THEMIS Software & Products

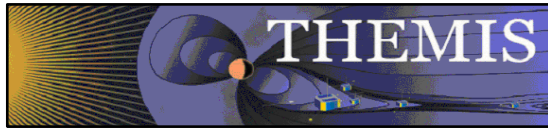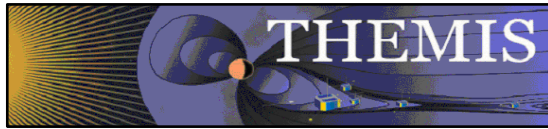# Agenda

- Products
  L1 & L2 – Jim L & Jim M

- TDAS
  Plotting Angular Spectra – Bryan
  Orbits and Mini language - Pat
  New GUI – Cindy
  Additional New Features – Vladimir and others

THEMIS - L2 Data Status Report

- ESA - L2 cdf files with omnidirectional energy spectrograms, ground-processed moments available, all probes, full mission

- FBK - L2 cdf files with frequency spectrograms available, all probes, full mission

- FFT (onboard) – L2 cdf files with on-board FFT's of electric (EFI) and magnetic (SCM) fields, currently being tested by SPDF

- FGM - L2 cdf files available, all probes, full mission

- FIT - L2 cdf files with spin-fit magnetic (FGM) and electric (EFI) fields available, all probes, full mission

- GMAG - L2 cdf files with ground magnetometer data from 41 stations

- MOM - L2 cdf files with ESA moments, (not SST moments) available, all probes, full mission (Only from UCB – not yet available from SPDF)

- SST - L2 cdf files with omnidirectional energy spectrograms available, all probes, full mission

- STATE - L1 CDF files contain position, attitude, sun pulse data for each probe

- EFI, SCM - L2 cdf's to be available by spring 2009
   - L1 burst waveforms have been de-spiked

THM_PART_GETSPEC

- Burst electron SST (pseb) spectra can now be plotted.

- Keyword changes
    - PITCH and GYRO keywords now affect energy (en_eflux) spectra generation.
    - Added DATAGAP keyword to help overlay burst data over full data.
    - Changed BINS2MASK keyword to BADBINS2MASK.
    - Removed MASK keyword.
    - OTHER_DIM keyword defaults to 'mphigeo' instead of 'xgse'.

- Options for removing sun contamination and electronic noise from SST data
    - Passed in through _EXTRA keyword.
    - See THM_SST_REMOVE_SUNPULSE and THM_CRIB_SST_CONTAMINATION.
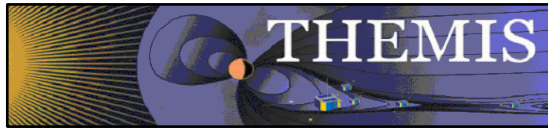
Plotting Angular Spectra

Overlaying gapped data on top of other data

- Use DATAGAP keyword to prevent interpolation of time gaps.

- Overlay data using tplot's psuedovariable feature.

