General Notes on the Magnetometer Data in TDAS

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Document can be found at:
http://themis.ssl.berkeley.edu/themisftp/3GroundSystems/3.2ScienceOperations/ScienceOperationsDocuments/

1. Introduction

The information in this document is intended to assist anyone managing GMAG data available through TDAS. Some information may be repeated in more than one section of the document. The information provided here should be considered a guide, it is neither comprehensive nor definitive. More detailed information about the download and processing scripts can be found in the Administrators Guide.

The magnetometer data available through TDAS can be divided up into a number of networks/groups:

THEMIS EPO (Education and Public Outreach) magnetometers, installed in US schools;
THEMIS GBO magnetometers;
AUTUMN University of Athabasca (presumably a collaborative venture with THEMIS UCLA);
CARISMA University of Alberta (sites mirrored here are partly funded by THEMIS in some way, see notes below);
MACCS Augsburg College;
GIMA University of Alaska;
Greenland (actually Greenland, Denmark, Norway, data from the TGO and DTU networks);
PENGUIn Virginia Tech (Antartica);
USGS ;
NRCan (Currently only FCC, YKC);
SGU (Abisko, Sweden);
LRV (Leirvogur, Iceland) - we have current data, but are waiting for back data;
AARI (Russia);
McMAC (Mid-Continent Magnetoseismic Chain) - added February 2013

For the most part the process for magnetometer data is as follows:
1. a script runs automatically each day to download the data from some external site;
2. another script runs to process the downloaded data into CDF format.

Information on the files downloaded or processed is written to databases. ASCII and php tables available on the web let users (and programmers) see the status of downloaded/processed files for each site. For EPO sites there is additional processing to generate jpg files which are used by the schools involved in the EPO program.

Notes:
1. SPDF picks up gmag cdfs from THEMIS (along with all our other cdfs) from ftp://justice.ssl.berkeley.edu/thg/l2/mag..
2. As mentioned above, a subset of sites in the CARISMA network are mirrored by THEMIS. The remaining CARISMA sites are (to be) made available to users of TDAS, but the data is directly downloaded from the CARISMA server.
3. If you need to manually run a download or processing script, first read the relevant information in the Administrators Guide.

2. GMAG data download and processing

As of May 2013 there are 137 'active' gmag sites available through TDAS. This number includes sites that are temporarily unavailable but does not include sites that are known to no longer operate.

GMAG number breakdown (As of May 2014)
    10 GBO
    12 EPO

7 CARISMA (This includes 5 CARISMA sites and NRCan data from SNKQ and ATHA)
7 MACCS
5 AUTUMN
12 GIMA
14 TGO
18 DTU (others only uncalibrated, ATU, DMH, SVS back as of April 2012)
4 PENGUIn
3 INTERMAGNET (ABK, FCC, YKC)
14 USGS
1 LRV (Iceland)
1 SGU (Sweden)
4 AARI (Russia)
9 McMAC (US)

A complete list of the GMAG sites with location details (including ones no longer active) can be found in the document THEMIS_GMAG_Station_List.xlsx. This document is linked to on the THEMIS gmag webpages and is in SVN (trunk/doc folder).

2.1 EPO Sites

2.1.1 Site list

The EPO magnetometers are currently:
BMLS – Bay Mills
CCNV – Carson City
DRBY – Derby
FYTS – Fort Yates (no longer operating)
HOTS – Hot Springs
LOYS – Loysburg
PGEO – Prince George (formerly classified as a GBO site)
PINE – Pine Ridge
PTRS – Petersburg
RMUS – Remus
SWNO – Shawano
UKIA – Ukiah

2.1.2 Contact Names

See the Calibration and JPGS sections below.

2.1.3 Data Download

Data from the sites listed above is downloaded from UCLA each day (every 4 hours in fact) using the script epo_ucla_rmd_mirror_batch.ksh. This script runs on the cron on gaia2. The downloaded files are in RMD format.
Full details of the download process can be found in the Administrators Guide, and will not be repeated here to avoid this copy becoming out of date.
At the time of writing, warning emails for the download process were not enabled.
The current status for the EPO mirror can be found at:
http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/epo_ucla_gmag_table.php

2.1.4 Data Processing

EPO (and also GBO and Athabasca at the same time) data is processed automatically each day by a script that runs on auxo: ucla_rmd2all.ksh. This script reads through the list of downloaded files and generates flatfiles as an intermediate step, then CDFs and ASCII files. This script must be run on a Sun OS, hence auxo. Again, full details can be found in the Administrators Guide.

2.1.5 Calibration

Calibration files are used in the process of generating flatfiles from RMD files. This directory contains the calibration files for all the stations from which we receive data in RMD format (EPO, GBO, Athabasca sites).

Calibration files can change for any number of reasons, and there is currently no automated process for ensuring that the calibration files in the above directory are up to date. For EPO sites the 'master' calibration files are located at
http://www-ssc.igpp.ucla.edu/themis_data/calib_files/
(this location is written into the EPO CDF files). The 'master' calibration files are the ones that will be updated by the team at UCLA responsible for maintenance of the EPO sites. It has been requested that they contact the TDAS team (in particular David King and L Philpott as of September 2011) if any calibration files are changed. However, it is recommended that the correspondence of the master and local calibration files be checked manually every six months at least.
Contacts for EPO hardware, including calibration questions (as of September 2011):
Kathryn Rowe krowe@igpp.ucla.edu;
Richard Hart rhart@igpp.ucla.edu

Calibration files last checked: October 2013
Calibration changes:
BMLS – installed facing south rather than north in September 2010. Calibration file changed in September 2011 to include rotation. Back processed.
HOTS – changed due to repair in May 2008(?) Files back processed in September 2011.
PINE – changed due to repair in June 2009(?) Files back processed in September 2011.
Note: no jpg reprocessing was done for these Sep 2011 reprocessings. HOTS and PINE calibrations were minor and reprocessing would be *very* time consuming. BMLS change was major, but the HDB plots are correct as they stand, XY are inverted.

2.1.6 Coordinate System

Data from EPO sites is in local magnetic coordinates (H: magnitude of field in local magnetic north direction, D: magnitude of field in local magnetic east direction, Z: magnitude of field in vertical direction). The GMAG sensors are initially set up aligned magnetic north, magnetic east, vertical down (a general discussion of GMAG coordinate systems can be found in Section 10).

2.1.7 Data Files

Flatfiles: Flatfiles are only used for onward processing to CDF.

CDFs: CDFs are generated from flatfiles with the help of mastercdfs. The script ucla_flat2cdf.ksh is called by ucla_rmd2all.ksh. ucla_flat2cdf.ksh ultimately runs the idl procedure uff2cdf.pro.

