

- Home
- The Mission
- Data
- Software**
- Publications
- News & Events
- Contact Us
- For the Public >>

Software >>

- Developers
- Documentation**



THEMIS Software

The THEMIS Data Analysis Software Suite consists of IDL routines which read data in CDF format, as well as other less refined data sets. IDL routines can be used to download, open, analyze, and plot Level 1 (L1) and Level 2 (L2) data quantities. They can also be used transform L1 data into L2 data. L1 data is raw, uncalibrated data in CDF format. L2 data is calibrated in physical units These IDL routines were derived from those used by the Cluster, Wind, Polar, and FAST missions. In addition to command line invoked IDL routines, the software provides a graphical user interface for opening, analyzing, and plotting data. This interface was designed to facilitate use of the most useful IDL routines.

To begin:

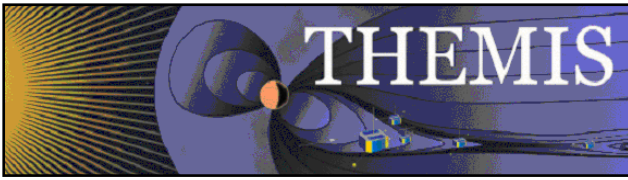
1. [Download](#) the latest release of the Software
Each download includes the User's Guide, (thm_soc_120_analysis_software_users_guide.pdf). You can also download the User's Guide directly from this website as a [DOC](#) or [PDF](#).
2. After downloading a version of the software, open up the users guide and follow the instructions provided.
3. You may also find the [HTML Docs](#) for the latest released version of the Software. You can also browse the IDL source.

Future Releases

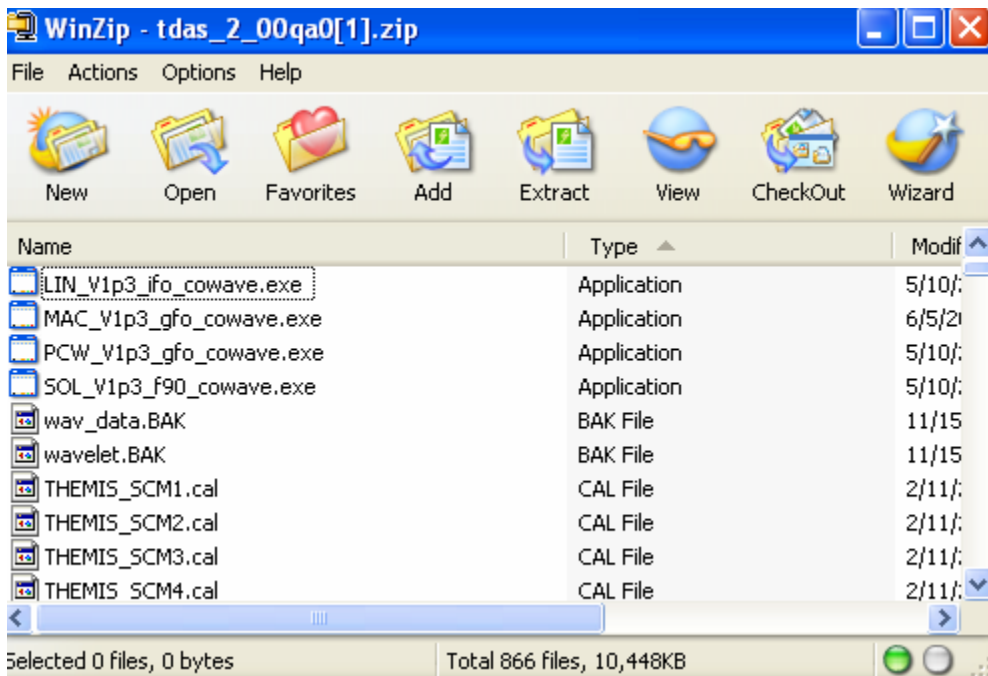
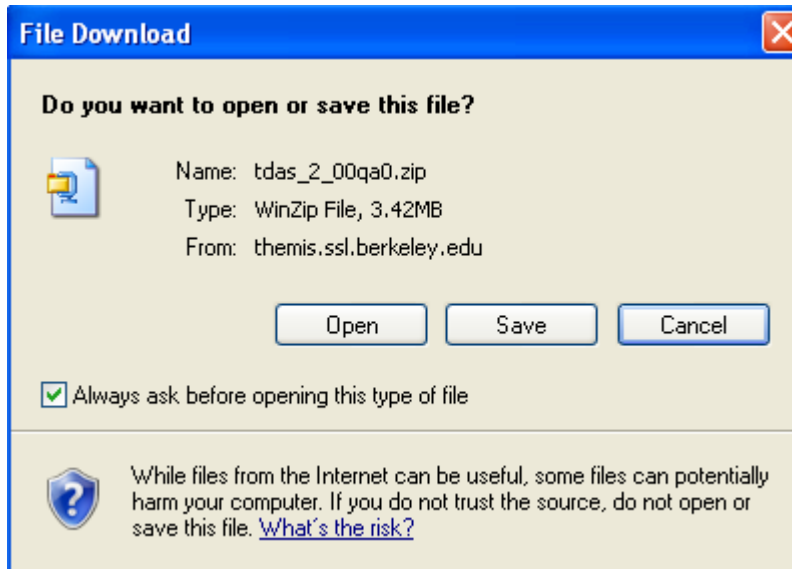
1. You can receive emails notifying you of New Software Releases by [Registering](#) on the THEMIS Science Support Distribution List.
2. [Download](#) not yet released future Software. Please Note this Software may not yet be fully tested and is not supported by the THEMIS Science Support Team.

For comments, observations, problems or questions about data access, software or web site content please contact the [Themis Science Support Team](#).

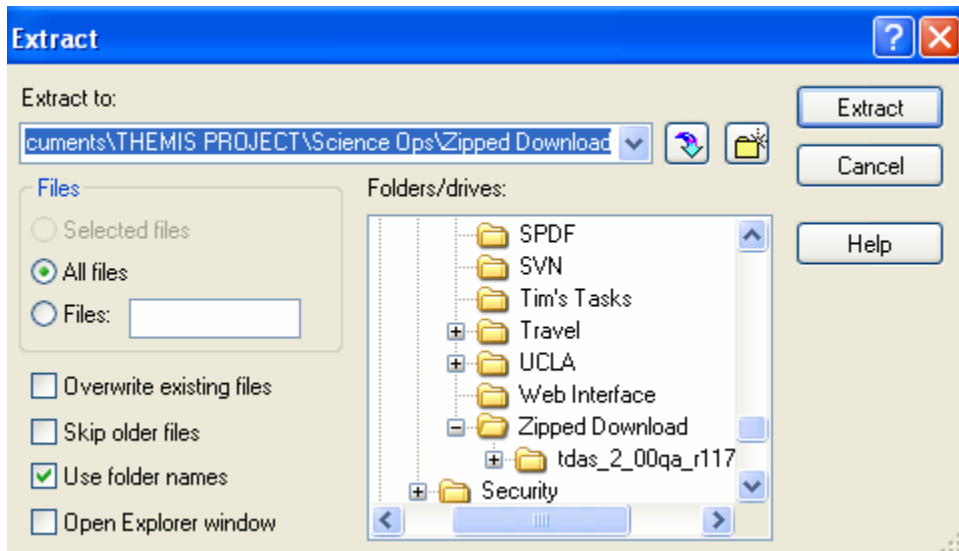
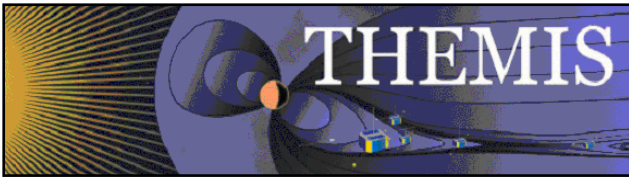
THEMIS Science Software Web Page



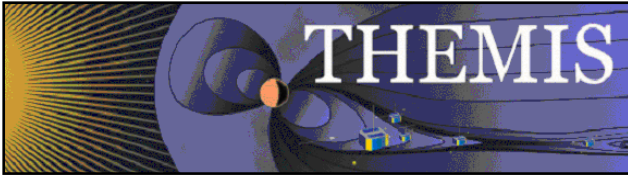
When you click on Download the latest release on a Windows machine a File Download dialogue box will be displayed. Click on 'Open' and the WinZip box will appear. Select the Extract icon to download the unzipped versions of the THEMIS Science Software to your computer. Notice the Extract display will ask you where to put the downloaded files. Please see Screen displays on this and the next page.



THEMIS Science Software - Download Software



THEMIS Science Software - Download Software



THEMIS SW Help for tdas_2_00qa_r1187_2007-07-19 - Windows Internet Explorer

http://themis.ssl.berkeley.edu/socware/tdas_2_00qa0/idl/_tdas_doc.html

File Edit View Favorites Tools Help

Google G Go RS Bookmarks Popups okay Check

THEMIS SW Help for tdas... Comcast Webmail - Email Mes...

THEMIS SW Help for tdas_2_00qa_r1187_2007-07-19

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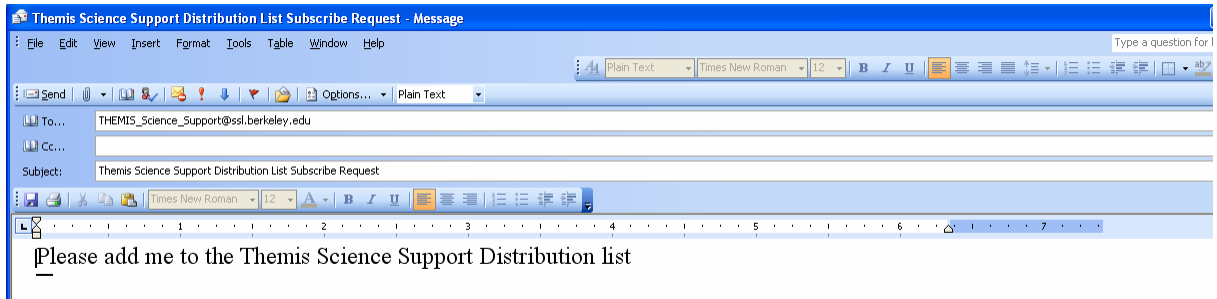
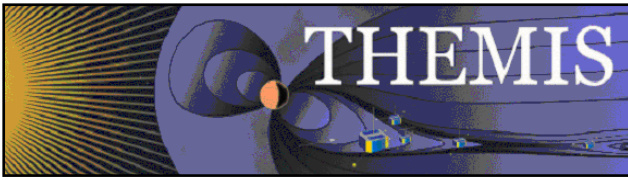
Last modified: Fri Jul 20 01:17:09 2007.

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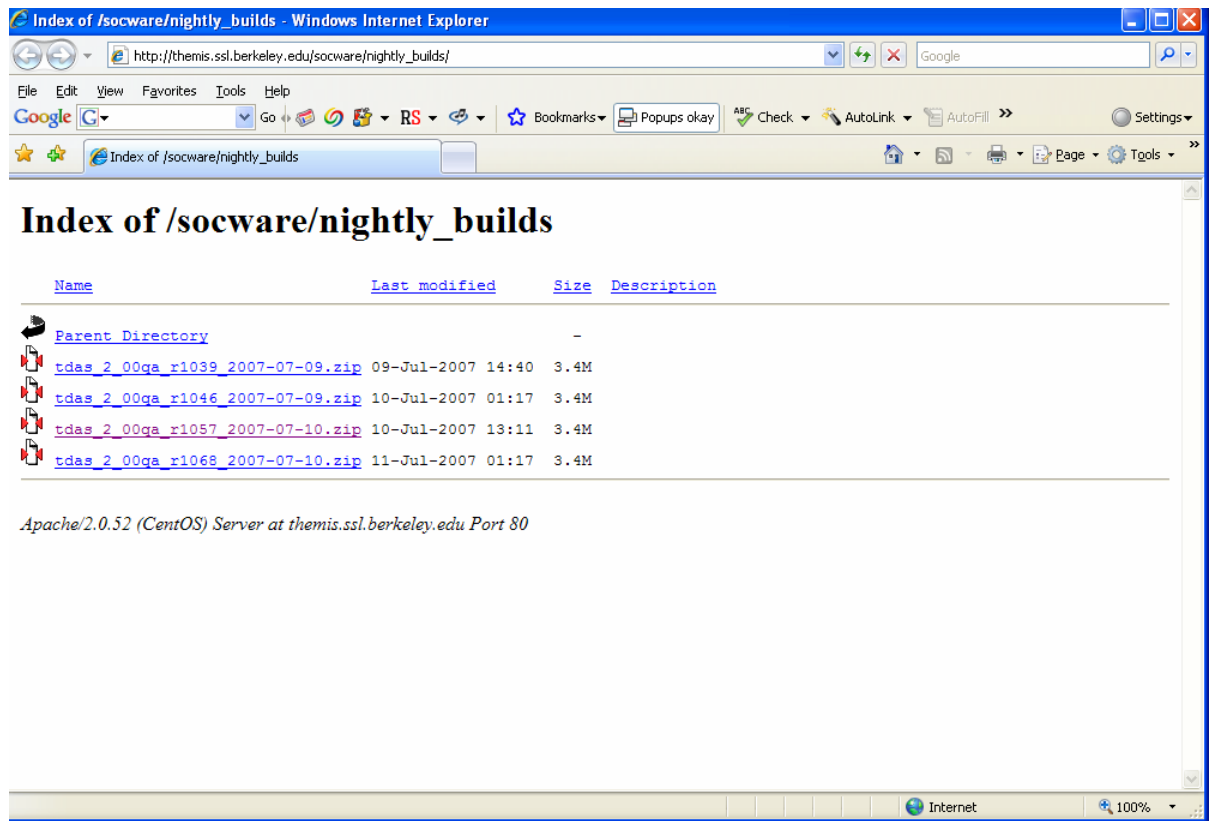
Directories Searched:

- [ssl_general/CDF](#)
- [ssl_general/cotrans](#)
- [ssl_general/davin/wind](#)
- [ssl_general/examples](#)
- [ssl_general/key_param](#)
- [ssl_general/misc](#)
- [ssl_general/misc/SSW](#)
- [ssl_general/misc/system](#)
- [ssl_general/science](#)
- [ssl_general/tools/fitting](#)
- [ssl_general/tools/misc](#)
- [ssl_general/tools/tplot](#)

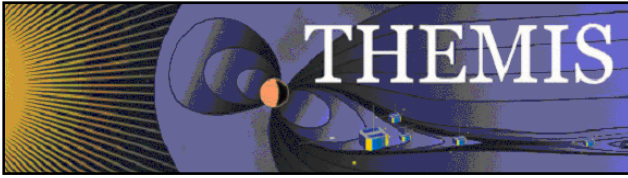
THEMIS Science Software - HTML Docs



THEMIS Science Software - Registration for Notification



THEMIS Science Software - Download Not Yet Released Software



2.4 THEMIS Science Software - For Developers Web Page

The THEMIS Science Software for Developers Web Page has links to aide software developers how to develop and contribute software to the THEMIS Science Software library. The 'Additional Documentation' option will link you to the ftp site where current THEMIS Science Software documentation can be found.

THEMIS
Time History of Events and Macroscale Interactions During Substorms

Home The Mission Data Software Publications News & Events Contact Us For the Public >>

Software
Developers >>
Documentation

THEMIS Software - For Developers

To work on development of Software for future releases, Developers of the Themis Data Analysis Suite can use Subversion (SVN) to get the latest version of the Software and commit their software changes. Below are links to the information you need on setting up and using SVN to develop and contribute software.