- Set y- and z-limits for all tplot vars.

```
thm_part_getspec, probe=['a'], $
  trange=['07-03-23/11:30','07-03-23/12:30'], $
  theta=[-90,90], phi=[0,360], data_type=['peif','peib'], $
  /energy, datagap=400

;Store the data in a tplot psuedovariable.
store_data,'tha_comb',data=['tha_peif_en_eflux',$
          'tha_peib_en_eflux']

;Set y- and z-limits so that full/burst data have same scale
ylim,'th*comb',5,23000 ;Set y-axis limits
zlim,'th*comb',10,3e6 ;Set all spectra to same color scale
ylim,'tha*eflux',5,23000 ;Set y-axis limits for spectra plots
zlim,'tha*eflux',10,3e6 ;Set all spectra to same color scale

tplot,'tha_peif_en_eflux tha_peib_en_eflux tha_comb'
```
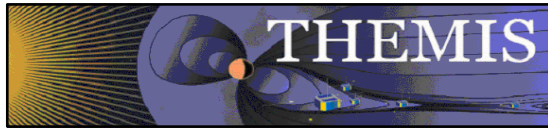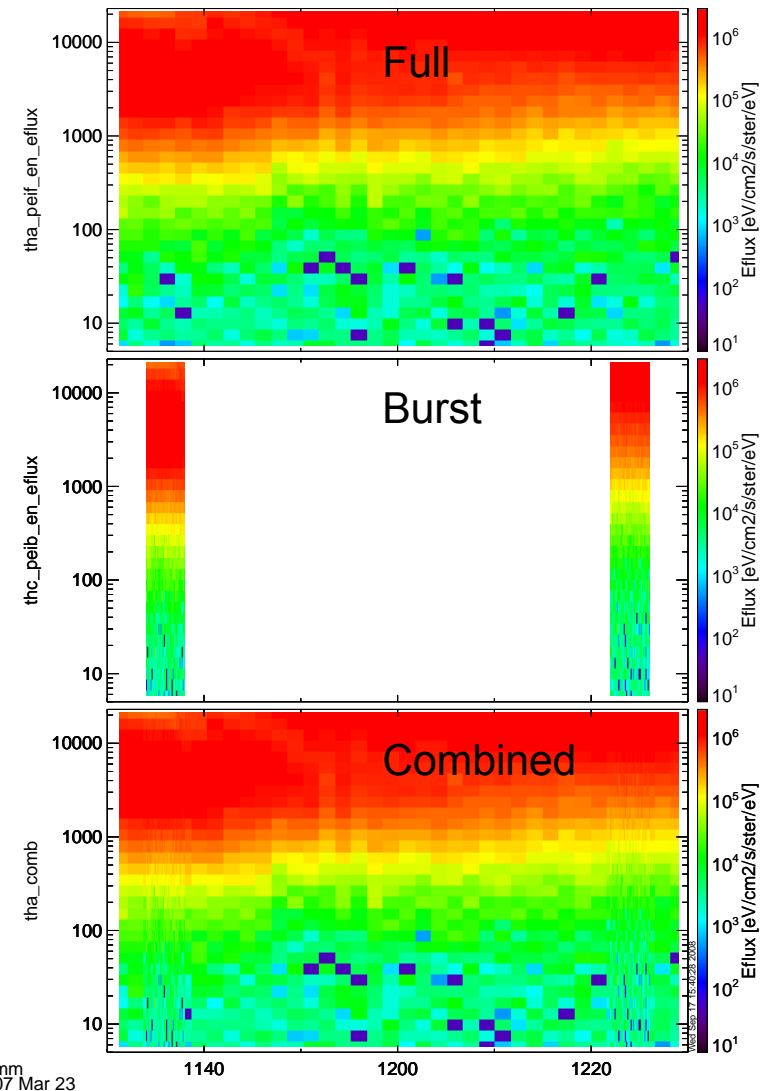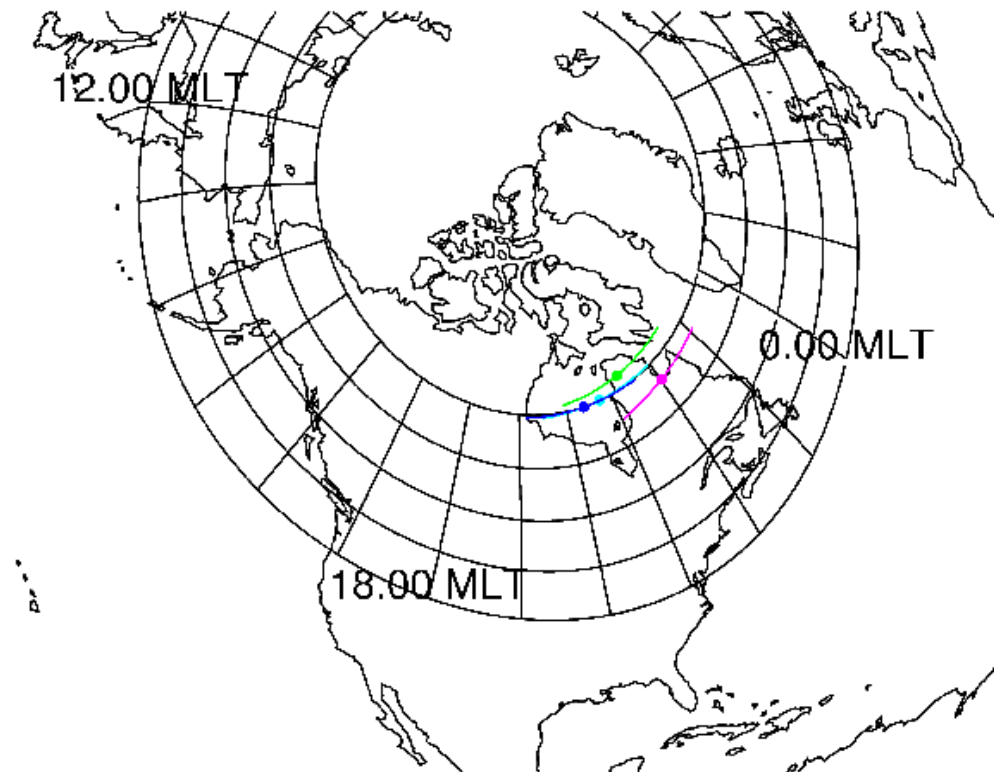
Trace / Orbit Plots