ASCII: ucla_rmd2all.ksh calls ucla_flat2ascii.ksh, which ultimately calls the idl procedure uff2asc.pro. ASCII files make the data available in a human-readable form, but are not used internally by the TDAS software.

2.1.8 EPO ASCII files

Some schools involved in the Education and Public Outreach program make use of the ASCII files (in addition to the JPGs produced primarily for the schools, discussed below). It seems likely that they access these files using the website http://themis.ssl.berkeley.edu/EPO_Access/.

2.1.9 EPO JPGS

For EPO stations, jpg plots of the data for each station are produced for 30 minute and daily intervals. These plots are made available at http://sprg.ssl.berkeley.edu/themis/GEONS/, for use by the schools involved in the Education and Public Outreach program. Note that this site contains archived data. 'Realtime' plots are available at http://ds9.ssl.berkeley.edu/themis/classroom_geons_data.html (the realtime plots are not produced by TDAS).

The EPO jpeg plots of XYZ/HDB components are produced automatically using TDAS software. Prior to 2010 the plots were received from EPO together with spectrograph jpgs. It was initially intended that the spectrographs continue to be received from EPO, but this process had not been working since March 2010. It was confirmed with the Education and Public Outreach team that they have decided that spectrograph plots will no longer be archived, although realtime spectrographs continue to be available at the site http://ds9.ssl.berkeley.edu/themis/classroom_geons_data.html.

The file names take the form:
[SITE]_[TYPE]_MMDDYYYY_HHMMSS.jpg
where SITE is the site name and TYPE={DS1, DS2, DS3, DSB, DSD, DSH, TS1, TS2, TS3, TSB, TSD, TSH, DStamp, TStamp, DS123, DSBDH, TS123, TSBDH, TSpectra, DSpectra}.
Types that begin with 'D' indicate daily plots, types that begin with 'T' are 30 minute plots.
The numbers 1, 2, 3 refer to data components X, Y, Z (these are the standard THEMIS HDZ local magnetic components).
The letters B, D, H refer to data components H = sqrt($X^2 + Y^2$) (the total horizontal field magnitude), D = arctan(Y/X) (angle between magnetic north and the horizontal field vector), B = sqrt($X^2 + Y^2 + Z^2$) (the total field magnitude).
The files DS123 etc are produced by combining the components (DS1, DS2, DS3 in this case). Spectral plots are no longer produced, but you may see old plots in the data directory.

Processing Scripts:
These scripts produce the jpg files, full details can be found in the Administrators Guide.
Scripts are also run to produce a list of the available JPG files. These lists appear at:
        http://themis.ssl.berkeley.edu/data_inventory/ground_data/mag/epo_jpg_lists/
The JPG lists may be helpful in diagnosing any problems that occur. - As of June 2012 - these jpg lists take a very very long time to produce. It appears they may be being used by teachers in the EPO program to check file availability so we do not want to remove them completely. Modifications being tested are: produce files only for the current year (create files for previous years initially, but day to day processing should only rewrite the current year file); look for file availability in the database rather than searching files (this means only combined files, eg. DS123 rather than component files DS1 DS2 DS3 will be listed in the file list. This make make diagnosing problems more difficult as you will not know at a glance whether the component or merge problem is at fault… however, these file lists were not much used by us for diagnosing problems anyway).

A new web table http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_epojpg_table.php shows the latest 'appended' files for each site, and will allow us to keep track of any major processing problems.

Note: JPGS for Prince George are not produced at the present.

Website:
The files at this site are picked up by a webserver and appear at: http://sprg.ssl.berkeley.edu/themis/GEONS/SCHOOLS/

The webform at http://sprg.ssl.berkeley.edu/themis/GEONS/ queries the EPOMAG database on Juneau (for more details see Section 6.2). If there is a problem with data not showing up on the website the first thing to check is problems with information not being written to the database.

The important files are geons_data.php, process_form_input.php, pan_display.php.

Note: The webform contains a year drop down list. At the beginning of a new year it is necessary to add the new year to the list (both geons_data and pan_display need to be modified).

It is not clear who has responsibility for maintaining the GEONS site, but unless another party steps forward it should be assumed that the TDAS team is responsible for ensuring jpgs are produced correctly and are available through the website. Minor changes such as adding new years to the drop down lists are simple enough to make.

Note: The ASCII EPO JPG lists showing jpg availability for each site over time available at http://themis.ssl.berkeley.edu/data_inventory/ground_data/mag/epo_jpg_lists/ *may* be being used by the EPO program. The scripts used to produce these lists (documented in the Administrators Guide) take a long time to run and should perhaps in the future be optimized.

Contacts:
The contacts for EPO (non-hardware issues) are:
        Laura Peticolas laura@sunearth.ssl.berkeley.edu.
        Nancy Ali nancy.ali@ssl.berkeley.edu
        Igor Ruderman igor@ssl.berkeley.edu
        Karen Meyer karena@ssl.berkeley.edu
As mentioned above, for EPO hardware/data issues contact the UCLA GMAG team.

2.1.10 Reprocessing

Reprocessing scripts discussed below can be applied to GBO or EPO sites.
Reprocessing is necessary if a calibration file for any site is updated, and if there is any problem with the generation of any of the data files.

2.1.10.1 All data types

Note: Regenerating CDFs will not automatically cause the regeneration of JPGS. By default, make_epo_plots_daily only looks at the last five days. It is necessary to regenerate the epo plots. However, regenerated plots should be merged automatically, as epo_magfile_append looks at files modified recently, rather than recent dates. Summary plots will be regenerated automatically.

2.1.10.2 CDF only

To run this script you must specify within the script whether the site is GBO or EPO, and the 'finalfileroot', this is the name of the relevant flatfile eg. B10113_GBAY is the finalfileroot if you wish to reprocess the site GBAY for the 113th day of 2010. Note that ucla_flat2cdf_regen_test.ksh does not need to be run on auxo.

2.1.10.3 JPGS

2.1.11 Related Websites

E/PO: http://ds9.ssl.berkeley.edu/themis/classroom_geons_data.html#nation
Calibration files: http://www-ssc.igpp.ucla.edu/themis_data/calib_files/
Status: (RMD) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/epo_ucla_gmag_table.php
        (CDF) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php.
        (ASCII) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.1.12 Related Databases

On Astraea2:   epo_ucla_rmd_mirror
              gmag_ascii_files
              gmag_cdf_files
On Juneau: EPOMAG

2.2 GBO Sites

2.2.1 Site list

The GBO magnetometers are:
CHBG - Chibougamau
GBAY – Goose Bay
INUV - Inuvik
KAPU - Kapuskasing
KIAN - Kiana
KUUJ - Kuujjuaq
MCGR - McGrath
SNAP – Snap Lake
TPAS – The Pas
WHIT - Whitehorse
(and previously EKAT, YKNF)

2.2.2 Contact Names

Contact Harald Frey hfrey@ssl.berkeley.edu, who is in contact with the relevant people at Calgary.