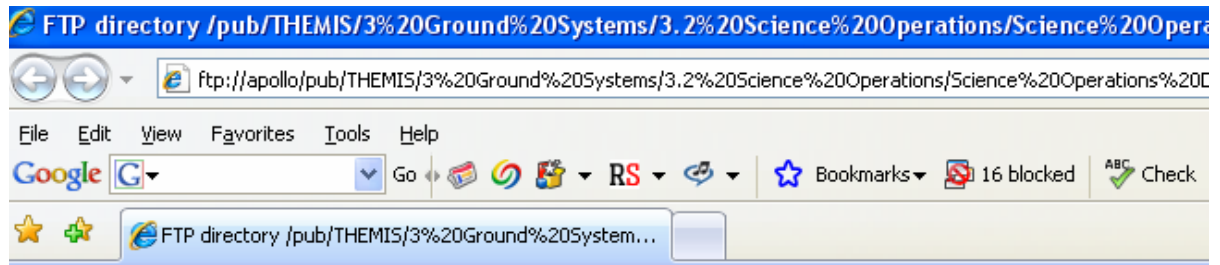
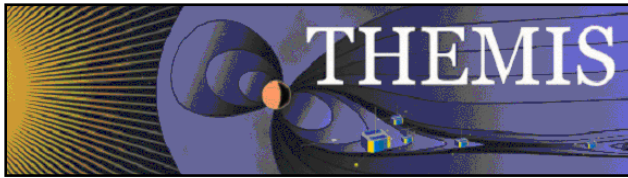
- [SVN Command Line Usage](#)
- [SVN GUI Usage](#)

Whether or not you're using SVN to develop code, follow the rules laid out in the Software Developers Guide.

- Software Developers Guide: [DOC](#) or [PDF](#)
- Software Users Guide: [DOC](#) or [PDF](#)
- [Additional Documentation](#)

For comments, observations, problems or questions about data access, software or web site content please contact the [Themis Science Support Team](#).

THEMIS Software - For Developers Web Page



FTP directory /pub/THEMIS/3%20Ground%20Systems/3.2%20Documents/ at apollo

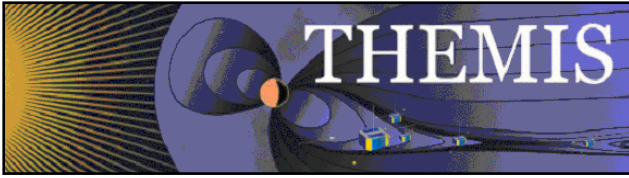
To view this FTP site in Windows Explorer, click **Page**, and then click **Open FTP Site in Windows Expl**

You are user #1 of 50 simultaneous users allowed.

[Up to higher level directory](#)

05/24/2007 02:41PM	Directory	Software Developers Guide
07/11/2007 02:14PM	Directory	Software Users Guides
06/15/2007 11:24AM	Directory	SpinFits Documents
04/24/2007 08:47AM	147,968	thm ogs 431m ephemeris format definition.doc
06/15/2007 11:08AM	208,126	thm ogs 431m ephemeris format definition.pdf
06/15/2007 11:14AM	130,560	thm soc 101 TIME 20070120.doc
06/15/2007 11:14AM	231,206	thm soc 101 TIME 20070120.pdf
06/15/2007 11:16AM	130,048	thm soc 102 STATEFILE 20070420.doc
06/15/2007 11:16AM	231,011	thm soc 102 STATEFILE 20070420.pdf
06/15/2007 11:16AM	231,936	thm soc 103 HSK VARNAMES 20070129.doc
06/15/2007 11:16AM	358,669	thm soc 103 HSK VARNAMES 20070129.pdf
06/15/2007 11:16AM	176,128	thm soc 105 FIELDS VARNAMES 20060929.doc
06/15/2007 11:16AM	202,932	thm soc 105 FIELDS VARNAMES 20060929.pdf
06/15/2007 11:17AM	117,760	thm soc 106 PARTICLES VARNAMES 20061102.doc
06/15/2007 11:17AM	151,715	thm soc 106 PARTICLES VARNAMES 20061102.pdf
06/15/2007 11:17AM	547,328	thm soc 108 GMAG L2 VARNAMES 20060929.doc
06/15/2007 11:17AM	498,732	thm soc 108 GMAG L2 VARNAMES 20060929.pdf
06/15/2007 11:17AM	224,256	thm soc 109 ASI L1 VARNAMES 20070108.doc
06/15/2007 11:17AM	281,333	thm soc 109 ASI L1 VARNAMES 20070108.pdf
06/15/2007 11:18AM	557,568	thm soc 110 COORDINATES 20060929.doc
06/15/2007 11:18AM	689,082	thm soc 110 COORDINATES 20060929.pdf
06/15/2007 11:18AM	1,062,400	thm soc 113 FGM CALPROC 20061018.doc
06/15/2007 11:18AM	466,223	thm soc 113 FGM CALPROC 20061018.pdf
06/15/2007 11:18AM	130,048	thm soc 119 ASI CALPROC 20061108.doc
06/15/2007 11:18AM	201,262	thm soc 119 ASI CALPROC 20061108.pdf
06/15/2007 11:19AM	2,983,424	thm sys 012 PDMP draft 18Oct04.doc
06/15/2007 11:19AM	7,477,970	thm sys 012 PDMP draft 18Oct04.pdf

THEMIS Software For Developers Web Page - Additional Documentation



2.5 THEMIS Contact Us Web Page

The THEMIS Contact Us Web Page lists the contact information for the THEMIS Principal Investigator as well as the Co-Investigators for each THEMIS Instrument. In addition there is an option to send a Help Request to the THEMIS Science Support Coordinator with comments, observations, problems or questions. The Help Request form and process will be explained in more detail in Section 3. Please see the screen display below.

THEMIS
Time History of Events and Macroscale Interactions During Substorms

Home The Mission Data Software Publications News & Events **Contact Us** For the Public >>

Contact Us >>
Help Request

Contact Us

For questions about the THEMIS mission:
Vassilis Angelopoulos (vassilis@ssl.berkeley.edu)

For questions about data from specific instruments, please contact the instrument leads below or the PI:

Vassilis Angelopoulos (vassilis@ssl.berkeley.edu)

Electric Field Instrument (EFI):
J. Bonnell (jbonnell@ssl.berkeley.edu) or F. Mozer (fmozer@ssl.berkeley.edu)

Search Coil Magnetometer (SCM):
A Roux (Alain.roux@cetp.ipsl.fr) or O. LeContel (Olivier.lecontel@cetp.ipsl.fr)

Flux Gate Magnetometer (FGM):
K. H. Glassmeier (kh.glassmeier@tu-braunschweig.de) or U. Auster (uli.auster@tu-braunschweig.de)

Electrostatic Analyzer (ESA):
C. W. Carlson (cwc@ssl.berkeley.edu) or J. P. McFadden (mcfadden@ssl.berkeley.edu)

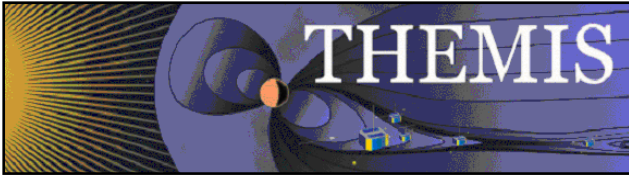
Solid State Telescope (SST):
D. Larson (davin@ssl.berkeley.edu) or R. P. Lin (boblin@ssl.berkeley.edu)

Ground-Based Observatories/All Sky Imagers:
S. Mende (mende@ssl.berkeley.edu) or H. Frey (hfrey@ssl.berkeley.edu) or E. Donovan (eric@phys.ucalgary.ca)

Ground-Based Observatories/Ground Magnetometers:
C.T. Russell (ctrussell@iqpp.ucla.edu) or I. Mann (imann@phys.alberta.ca)

For comments, observations, problems or questions about data access, software or web site content please contact the [Themis Science Support Team](#).

THEMIS Software Contact Us Web Page



3 THEMIS Science Support Help System

3.1 THEMIS Science Support Help Process

The THEMIS Science Support Help Process for users who have Comments, Observations, Problems or Questions concerning data, a document, download, GUI, Plot, Software, Web Interface or any other issue not listed. The Help Process is a bit different for [Step 1](#) if you are using the Web or the GUI Interface.

For the Web to Help Request Form Interface:

Step 1: From either the Software or Contact Us Web Pages (example on previous page) the user will see the following:

For comments, observations, problems or questions about data access, software or web site content please contact the [THEMIS Science Support Team](#).

If you click on [THEMIS Science Support Team](#) a Themis Science Support Help Request Form (example in Section 3.2) will be displayed. The user fills out the form and hits 'Submit'. Depending on your computer and email application the processing will be different for the email to be sent. Some computers that is all you need to do and the form is sent automatically.

If you have a PC running Windows a box will be display asking you which email Application you use.

If you use a desktop email application like Outlook, Outlook Express, select that button, hit OK and the Form will be automatically sent to the Support Coordinator. If you choose either of the two other options (Internet Email or Other) Windows will guide you through a three step process to send your email.

Again, if not using windows (e.g. Mac, Linux or Unix) the process maybe different. Yet the main goal is for the Help Request Form to be sent to THEMIS_Science_Support@ssl.berkeley.edu.

For the GUI to the Help Request Form Interface:

Step 1: By clicking on the 'ERROR' box on the GUI Main widget or if the THEMIS Science Software detects an error, a text version of the Help Request Form will be displayed (example in Section 3.3). Fill out the form and then click on 'Save'. In the message window of the GUI Main Widget will be where the GUI has saved your form (example in Section 3.4). It is also good practice to also save your history file by clicking on 'Save History' on the GUI Main widget. As was with the Help Request Form the in the GUI Main widget's message window will be displayed where the system has put your saved History file example in Section 3.5). At this point you can address your email to [THEMIS Science Support Team](#), attach your Help Request Form and your History file and send.

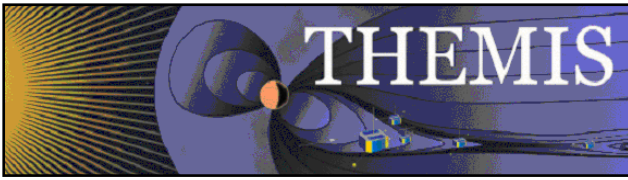
The remaining steps are the same for either the Web or GUI Interface.

Step 2: User sends any additional information (logs, error messages, etc) to THEMIS_Science_Support@ssl.berkeley.edu.

Step 3: The Support Coordinator will log in your help request, send you back an email confirming receipt of your help request with your Help Request Number. The Support Coordinator will also forward your Help Request and any attachments to the person (Actionee) who will investigate and answer your Help Request.

Step 4: The Actionee will contact the User to respond to the comment, observation, problem or question.

Step 5: Feel free at any time to send an email to the Support Coordinator requesting status of your request.



3.2 THEMIS Science Support Help Form - Web Form

Themis - Windows Internet Explorer

http://themis.ssl.berkeley.edu/thm_sci_help_request_form.shtml#top

File Edit View Favorites Tools Help

Google Go RS Bookmarks Popups okay Check AutoLink Aut

Themis

Home The Mission Data Software Publications News & Events Contact Us For the Public >>

Contact Us
Help Request>>

THEMIS Science Help Request

Request Type:
 Comment Observation Problem Question

Category:
 Data Document Download Gui Instrument
 Plot Software Web Content Other Not Sure

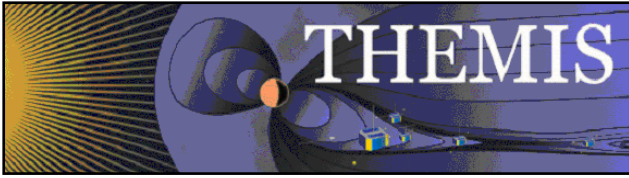
Request Title:

Requestor Info:
Name: Office Phone:
Email:

Help Request Details
If Problem or Observation(Please fill in as completely as you can):
Date Occurred:
Operating System: (e.g. Linux,Unix,Windows)
CDF Version: (If known,otherwise leave blank)
Version of Software: (See Software download zip file name)
Version of IDL: (See IDL help button)

For all types, please include a detailed description below:
(If applicable, include IDL error messages, crib sheet or lines of code used to run, and the GUI history file)

Please email any supporting materials that would help in researching your request to:
Themis_Science_Support@ssl.berkeley.edu with the Help Request Title from above in the subject line.



3.3 THEMIS Science Support Help Form - GUI Text 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: _____

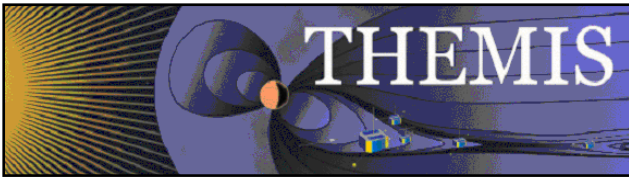
Operating System _____ (e.g. Linux, Unix, Windows)

CDF Version ____ Version of Software ____ Version of IDL ____

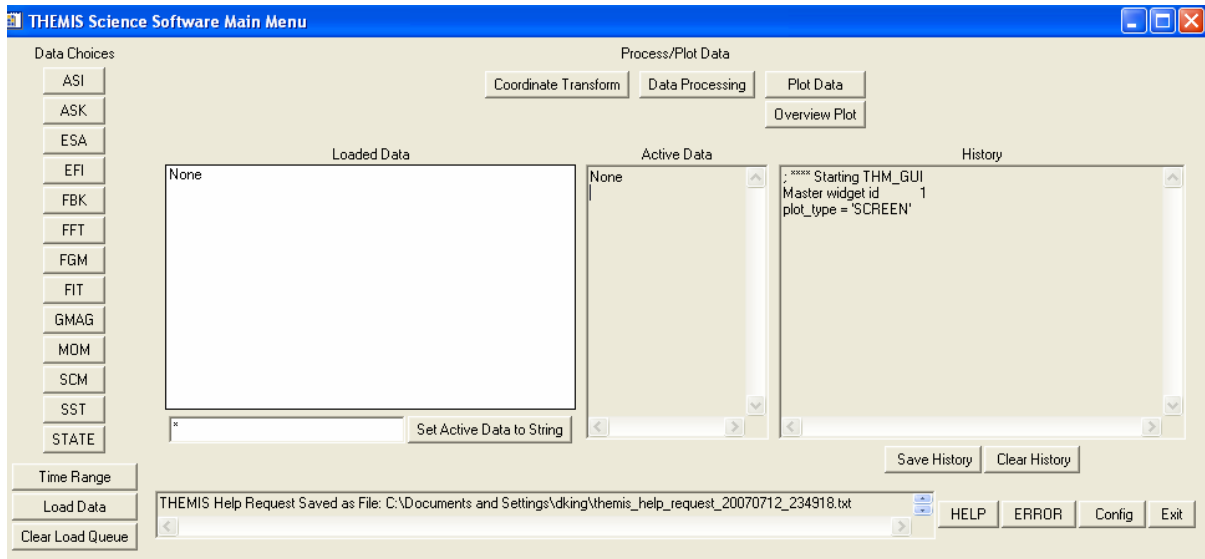
Detail Description of Comment, Observation, Problem or Question:
(if applicable, please include IDL error messages, crib sheet or
lines of code used to run and if using the GUI the History File)

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.

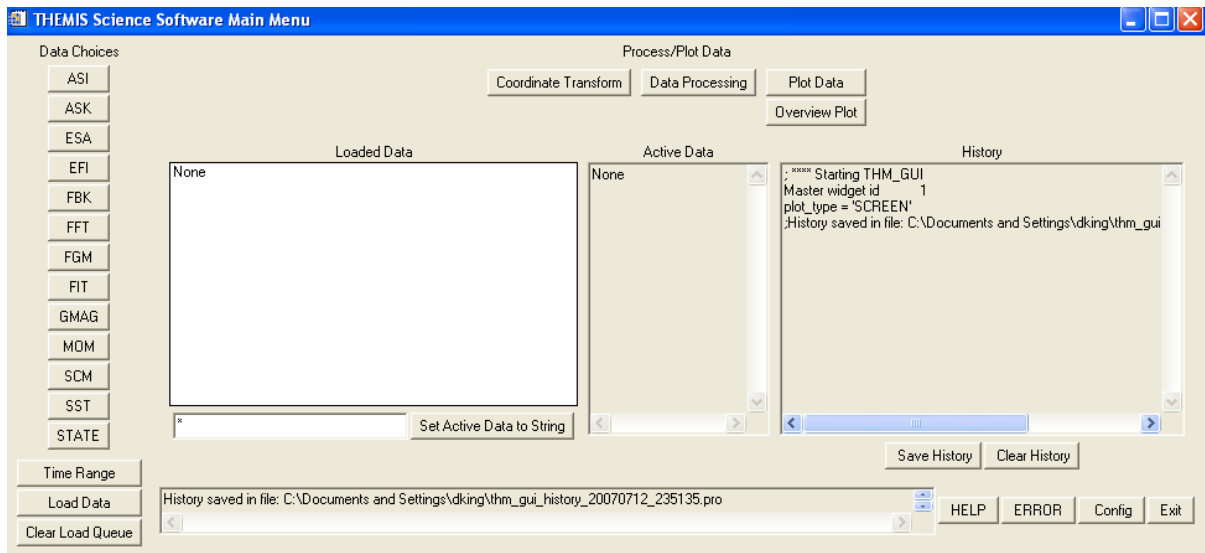
Thanks so much,
THEMIS Science Support Team

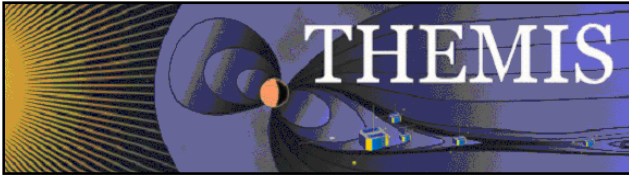


3.4 Help Form Location - GUI Message Window



3.5 Saved History Location - GUI Message Window





4 THEMIS DATA

This section describes the THEMIS data, as seen by the THEMIS Data Analysis Software.

