

THEMIS

GBO All-Sky Imager Calibration File Definition

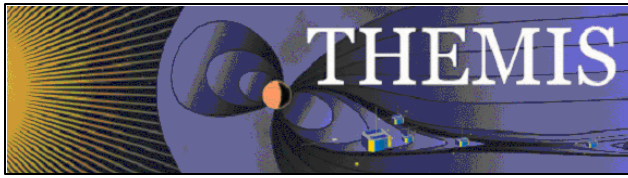
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TBD List

Identifier	Description
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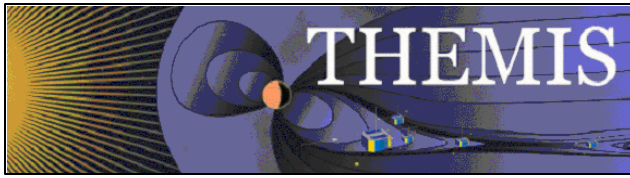


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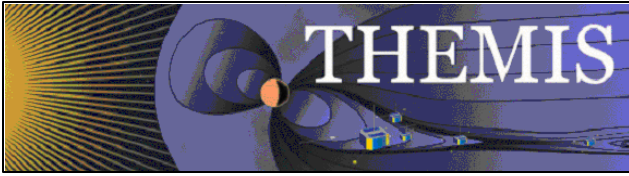
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1. Introduction

1.1 Purpose and Scope.

THEMIS Level 1 ASI data are stored in CDF files. This document defines the additional calibration files that together with plotting tools have to be used in order to plot the data in a scientifically useful way (produce physical quantities and plots) and integrate analysis and plotting routines together with the rest of THEMIS data products (GMAGs and spacecraft). The calibration files will contain all the information that is necessary to derivative L2 files from L1 data files.

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_108_GMAG_L1_VARNAAMES | THEMIS GMAG Variable Name Def's |
| 4. THM_SOC_109_ASI_L1_VARNAAMES | THEMIS ASI variable name definition |

1.3 General calibration file content

Each of the 20 GBO stations will have one calibration file that will contain all information necessary to calibrate full-resolution images, thumbnail images, and keogram strips. The validity of a certain parameter set will be marked with a validity start- and end-time. All the following varaibale names will be shown for the example of Athabasca station ("atha") but will apply in the same way to all the other 19 stations of the THEMIS GBO array as they are defined in document THM_SOC_109_ASI_L1_VARNAAMES.

2. Calibration parameter definition

2.1 General parameters

The general parameters refer to the time and time range of validity of a certain parameter set and station parameters that are not expected to change dramatically over the time of the mission. Whenever a parameter in the calibration files needs to be updated, a completely new parameter set with a new start- and end-time will be put into the file.

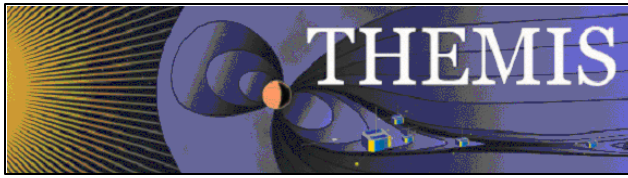


Table 1: THEMIS GBO station general calibration parameters

Variable	Type	Purpose
thg_asc_atha_time	REAL*8	Start time of validity of parameter set in seconds since 1970-01-01/00:00:00, first set will have 0.0
thg_asc_atha_tend	REAL*8	End time of validity of parameter set in seconds since 1970-01-01/00:00:00, last set will have 4.E9 (2096-10-02/07:06:00)
thg_asc_atha_epoch	EPOCH	CDF Epoch for start time
thg_asc_atha_epoch0	EPOCH	EPOCH value of time baseline 1970-01-01/00:00:00.000
range_epoch	EPOCH, 2 elements	Epoch values of first and last data record
thg_asc_atha_longitude	REAL*4	Geographic longitude of station
thg_asc_atha_latitude	REAL*4	Geographic latitude of station
thg_asc_atha_altitude	REAL*4	Geographic altitude of station
thg_asc_atha_maglong	REAL*4	Geomagnetic longitude of station
thg_asc_atha_maglat	REAL*4	Geomagnetic latitude of station
thg_asc_atha_midnight	CHAR	UT of magnetic midnight at station

2.2 Parameters related to mapping of images

These parameters will allow the mapping the image pixels into useful coordinates (geographic and geomagnetic).