2.2.3 Data Download

Full details of the download process can be found in the Administrators Guide.

Note:
1. As of Oct 2011 we moved from using rsync to using wget as UCalgary stopped their rsync server and moved files to http (http://aurora.phys.ucalgary.ca/data/themis/fluxgate/stream0/).
2. The current status for the GBO mirror can be found at:
   http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/gbo_ucla_gmag_table.php

2.2.4 Data Processing

GBO sites are processed using the same processing pipeline as EPO (see section above). Calibration files appear on the master calibration site http://www-ssc.igpp.ucla.edu/themis_data/calib_files/, but it is unclear whether the UCLA GMAG team take responsibility for maintaining these calibration files.

2.2.5 Coordinate System

Data from GBO sites is in local magnetic coordinates (H: magnitude of field in local magnetic north direction, D: magnitude of field in local magnetic east direction, Z: magnitude of field in vertical direction). The GMAG sensors are initially set up aligned magnetic north, magnetic east, vertical down.

2.2.6 JPGS

KIAN and MCGR are included on the list of 'EPO' sites for the generation of jpgs.

2.2.7 Reprocessing

See discussion for EPO above.

2.2.8 GBO related websites

Status page at Calgary: http://themis-rt.phys.ucalgary.ca:8080/dataflow/monitor
Calibration files: http://www-ssc.igpp.ucla.edu/themis_data/calib_files/
Status: (RMD) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/gbo_ucla_gmag_table.php
    (CDF)   http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php.
    (ASCII) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.2.9 GBO related databases

On Astraea2:   gbo_uc_gmag_rmd_files
              gmag_ascii_files
              gmag_cdf_files

2.3 Athabasca (AUTUMN)

2.3.1 Site List

Sites mirrored from Athabasca:
ROTH: Priddis
LETH: Lethbridge
REDR: Red Deer
LARG: La Ronge
VLDR: Val-d'Or (no longer operating)

2.3.2 Contact Names

The person to contact is probably Ian Schofield schofiel@athabascau.ca.

2.3.3 Data Download

Data from the AUTUMN sites is downloaded using rsync multiple times a day by a script running on the cron on gaia2: gbo_atha_rmd_mirror_batch.ksh (calling the script gbo_atha_rmd_mirror.ksh). The process looks at the present (and sometimes last) month of data only. Details can be found in the Administrators Guide.
The date of the most recent files can be found at
http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/autumn_ucla_gmag_table.php

2.3.4 Data Processing

AUTUMN RMD files are processed to CDFs using the same process as EPO and GBO files (ucla_rmd2all).
It is not clear where THEMIS got the calibration files for the sites, or who ensures that they stay correct. The calibration files are not included on the UCLA site.
There are some calibration files at: http://autumn.athabascau.ca/themis.gbo.mag.calibration/, but these take a slightly different form and LETH is absent.

2.3.5 Coordinate System

As with EPO and GBO, data from AUTUMN sites is in local magnetic coordinates (H: magnitude of field in local magnetic north direction, D: magnitude of field in local magnetic east direction, Z: magnitude of field in vertical direction).

2.3.6 Reprocessing

See EPO section for discussion of reprocessing using ucla_rmd2all.

2.3.7 Related Webpages

AUTUMN homepage: http://autumn.athabascau.ca/
Calibration files: http://autumn.athabascau.ca/themis.gbo.mag.calibration/?
Status: (RMD) http://themis.ssl.berkeley.edu/data_processing_check/autumn_ucla_gmag_table.php
　　　(CDF)　http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php.
　　　(ASCII) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.3.8 Related Databases

On Astraea2:　　gbo_uatha_rmd_files
　　　　　　　　gmag_ascii_files
　　　　　　　　gmag_cdf_files

2.4 University of Alberta/CARISMA

Note: In May of 2012 there was a disk failure at CARISMA. When their server came back up, our processes did not.

2.4.1 Site List

FSIM: Fort Simpson
FSMI: Fort Smith
GILL: Gillam
PINA: Pinawa
RANK: Rankin Inlet
SNKQ: Sanikiluaq (this is an NRCan site, provided to us by University of Alberta)
ATHA: Athabasca (This was apparently the THEMIS prototype GBO, data provided to us by University of Alberta, but they say they retrieve the data from NRCan)

Additional CARISMA sites will be made available to TDAS users in the near future. Only the sites listed above are mirrored by THEMIS - data from the remaining sites in the CARISMA network will be loaded through TDAS directly from the CARISMA servers.

2.4.2 Contact Names

Ian Mann ian.mann@ualberta.ca
David Milling dmilling@ualberta.ca (particularly for anything regarding the additional CARISMA sites being made available)

2.4.3 Data Download

Data is downloaded via rsync (over ssh) from carisma_rt@bluebird.physics.ualberta.ca:/data/THEMIS (previously .phys. rather than .physics. , changed 2011). The rsync process is run automatically multiple times
a day from the script gbo_ua_canmag_mirror_batch.ksh on gaia2.
Note that the rsync process looks at the year directory level so will download all missing files for the current year. Details can be found in the Administrators Guide.

2.4.4 Data Processing

The data from UAlberta is received in an ASCII format and processed to CDF using an automated script that runs on astraea2. The script also produces additional ASCII files of the data in the same format as those produced by the scripts that process the GBO/EPO sites. Details can be found in the Administrators Guide.

2.4.5 Coordinate System

Data mirrored from Alberta is in HDZ local geomagnetic coordinates. The header also contains a rotation angle value if the data has been rotated from geographic XYZ to HDZ coordinates. eg.

```
FSIM   61.756 238.770 20071126 HDZ 23.3 nT   2Hz
```

indicates that they rotated the data by 23.3 degrees. This declination is currently obtained from the calculator at http://geomag.nrcan.gc.ca/calc/mdcal-eng.php. According to David Milling at Alberta this produces reasonable results, though he is in the process of developing a more complicated declination angle calculation.

2.4.6 Reprocessing

2.4.7 Related Webpages

CARISMA homepage: http://bluebird.phys.ualberta.ca/carisma (if this doesn't work try www.carisma.ca)
Status (Mirrored files): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/canmag_table.php
     (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
     (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.4.8 Related Databases

On Astraea2:   gbo_ua_canmag_mirror
                gmag_ascii_files
                gmag_cdf_files

2.5 MACCS

2.5.1 Site List

(MACCS code/THEMIS code)
CDR/CDRT: Cape Dorset
CRV/CRVR: Clyde River
GJO/GJOA: Gjoa
IGL/IGLO: Igloolik
NAN/NAIN: Nain
PGG/PANG: Pangnirtung
RBY/RBAY: Repulse Bay
CHB Coral Harbour and PEB Pelly Bay have minimal data to date and are not mirrored.