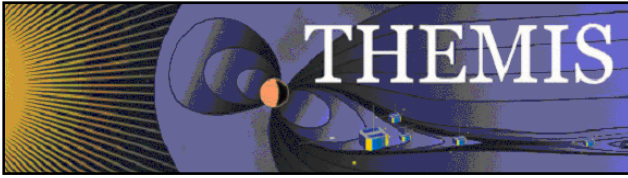
4.1 *THEMIS DATA Overview*

THEMIS data is available in 3 levels

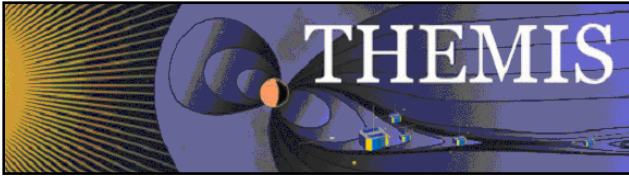
Level 0	telemetry packet format, overlaps removed and formatted into daily files
Level 1	CDF data files, contain raw telemetry data
Level 2	CDF data files, calibrated data

4.2 *THEMIS DATA Quantity Summary*

The table on the next few pages summarize the datatypes recognized by TDAS. They will include the variable names as they appear on an Instrument's GUI Widget as well as in the GUI Main widget's Active Data window (GUI concepts will be discussed on Section 6). Please note that in the table below the variable names will not include their probe prefix (e.g. tha_ for a probe 'A' variable).



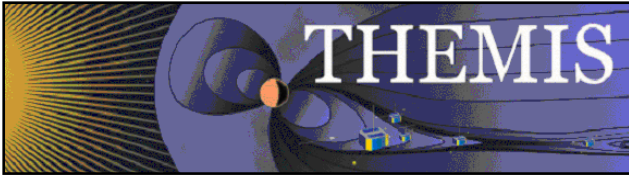
Instrument	Level	Data Name	Description
ASI	L1	asf_????	All-sky imager full resolution images of 256x256 pixels (???? = 4-letter code of ground station)
		ast_????	All-sky imager thumbnail images of 32x32 pixels (???? = 4-letter code of ground station)
ASK	L1	ask_????	All-sky imager keogram images of 256 pixels (???? = 4-letter code of ground station)
ESA	L0 or L2	For ESA: ? = f or r or b	f=full, r=reduced, b=burst
		pei?_density	ion density
		pei?_t3	diagonalized ion temperature
		pei?_en	ion energy spectrogram
		pei?_en_eflux	ion energy flux spectrogram
		pei?_velocity	ion velocity (DSL)
		pei?_velocity_???	ion velocity (???=DSL or GSE or GSM)
		pei?_ptens	ion pressure tensor (DSL)
		peif_mftens	ion momentum flux tensor (DSL)
		pei?_magt3	ion temperatures in B frame
		pei?_avgtemp	trace of diagonalized temperature tensor divided by 3
		pei?_vthermal	ion thermal velocity
		pei?_symm	direction of pressure tensor symmetry (DSL)
		pei?_symm_ang	angle between symmetry direction and B
		pei?_ang	ion angle spectrogram
		pei?_tot	total ion count
		pei?_en_counts	ion count vs. energy
		pei?_mode	ion instrument mode
		pee?_density	electron density
		pee?_t3	diagonalized electron temperature
		pee?_en	electron energy spectrogram
		pee?_en_eflux	electron energy flux spectrogram
		pee?_velocity	electron velocity (DSL)
		pee?_velocity_???	electron velocity (???=DSL or GSE or GSM)
		pee?_ptens	electron pressure tensor (DSL)
		pee?_mftens	electron momentum flux tensor (DSL)
		pee?_magt3	electron temperatures in B frame
		pee?_avgtemp	trace of diagonalized temperature tensor divided by 3
		pee?_vthermal	electron thermal velocity
		pee?_symm	direction of pressure tensor symmetry (DSL)
		pee?_symm_ang	angle between symmetry direction and B
pee?_ang	electron angle spectrogram		
pee?_tot	total electron count		
pee?_en_counts	electron count vs. energy		
pee?_mode	electron instrument mode		



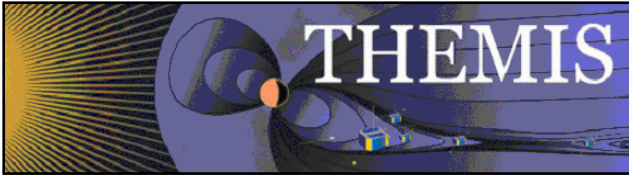
Instrument	Level	Data Name	Description
SST	L1 or L2	psi?_# pse?_#	? = f or r or b ; # = same quantities as for ESA ? = f or r or b ; # = same quantities as for ESA
MOM (on-board moments)	L1 and L2	peim_density peim_flux peim_mftens peim_eflux peim_velocity peim_press peem_density peem_flux peem_mftens peem_eflux peem_velocity peem_press	ESA ion density ESA ion flux ESA ion momentum flux tensor ESA ion energy flux ESA ion velocity ESA ion pressure ESA electron density ESA electron flux ESA electron momentum flux tensor ESA electron energy flux ESA electron velocity ESA electron pressure
	L1 and L2	psim_# psem_#	# = SST quantities (same as for ESA) # = SST quantities (same as for ESA)
EFI	L1 or L2	eff efp efw eff_dot0 efp_dot0 efw_dot0 eff_0 efp_0 efw_0 efs efs_0 efs_dot0 vaf vap vaw vbf vbp vbw ef?_hed ef?_raw va?_hed va?_raw	E field, fast survey/full orbit, 3D E field, particle burst, 3D E field, wave burst, 3D E field, fast survey/full orbit, 3D, using E dot B=0 E field, particle burst, 3D, using E dot B=0 E field, particle burst, 3D, using E dot B=0 E field, fast survey/full orbit, 3D, using Ez=0 E field, particle burst, 3D, using Ez=0 E field, particle burst, 3D, using Ez=0 On-board spin-fit On-board spin-fit electric field using Ez=0 On-board spin-fit electric field using E dot B=0 Voltage, processor A, fast survey/full orbit Voltage, processor A, particle burst Voltage, processor A, wave burst Voltage, processor B, fast survey/full orbit Voltage, processor B, particle burst Voltage, processor B, wave burst 16-byte packet header for analogous data type; ?=f or p or w raw data for analogous data type; ?=f or p or w 16-byte packet header for analogous data type; ?=f or p or w raw data for analogous data type; ?=f or p or w



Instrument	Level	Data Name	Description
FBK	L1 only	fb1	Filter Bank 1 (E and/or B)
		fb2	Filter Bank 2 (E and/or B)
		fbh	Filter Bank high frequency (100-300kHz)
	L1 and L2	fb_hff	High-frequency filter peak and average values
		fb_eac12	Spectrogram FBK EAC12, AC component
		fb_eac34	Spectrogram FBK EAC34, AC component
		fb_eac56	Spectrogram FBK EAC56, AC component
		fb_edc12	Spectrogram FBK EDC12, DC component
		fb_edc34	Spectrogram FBK EDC34, DC component
		fb_edc56	Spectrogram FBK EDC56, DC component
		fb_scm?	Spectrogram FBK SCM? ; ?=1,2,3
fb_v?	Spectrogram FBK V? ; ?=1,2,3,4,5,6		
FFT (on-board)	L1 and L2	ffp_16	FFT power spectrum in particle burst x 16 frequencies
		ffp_16_dbpara	FFT power spectrum for dB (parallel)
		ffp_16_dbperp	FFT power spectrum for dB (perpendicular)
		ffp_16_eac12	FFT power spectrum fo AC component E12
		ffp_16_eac34	FFT power spectrum for AC component E34
		ffp_16_eac56	FFT power spectrum for AC component E56
		ffp_16_edc12	FFT power spectrum fo DC component E12
		ffp_16_edc34	FFT power spectrum for DC component E34
		ffp_16_edc56	FFT power spectrum for DC component E56
		ffp_16_epara	FFT power spectrum for E (parallel)
		ffp_16_eperp	FFT power spectrum for E (perpendicular)
		ffp_16_scm??	FFT power spectrum for SCM? ; ?=1,2,3
		ffp_16_v?	FFT power spectrum for V? ; ?=1,2,3,4,5,6
		ffp_32_#	# = same quantities in particle burst x 32 frequencies
ffp_64_#	# = same quantities in particle burst x 64 frequencies		
ffw_#	# = same quantities in wave burst		
FGM	L1 and L2	fgl	B field, low telemetry (low data rate)
		fgh	B field, high telemetry (high data rate)
		fge	engineering data (decimated from FGH)
	L2 only	fgs	B field, spin-resolution magnetic field B in DSL
	FIT (on-board)	L2 only	efs
efs_0			On-board spin-fit electric field (EFI) using $E_z=0$
efs_dot0			On-board spin-fit electric field (EFI) using $E \cdot B=0$
efs_sigma			Variance of onboard spin-plane electric field spin fit
fgs			On-board spin-fit FGM data
fgs_sigma			Variance of onboard spin-plane magnetic field spin fit
fit			SpinFIT file E&B raw data
fit_bfit			FGM spinfit calibrated data: A,B,C,sig,avg
fit_efit	EFI spinfit calibrated data: A,B,C,sig,avg		



Instrument	Level	Data Name	Description
GMAG	L2	mag_????	Ground magnetometer data in DHZ coordinates (???? = 4-letter code of ground station)
SCM	L1 and L2	scf scp scw sc?_misalign sc?_dc sc?_iano sc?_cal	waveform fast survey (DSL) waveform particle burst (DSL) waveform wave burst (DSL) misalignment of Z axis from spin axis (?=f or p or w) X-Y (spin plane) values of the DC field in DSL time discontinuities of scp data calibrated scp data (unit depends on selected step)
STATE	L1	state_pos state_vel state_man state_roi state_spinras state_spindec state_spinalpha state_spinbeta state_spinper state_spinphase	GEI position, xyz GEI velocity, xyz Maneuver flag Regions of interest spin axis right ascension, deg spin axis declination, deg Geom to spin axis, Euler alpha, deg Geom to spin axis, Euler beta, deg spin period, sec spin phase, deg



5. THEMIS DATA ANALYSIS SOFTWARE

The THEMIS Data Analysis Software (hereafter referred to as TDAS) is IDL-based. TDAS routines can be used to download, open, analyze and plot L1 or L2 data and process L1 data into L2 data quantities. There are two main ways to use the programs: with the command line interface, or with the GUI interface.

Other features include coordinate transformations and utility routines to translate data into other products (e.g., ascii) as necessary.

5.1 System Requirements

The THEMIS Data Analysis Software requires IDL developers license for Windows or a UNIX-like operating system like Solaris, Linux, or Mac OS X. The software has been tested on IDL 6.3, but should work on IDL 6.2 and 6.4. There is a patch to IDL, which is recommended for best handling of the CDF file format that is used by the THEMIS data files. See:

http://cdf.gsfc.nasa.gov/html/cdf_patch_for_idl6x_new.html

If you are using IDL 6.2 or earlier, or if you are using Intel Mac with any version of IDL (up to 6.4) you *must* install this patch to read CDF files properly.

Mac OS X notes:

You need X11 to view plots and use the GUI in IDL. You can search for X11 in the Spotlight to see if the X11 application is installed on your system. X11 is available on your Mac installation disks, but may not be installed by default.

There is a known problem, mentioned in the IDL 6.3 release notes, which affects all IDL users running Mac OS 10.4 (Tiger) The `tlimit` command will lock up IDL because the plot window will not receive any mouse clicks. Workaround: Change the X11 start-up parameters. Do the following:

1. Open any terminal window (in the X11 application menu bar, you can choose `xterm` from the applications menu)
2. Enter the following at the shell prompt:
`defaults write com.apple.x11 wm_click_through -bool true`
3. Quit X11 (if it is running).

The new default will take effect the next time you start X11, and it will persist from that point (i.e., you will not have to make the change again).

5.2 Known Limitations

Incompatibilities with SolarSoftWare (SSW). There exist some name clashes if both TDAS and SSW are on your `IDL_PATH`.

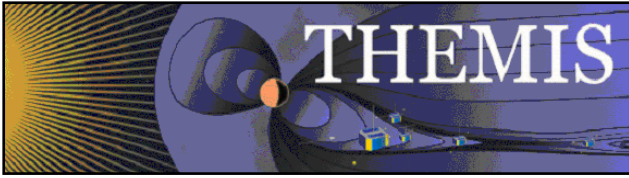
ASI data: ASF (full resolution ASI data) requires a 64-bit machine to load more than 1 hour's worth of data.

5.3 Installation and Configuration

Getting started is usually as simple as of downloading the code and setting up your IDL path, according to the instructions, below.

For a new installation:

1. Download and expand the latest TDAS release .zip file. See section 2.3 THEMIS Science Software – Download Software.
2. Create a directory called TDAS into which you will copy the latest software.
3. Move the `tdas_x_xx` folder into the TDAS directory you created.



4. Configure IDL to search the TDAS directory for IDL programs. See section 5.3.1 IDL PATH setup.

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

1. Remove old `tdas_x_xx` from the TDAS directory.
2. Download and expand the latest TDAS release .zip file.
3. Copy the new `tdas_x_xx` directory into the pre-existing TDAS directory.
4. Re-start IDL.

5.3.1 IDL PATH setup

5.3.1.1 IDL PATH Setup on Windows (and IDLDE on UNIX, Linux and Mac)

For Windows or IDLDE on UNIX, you can use the File->Preferences widget to set up the path so IDL can find the THEMIS IDL files.

UNIX Note: If you use IDLDE on UNIX-like systems, these instructions only work if you do not set the `IDL_PATH` environment variable before you call IDLDE. If IDLDE does not allow you to set the path by following these instructions, then follow the instructions for UNIX installation, below.

Start IDL (Windows) or IDLDE (UNIX, Linux, Mac).

Go to File->Preferences

Select the 'Path' tab.

If `<IDL_DEFAULT>` is not present, press 'Insert Standard Libraries'

Press Insert

Browse to find the TDAS directory you created (see section 5.3 Installation and Configuration)

Check the box to indicate "search subdirectories"

5.3.1.2 IDL PATH Setup for IDL Command Line (UNIX, Linux or Mac OS X)

For the command line version of IDL, installation consists of setting up the `IDL_PATH` environment variable

Simply set the `IDL_PATH` environment to search all subdirectories of the TDAS directory you created in section 5.3 Installation and Configuration.

for `csh` or `tcsh`, place the following in your `.cshrc` file
`setenv IDL_PATH '<IDL_DEFAULT>:~/path/to/tdas'`

for `bash` or `sh`, place the following in your `.bashrc` (Linux, Solaris) or `.bash_profile` (Mac) file:
`export IDL_PATH='<IDL_DEFAULT>:~/path/to/tdas'`

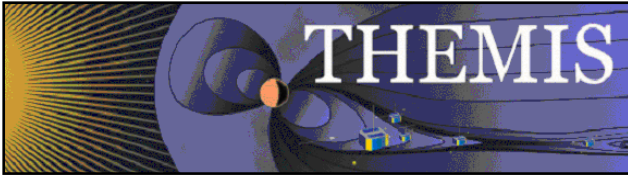
Mac OS X Notes:

You can edit your `.bash_profile` file using the standard Mac TextEdit program (normally, it's impossible to open 'hidden' files beginning with `.'` using TextEdit or the Mac Finder)

In the Terminal, type (or cut-and-paste)

`/Applications/TextEdit.app/Contents/MacOS/TextEdit ~/.bash_profile`

That will open the `.bash_profile` file in the standard Mac text editor. The following configurations are recommended to enable you to use IDL from the Terminal.



```
# Configurations to make IDL and TDAS work from the Terminal
export DISPLAY=:0.0
IDL_LOC='/Applications/rsi/idl_6.3'
source ${IDL_LOC}/bin/idl_setup.bash
export IDL_PATH='<IDL_DEFAULT>:/path/to/tdas'
# End configurations for IDL and TDAS
```

Note that IDL_LOC may vary, depending on version of IDL installed. Search for actual location of IDL using Spotlight.

