



ERG-SCによるSuperDARN CDFデータベース構築とTDASプラグイン開発の現状

CDF database and TDAS plug-in for SuperDARN data developed by **ERG-SC**

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 - Why TDAS?
- ERG-SC activity
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- Summary

ERG project

ERG: Energization and Radiation in Geospace

Geospace exploration project during the next solar maximum

Goal: Acceleration of radiation belt particles and space storm dynamics

Target: Inner magnetosphere (coupled with sub-auroral region)



ERG satellite

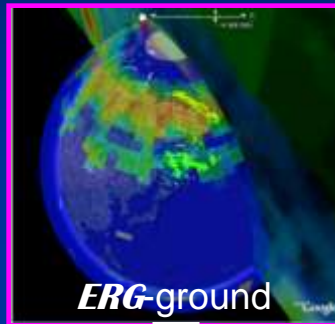
Selected as 2nd mission candidate of the small satellite series by JAXA/ISAS (Aug., 2009)

ERG Science Center (ERG-SC)

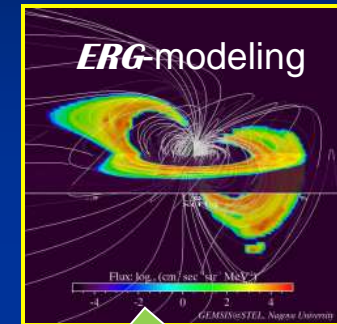
ERG project



Universities, Institute



Universities, Institute



The data of ERG-satellite will be archived in JAXA.



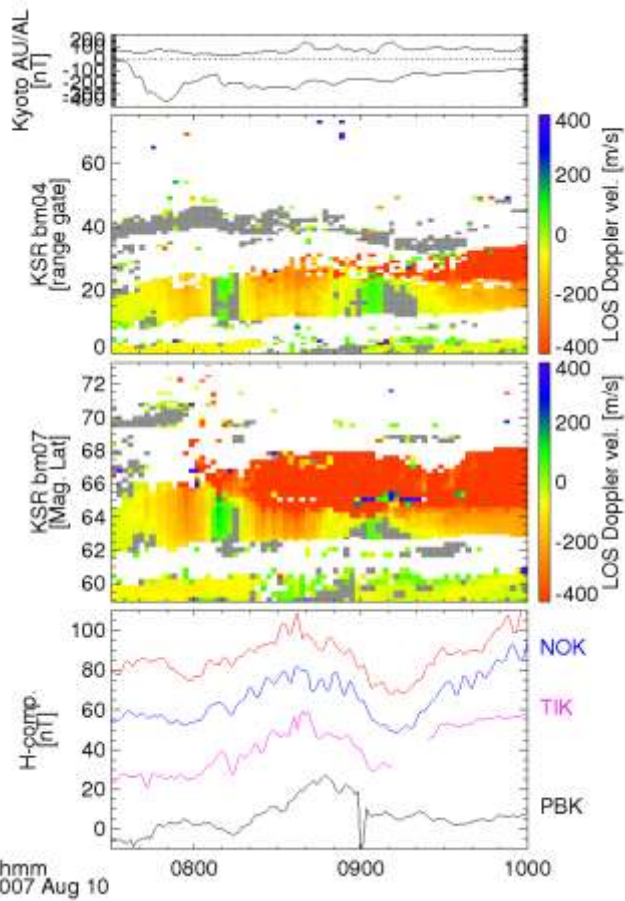
User

The ERG-science center that archives all kind of project data is installed in STELab and develops the integrated analysis tool based on TDAS.