2.5.2 Contact Names

Erik Steinmetz steinmee@augsburg.edu

2.5.3 Data Download

ASCII files are downloaded automatically each day using wget from ftp://yspace.augsburg.edu/MACCS_DATA/IAGA2000/. The download process looks at all files for the current year and downloads any missing or changed files. Again, details can be found in the Administrators Guide.
NOTE: When the MACCS folks switch from yspace server to zspace server wget_maccs_gmag.config file will need to change to new site and directory structure. The new site will be ftp://zspace.augsburg.edu//processed/MACCS/IAGA2000/.

2.5.1 Data Processing

Downloaded ASCII files are automatically processed each day into CDF. An additional ASCII file is also produced in the same format as for the EPO/GBO processing.

2.5.2 Coordinate System

The MACCS data is provided in IAGA2000 format with XYZ reported. The existing process reads this data directly as THEMIS HDZ components. It has been confirmed that this data is in local geomagnetic coordinates.
On their website MACCS provides some data rotated to geographic coordinates and some more recent in local geomagnetic coordinates. ALL data mirrored by THEMIS is in local geomagnetic coordinates.

2.5.3 Reprocessing

2.5.4 Related Webpages

MACCS homepage: http://space.augsburg.edu/maccs/index.html
Status (Mirrored files): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/maccs_table.php
        (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
        (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.5.5 Related Databases

On Astraea2:   web_downloads contains a table augsburg_maccs_gmag
                gmag_ascii_files
                gmag_cdf_files

2.6 Alaska (GIMA)

2.6.1 Site List

ARCT: Arctic   (no longer operating)
BETT: Bettles
CIGO: College International Geophysical Observatory (This is the USGS CMO station)
EAGL: Eagle   (no longer operating)
FYKN: FtYukon
GAKO: Gakona
HLMS: High Latitude Monitoring Station
HOMR: Homer   (no longer operating)
KAKO: Kaktovik
POKR: Poker
TOOL: Toolik Lake
TRAP: Trapper Creek

(Note that as of May 2014 only Kaktovik, Toolik Lake, Ft Yukon, Poker Flat, CIGO, Eagle, Gakona, and Trapper Creek are listed on the GIMA site as currently available).

2.6.2 Contact Names

Bill Hauer uso@asf.alaska.edu
Don Hampton dhampton@gi.alaska.edu (PI for magnetometer array)

2.6.3 Data Download

Data from the sites in the GIMA network is downloaded automatically each day using rsync. Details can be found in the Administrators Guide.

2.6.4 Data Processing

Data from GIMA is retrieved in netCDF format. The netCDF files are processed to CDF and ASCII automatically each day. See the Administrators Guide for details.

2.6.5 Coordinate System

Data from the GIMA network is provided as HDZ components, all in nT. As far as can be determined, this matches the THEMIS HDZ ie. field magnitude in magnetic north, magnetic east, and vertical directions.

2.6.6 Reprocessing

To reprocess the CDFs you can use gima_netcdf2all.ksh

2.6.7 Related Webpages

GIMA Homepage: http://www.asf.alaska.edu/program/gdc/project/magnetometer
Status (Mirrored files): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/alaska_table.php
     (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
     (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.6.8 Related Databases

On Astraea2:   gbo_alaska_mirror
                gmag_ascii_files
                gmag_cdf_files

2.7 Greenland

The 'Greenland' sites are in fact located in Greenland, Denmark, Norway, and Sweden. We retrieve the data from one location, but the sites belong to two different networks: the Technical University of Denmark (DTU), and the Tromsø Geophysical Observatory (TGO).
Data was originally retrieved by THEMIS from a different provider. For some DTU stations we have only that initial set of data as the sites have not yet been placed online. Three such stations became available in 2012. It would be a good idea to check periodically to see whether the remaining stations are available. Additional stations in the TGO network also become available occasionally.

2.7.1Site List

DTU sites:
AMK: Tassiilaq, Greenland
ATU: Attu, Greenland
BFE: Brorfelde, Denmark,
DMH: Danmarkshavn, Greenland
DNB: Daneborg, Greenland *(NO LONGER OPERATING)*
FHB: Paamuit (Frederikshåp), Greenland
GDH: Qeqertarsuaq (Godhavn), Greenland

GHB: Nuuk (Godthåp), Greenland
KUV: Kullorsuaq, Greenland
NAQ: Narsarsuaq, Greenland (Also referred to by THEMIS abbrev NRSQ)
NRD: Nord, Greenland *(CURRENTLY ONLY DATA TO 2009)*
ROE: Rømø, Denmark
SCO: Ittoqqortoormiit, Greenland
SKT: Maniitsoq (Sukkertoppen), Greenland
STF: Kangerlussuaq (Søndre Strømfjord), Greenland
SVS: Savissivik, Greenland
TDC: Tristan da Cunha
THL: Qaanaaq (Thule), Greenland
UMQ: Uummannaq, Greenland
UPN: Upernavik, Greenland

TGO Sites:
AND: Andenes, Norway
BJN: Bjørnøya, Norway
DOB: Dombås, Norway
DON: Dønna, Norway
HOP: Hopen, Norway
JCK: Jackvik, Sweden
KAR: Karmøy, Norway
LYR: Longyarbyen, Norway
NAL: Ny Ålesund, Norway
NOR: Nordkapp, Norway
RVK: Rørvik, Norway
SOL: Solund, Norway
SOR: Sørøya, Norway
TRO: Tromsø, Norway

2.7.2 Contact Names

TGO:
Truls Lynne Hansen truls.hansen@uit.no (for questions relating to TGO or relating to data format and access for either network)

DTU:
Claudia Stolle cst@space.dtu.dk
Jürgen Matzka jrgm@space.dtu.dk

2.7.3 Data Download

Data from these sites was initially downloaded manually when requested. In 2011 it was moved to a daily automatic download. Data for both TGO and DTU sites is retrieved from TGO. Data on the TGO site is provided in IAGA2002 format, with three choices of coordinate system. The data made available through TDAS has changed coordinate systems on several occasions. See the Coordinate System section below for more information, and the Administrators Guide for details of the download script.

Note that you can also use the webform on the TGO data site to download data in varying formats if any checking is required.