- New routines have been added to perform different 2d projections of 3d data. This particularly useful for plotting orbits and field lines.

- A Tsyganenko interface has been added to TDAS that allows us to calculate model field lines for T89,T96,T01,&T04 models. Field lines can also be Traced.

- Examples of these routines can be found in themis/examples/thm_crib_trace.pro, themis/examples/thm_crib_plotxy.pro and themis/examples/thm_crib_tplotxy

- The graphics in this slide were generated with thm_crib_trace.pro
  Example: .run thm_crib_trace.pro

- A routine was added to plot an arbitrarily sized and spaced AACGM coordinate grid on a world map.
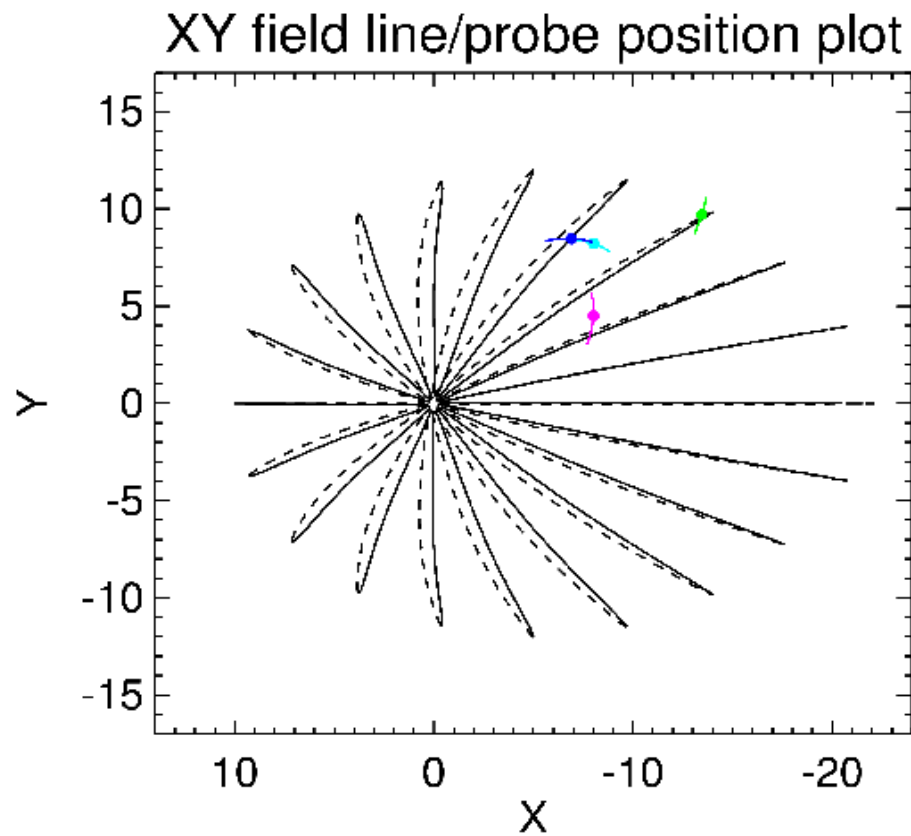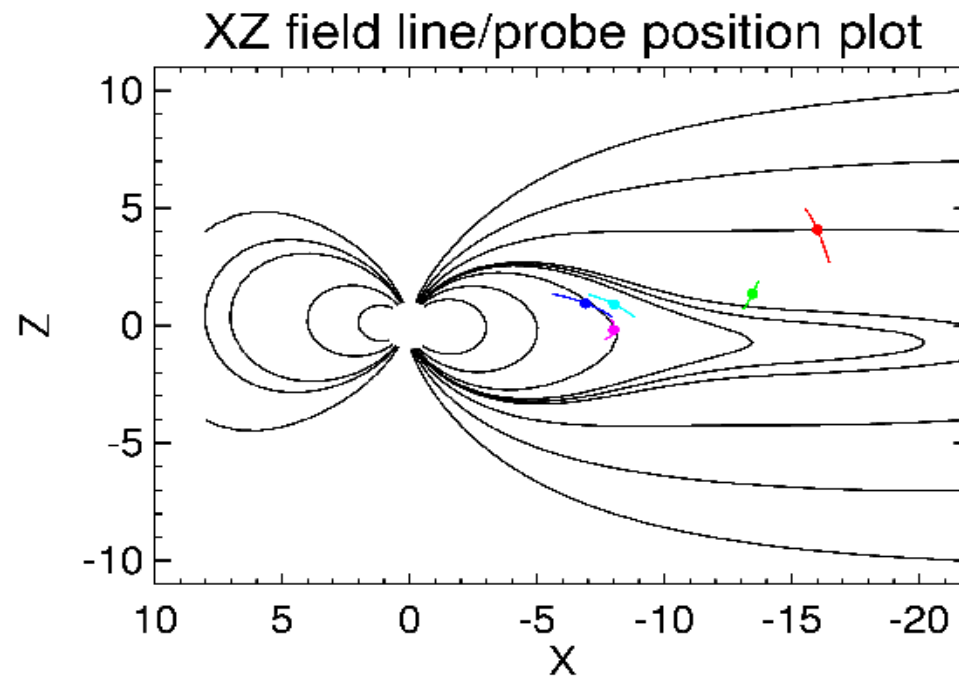
Trace/Orbit Plots - AACGM/Iono Trace Plot

Trace / Orbit Plots – XY Plot
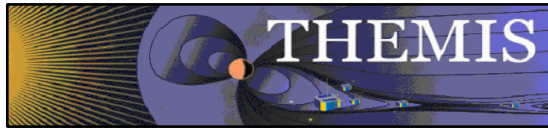

XY field line/probe position plot

Trace / Orbit Plots – XZ Plot


XZ field line/probe position plot
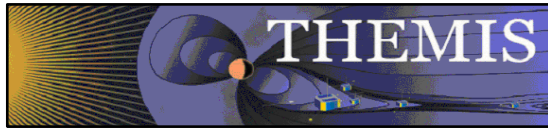
THEMIS – Mini Language

- Simple scripting language has been written in IDL.

- This language allows access to some data analysis functionality in the IDL virtual machine and eases manipulations of time series data.(tplot)

- This language allows composition of statements and functions with order of operations to give significant flexibility in statement construction.

- Examples:
    1: Position to RE: calc,'"tha_pos_re" = "tha_state_pos"/6374.4'
    2: Natural log of total esa density:
       calc,'"tha_density_log" = ln("tha_peir_density"+"tha_peer_density")
    3: Store tplot data in non-tplot idl variable: calc,'var_data = "tha_efs"'
    4: Average Magnetic Pressure:
       calc,'Pb_avg = mean(0.01*total("tha_fgs_dsl"^2,2)/25.132741)'