Integrated analysis

- How easily a researcher can create combined plots like below is crucial for facilitate integrated analysis

AU/AL

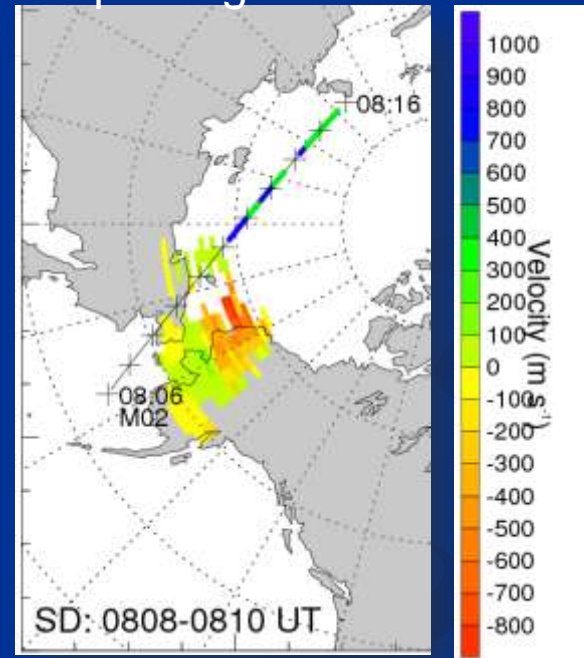


SD
RTI

SD
RTI

gmag

SD and NOAA trajectory and precipitating e- flux



[Some figures from Hori et al. in preparation]

ERG-SC Strategy for integrated analysis



All ground data in various formats are converted to the same format as ERG satellite data, that is, **Common Data Format (CDF)**

CDF

- A self-describing data format including metadata
- Developed and being maintained by NASA/GSFC. Available freely.
- Supports C, C++, Fortran, Perl, Java, Python, IDL, Malab, ... on Unix, Win, Mac.



Adopted **THEMIS Data Analysis Software suite (TDAS)** as the standard tool for data analysis.

ERG-SC provides **plug-in programs for ERG-SC CDF data** to load them on the TDAS processing platform.

TDAS

- **IDL libraries** to read, manipulate, and plot various kinds of STP data.
- Developed and being maintained by the TDAS team of UCB and UCLA.
- Supports Unix, Win, and Mac.

Why CDF?

- Integrated analysis of both satellite data and various ground data is the key to scientific goals.
- The compiled RST set (available for only Linux and Mac) is needed to read SD fitacf files.
- Once converted to CDF, SD data can easily be accessible from free/commercial softwares on various platforms including Windows.

Why TDAS?

- ERG-SC provides TDAS as a common data analysis tool by supplying IDL plug-ins to load SD data.
- THEMIS Data Analysis Software suite (TDAS) can load and process **both satellite and ground data seamlessly** in the same manner
 - Key to realizing the “integrated analysis”
 - **Latest revision data are automatically downloaded** from the data repository
 - no longer need to ftp/wget manually

CDF database of SD fitacf data

■ As of Jan 2011

■ HOK

- Archived CDFs through recent date in 2010

■ KSR

- Archived CDFs through recent date in 2010

■ SYS, SYE

- Ready to generate CDFs (already done experimentally)
- Waiting for rules of the road to be finalized by PI (Prof. Sato)

Only Common Time (CT) data and those permitted by PIs are stored in *ERG-SC* CDFs

CDF database of SD fitacf data

Index of /data/ergsc/

gemsissc.stelab.nagoya-u.ac.jp/data/ergsc/ground/radar/sd/fitacf/

Index of /data/ergsc/ground/radar/sd/fitacf

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
Parent Directory		-	
hok/	10-12æœ^-2010 17:09	-	
ksr/	10-12æœ^-2010 17:09	-	
sve/	30-11æœ^-2010 17:08	-	
svv/	30-11æœ^-2010 17:08	-	

Apache/2.2.3 (CentOS) Server at gemsissc.stelab.nagoya-u.ac.jp Port 80

Currently the test location of the CDF DB server (with HOK,KSR, and geomag. data) and trial of load programs are going on for the limited members (Japanese SD PI groups and **ERG**-SC collaborators).

CDF design for SD fitacf data by ERG-SC

ERG-SC CDF files ...