2.7.4 Data Processing

Data retrieved from TGO/DTU is in IAGA2002 ASCII format. The data is processed automatically each day to produce CDF and standard ASCII files.

2.7.5 Coordinate System

As of May 24th 2012 we retrieve the data in geographic coordinates XYZ (XYZ(1) on the TGO website) i.e. the components are magnetic field strength in geographic north, geographic east, and vertical directions. This data is then rotated to local magnetic coordinates using the declination angle for each site. The declination angles were provided by Truls Lynne Hansen and are stored in the CDF (attribute station_declination). Back data to 2007 where available has been retrieved and processed in this way. Some sites have only uncalibrated data for 2009 and earlier (data that was retrieved from DTU prior to the move to TGO as a data supplier, and that is not available on the TGO site now).
We previously retrieved (up to May 2012) the data in 'Sensor XYZ' format. This is raw, uncalibrated data in THEMIS HDZ coordinates. The values reported are variations only, from an arbitrary level. There are potential issues with some of the TGO sites where the sensors are oriented in DIF rather than HDZ. Prior to that it was retrieved in DHZ but incorrectly converted to THEMIS HDZ.

2.7.6 Reprocessing

2.7.7 Related Webpages

Data site: http://flux.phys.uit.no/ascii/
TGO homepage: http://geo.phys.uit.no/
DTU homepage: http://www.space.dtu.dk/English/Research/Scientific_data_and_models/Magnetic_Ground_Stations.aspx
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
        (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.7.8 Related Databases

On Astraea2:   gmag_ascii_files
                gmag_cdf_files
Note: There is no database of the mirrored files. A table greenland_nrsq_gmag exists in the database web_downloads, but it relates to an earlier file retrieval process and is no longer used.

2.8 Antarctic (PENGUIn)

2.8.1 Site List

PG1: Antarctica (nominally conjugate to Greenland station UMQ)
PG2: Antarctica (nominally conjugate to Greenland station GDH)
PG3: Antarctica
PG4: Antarctica

2.8.2 Contact Names

Bob Clauer rclauer@vt.edu (Principal Investigator)
Daniel Weimer dweimer@vt.edu (Queries relating specifically to the CDFs)

2.8.3 Data Download

Data is retrieved automatically each day from Virginia Tech, using wget. Unlike the other networks, the Antarctic data is provided to us as CDFs that meet TDAS CDF standards. See the Administrators Guide for more details of the download script.

2.8.4 Data Processing

As the data is provided as CDFs, the processing needed is very limited. ASCII files are generated from the CDFs in the same format as for other gmag stations for completeness. See the Administrators Guide for details.

2.8.5 Coordinate System

Data from the Antarctic stations is provided in local magnetic north, east, vertical components, matching the THEMIS HDZ coordinate system.

2.8.6 Reprocessing

At this point no reprocessing has been required so no reprocessing scripts exist.

2.8.7 Related Webpages

Virginia Tech PENGUIn homepage: http://mist.nianet.org/
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
      (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.8.8 Related Databases

On Astraea2:   gmag_ascii_files
             gmag_cdf_files

(No database for mirrored files as mirrored files are CDFs)

2.9 USGS

2.9.1 Site List

BOU: Boulder, CO
BRW: Barrow, AK
BSL: NASA Stennis Space Center, MS
CMO: Fairbanks, AK (College)
DED: Deadhorse, AK
FRD: Corbin (Fredericksburg), VA
FRN: Fresno, CA
GUA: Dededo, Guam
HON: Honolulu, Hawaii
NEW: Colville National Forest (Newport), WA
SHU: Sand Point (Shumagin), AK
SIT: Sitka, AK
SJG: Cayey, Puerto Rico (San Juan)
TUC: Tucson, AZ

2.9.2 Contact Names

Duff Stewart dcstewart@usgs.gov

2.9.3 Data Download

Data from the USGS sites are downloaded automatically each day. The data is in IAGA2002 ASCII format. See the Administrators Guide for details of the download script.

2.9.4 Data Processing

Barrow data is processed automatically to CDF and ASCII each day. See the Administrators Guide for details.

2.9.5 Coordinate System

Data from Barrow is provided in THEMIS HDZ coordinates. The D component is supplied in arc minutes (note some of the older files provide 'E' in nT) and is transformed back to the local magnetic east component in nT using a small angle approximation. See Section 10 below for extensive discussion of the BRW coordinate system.

2.9.6 Reprocessing

There are no particular scripts for the reprocessing of USGS data. Be aware that some of the older files provided by USGS were in a different format to the current files. If files need to be reprocessed due to a change in mastercdf for example, the older 'raw' files will need to be processed separately. The initial routines used to process the raw files are in SVN.

Older files should be processed using usgs_raw_ascii2all.ksh

2.9.7 Related Webpages

USGS page: http://geomag.usgs.gov/observatories/barrow/
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
(ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.9.8 Related Databases

On Astraea2:   web_downloads (table usgs_gmag)
                gmag_ascii_files
                gmag_cdf_files

2.10 NRCan

2.10.1 Site List

FCC: Fort Churchill
YKC: Yellowknife

Note that data from SNKQ and ATHA also comes from NRCan, via University of Alberta.

2.10.2 Contact Names

David Calp david.calp@nrcan.gc.ca
Charles Blais chblais@nrcan.gc.ca (for queries relating to accessing data through INTERMAGNET)
Randy Shaugnhnessy rshaugn@nrcan.gc.ca

2.10.3 Data Download

Data is downloaded automatically each day from the INTERMAGNET ftp site in IAGA2002 ASCII format. The script that downloads the data for FCC and YKC also downloads the Abisko data. See the Administrators Guide for details of the download script.

2.10.4 Data Processing

Data is processed automatically each day to CDF and ASCII. This process includes rotating the data from geographic to local magnetic coordinates. See the Administrators Guide for details of the processing script.

2.10.5 Coordinate System

Data for FCC and YKC is retrieved from INTERMAGNET in XYZ components. Although this is classed as variation data (preliminary data) it seems this really is geographic components of the field - For FCC and YKC at least the sensor alignment of the magnetometers is XYZ.
The data is rotated from XYZ to local magnetic coordinates before being written to CDF. The declination angle chosen is only approximate: calculated using IGRF11 with a date of 2007-02-17. The declination angle used is stored in the CDF.

2.10.6 Reprocessing

No specific reprocessing scripts currently exist. If you need to reprocess the CDFs due to a change in mastercdf for example, simply copy the files that need reprocessing into the INTERMAGNET 'to do' folder and call the standard processing routine (intermagnet_ascii2all).