 Additional examples can be found in themis/examples/thm_crib_calc.pro
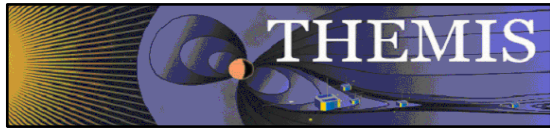
THEMIS – New GUI
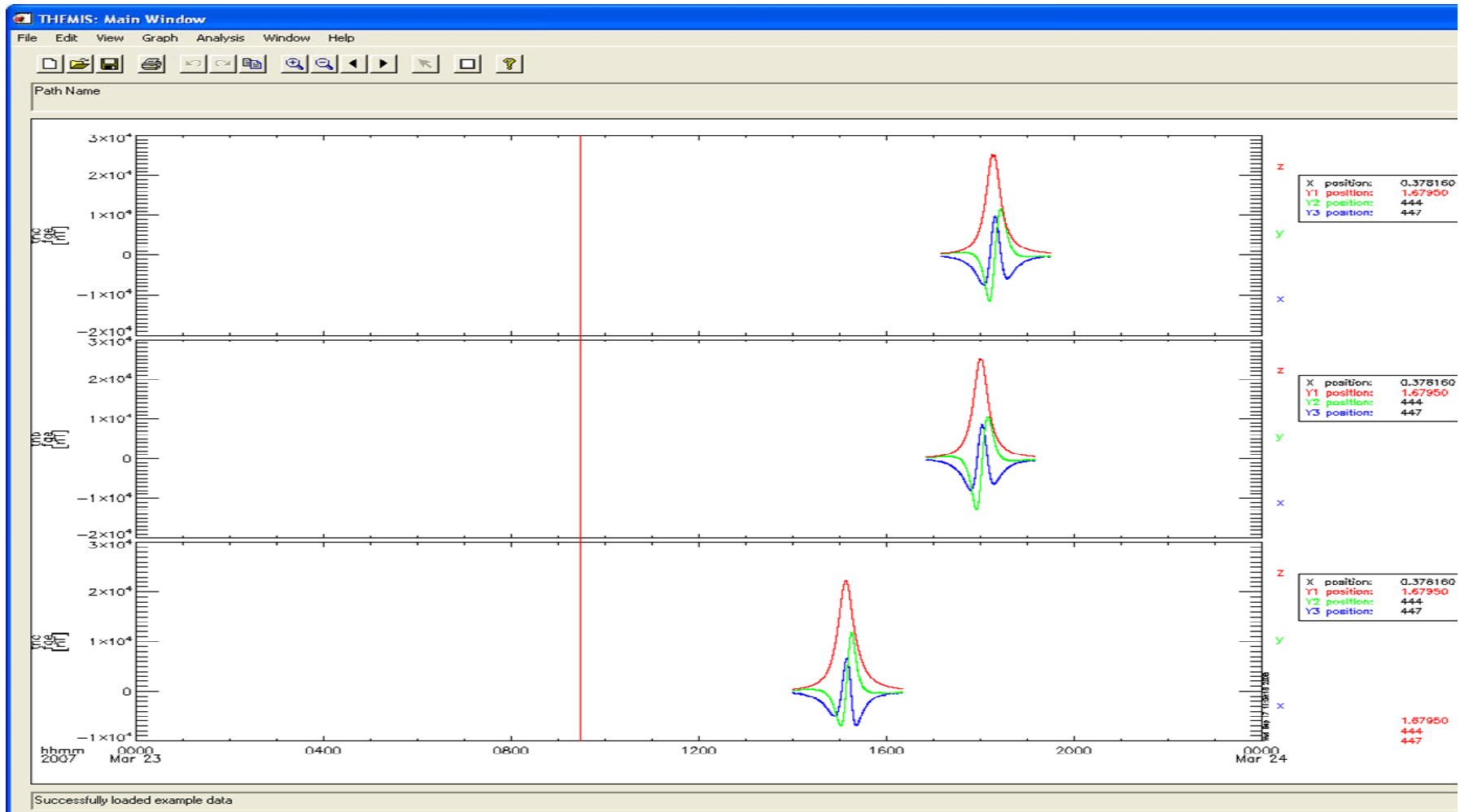
THEMIS – New GUI Features