Tip:

You can drag the 'tdas' directory from the Finder into the TextEdit or Terminal window to paste the actual path for /path/to/tdas.

After saving the file, be sure to exit the TextEdit application from the menu bar, so you can get your command line prompt back!

5.3.2 Data Directory Setup

The THEMIS Data Analysis Software requires a local data directory in which THEMIS data files can be cached. The THEMIS will attempt to create the local data directory for you at the following default location, depending on your operating system.

OS	LOCAL_DATA_DIR
Windows	C:\data\themis
Solaris, Linux, Mac OS X	~/data/themis

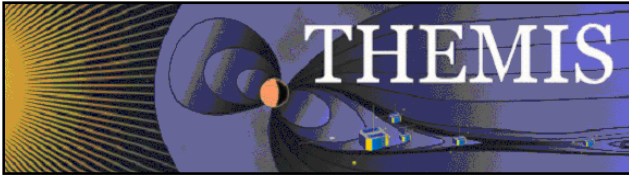
These locations should work as-is for most installations; however, if you don't have administrative privileges to create the data directory in the above locations, you can have your system administrator create it for you, or you can configure the THEMIS Data Analysis Software to use an alternate location. See Remote Data Access and Local Data Cache for information about configuring an alternate location.

5.4 How to Get Started

Assuming you have the software installed, the best place to start is with a crib sheet. The crib sheets in the idl/themis/examples folder give end-to-end examples of how to load, process and plot the highest level data available for a given instrument.

Crib sheets in idl/themis/examples:

thm_crib_asi	Crib sheet for loading and displaying All Sky Imager and Keogram data.
thm_crib_efi	Crib sheet for Electric Fields Instrument waveforms.
thm_crib_esa_da	Crib sheet for analysis of ESA particle distributions
thm_crib_esa_moments	Crib sheet for ground processed ESA moments
thm_crib_export	Crib sheet for exporting THEMIS data and/or plots in common data formats.
thm_crib_fbk	Crib sheet for Filter Bank.
thm_crib_fft	Crib sheet for on-board Fast Fourier Transform data.
thm_crib_fgm	Crib sheet for Flux Gate Magnetometer
thm_crib_fit	Crib sheet for on-board Fields Spin Fit
thm_crib_gmag	Crib sheet for GMAG, including wavelet demo.
thm_crib_mom	Crib sheet for on-board particle Moments.
thm_crib_scm	Crib sheet for Search Coil Magnetometer
thm_crib_sst	Crib sheet for Solid State Telescope.
thm_crib_state	Crib sheet for State data – loading and plotting probe position data
thm_crib_tplot	Crib sheet for using tplot plotting package, using GMAG data as an example.
thm_map_examples	Examples for mapping Ground Base Observatories (GBO)



You can run any of the crib sheets by typing

```
.run <thm_crib_xxx>
```

when execution stops at a 'stop' command in the crib sheet, type

```
.c
```

to continue.

Alternatively, you can cut and paste from the crib sheet to the command line.

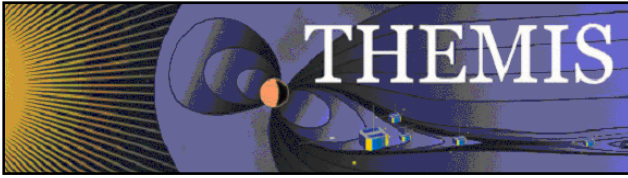
thm_map_examples is not in the same format as the other crib sheets: it defines some procedures which you can then run for yourself, or use as examples for your own code.

To find more information on any of the TDAS routines used in the crib sheets, use:

- The source code of the crib sheets, which is included in the idl/themis/examples directory of the software distribution.
- HTML help included with the software distribution: point your web browser to idl/_tdas_doc.html at the location where your TDAS software is installed locally.
- IDL XDOC widget. At the IDL prompt, type:
xdoc
- IDL doc_library procedure. At the IDL prompt, type:
doc_library, 'command_name'

Sample THEMIS routine documentation:

```
;  
;+  
;Procedure: THM_LOAD_GMAG,  
; thm_load_gmag, site = site, datatype = datatype, trange = trange, $  
;     level = level, verbose = verbose, $  
;     subtract_average = subtract_average, $  
;     subtract_median = subtract_median, $  
;     varname_out = varname_out, $  
;     subtracted_values = subtracted_values, $  
;     downloadonly = downloadonly, $  
;     valid_names = valid_names  
;keywords:  
; site = Observatory name, example, thm_load_gmag, site = 'bmls', the  
;     default is 'all', i.e., load all available stations . This  
;     can be an array of strings, e.g., ['bmls', 'ccmv'] or a  
;     single string delimited by spaces, e.g., 'bmls ccmv'  
; datatype = The type of data to be loaded, for this case, there is only  
;     one option, the default value of 'mag', so this is a  
;     placeholder should there be more than one data type. 'all'  
;     can be passed in also, to get all variables.  
; TRANGE= (Optional) Time range of interest (2 element array), if  
;     this is not set, the default is to prompt the user. Note  
;     that if the input time range is not a full day, a full  
;     day's data is loaded  
; level = the level of the data, the default is 'l2', or level-2  
;     data. A string (e.g., 'l2') or an integer can be used. 'all'  
;     can be passed in also, to get all levels.  
; /VERBOSE : set to output some useful info  
; /SUBTRACT_AVERAGE, if set, then the average values are subtracted  
;     from the loaded variables,  
; /SUBTRACT_MEDIAN, if set, then the median values are subtracted  
;     from the loaded variables,  
; varname_out= a string array containing the tplot variable names for  
;     the loaded data, useful for the following keyword:  
; subtracted_values = returns N_elements(varname_out) by 3 array  
;     containing the average or median (or 0) values  
;     subtracted from the data.
```



```
; /downloadonly, if set, then only download the data, do not load it
; into variables.
; no_download: use only files which are online locally.
; relpathnames_all: named variable in which to return all files that are
; required for specified timespan, probe, datatype, and level.
; If present, no files will be downloaded, and no data will be loaded.
; /valid_names, if set, then this will return the valid site, datatype
; and/or level options in named variables, for example,
;
; thm_load_gmag, site = xxx, /valid_names
; get_support_data = does nothing. present only for consistency with other
; load routines
;
;Example:
; thm_load_gmag, site = 'bmls', trange =
; ['2007-01-22/00:00:00','2007-01-24/00:00:00']
;
;Written by: Davin Larson, Dec 2006
; 22-jan-2007, jimm, jimm@ssl.berkeley.edu rewrote argument list, added
; keywords,
; 1-feb-2007, jimm, added subtract_median, subtracted_value keywords
; 19-mar-2007, jimm, fixed the station list...
; $LastChangedBy: jimm $
; $LastChangedDate: 2007-05-21 19:44:54 -0400 (Mon, 21 May 2007) $
; $LastChangedRevision: 678 $
; $URL: svn+ssh://thmsvn@ambrosia.ssl.berkeley.edu/repos/thmsoc/branches/QA/idl/themis/ground/thm_load_gmag.pro $
;-
```

5.5 Software Functions

This section described the functionality of the THEMIS software. The examples are given using the command line interface, but the concepts are the same for the GUI.

5.5.1 Loading THEMIS Data

The THEMIS software is set up to work with Level 2 THEMIS data by default. However, it can also be used to load Level 1 data, calibrate it, and output data quantities, which are essentially the same as the Level 2 product.

It is also possible to load raw Level 1 data. Calibration routines are available for those who want to have full access to intermediate outputs, settings of calibration parameters, diagnostic outputs, etc.

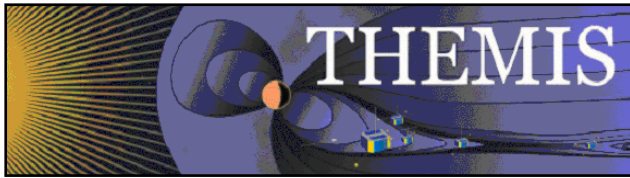
With the exception of ESA data, TDAS does not work with Level 0 data, and instead works with the Level 1 in CDF data format.

The THEMIS software will automatically create a local data cache which mirrors the structure of the THEMIS data archive. The software is written such that the default settings will work for the majority of users. The location of the THEMIS data archive is also found automatically by the software.

To download some data and load it into IDL, you simply specify a timespan and type of data you want to load. If the data does not exist locally on your local_data_dir, it will be downloaded automatically before it is loaded into IDL.

At the IDL prompt, type:

```
timespan, '2006-11-11', 1, /day
Then, use one of the thm_load commands, e.g.
```



thm_load_gmag, site='ccnv'

List of routines for loading data:

thm_load_asi	Loads All-Sky Imager data for any ground station (by keyword) or all available.
thm_load_ask	Loads All Sky Keogram data for all observatories.
thm_load_efi	loads efi waveforms
thm_load_esa	Load ElectroStatic Analyzer data (for L2 esa data)
thm_load_esa_pkt	Load Level 0 ESA data
thm_load_fbk	Load Filter Bank data
thm_load_ffg	Load on-board Fast Fourier Transform data.
thm_load_fgm	loads all fgm waveforms (choice of fgl, fgh...)
thm_load_fit	Load On-Board Fields Spin-Fit data
thm_load_scm	Load Search Coil Magnetometer data.
thm_load_gmag	loads ground mag data for any ground station (by keyword) or all available.
thm_load_hsk	loads housekeeping data – all or one by keyword.
thm_load_mom	loads on-board moments data (only density moment is currently valid)
thm_load_scm	loads SCM waveform.
thm_load_sst	Load Solid State Telescope data.
thm_load_state	Loads Orbit and Attitude data

Standard Load Procedure Keywords:

SITE	string: ground station name, or a list of ground station names, or 'all'
PROBE	string: probe name, or a list of probe names, or 'all'. e.g. 'a b c'
DATATYPE	type of CDF file for the given instrument.
LEVEL	Level of data file to load: '11' or '12' default is '12' for Level 2.
TYPE	'raw' or 'calibrated'. applies to '11' data only. 'Calibrated' is the default.
VALID_NAMES	Return valid names for DATATYPE, SITE, PROBE, and LEVEL
VERSION	Version of CDF file to load (useful for STATE data): 'v01', 'v02'
GET_SUPPORT_DATA	Get support data quantities from CDFs as well as data quantities, only useful for '11' data.
CDF_DATA	Return a structure containing data and metadata from CDF.

5.5.2 General Conventions: variable name construction and reference

The command line interface of TDAS provides a general interface for referring to a data quantity, based on keywords. The lists in these keywords can be arrays of strings, or scalar strings containing space-separated lists.

PROBE : specifies the probe, or probes of interest: 'a b c' or ['a', 'b', 'c']

DATATYPE: specifies the type of data, for a given instrument: corresponds to name in CDF file

SUFFIX: a suffix to the variable name

the data is loaded into variables with the following name:

tha_bbb_suf

where a is the probe designation, bbb is the datatype designation, and _suf is the optional suffix.

For some data, a midfix is added before the datatype: e.g. for all STATE and HSK data a midfix is added before the datatype it in the TPLOT variable name. e.g.

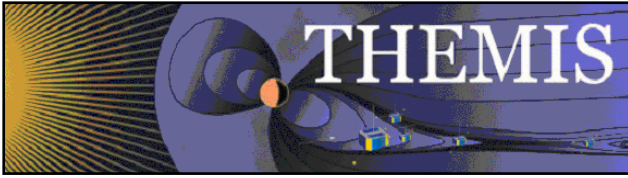
tha_state_pos

In this example, the datatype is POS, but the state_ midfix had been added before it in the name.

The various thm_load and thm_cal routines, as well as thm_cotrans all accept the above keywords to determine which data to operate upon.

General-purpose routines (e.g. tplot) contained in TDAS can refer to sets of tplot variables using glob-style patterns:

th?_??_raw



Refers to data for all probes for all datatypes, and with any suffix.

th[ab]_fg?

Refers to FGL, FGH, FGE for probes A and B.

Some routines, (e.g. thm_cotrans) accept both conventions.

5.5.3 Plotting the data

In the command line, type

tplot_names

to see available data quantities. Type, e.g.,

tplot, 1

to plot the first quantity.

tplot, [1,2,3]

plots a stack plot of the first 3 data quantities.

tplot, `th?_fgh`

plots a stack plot of High Rate Flux Gate Magnetometer data for all available probes.

Plotting routines:

tplot	General purpose time plotting utility for creating stack plots of waveforms and sonograms.
tlimit	Zoom into or out of a tplot
get_data	Get data out of a tplot variable into a structure containing a time tag array and a data array.
store_data	Store a data array structure into a tplot variable.

tlimit

zoom in.

tlimit, /last

zooms out again (or in again)

tlimit, /full

zooms to the full time range available.

You can also retrieve data from tplot variables and manipulate it in IDL. Refer to thm_crib_tplot for examples of using get_data and store_data.

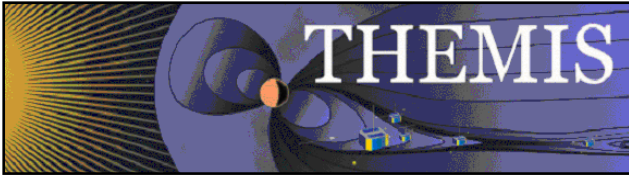
5.5.4 Calibrations and Beyond

Refer to the crib sheet for each instrument for usage of the calibration routines. The interface to the various calibration routines has not yet been standardized.

Calibration: from L1 data to physical quantities

thm_cal_efi	Electric Fields Instrument
thm_cal_fbk	Filter Bank
thm_cal_fft	FFT data
thm_cal_fgm	Flux gate magnetometer
thm_cal_fit	same as thm_cal_sst, above, but for ESA data.
thm_cal_mom	calibrates all (ESA and SST) moment data
thm_cal_scm	calibrate SCM data

For working with SST or ESA data, see the crib sheets.



5.5.5 Coordinate Transformations

thm_cotrans can be used to transform a THEMIS vector data quantity stored in a tplot variable to any of the following coordinate systems:

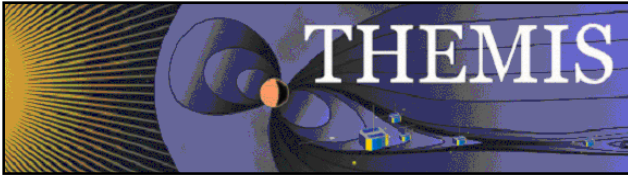
Abbreviation	Description
SPG	Spinning Probe Geometric
SSL	Spinning SunSensor L-vectorZ
DSL	Despun SunSensor L-vectorZ
GEI	Geocentric Equatorial Inertial
GSE	Geocentric Solar Ecliptic
GSM	Geocentric Solar Magnetospheric

For details and diagrams, see THM_SOC_110_COORDINATES.