2.10.7 Related Webpages

NRCan Geomagnetism: http://geomag.nrcan.gc.ca/data-donnee/sd-eng.php
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
        (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.10.8 Related Databases

On Astraea2:   web_downloads (table intermagnet_gmag)
                gmag_ascii_files
                gmag_cdf_files

2.11 SGU

2.11.1 Site List

ABK: Abisko, Sweden

2.11.2 Contact Names

Gerhard Schwarz gerhard.schwarz@sgu.se
Charles Blais chblais@nrcan.gc.ca (for queries relating to accessing data through INTERMAGNET)

2.11.3 Data Download

Data is downloaded automatically each day from the INTERMAGNET ftp site in IAGA2002 ASCII format. The script that downloads the data for ABK also downloads the NRCan data. See the Administrators Guide for details of the download script.

2.11.4 Data Processing

Data is processed automatically each day to CDF and ASCII. This process includes rotating the data from geographic to local magnetic coordinates. See the Administrators Guide for details of the processing script.

2.11.5 Coordinate System

Data for ABK is retrieved from INTERMAGNET in geographic coordinates. The data is rotated from XYZ to local magnetic coordinates before being written to CDF. The declination angle chosen is only approximate: calculated using IGRF11 with a date of 2007-02-17. The declination angle used is stored in the CDF.

2.11.6 Reprocessing

No specific reprocessing scripts currently exist. If you need to reprocess the CDFs due to a change in mastercdf for example, simply copy the files that need reprocessing into the INTERMAGNET 'to do' folder and call the standard processing routine (intermagnet_ascii2all).

2.11.7 Related Webpages

Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
        (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.11.8 Related Databases

On Astraea2:   web_download (table intermagnet_gmag)
                gmag_ascii_files
                gmag_cdf_files

2.12 Leirvogur

2.12.1 Site List

LRV: Leirvogur, Iceland

2.12.2 Contact Names

Gunnlaugur Björnsson gulli@hi.is

2.12.3 Data Download

Data is downloaded automatically each day from the Leirvogur ftp site. Leirvogur provides 10 second resolution preliminary data each day and 1 minute resolution definitive data at the end of the month. The 10 second files are only available until the monthly 1 minute resolution file has been produced. We download both the 10 second daily files and the 1 minute monthly files, but only the 10 second files are processed to CDF.
See the Administrators Guide for more details.

2.12.4 Data Processing

Data is processed to CDF and ASCII automatically each day. The data used to produce the CDFs is the preliminary 10 second resolution data. This data is provided as total horizontal field, declination angle, and vertical component and transformed to THEMIS HDZ components using the declination angle stored in the mastercdf.

2.12.5 Coordinate System

Data from Leirvogur is provided in coordinates

H: total horizontal field magnitude in nT
D: angle between geographic north and the field vector H in 1/10000 radians
Z: vertical filed magnitude in nT
The data is converted to standard THEMIS HDZ (local magnetic coordinates) using the mean declination angle for 2007-2010 (this value is stored in the CDF). The annual means for the years 2007 to 2010 can be found in the Leirvogur yearbook (available online, or through the contact listed above).

2.12.6 Reprocessing

No particular scripts exist for the reprocessing of LRV data.

2.12.7 Related Webpages

Leirvogur: http://www.raunvis.hi.is/~halo/lrv.html
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
        (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.12.8 Related Databases

On Astraea2:   web_downloads (table lrv_gmag)
                gmag_ascii_files
                gmag_cdf_files

2.13 Russian stations (AARI)

2.13.1 92Site List

AMD: Amderma, Russia
DIK: Dikson, Russia
TIK: Tiksi, Russia
PBK: Pevek, Russia
Note that AMD is not a Kyoto AE site, it does provide useful coverage between ABK (Abisko) and DIK though.
Note also that the station CCS (Cape Chelyuskin) is listed as an AE station but has been out of service for five years.

2.13.2 Contact Names

Oleg Troshichev olegtro@aari.nw.ru
Alexander Janzhura alex_j@aari.ru (for details relating to data availability, format etc)

2.13.3 Data Download

1 minute resolution data in IAGA2002 format is downloaded via rsync using the script aari_gmag_mirror.ksh (see the Administrators Guide for more details). Note that the data is variation data, with respect to unknown baseline. An SSH key pair has been set up for the download.

Note that AARI does not have regular 1 second data from the stations.

2.13.4 Data Processing

Data is processed automatically to CDF and ASCII using the script aari_ascii2all.ksh (see the Administrators Guide for more details). As the data is in IAGA2002 format the processing is almost identical to that for USGS and INTERMAGNET.

2.13.5 Coordinate System

AARI has said that their magnetometer sensors are aligned with mean magnetic north, east, and vertical. The H E Z components provided correspond to local magnetic coordinates, but only a variation with respect to an undefined baseline is given. They have said that they intend to install new equipment in the near future, which would allow baselines to be established.

'Model' values are available in the downloaded IAGA2002 files, these could presumably be used to calculate approximate absolute field values.

2.13.6 Reprocessing

None as yet.

2.13.7 Related Webpages

Will be added to the standard tables below.
Status (CDF): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php
          (ASCII): http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.13.8 Related Databases

On Astraea2:   web_downloads - table aari_gmag
                gmag_ascii_files
                gmag_cdf_files

2.14 McMAC Sites

2.14.1 Site list

The McMAC magnetometers are:
AMER – Americus, KS
BENN – Bennington, NE
GLYN – Glyndon, MN
LRES – Linares, Mexico
LYFD – Lyford, TX
PCEL – Purcel, OK
RICH – Richardson, TX
SATX – San Antonio, TX
WRTH – Worthington, MN

2.14.2 Contact Names

Contact Peter Chi pchi@igpp.ucla.edu.

2.14.3 Data Download

Data from the McMAC sites is downloaded everyday. Full details of the download process can be found in the Administrators Guide.

Note:
        The current status for the GBO mirror can be found at:
        http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/gbo_mcmac_gmag_table.php

2.14.4 Data Processing

McMAC sites are processed using the same processing pipeline as EPO and GBO (see sections 2.1 and 2.2). Calibration files appear on the master calibration site http://www-ssc.igpp.ucla.edu/themis_data/calib_files/, but it is unclear whether the UCLA GMAG team takes responsibility for maintaining these calibration files.

2.14.5 Coordinate System

Data from McMAC sites are in local magnetic coordinates (H: magnitude of field in local magnetic north direction, D: magnitude of field in local magnetic east direction, Z: magnitude of field in vertical direction). The GMAG sensors are initially set up aligned magnetic north, magnetic east, vertical down.

2.14.6 Reprocessing

See discussion for EPO or UCLA (Sections 2.1 and 2.2).