- archive **only** the **common time data**
 - to do our best to avoid any data policy issue
- include the Rules of the road
 - shown (on IDL terminal) every time data are loaded by users
- include **pre-calculated** (by rpos lib) **positions of range gates**
- include calibration history, quality flags, and parameters which enable users to do initial check of data quality

CDF generation

- converted to CDF, then added to the DB as new rawacf data arrive from U. of Saskatchewan (~every 3—6 months)
- Attributes/variables defined by the master Excel table
 - Can easily be filled in and checked by SD PIs
 - **applicable for other SD radar data**

- Developed by studying/partly-planting “go” routines
- AACGM coords by AACGM DLM or native IDL routines

- Data load:

- `erg_load_sdfit.pro`

- Visualization

- RTI plot:

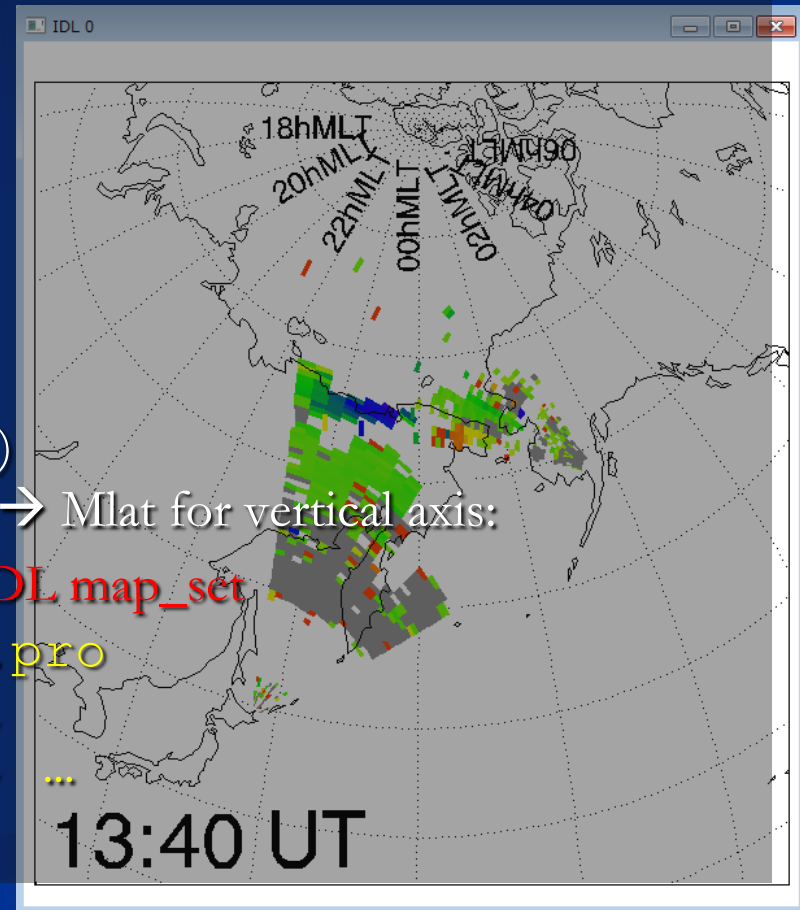
- `tplot` (a basic command of TDAS)

- `set_coords.pro` Range gate \leftrightarrow Mlat for vertical axis:

- 2D fan plot on world map: using IDL `map_set`

- `sd_init.pro`, `sd_map_set.pro`

- `overlay_polar_sdfit.pro`,
`overlay_polar_coast.pro`, ...