- UCLA SPLASH GUI used as a model for the design

- Windows Environment - provides a more universal and standard interface
  Pull Down Menu's   Tool Bar   Accelerator Keys

- Increased User Interaction – added cursor, mouse, and keyboard features
  Click and Drag – to mark data sections or zoom in
  Right Click, Single and Double Clicks
  Tab/Backspace and Right/Left Arrow keys

- Plot Capabilities – multiple pop up windows allow user to control plot settings
  Line/Spectral plots   X/Y Axis and Grid styles   Panel layout   Page setup

- Tracking –vertical and horizontal tracking features
  Tracking cross hairs displayed as cursor moves over plot region
  Tracking data is displayed and updated as cursor moves

- Markers – users can select regions of interest on their plot by Ctrl-Click-Drag
  Multiple markers can be set, area is marked by highlighting
  Markers can be can be saved and zoomed into

- Variables - user can select any loaded data to be displayed at bottom

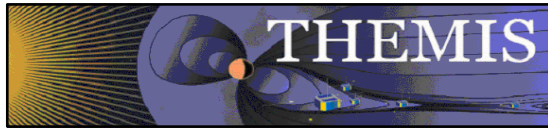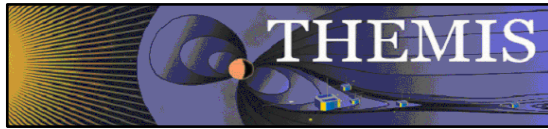- Original GUI – all current functionality will be preserved
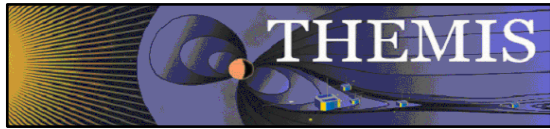
THEMIS New GUI – Example of Pull Down Menu
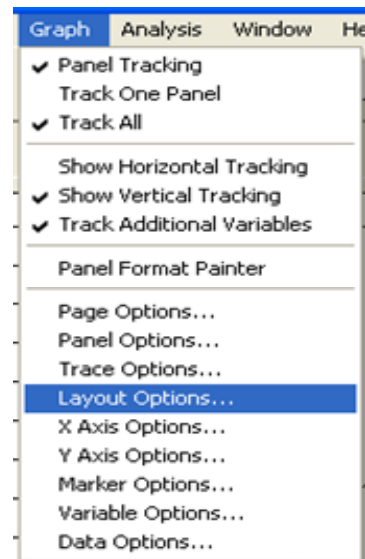
THEMIS – New GUI Availability Dates

- Release with TDAS v5.0 - January 2009

- Presentation and Clinic at the GEM
  San Francisco on December 14, 2008

- Webcast Trainings during January 2009

- Original GUI will be available until March 2009

THEMIS – Additional New Features

- Solar Wind Code - The solar wind code serves SW data propagated to the bow-shock nose, which can be used, potentially, by various applications (currently, they are used in dynamic magnetopause model). The code takes WIND SWE and MFI data, served by SPDF, and propagates them to the bow-shock nose using OMNI methodology. There is also the option of use of already-propagated OMNI HRO and OMNI-2 data. Recently-appeared opportunity to test directly the propagated data by comparison with THEMIS B data shows a good agreement and potential for improvement.

- Outlier Removal Code - Quadratic trend is determined in a hollow vicinity of each point. The data value is compared with the trend value. If the deviation is statistically improbable, the value is repaired. There are 6 options for repair to chose.

- We have now six new routines which allow downloading/creating all A-indices from Kyoto, the Dst index from Kyoto, and the pseudo A-indices using THEMIS data plus crib sheets for each routine. All routines are fully "automatic", i.e., they don't require any manual download of data.

- Program developed to read ACE ascii data. Example: idl> noaa_ace_nrt_load

- A new plotting routine (plotxyvec.pro) has been added for plotting arrows on top of plotxy and plotxyz plots. In addition a new routine grad.pro has been developed for calculating the gradient of a scalar field.
  Examples of usage can be found in themis/examples/thm_crib_plotxyvec.pro

Plotxyvec – Position/Velocity Plot

THEMIS A Position & Velocity