2.14.7 GBO related websites

Status page at McMAC: http://spc.igpp.ucla.edu/mcmac/stations.html
RMD remote server: http://spc.igpp.ucla.edu/mcmac/rmd_files
Status: (RMD) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/gbo_mcmac_gmag_table.php
      (CDF)   http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_cdf_table.php.
      (ASCII) http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_ascii_table.php

2.14.8 GBO related databases

On Astraea2:   mcm_gmag_rmd_files
                gmag_ascii_files
                gmag_cdf_files

3. AE indices

AE indices give a measure of magnetic activity. The indices are calculated by looking at data from a collection of observatories. Data from each station is first normalized by subtracting a baseline average (the quiet day variation). The AU index is the largest value over all the observatories at each point in time. Similary, the AL index is the smallest value. If you superimpose plots of the data from all observatories, the AU and AL indices form the upper and lower envelopes. The AE index is the difference between the AL and AU indices. There is also an AO index, which is the mean value (AU+AL)/2. A full description of AE indices can be found at http://wdc.kugi.kyoto-u.ac.jp/aedir/ae2/onAEindex.html. Figure 3.a below illustrates the AU, AL and AE indices (in this case these are actually the pseudo-AE indices created from THEMIS data).

3.1 Kyoto AE sites

ABK: Abisko, Sweden
DIK: Dikson, Russia
CCS: Cape Chelyuskin, Russia
TIK: Tixie, Russia
BRW: Barrow, Alaska
CMO: College, Alaska (THEMIS receives this as CIGO)
YKC: Yellowknife, Canada
FCC: Fort Churchill, Canada (Note that FCC is distinct from FCHU also at Fort Churchill)
SNK: Sanikiluaq, Canada (THEMIS receives this as SNKQ)
NAQ: Narsarsuaq, Greenland

LRV: Leirvogur, Iceland
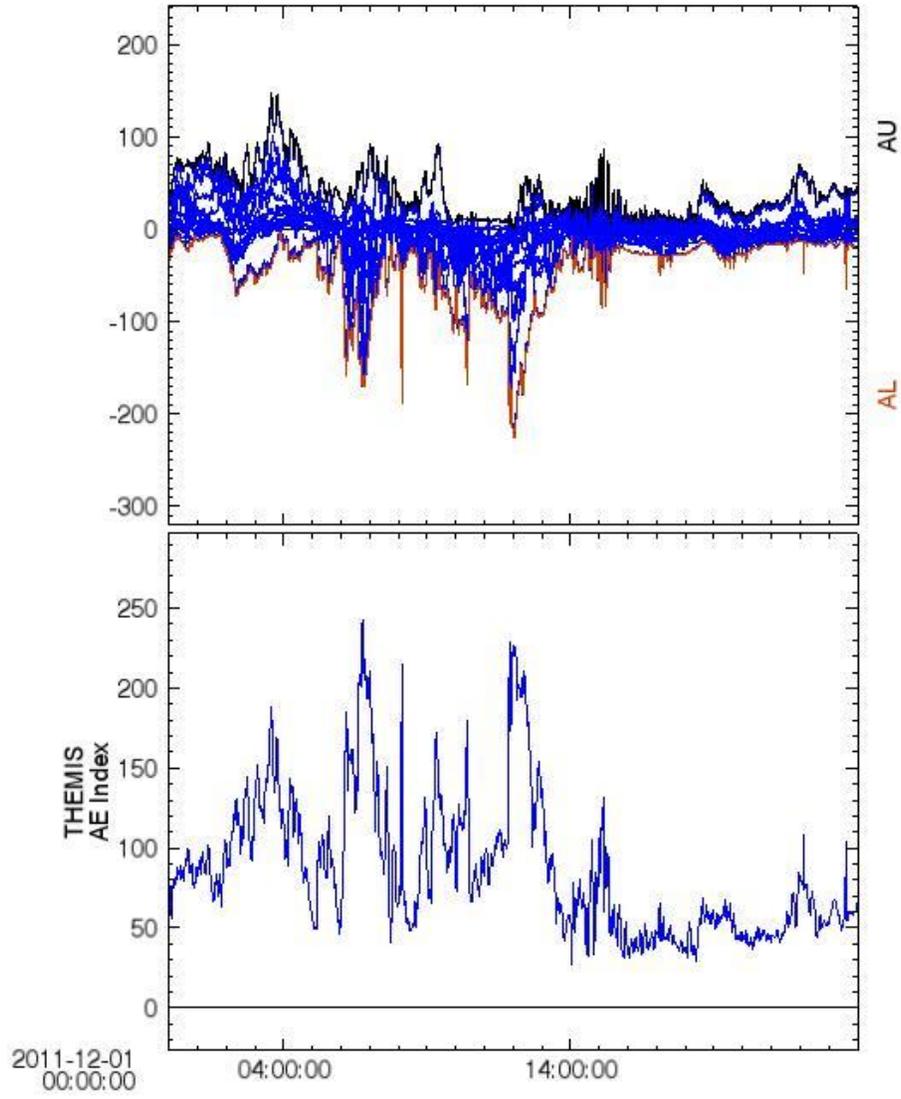PBK: Pebek, Russia

Former/Closed AE sites:
PBK: Poste-de-la-Baleine - Replaced by SNK
CWE: Cape Wellen - Replaced by PBK

Data is now available through TDAS for all current AE sites *except* Cape Chelyuskin.

3.a Pseudo-AE index example. The top plot shows superimposed median-subtracted THEMIS gmag data together with the resulting AL and AU indices. The lower plot shows the AE index.

3.2 THEMIS products

THEMIS pseudo-AE indices are generated daily using an automated script call_make_ae_index.ksh (see the Administrators Guide for details). These CDFs can be loaded using the IDL routine thm_load_pseudoAE.pro. The CDFs generate AE indices from a list of THEMIS sites (ATHA, CHBG, EKAT, FSIM, FSMI, FYKN, GAKO, GBAY, GILL, INUV, KAPU, KIAN, KUUJ, MCGR, PGEO, PINA, RANK, SNAP, SNKQ, TPAS, WHIT, YKNF). A list of sites to exclude for each day (due to problems in the data) is maintained by hand by Hannes - however, it is updated infrequently and the AE index CDFs are not currently reprocessed after updates so sites that should be excluded are not necessarily. Note that THEMIS pseudo-AE indices subtract the median from the gmag data rather than the quiet day variation.
The pseudo-AE index CDFs are used to generate the THEMIS AE index panel in the daily overview/summary plots.

The IDL routine thm_make_ae.pro can be used to generate AE indices with data from any available gmag sites (specify the sites or use the default list).
The IDL routine kyoto_load_ae.pro can be used to load the standard Kyoto AE indices from the WDC site.