TDAS plug-in for fitacf CDF

HOK (v.s. Mlat) + KSR (v.s. RG)

```

IDL> thm_init ;Initialize TDAS environment

IDL> timespan, '2007-06-21' ;Set plot period

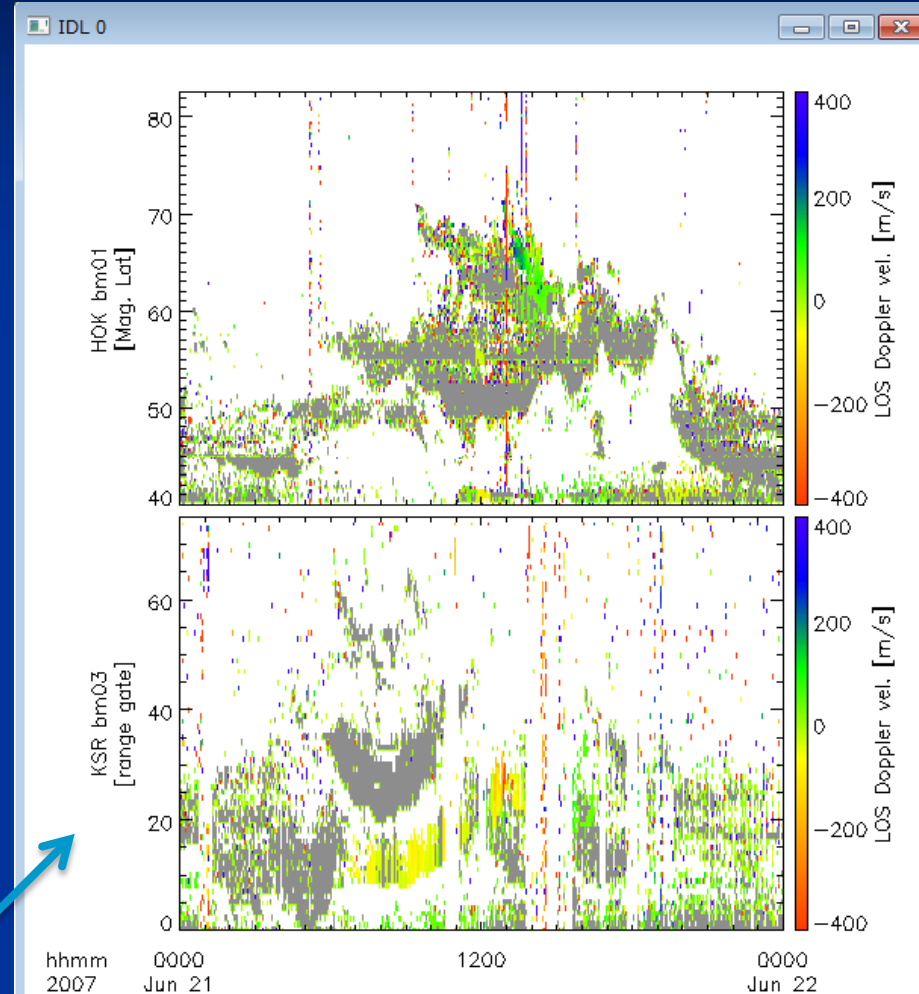
IDL> erg_load_sdfit, site='hok' ; Load HOK and
IDL> erg_load_sdfit, site='ksr' KSR data for the
                                day
IDL> loadct_sd, 44 ; Load Cutlass color table
% Loading table Cutlass color bar for SD

                                ; Plot all beams for HOK and KSR
IDL> tplot, ['sd_hok_vlos_bothscat_1', $
            'sd_ksr_vlos_bothscat_0' ]

                                ; Divide into each beam and plot the selected 2 beams
IDL> splitbeam, ['sd_hok_vlos_bothscat_1', $
                'sd_ksr_vlos_bothscat_0' ]
IDL> tplot, ['sd_hok_vlos_bothcat_1_azim01', $
            'sd_ksr_vlos_bothcat_0_azim03' ]

                                ; Change the y-axis of HOK to Mag. Lat. and Plot!
IDL> set_coords, 'sd_hok_vlos_bothscat_1', 'mlat'
IDL> tplot, ['sd_hok_vlos_bothcat_1_azim01', $
            'sd_ksr_vlos_bothcat_0_azim03' ]
IDL>