The default output of thm_load routines is DSL. The thm_load routines set metadata in the tplot variable, which indicates the coordinate system of the data. Thm_cotrans is aware of this metadata, so it is not necessary to specify thin input coordinate system when calling thm_cotrans.

thm_cotrans usage:

```
;Procedure: thm_cotrans
;Purpose: Transform between various THEMIS and geophysical coordinate systems
;keywords:
; probe = Probe name. The default is 'all', i.e., transform data for all
; available probes.
; This can be an array of strings, e.g., ['a', 'b'] or a
; single string delimited by spaces, e.g., 'a b'
; datatype = The type of data to be transformed, can take any of the values
; allowed for datatype for the various thm_load routines. You
; can use wildcards like ? and [lh].
; 'all' is not accepted. You can use '*', but you may get unexpected
; results if you are using suffixes.
; in_coord = 'spg', 'ssl', 'dsl', 'gse', 'gsm', or 'gei'
; coordinate system of input.
; This keyword is optional if the coord_sys attribute
; is present for the tplot variable, and if present, it must match
; the value of that attribute. See cotrans_set_coord, cotrans_get_coord
; out_coord = 'spg', 'ssl', 'dsl', 'gse', 'gsm', or 'gei'
; coordinate system of output.
; in_suffix = optional suffix needed to generate the input data quantity name:
; 'th'+probe+'_datatype'+in_suffix
; out_suffix = optional suffix to add to output data quantity name. If
; in_suffix is present, then in_suffix will be replaced by out_suffix
; in the output data quantity name.
; valid_names: return valid coordinate system names in named variables supplied to
; in_coord and/or out_coord keywords.
;Optional Input Parameters:
; in_name Name(s) of input tplot variable(s) (or glob pattern) (space-separated; string list or array of strings.)
; out_name Name(s) of output tplot variable(s). glob patterns not accepted.
; Number of output names must match number of input names (after glob
; expansion of input names). (single string, or array of strings.)
;
;
;Example:
```



```
; thm_cotrans, probe='a', datatype='fgl', out_coord='gsm', out_suffix='_gsm'
```

Several examples of thm_cotrans usage can be found in thm_crib_fgm.pro.

A low-level coordinate transformation routine is available if working with simple arrays rather than tplot variables is desired.

cotrans	Transform between geophysical coordinate systems GSE, GEI, GSM.
---------	-----------------------------------------------------------------

5.6 Data Export

You can export your data and/or plots to a variety of data formats.

Examples:

Export to ASCII files:

```
tplot_ascii, 'th?_fgs', trange=timerange(/current), dir='~/thm/waves', ext='_20070520.txt'
```

This example writes out Flux Gate Magnetometer Slow Survey data for all probes.

The ext keyword is being used to add the time of the data to the filename.

The dir keyword is being used to set the directory to which the files will be written.

5.7 Managing Your Data Cache

There currently exist some experimental routines for managing your THEMIS data file cache. These routines serve as an example of how you will be able to download all data for a given time range with a single command.

- thm_file_download – can be used to download all types of THEMIS data for a given time span.
- thm_file_cleanup – delete empty directories. This is a function call. It searches the hierarchy and return files matching a given pattern, sorted by access time. Currently does not delete files, but can be used as a tool for finding old data.

5.5.8 Configuring Local Data Cache and Remote Access Behavior

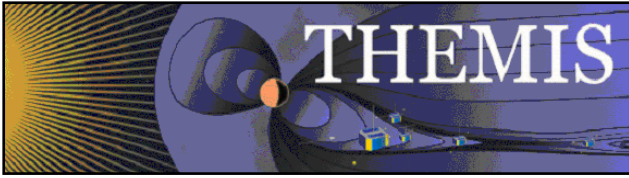
Data locations may be configured at IDL startup (for example, if you want the data to reside in a non-standard location), or dynamically during an IDL session.

The following table summarizes the controls that can be used, in order of precedence:

- !THEMIS system variable
- thm_config.txt (editable with thm_ui_config)
- environment variable settings

The following table summarizes the settings available:

'themis structure element	Environment Variable	Description
local_data_dir	THEMIS_DATA_DIR	a writable, local directory in which to cache data files
remote_data_dir	THEMIS_REMOTE_DATA_DIR	URL to a data archive where THEMIS data can be found. By default, http://sprg.ssl.berkeley.edu/data/themis
no_download	N/A	1: don't access remote_data_dir
no_update	N/A	0: download only if file on server differs or if local file does not exist. 1: download only if local file does not exist. i.e. no clobber.
progress	N/A	0: don't show progress bar 1: show progress bar for each file downloaded.



verbose	N/A	level of verbosity for themis commands, 0=silent. Values >1 are generally for debugging.
---------	-----	------------------------------------------------------------------------------------------

5.5.8.1 Configuration at startup

If you want to change the local_data_dir where data will be stored, run thm_ui_config at the IDL prompt.

Change the setting for Local Data Directory and press 'Save' this will save the configuration to be used in all future IDL sessions. The configuration is saved in a thm_config.txt file in an OS-specific location.

5.5.8.2 On-the-Fly configuration

The local data directory location can be changed on-the-fly by setting the !themis.local_data_dir system variable. For example, when you are connected to the network, you may choose to use a networked data dir:

```
!themis.local_data_dir = '\\justice\data\themis\'
```

The remote_data_dir structure element can also be updated to a different URL.

If you want the software to use only locally available data, and don't want the software to try to download data, you can set:

```
!themis.no_download = 1
```

Note that you can only set the !themis variable in an IDL session after a thm_ command has already been run, or after explicitly calling thm_init.

Using thm_ui_config from the IDL prompt without pressing 'Save' in the widget is an alternate way of setting !themis for the current IDL session.

5.5.8.3 Note for users who connect using a web proxy server

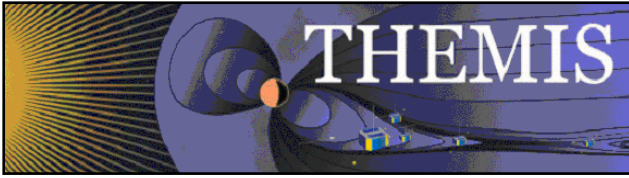
If you are behind a firewall and have to access the net through a Web proxy, set the environment variable 'http_proxy' to point to your proxy server and port, e.g. (for Unix)

```
'setenv http_proxy=http://web-proxy-server.my\_institution.edu:3128'
```

The URL **MUST** begin with "http://".

This can be done in your IDL_startup file, e.g.,

```
IDL > setenv, 'http_proxy= http://web-proxy-server.my_institution.edu:3128'
```

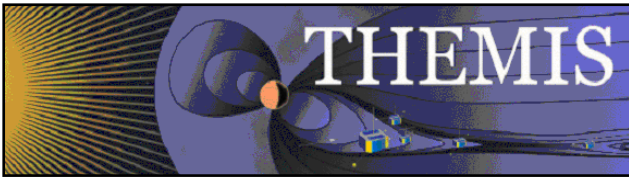
5.6 Software Organization

The themis directory contains THEMIS-specific routines. The general directory (currently named ssl_general) contains routines which are useful for more than one space-science mission for which THEMIS team members are developing code. The external directory contains packages developed and maintained by other groups, but which are required for writing (and running) the themis and/or general routines.

The idl directory of the distribution includes the following files and sub-directories.

_tdas_doc.html	Documentation in HTML format, including alphabetical list of all routines.		
themis/	setup_themis	Sample setup script for csh (UNIX)	
	ground/	routines for loading, processing and plotting ground-based data. e.g. thm_load_gmag, thm_gmag_stackplot, imageplot, mosaicplot	
	spacecraft/	fields/	routines for loading, processing and plotting particles data, e.g. thm_proc_fgm
		particles/	routines for loading, processing and plotting particles data, e.g. thm_load_sst, thm_cal_sst
	state/	Routines for reading state and performing coordinate transformations, e.g. thm_load_state, thm_cotrans.	
	examples/	Crib sheets, like thm_crib_ask	
	common/	THEMIS-specific tools useful to multiple data types and instruments, eg thm_gui, thm_file_download, thm_init	
ssl_general/	CDF/	CDF utilities, including cdf2tplot, and other utilites like cdf2tplot, cdf_info, cdf_load_vars (into IDL structure representation of CDF)	
	science/	Routines useful for specific scientific analysis.	
	cotrans/	General coordinate transformation: cotrans, ssl2dsl, dsl2gse	
	tplot/	General time-plotting utilites	
	misc/	Miscellaneous routines used by tplot and other ssl_general routines.	
	key_param/	Load routines for ACE, KP, WIND, POLAR data.	
external/	CDAWeb		

The _tdas_doc.html file contains a complete listing of all routines in the hierarchy, along with links to complete documentation.



6. Graphical User Interface

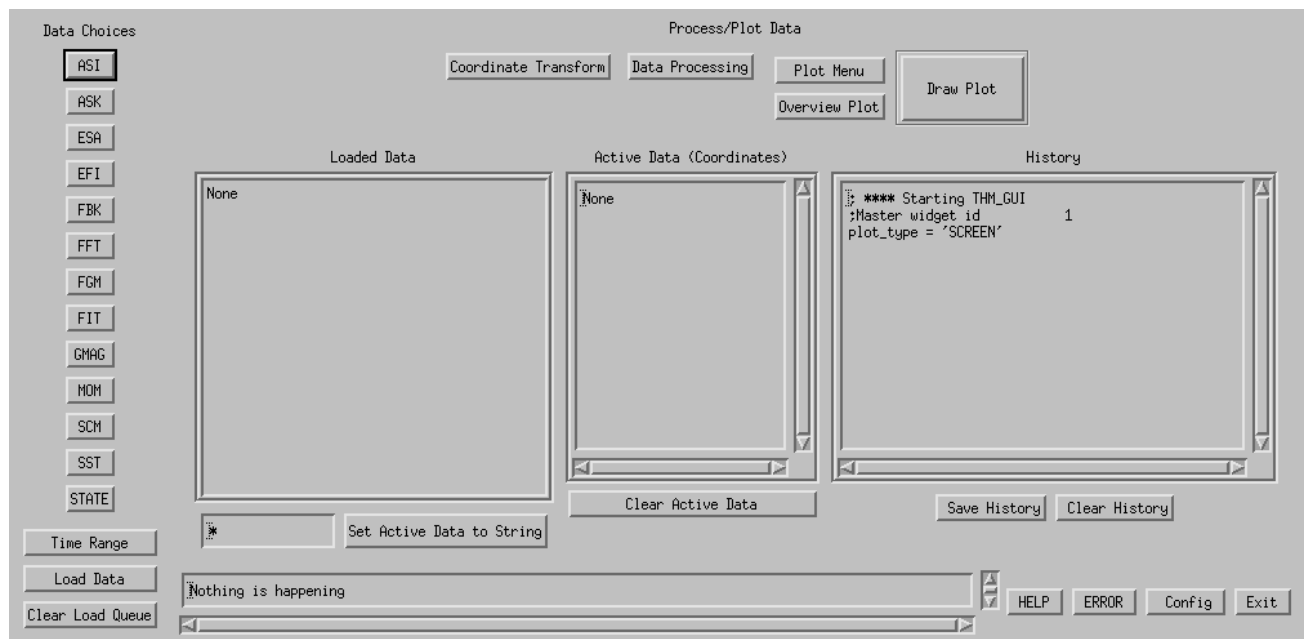
The philosophy of the graphical user interface (GUI) is to provide a convenient interface to the most generally useful capabilities of the command-line THEMIS IDL routines. General users can use the GUI without being required to know the individual IDL routines. Users who want a jump-start to using the more powerful and customizable IDL programming interface may begin with the GUI and then use the GUI to generate a script of the underlying IDL commands which perform the same function. This script can then be used as a starting point for creating an IDL program to process THEMIS data, or can be used as a crib sheet for using the THEMIS IDL programming interface.

The GUI code is bundled together with the THEMIS IDL code distribution; they are downloaded and installed as a single package.

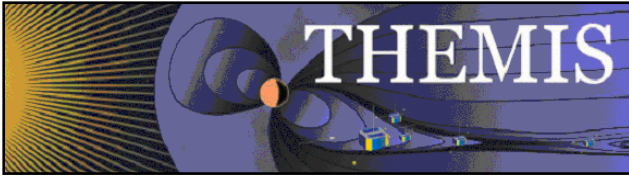
A text-only version of the documentation for the GUI is available within the software distribution at `idl/themis/examples/thm_gui.txt`.

The GUI is comprised of a series of windows (also known as widgets) and sets of buttons and popups. The user navigates through these options by simply clicking on the option wanted.

6.1 Main Window



Starting from the left, the buttons in the first column (under "Data Choices") on the left side are used to choose different kinds of data to load, to choose the time range for the data, and to load the data. There is a button for each instrument, a button for time range selection, a button which initiates the



loading process and a button which clears the queue for loading data. Each of these buttons (except for the load/clear load buttons) pops up a selection widget.

The buttons across the top in the middle are for coordinate transforms, data processing, plotting and overview plots. When clicked, each of these buttons pops up a widget for different data manipulation tasks. If the "Draw Plot" button is clicked, a plot of the data is created.

In the middle of the window there are windows which show the data sets that have been loaded and selected and the history of IDL commands.

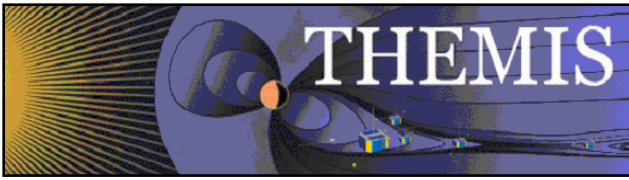
On the bottom of the main window there is a one-line progress widget that informs the user about the status of the current data loading or processing. Also there are buttons: "Help", "Error", "Config" and "Exit". The Help button pops up a text widget that shows this text. The Error button pops up a widget with the THEMIS help request form, which can be edited, saved and emailed. The Config button pops up a widget that allows the user to set different parameters in the system variable that controls automatic downloading. The Exit button ends the program.

6.1.1 Loaded Data Window

When data is loaded, information appears in the window. For each data set loaded, the appropriate variable name and time range are listed. To choose a particular data set for plotting or other processing, left-click on it. Multiple data sets can be selected by holding the "control" key, and clicking more than one. Also, you can click on an option, then hold "shift" and the left mouse button, and drag the cursor over the other data sets. Each of the data sets includes one "tplot variable", which can be processed and plotted using the IDL program TPLOTT. The data sets that you click on in the Loaded Data window are called the "active" data sets.

6.1.2 Choosing Data Using Strings

Just below the Loaded Data window is a window in which the user can type in a string (or a set of strings separated by spaces) and set the active data sets to the variables including those strings. For example, typing in "tha_spin* tha_fg*" (don't include the quotes in the actual window) will set the active data sets to all variables that start with the string "tha_spin" and also all variables with names starting with the string "tha_fg". The question mark can be included as a wild card for single characters: e.g., "th?_spin*", will return all variables with "th" then one letter, then "_spin*". Once the string is typed, click on the "Set Active Data to String" button, and the appropriate data sets will become active. If you type "*" in the window, and click the "Set Active Data to String" button, all of the data available will be set to active.



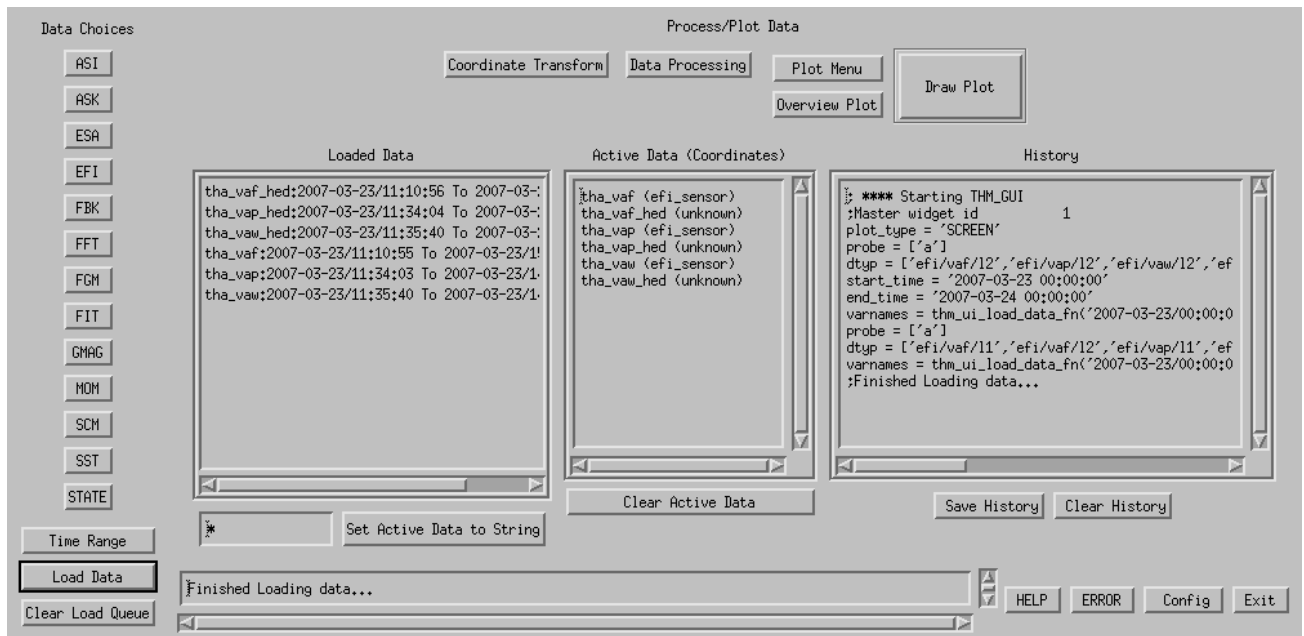
6.1.3 Active Data Window

In this window, the "active" data sets are shown. The data sets that you click on in the Loaded Data window are called the "active" data sets. Any coordinate transform, data processing or plotting task will refer to these data only.