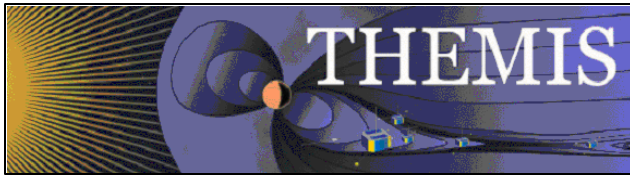
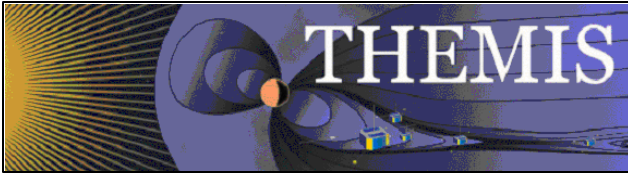


Table 2: THEMIS GBO station mapping calibration parameters

Variable	Type	Purpose
thg_asc_atha_32_elevation	REAL*4, 1024x4 values of degrees from 0. at horizon to 90. at zenith	Elevation of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left
thg_asc_atha_32_azimuth	REAL*4, 1024x4 values of degrees from 0. at geographic north, 90. at geographic east, and 180 at geographic south	Azimuth of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left
thg_asc_atha_32_latitude	REAL*4, 1024x4 values of degrees	Geographic latitude of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left at assumed altitude
thg_asc_atha_32_longitude	REAL*4, 1024x4 values of degrees	Geographic longitude of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left at assumed altitude
thg_asc_atha_32_altitude	REAL*4, single value	geographic altitude that was used to calculate latitude/longitude
thg_asc_atha_32_maglat	REAL*4, 1024x4 values of degrees	Geomagnetic latitude of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left at assumed altitude
thg_asc_atha_32_maglong	REAL*4, 1024x4 values of degrees	Geomagnetic longitude of 1024 pixel corners of thumbnails from lower-left, lower-right, upper-right, upper-left at assumed altitude
thg_asc_atha_img_elevation	REAL*4, 257x257 values of degrees from 0. at horizon to 90. at zenith	Elevation of lower left corner of all 256x256 pixels of full resolution images
thg_asc_atha_img_azimuth	REAL*4, 257x257 values of degrees from 0. at geographic east, and 180 at geographic south	Azimuth of lower left corner of all 256x256 pixels of full resolution images
thg_asc_atha_img_latitude	REAL*4, 257x257 values of degrees	Geographic latitude of lower left corner of all 256x256 pixels of full resolution images
thg_asc_atha_img_longitude	REAL*4, 257x257 values of degrees	Geographic longitude of lower left corner of all 256x256 pixels of full resolution images
thg_asc_atha_img_maglat	REAL*4, 257x257 values of degrees	Geomagnetic latitude of lower left corner of all 256x256 pixels of full resolution images
thg_asc_atha_img_maglong	REAL*4, 257x257 values of degrees	Geomagnetic longitude of lower left corner of all 256x256 pixels of full resolution images



2.3 Quantitative calibration

Those parameters will be used to transform the image counts into physical quantitative units once a thorough instrument and star calibration will be performed. Most of the will at this time just contain default values.

Table 3: THEMIS GBO station quantitative calibration parameters

Variable	Type	Purpose
thg_asc_atha_offset	UINT2, default is 0	DC offset to transform Value = counts - offset
thg_asc_atha_radial	REAL*4, 128 elements, default is 1.0	Radial sensitivity correction to obtain flat field with Value = radial * value
thg_asc_atha_sensitivity	REAL*4, default is 1.0	Calibration factor to obtain the same apparent brightness of Polaris in all cameras Value = sensitivity * value