```



TDAS plug-in for fitacf CDF

HOK + KSR on 2D map

```

IDL> window, 0      ; Create a new
IDL> wset, 0        window and
                    activate
IDL> sd_init        ; Initialize 2D plot environment and
IDL> sd_time, 1340  set time for 2D plot to 13:40 UT

                    ; Set a map grid centered at (glat,glon) = (68,170 deg)
IDL> sd_map_set, /erase, /clip, /mlt_label, $
                    center_glat=68,center_glon=170

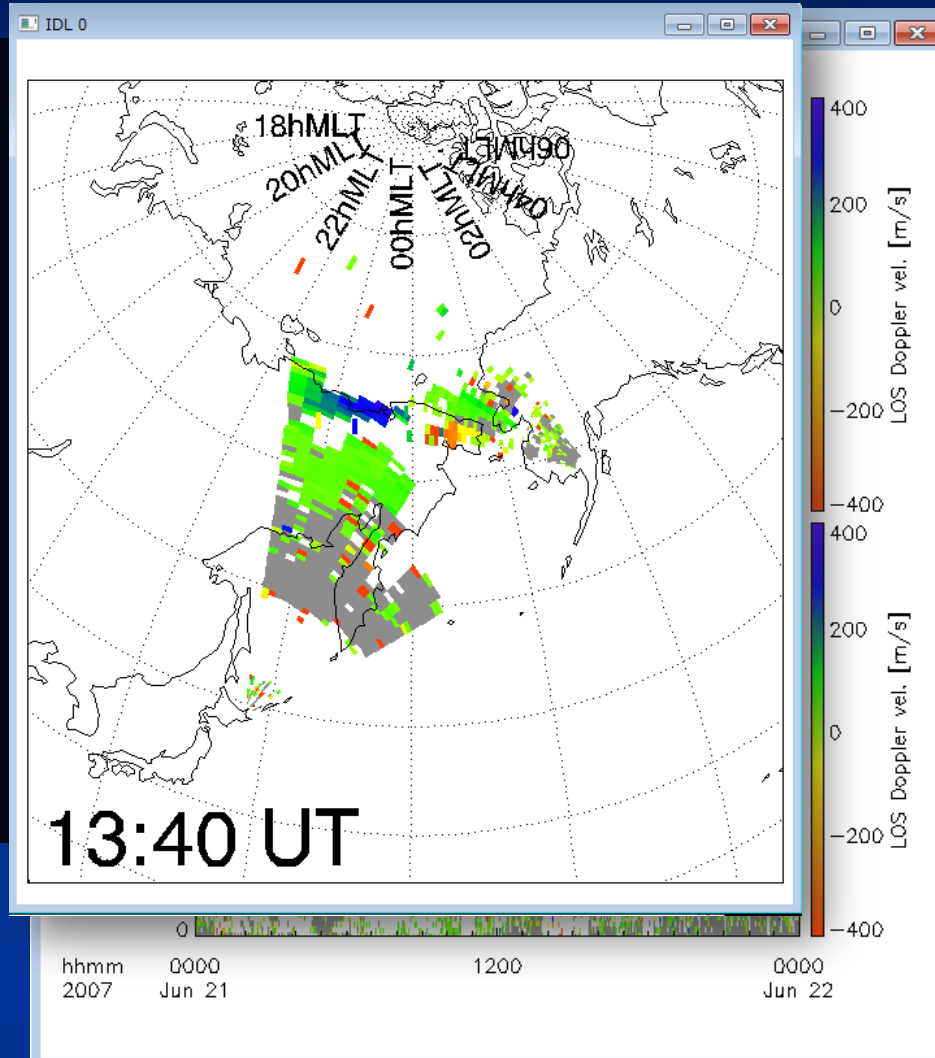
                    ; Draw LOS V of HOK on the map in AACGM
IDL> overlay_polar_sdfit, 'sd_hok_vlos_bothscat_1'

                    ; Superpose LOS V of KSR
IDL> overlay_polar_sdfit, 'sd_ksr_vlos_bothscat_0'

                    ; Superpose the coast lines
IDL> overlay_polar_coast

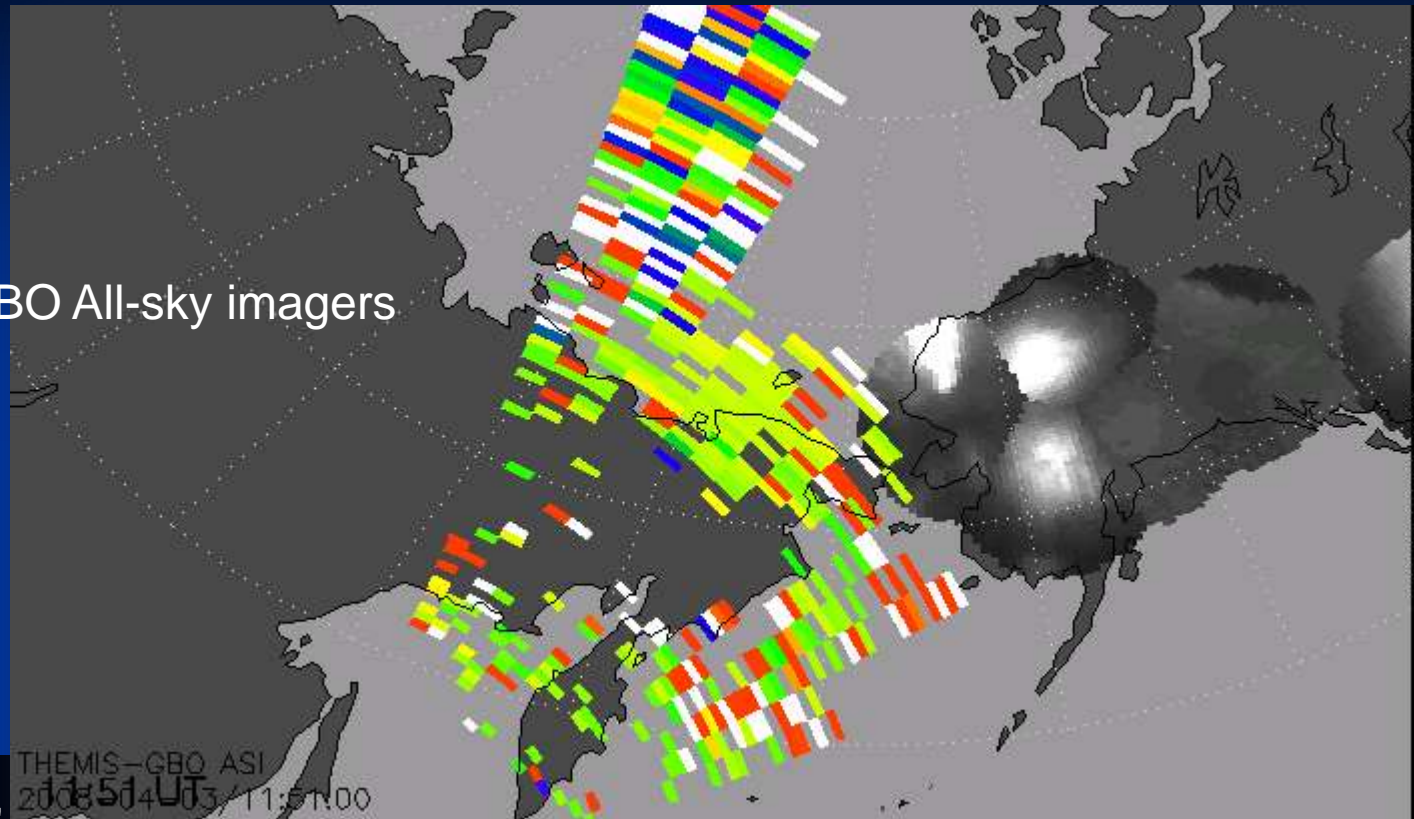
IDL>