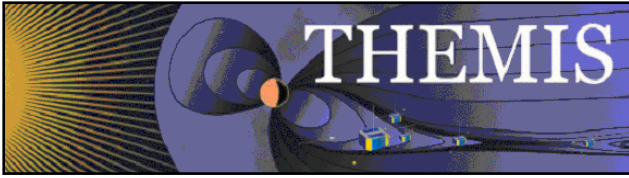
Right after you load data, then the "active" data sets are those which have just been loaded. Usually a data processing task will change the active data set to be the data that has been just been created. When you are in doubt which is the active data set, click on it and it will be set.

The coordinate systems of the active data sets are shown in parentheses after the variable name for informational purposes. "(Unknown)" means that there is no coordinate system associated with that data. This is shown in the screenshot below, which shows the state of the widget after loading data. If you click the "Clear Active Data" button below the window, the active data is cleared. The window is also cleared and the active data sets become inactive. No data is deleted. Just click on data in the loaded data window to activate it.

6.1.4 History Window



This is a list of the IDL commands which have been used, and error messages. Just below the history window are buttons that allow the user to save the history in a file, and clear the history. The "Save History" button will save the history in an IDL source file. When you click here, a file selection widget pops up, allowing you to choose the filename and path for the file. The default file is "thm_gui_history_yyyymmddss.pro" in your local working directory. The time stamp on the default



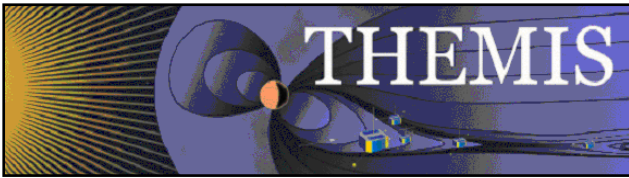
file name is the local system time. The "Clear History" button deletes the history. Since this history includes error messages, it is hoped that users will save and email this file when errors occur. This will be used as a debugging tool.

6.1.5 Progress Window

In this window, at the bottom of the main widget, there is a line of text that tells the user what is happening, with respect to data loading and processing tasks. It will also display warnings; in particular, when an invalid input value for some data processing task is input, there will be a warning in the progress widget. If there is an error that causes the code to crash, then this window will display the string "Error - See History:" to alert the user to an error.

6.1.6 Data Choices Selection Buttons

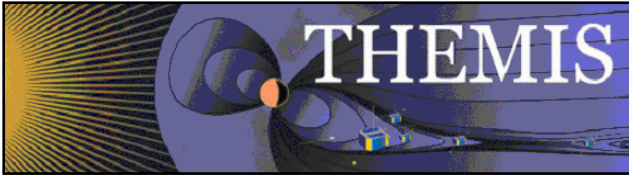
Each data choices selection button pops up a widget that shows the different types of data that can be loaded for that instrument. For ground-based data the list on the left gives the different ground stations that are available. For spacecraft data, the choice is of the different probes. To choose data from that station/probe, click on it. Multiple stations/probes can be selected by holding the "control" key, and clicking 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. Clicking "*" will select all available ground stations or probes. The example in the screenshot below is for EFI data.



The types of data that are available are listed in the middle, for level 1 data, and on the right for level 2 data. Click on the type of data to choose it, multiple selections and "*" are handled in the same manner as the choice of ground station or probe.

Below these windows, there is a place to type in a string for the data selection. If you type in here, the data types that match this string are then displayed in the list windows. Wild card characters are necessary. If for example, you are selecting state data, and you wanted all data types that include "spin", then you type "*spin*". If there are no matches, "None" is displayed. Note that you still need to click on something in the list window to choose the data, even if there is only one variable available. Below this window, there are windows that show what the current data that is being selected and the probe or ground station selected. If no data types are selected, then no data for that instrument will be loaded.

There are 3 buttons, one that allows the user to clear the choice of probe/station, one that allows the user to clear the chosen data types, and one that exits the widget. When you are done, click the "Accept and Close" button to exit the popup. The chosen data types will show up in the history window. Occasionally, the highlighted data types/probes/stations may not match what is displayed in



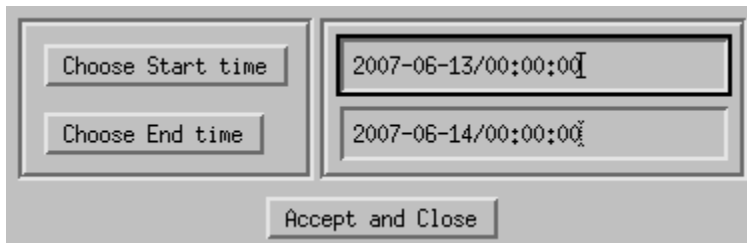
the bottom windows – if you clear the data types or probes, then the values are cleared, even if the highlights remain on the upper windows.

The GUI is set up to allow data from multiple instruments to be input together. For example, the user can choose some EFI data types, and some FGM data types, and some other types, and load it all with one click on the "Load Data" button. Note that the selection of "probe" is global. 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.

You will notice that all of the other buttons on the widget are inactive while this popup is active. You must click on "Accept and Close" for anything to happen after you choose data types.

The data names can be cryptic, and are not necessarily clear to the casual user. Please see Section 4.2 for a list of data types, with some description.

6.1.7 Time Range Selection Button

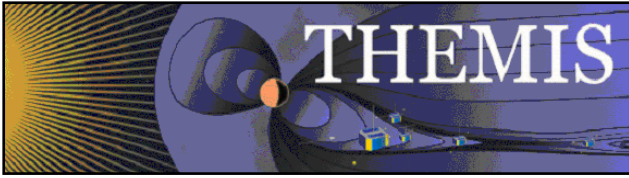


Choose Start Time: Pops up a widget that allows you to choose a start time for data to be loaded. You may also type a string value of the form yyyy-mm-dd/hh:mm:ss in the window next to the button. The selected time is displayed in the history window. This allows the user to check that the time is correct, before loading data.

Choose End Time: Pops up a widget that allows you to choose an end time for data to be loaded. You may also type a string value of the form yyyy-mm-dd/hh:mm:ss in the window next to the button.

When you are done, click the "Accept and Close" button to exit the popup.

Note that the initial times are 1970-01-01/00:00:00. You are required to choose a time range before you can load any data. Once an initial time range is set, it is saved, and when the widget is popped up later in the session, the most recent inputs are displayed. You need not type or select a full time; all you have to do is edit.

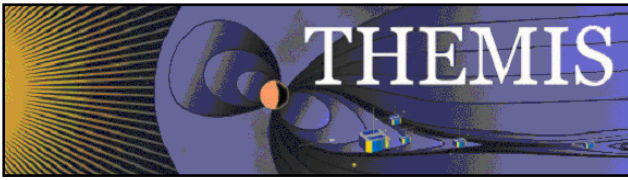


6.1.8 Load Data Button

Click on this button to load the selected data. All selected data types will be loaded. The list of loaded data types, or "Load Queue" are saved. If you want to reload the same data for a different time range, you can simply change the time range and hit the load button. This only works if you haven't chosen any other data types, though. The list of data types is re-initialized when you click a data selection button after loading. As discussed above in section 6.1.3, the data sets loaded in the most recent button click are the "active" data sets and will appear in the Active Data window.

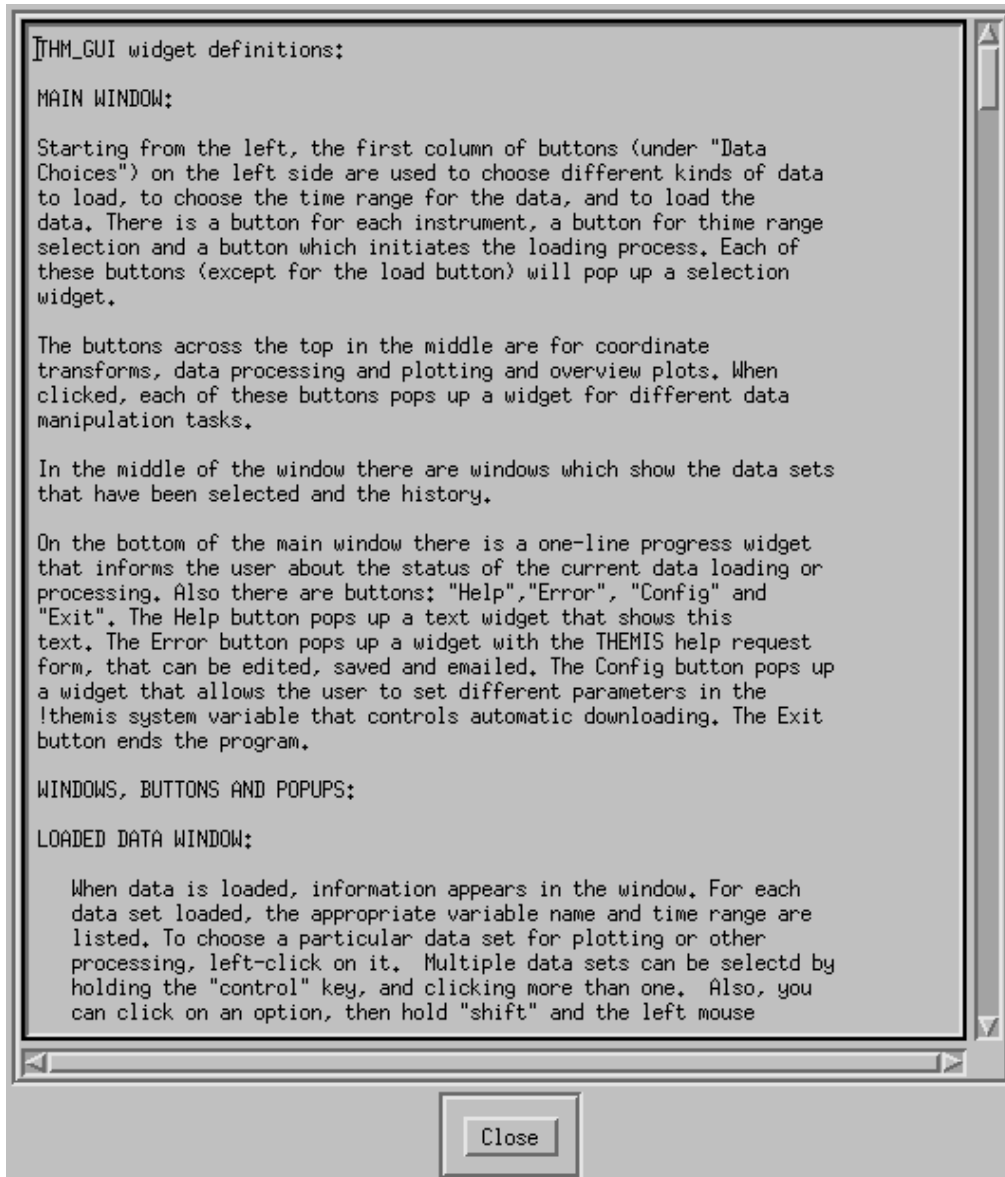
6.1.9 Clear Load Queue Button

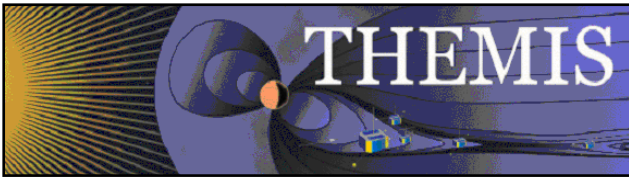
Click this button to clear out the load queue. This is useful if a load request failed. If the load routine crashes (heaven forbid), then it is a good idea to clear out the queue before trying to load other data.



6.1.10 Help Button

Clicking on the "HELP" button displays the text from this document related to the GUI. Clicking "Close" closes the widget.





6.1.11 Error Button

I

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)

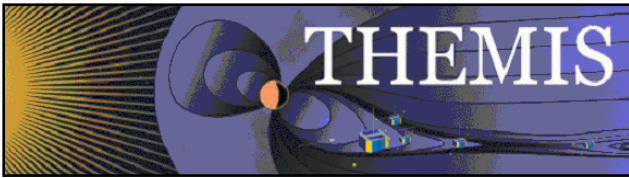
Please email any supportive materials that would help in researching
your request to:THEMIS_Science_Support@ssl.berkeley.edu
with the Help Request Title above in the subject line.

Thanks so much,
THEMIS Science Support Team

Save Close

When this button is clicked, an editable text widget pops up displaying the THEMIS Science Help Request Form. This allows the user to input information about the error which has occurred. There is a save button, which saves the request in a file, which can be emailed to THEMIS_Science_Support@ssl.berkeley.edu. Click “Close” to dismiss this widget.

IMPORTANT NOTE: This error widget also pops up automatically when processing errors occur. The Error button should only be needed if everything else fails.



6.1.12 Config Button

Configuration Settings

Local data directory

Remote data directory

no_download: 0 for auto download, 1 to use local data only

no_update: 0 - update files if newer on server, 1 - never overwrite local files

downloadonly: 0 to download and load data, 1 to only download

Verbose: from 0 to 10, higher value = more comments

This button pops up a widget that allows access to the system variable that controls the automatic downloading process. You can type in values for the different options in the windows. Note that you should not need to do this very often.

The top window gives the local data directory. Any THEMIS data downloaded is expected to be downloaded into this directory. The default value for users who are logged on to an ssl.berkeley.edu machine is `"/disks/data/themis/"`. For windows users, the default value is `"C:\data\themis\"`. It can be set to any directory for which the user has write permission.

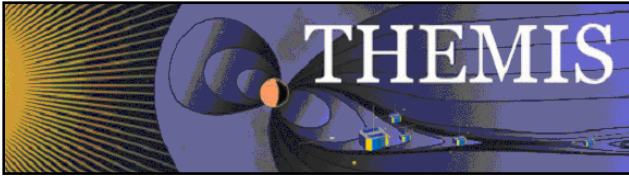
The second window shows the remote data directory. The default is `"http://themis.ssl.berkeley.edu/data/themis/"`

Next is the flag for automatic downloads; set this to 0 for automatic downloads, 1 for no automatic downloads. (This should be set to 1 for local SSL users, or anybody who has the entire database stored locally).

Next is the flag for file updates, if set to zero this will update files in local data directories if there is a file in the remote data directory which has the same name, but is new. If set to 1, then this is not done.

Next is the download only flag; Set this to 0 to download and load data, set to 1 to only download data, and not load.

Last is the verbose flag, set this to a number from 0 to 10. The higher the number, the more messages you get during processing.



6.1.12.1 Reset

If you press this button, the configuration is returned to the state which existed before you popped up the widget.

6.1.12.2 Reset to Default

If you press this button, the configuration is returned to the default state in THM_CONFIG.pro, and any saved configuration file is deleted. This means that if you want to go back to a configuration that you have saved previously, you need to reset the values and then save the configuration.

Alternatively, you can locate the previously saved file and copy it to the appropriate location in the APP_USER_DIR shown below.

6.1.12.3 Save

If this button is pressed, then the current configuration is saved in a file. This file ends up in a directory created by the IDL APP_USER_DIR routine, on a windows system the path looks like this: "C:\userme\.idl\themis\thm_config-4-win32\thm_config.txt". On a linux machine, it looks like: "\$HOME/.idl/themis/thm_config-4-linux/thm_config.txt"

Important: Once you have saved this file, it will always be read when you run any THEMIS routines -- you should only need to do this once for each operating system that you are using.

Whenever you save a new file, the old file is copied to a file tagged with the current date and time, for retrieval in case of disaster.

6.1.12.4 Message Window

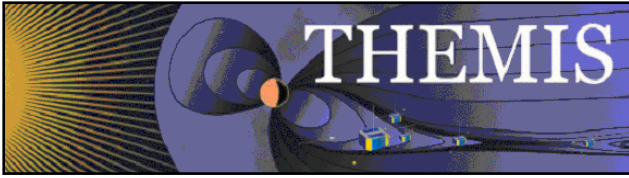
This message window will alert the user when an invalid input parameter is set. The text is the same as in the progress window of the main GUI.

6.1.12.5 Close Button

Closes the configuration widget

6.1.13 Exit Button

Exits the program, and closes all of the popups, except for the Help, Error and Configuration widgets, which are designed as stand-alone widgets.

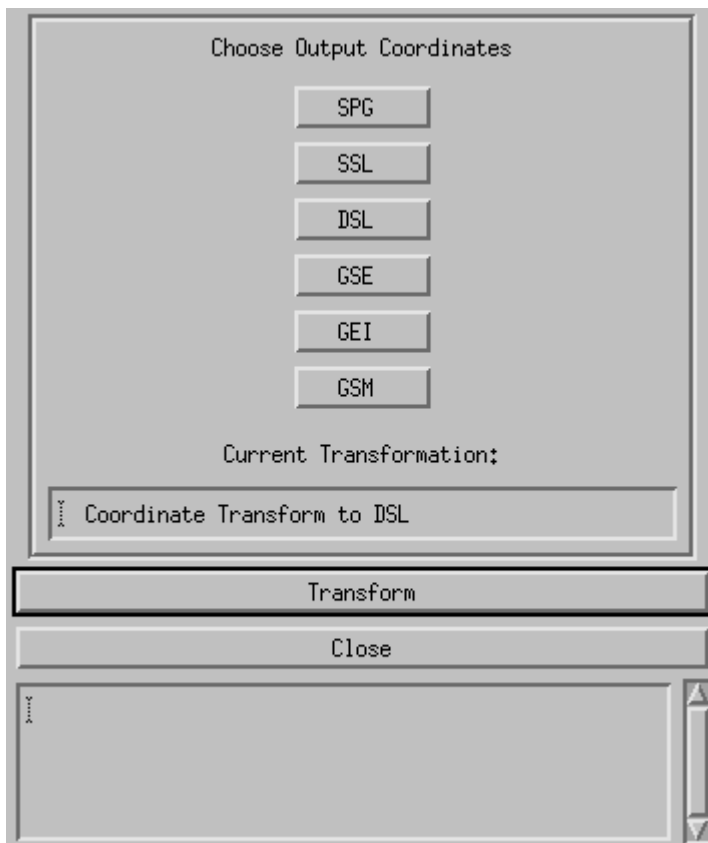


6.2 Coordinate Transform Widget

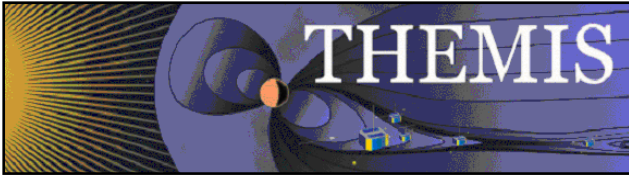
When the "Coordinate Transform" button is clicked, a popup appears with different choices for coordinate transforms. Each possible output coordinate system has a button. The possibilities are: "SPG" (Spacecraft Probe Coordinates), "SSL" (Spinning Spacecraft Coordinates), "DSL" (Despun Spacecraft Coordinates), "GSE" (Geocentric Solar Ecliptic), "GSM" (Geocentric Solar Magnetospheric), and "GEI" (Geocentric Earth Inertial). A window below the buttons shows the current output coordinate system.

Only the active data sets are transformed. The input coordinate systems for the active data sets are automatically obtained. Data with "Unknown" coordinates will not be transformed.

Click on the "Transform" button to perform the transformation. Warnings and error messages will appear in the window at the bottom, and also in the progress window on the main widget.

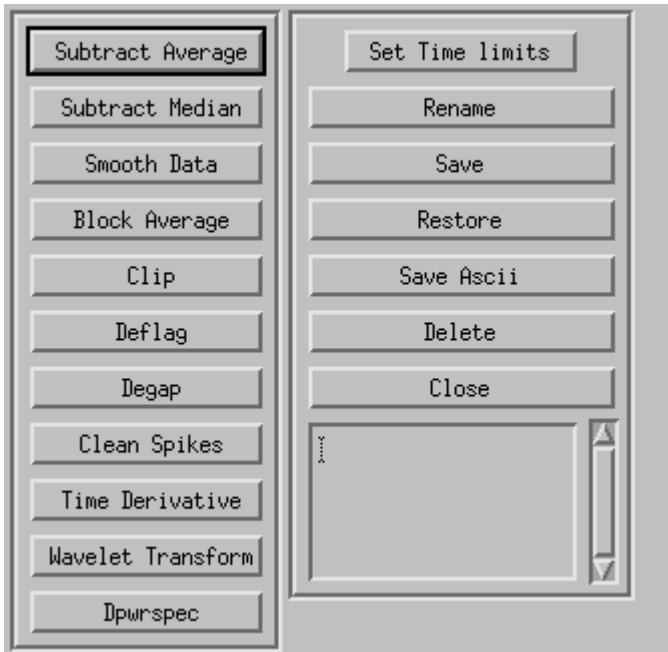


Click on the "Close" button to dismiss the popup.



6.3 Data Processing Widget

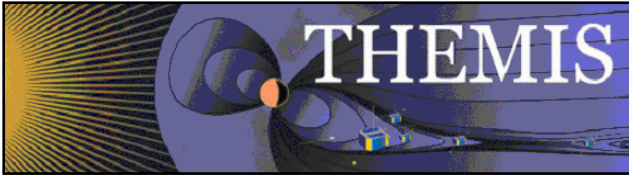
When the "Data Processing" button is clicked, a popup appears with various options for data processing. Only one data processing popup will appear; if you click the button multiple times, the same popup will show up. The popup contains multiple buttons and a text widget which displays messages. When one button is clicked, the other buttons are disabled.



Only the variables shown in the Active Data window will be operated on by these processes. Also, these processes change the active data sets to the output variables of the processes. If you want to do multiple processes on the same data sets, you need to reset the active data sets each time.

6.3.1 Message Window

In addition to alerting the user when a process crashes, the message window will alert the user when an invalid input parameter is set for the processes. The text is the same as in the progress window of the main GUI. For user input errors, the THEMIS Error widget does not pop up. It is important to note, however, that the user input error checking in IDL does not catch everything with respect to values typed into a widget. If the necessary input is a numerical value, then most strings that are not true numbers will not be rejected. For example, if a user inputs "XDFB%%%", this is interpreted as a value of zero; IDL does not stop processing when there is a type conversion error, it simply returns zero. Unusual things can happen. If the user inputs "1apppk", then this is interpreted by IDL as one, but if the user inputs "a1pppk", then this is interpreted as zero. If there seems to be a problem, and no error message pops up, look at the history window in the main GUI. The input values will be recorded there.



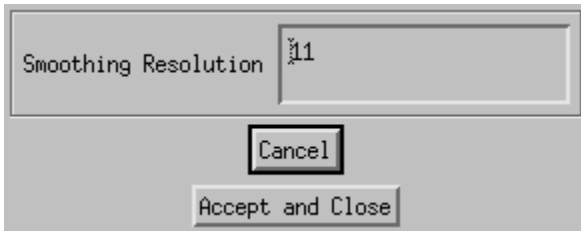
6.3.2 Subtract Average

For each active data set, the average value is subtracted. new variables are created, the new names have the syntax: `new_var = old_var+"-d"`, and the new variables become the active data sets`.

6.3.3 Subtract Median

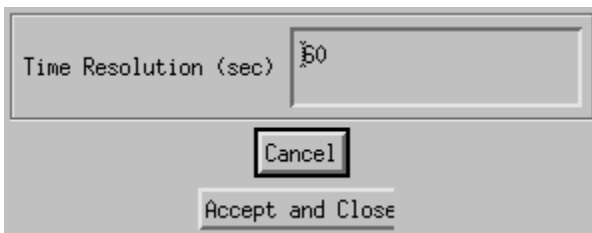
For each active data set, the median value is subtracted. new variables are created, the new names have the syntax: `new_var = old_var+"-m"`, and the new variables become the active data sets.

6.3.4 Smooth Data

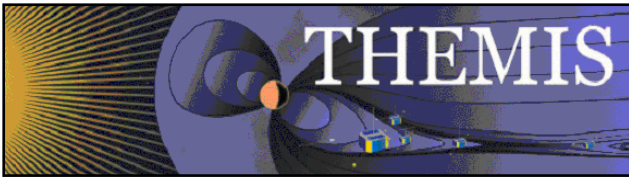


Boxcar smoothing of the data. A widget will pop up, asking how many data points to smooth over. Choose a value, and click on "Accept and Close". The default is 11 points. New variables will be created, with "_sm_npts" appended to the old variable names, where npts is the smoothing resolution. Click "Cancel" to cancel the operation.

6.3.5 Block Average



Click this button to average that data over time; a window will pop up, asking for the time resolution. The default time resolution is 60 seconds. New variables will be created, with "_av_tres" appended to the old variable names, where "tres" is the time resolution. Click "Cancel" to cancel the operation.



6.3.6 Clip

A dialog box for clipping data. It has two input fields: "Max for clipping" with the value "20.0" and "Min for clipping" with the value "-20.0". Below the fields are two buttons: "Cancel" and "Accept and Close".

Clips data above and below a set maximum and minimum, a widget pops up which allows these values to be set. Then data outside the range is set to NaN. New variables will be created, with "_clip" appended to the old variable names. Click "Cancel" to cancel the operation.

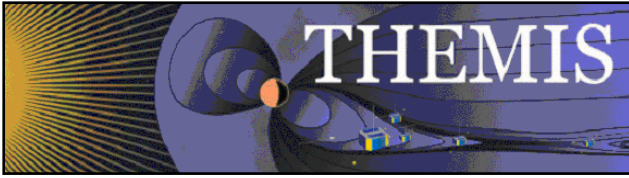
6.3.7 Deflag

A dialog box for deflagging data. It has a single input field with the text "deflag method: LINEAR (Interpolate) or REPEAT (Last Value)" and the value "repeat". Below the field are two buttons: "Cancel" and "Accept and Close".

Interpolates or repeats the most recent valid data value over gaps in the data (gaps are denoted by NaNs, and can be created by the clipping process). A window pops up which is used to set the method, there are two choices: "repeat" will repeat the last good value over the gap; "linear" will interpolate over gaps. New variables will be created, with "_deflag" appended to the old variable names. Click "Cancel" to cancel the operation.

6.3.8 Degap

A dialog box titled "Input Values" with a blue header and standard window controls. It contains three input fields: "Time Interval (sec) for degap" with the value "1.0", "Margin (sec) for degap" with the value "0.25", and "max gapsize (sec) for degap" with the value "10000". Below the fields are two buttons: "Cancel" and "Accept and Close".



The degap procedure locates gaps in data, and fills them in with 'NaN' values, so that the plotting process displays the data gaps correctly (Otherwise it simply draws a line across the gap). It figures out where to add data points by checking which time differences are greater than or equal to an input time interval, plus a margin, and inserts equally spaced 'NaN' data points at time intervals with spacing determined by the size of the data gap divided by the number of points that fit with minimum cumulative error. Click “Cancel” to cancel the operation.

6.3.9 Clean Spikes

Removes large spikes from messy data. New variables will be created, with "_dspk" appended to the old variables.

6.3.10 Time Derivative

Takes the time derivative of the active data sets. New variables will be created, with "d_" prepended to the old variable names.

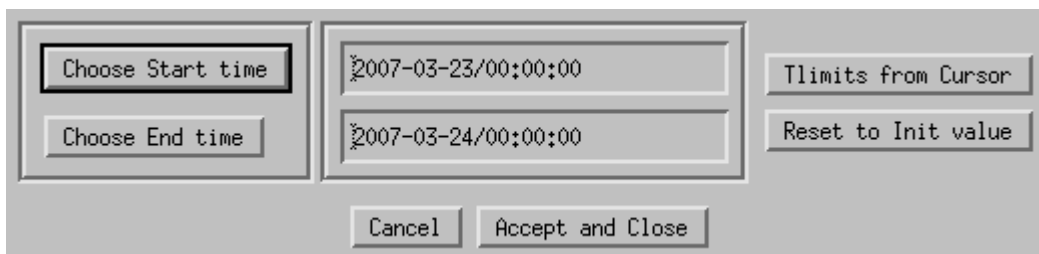
6.3.11 Wavelet Transform

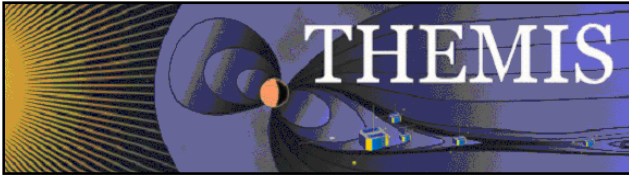
The data is split into components, and a basic wavelet transform is performed on each component, with "_wv" appended to the old variable names. Note that this is designed for data which are either 1-dimensional or 3-dimensional, e.g., electric or magnetic field data. Applying this to other data (e.g., spectrograms) will cause non-intuitive results.

6.3.12 Dpwrspec

The data is split into components, and a dynamic power spectrum is obtained from each component, with "_dpwrspec" appended to the old variable names. Note that this is designed for data which are either 1-dimensional or 3-dimensional, e.g., electric or magnetic field data. Applying this to other data (e.g., spectrograms) will cause non-intuitive results. For some time ranges and data types, the "dpwrspec" button crashes in the IDL POLY_FIT routine. We have no clue why this happens. Try changing the input time range.

6.3.13 Set Time Limits





A popup will appear, allowing the user to set time limits for the processing application, either by using the cursor on the existing plot window, or by using a time selection widget. The “Choose Start time” and “Choose End time” buttons work as in the loading time selection widget, as to the windows for typing in values. The additional buttons work as follows:

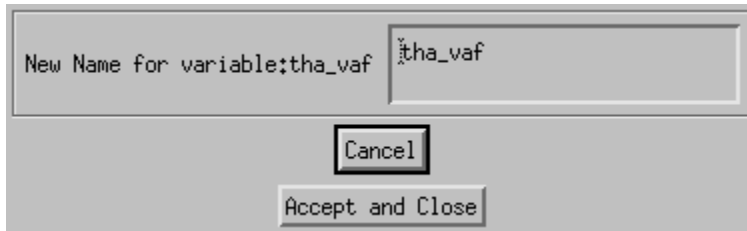
Tlimits from Cursor: Click here move the cursor over the plot window, and click twice on the plot to choose a new time range. You must select a time range by clicking twice on the plot; all other operations on this widget are disabled while you do this.

Reset to Init value: Click here and the time limits will be reset to the initial values in the active data variables.

When you are done, click the "Accept and Close" button to exit the popup. The plot will be reset to the new time limits.