```



TDAS plug-in for fitacf CDF

THEMIS-GBO All-sky imagers
+ SD HOK



;Load SD data

IDL> timespan, '2008-04-03'

IDL> erg_load_sdfit, site='hok',/get_support

;Generate an ASI mosaic plot

IDL> thm_asi_create_mosaic, '2008-04-03/11:51:00', central_lat=70, central_lon=170, /thumb

;Superpose SD data in geographical coords after restoring

;the Cutlass color table

IDL> loadct_sd, 44

IDL> sd_time, 1151

IDL> overlay_polar_sdfit, 'sd_hok_vlos_iscat_1', /geo_plot

IDL> overlay_polar_coast, /geo_plot **;redraw the coast lines**

; draw a HOK scan and world map in geographical coords.

Trial of TDAS plug-in

Index of /erg_socware/bleeding_edge/

Name	Last modified	Size	Description
Parent Directory	-		
ergsc r74 2010-11-30.zip	05-12æœ^-2010 03:00	9.7K	
ergsc r75 2010-12-05.zip	09-12æœ^-2010 02:07	9.7K	
ergsc r76 2010-12-09.zip	10-12æœ^-2010 03:00	12K	
ergsc r90 2010-12-10.zip	22-12æœ^-2010 03:00	12K	
ergsc r91 2010-12-22.zip	24-12æœ^-2010 03:00	12K	
ergsc r92 2010-12-24.zip	10-1æœ^-2011 03:00	12K	
ergsc r96 2011-01-10.zip	11-1æœ^-2011 03:00	18K	
ergsc r97 2011-01-11.zip	13-1æœ^-2011 03:00	18K	
ergsc r99 2011-01-13.zip	13-1æœ^-2011 21:20	47K	
ergsc r101 2011-01-13.zip	24-1æœ^-2011 03:00	84K	
ergsc r105 2011-01-24.zip	27-1æœ^-2011 03:00	89K	
ergsc r109 2011-01-27.zip	30-1æœ^-2011 03:00	89K	
note ERG-SC_procedures_en.pdf	05-12æœ^-2010 09:17	79K	
note ERG-SC_procedures_jp.pdf	22-12æœ^-2010 23:46	218K	

Apache/2.2.3 (CentOS) Server at gemsissc.stelab.nagoya-u.ac.jp F

TDAS plug-ins (for SD and geomag. data) are now available from the website shown here.

This is to be distributed among Japanese SD PI groups and **ERG** working group, and collaborators (THM-J, IUGONET) for a trial use.

Please subscribe the ML to get information:
erg-science-support-announce@st4a.stelab.nagoya-u.ac.jp

Please send comments and bug reports to:
erg-sc-help@st4a.stelab.nagoya-u.ac.jp

Timeline

- FY2009 (*Apr,2009-Mar,2010*)
 - CDF design and conversion code for HOK fitacf data
 - Development of TDAS plug-in procedures
 - data load, RTI plot, 2D fan plot
- FY2010 (*Apr,2010-Mar,2011*)
 - Fitacf CDF DB
 - HOK, KSR: now open for limited groups in jp (test location)
 - SYE, SYS: ready to go CDF soon
 - Development of TDAS plug-in procedure (continued)
 - *CDF design for map potential data? (already by JHU/APL?)*
- FY2011 (Apr, 2011-Mar, 2012)
 - CDF DB of Japanese SD data → open for public
(upon approval from SD PI committee represented by M. Lester)
 - Plug-in for SD CDF → incorporated into the official TDAS ver. 6
release (nominally Apr. 2011)



Now

Summary

- **ERG-SC** has been working on development of the **CDF DB of Japanese SD data** and the integrated analysis tool as **TDAS plug-in**, in collaboration with Japanese SD PI groups.
- **Currently** the CDF DB and TDAS plug-in undergo a **test location/trial** among the domestic collaborators.
- We are preparing for making them freely available for the international community (hopefully some time in 2011) and to extend the same scheme to the other SD radar data, leading to integrated studies on the inner magnetosphere during the ERG era.