If you click the "Cancel" button, the popup will close, with nothing happening

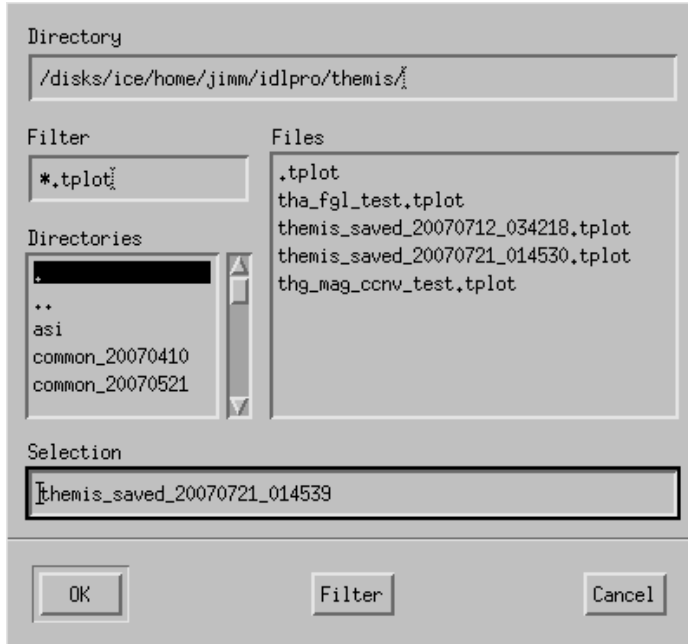
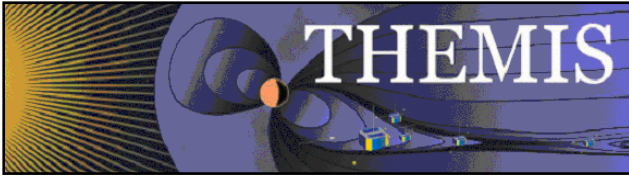
6.3.14 Rename



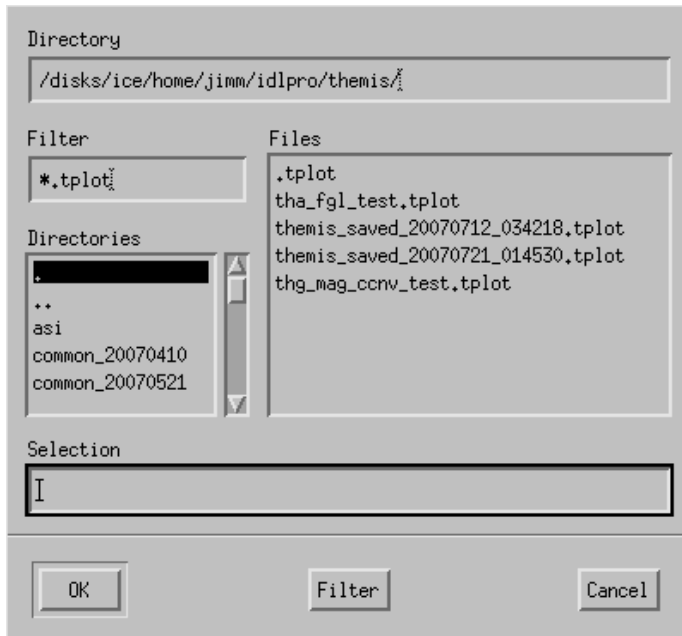
A popup prompts the user for the new variable name for each of the "active" data sets, and each variable is renamed to the new name. Click the “Cancel” button to cancel the operation.

6.3.15 Save

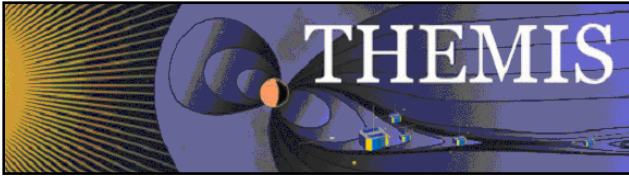
An IDL save file is created with all of the active data sets. A filename selection window is popped up, and the user can change the default filename; “.tplot” is always appended to the selected file. This can be changed, but it is not advised, since the restore routine will look only for those files that end in “.tplot”. Click “Ok” to save. Click the “Cancel” button to cancel the operation.



6.3.16 Restore



Saved files can be restored using this button. A filename selection window will pop up and the user can use this to select a saved file. Click or type the filename, select “Ok” to restore the variables. Click “Cancel” to cancel the operation. The data sets restored from the chosen file are set to be the “Active” data sets.



6.3.17 Save Ascii

The active data sets are saved in ascii files in the current working directory. These cannot be restored, but can be read.

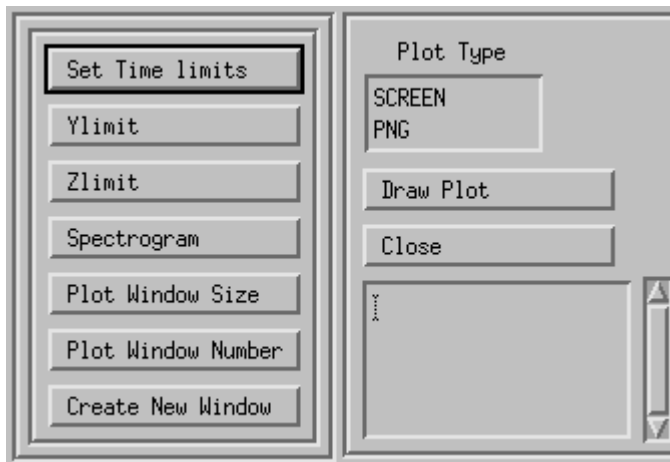
6.3.18 Delete

The active data sets are deleted. To delete all loaded data, type "*" in the window below the Loaded Data window on the main GUI widget, click the "Set Active Data to String" button on the main widget, and then click the delete button on this widget.

6.3.19 Close

Click here to close the widget.

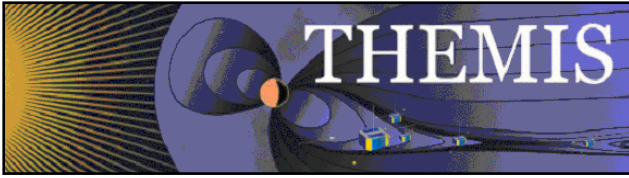
6.4 Plot Menu Widget



When the "Plot Menu" button is first clicked a plot of the active data sets pops up, if there are active data. This is because certain plot parameters have to be initialized for some of the buttons to work properly. If there is no active data, then no plot appears, and nothing will happen if the buttons on this widget are clicked.

6.4.1 Set Time Limits

A popup will appear, allowing the user to set time limits for the processing application, either by using the cursor on the existing plot window, or by typing the limits directly, or using a time selection widget. This is the same as described in section 6.3.13.



6.4.2 *Ylimit*

tha_vaf: YMAX 0.000000

tha_vaf: YMIN 0.000000

tha_vaf: YLOG 0

Cancel

Accept and Close

Sets the Y limits for the active data sets. For each active data set, a text widget pops up, allowing the limits to be set, and also log plotting can be set/unset: if ylog is set to 1, then the plot for this variable will be a log plot. If both the maximum and minimum are zero, the plotting process chooses the default limits. Click “Cancel” to cancel the operation.

6.4.3 *Zlimit*

tha_vaf: ZMAX 0.000000

tha_vaf: ZMIN 0.000000

tha_vaf: ZLOG 0

Cancel

Accept and Close

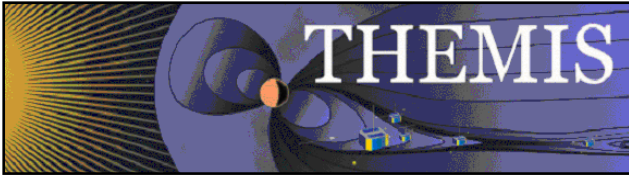
Same as Ylimit, for the Zlimits for spectrogram data.

6.4.4 *Spectrogram (Set/Unset)*

tha_vaf: Set to 1 for spectrogram, 0 for lines 0

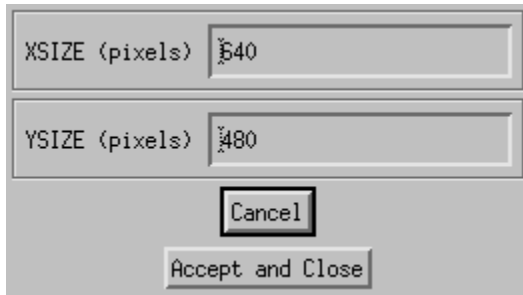
Cancel

Accept and Close



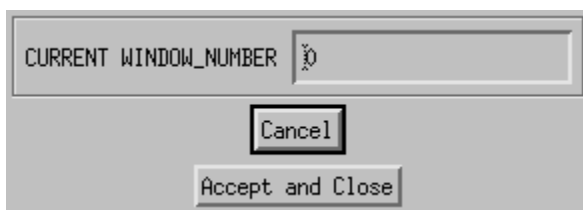
For each active data set, this widget pops up. If this value is set to 1, then the active data is set to be plotted as a spectrogram, if set to 0, then line plots will be drawn. Note that not all data can be characterized as a spectrogram. For those data sets, the pop up will not appear and a message will be issued in the message window for the plot menu, and in the progress window of the main GUI. Click “Cancel” to cancel the operation.

6.4.5 Plot Window Size



Pops up a widget for the window size. For screen plots you can just drag the window for resizing. The set plot window size window can also be used to set the size for png plots. Note that you must set xsize and ysize greater than zero for this to work. Otherwise an error message appears and the window size is not set. It is a good idea not to make windows larger than your screen size. Click “Accept and Close” to close the window and set the window size. Click “Cancel” to cancel the operation.

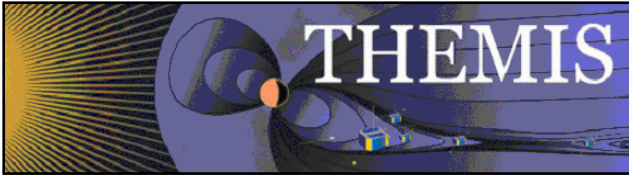
6.4.6 Plot Window Number



Sets the window number for the screen plots. Only window numbers between 0 and 32 are accepted. The current window number is displayed when the window pops up. Click “Accept and Close” to close the window and set the window size. Click “Cancel” to cancel the operation.

6.4.7 Create New Window

Pops up a plot window with whatever values are currently saved in the widget. The default initial values are 0 for the window number and [xsize,ysize] = [640,480]. This option is not enabled if the plot type is set to 'PNG'.



6.4.8 Plot Type

Click on "SCREEN" for screen plots. Click on "PNG" for png plots.

6.4.9 Draw Plot

Click here to draw the plot. If "SCREEN" is set, then the plot will show up on the screen. If "PNG" is set a png plot will be created when you click the "Draw Plot" button, with a default filename of "thm_gui_plot_yyyymmddss.png" in your local working directory. The time stamp on the file is the local system time. A file selection window pops up to allow you to change the filename.

6.4.10 Close

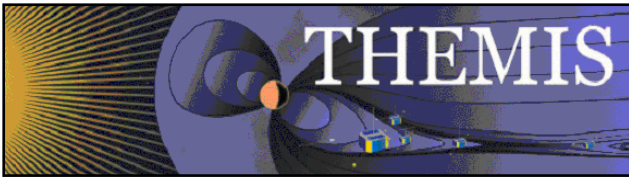
Click here to dismiss the widget.

6.4.11 Message Window

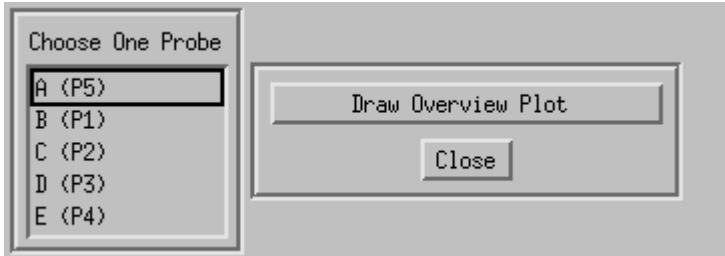
In addition to alerting the user when a process crashes, this message window will alert the user when an invalid input parameter is set for the processes. The text is the same as in the progress window of the main GUI. For user input errors, the THEMIS Error widget does not pop up.

6.5 Plot Data (Main GUI widget)

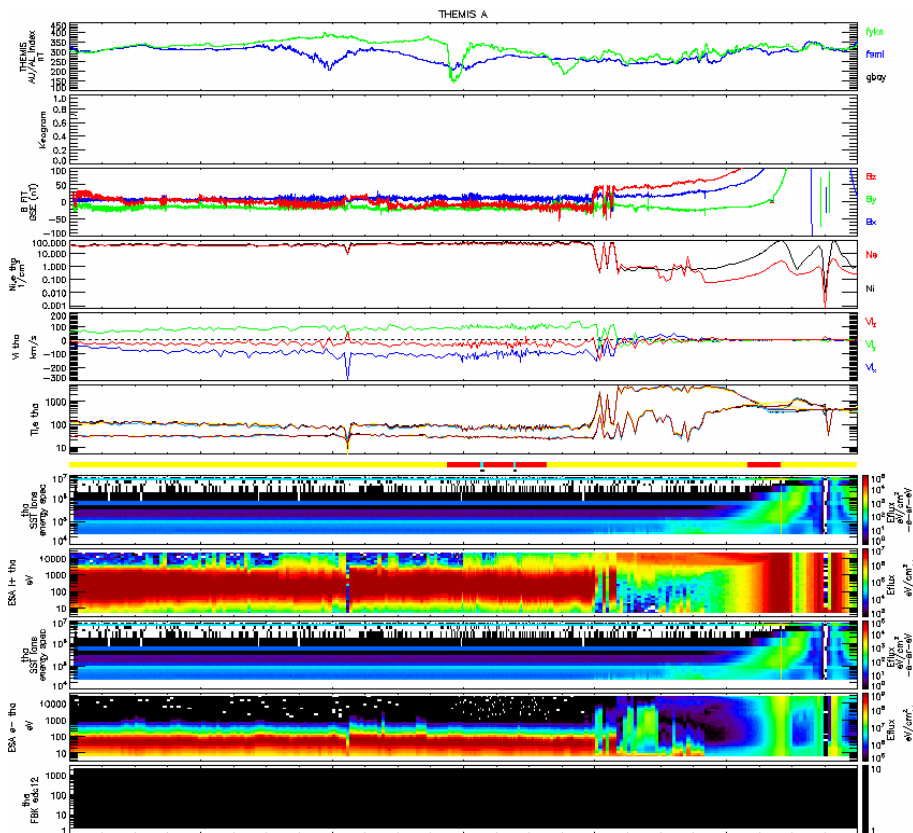
There is also a "Draw Plot" button on the main GUI widget. This has exactly the same effect as the "Draw Plot" button on the Plot Menu widget: If "SCREEN" is set, then the plot will show up on the screen. If "PNG" is set a png plot will be created when you click the "Draw Plot" button, with a default filename of "thm_gui_plot_yyyymmddss.png" in your local working directory. The time stamp on the file is the local system time. A file selection window pops up to allow you to change the filename.

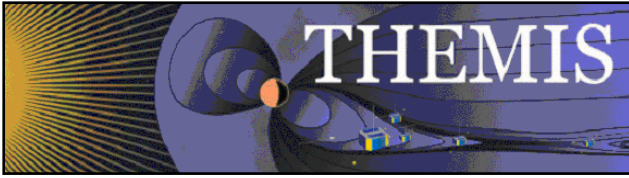


6.6 Overview Plot



Clicking on this button pops up a widget that will do an overview plot of various THEMIS data. On the overview plot widget, there is a widget that allows you to choose a probe. Only one probe is allowed at a time. The "Draw Overview plot" button pops up a plot that shows a broad view of THEMIS data. The data sets that are plotted are set to be the active data sets. Here is a sample plot:





6.7 GUI Tips

- a. 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.
- b. Always choose a time range before loading data.
- c. 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.
- d. The choice of "probe" in the data loading widgets 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.
- e. 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 widget for guidance.
- f. 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.
- g. 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.
- h. 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 widget, and click "Delete".
- i. 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.
- j. Data Processing and Plotting tasks are only possible when there is "active" data.
- k. 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.
- l. 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.
- m. For some time ranges and data types, the "dpwrspec" button crashes in the IDL POLY_FIT routine. We have no idea why this happens, but are working on a fix. Try changing the input time range to a longer range, and see if that helps.
- n. 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.
- o. The Plot Data button first issues a "tplot" call when the widget pops up.
- p. If you create a "PNG" plot, remember to reset to "SCREEN" for screen plotting.
- q. Don't try to plot more than about 10 quantities at a time, if there is spectrogram data, there will be a crash.