It is intended that once data is available from all stations (where possible) used to generate the Kyoto AE indices, a routine will be made available to generate indices from both the THEMIS sites and the official AE sites. This may replace the 'pseudo-AE' indices as they currently are.

4. Stackplots

GMAG stackplots, showing data from multiple magnetometers on one plot, appear on the THEMIS summary plot page http://themis.ssl.berkeley.edu/summary.shtml. There are two groups of plots: High Lat (above 49 degrees) and Low Lat (below 49 degrees). For each of these there is a separate plot for each of the H, D, and Z components of the magnetic field. The plots are generated automatically by the script call_make_stack.ksh (see the Administrators Guide for details). The script ultimately calls the idl routine thm_gmag_stackplot. It appears that any gmag station with a four letter code will be included in the stackplots. The latitude information is retrieved from the CDF metadata.
Stackplot status is available at
http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_stackplots_table.php

5.Station Lists

There are several data files that list the stations in various formats.

THEMIS_GMAG_Station_List.xlsx – This is a large excel spreadsheet that lists all stations. For each station the abbreviated name, network, lat, long, city, mag lat, mag long, UT at midnight, conj lat, conj lon, altitude and elevation. This spreadsheet is available on the THEMIS website. You can get there by navigating through The Mission, Instruments, GMAG menus.
This file is in the svn distribution and can be found under trunk/doc.

GMAG-Station-Code-19700101.txt – This ascii text file contains the same information as the spreadsheet noted above. It is used by various IDL routines in TDAS.
This file can be found in the svn respository under trunk/idl/themis/ground

GBO Site List with Years (date last updated).xls – This file is a shortened version of THEMIS_GMAG_Station_List. It contains only the site name and the year for which data exist. This can be found on the THEMIS web site on the same page noted by the THEMIS_GMAG_Station_List description.

6.Databases

There are a number of database tables of relevance to the GMAG data processing. The following sections provide some details about the databases and their purpose. The php scripts used to write to and read from the database should all be in SVN (trunk/src/php). Any that are not should be added as you encounter them.

6.1GMAG data files

A number of databases store information about the GMAG files downloaded and processed to CDF and ASCII. ...

6.1.1 List of GMAG databases on astraea2

6.1.1.1 Databases that record the mirrored files

epo_ucla_rmd_mirror
Tables: epo_[SITE]_rmdfiles
epo_ucla_rmd_rsync_stats
where   SITE = {BMLS, CCNV, DRBY, FYTS, HOTS, LOYS, PINE, PGEO, PTRS, RMUS, SWNO, UKIA}
Note that PGEO was formally a GBO and that this table was added September 2011.

gbo_uc_gmag_rmd_mirror
Tables: gbo_[SITE]_rmdfiles
gbo_ucla_rmd_rsync_stats
where   SITE = {CHBG, EKAT, GBAY, INUV, KAPU, KIAN, KUUJ, MCGR, NAIN, PGEO, SNAP, TPAS, WHIT, YKNF}
Note that the PGEO table is not being updated – presumably from the date that PGEO switched to EPO.
Also, the NAIN table is empty – NAIN is loaded as MACCS.
In October 2011 the download process switched from rsync to wget. The rsync stats table is no longer updated (it is harder to obtain the equivalent statistics from a wget process).

gbo_ua_canmag_mirror
Tables: gbo_[SITE]_canmagfiles
gbo_ua_canmag_rsync_stats
where   SITE = {ATHA, FSIM, FSMI, GILL, PINA, RANK, SNKQ}

gbo_mcm_rmd_mirror
Tables: mcm_[SITE]_filess
where   SITE = {AMER, BENN, GLYN, LRES, LYFD, PCEL, RICH, SATX, WRTH}

gbo_ualaska_mirror
Tables: gbo_[Site]_magfiles
gbo_ualaska_rsync_stats
where   Site = {Arctic, Bettles, CIGO, Eagle, FtYukon, Gakona, HLMS, Homer, Kaktovik, Kodiak, Poker, Trapper}
Note that the table gbo_Kodiak_magfiles is empty – we don't have any Kodiak files.

gbo_uatha_rmd_mirror
Tables: gbo_[SITE]_rmdfiles
where   SITE = {LARG, LETH, REDR, ROTH, VLDR}

gbo_usgs_rmd_mirror
Tables: gbo_[SITE]_rmdfiles

where   SITE = {bou, brw, bsl, cmo, ded, frd, frn, gua, hon, new, shu, sit, sjg, tuc}

6.1.1.2 Databases that record processed files

gmag_ascii_files - site list below slightly out of date, new sites have been added
    Tables: epo_[SITE]_asciifiles
    where   SITE = {BMLS, CCNV, DRBY, FYTS, HOTS, LOYS, PINE, PGEO, PTRS, RMUS, SWNO, UKIA}

        gbo_[SITE]_asciifiles
    where   SITE = {ARCT, ATHA, BETT, CDRT, CHBG, CIGO, CRVR, EAGL, EKAT, FSIM, FSMI, FYKN,
        GAKO, GBAY, GILL, GJOA, HLMS, HOMR, IGLO, INUV, KAKO, KAPU, KIAN, KUUJ, MCGR,
        NAIN, NRSQ, PANG, PGEO, PINA, POKR, RANK, RBAY, SNAP, TPAS, TRAP, WHIT, YKNF,
        PGEO}

        ath_[SITE]_asciifiles
    where   SITE = {LARG, LETH, REDR, ROTH}

        mcm_[SITE]_asciifiles
    where   SITE = {AMER, BENN, GLYN, LRES, LYFD, PCEL, RICH, SATX, WRTH }

    Note that gbo_PGEO_asciifiles is no longer updated. Recent information is in epo_PGEO_asciifiles.

gmag_cdf_files
    Tables: epo_[SITE]_cdffiles
        gbo_[SITE]_cdffiles
        ath_[SITE]_cdffiles
        mcm_[SITE]_cdffiles

        gbo_aeIndex_cdffiles
    where SITE is as for the gmag_ascii_files database above.

gmag_stackplots
    Table: stackplot_file_list

web_downloads
    Tables: ace
        aari_gmag
        augsburg_maccs_gmag
        greenland_nrsq_gmag
        intermagnet_gmag
        usgs_gmag
        lrv_gmag
    Note: The ace table has not been updated since 2008. The greenland_nrsq_gmag table is no longer updated as
        data from NRSQ is now downloaded as NAQ with the Greenland sites.

6.2 EPO JPG files

The database EPOMAG on Juneau contains information about all the EPO jpg files produced. This database is queried by the
webforms that allow access to the jpg files so it is important that file information is written to the database correctly - if a file
exists but isn't in the database the GEONS website (http://sprg.ssl.berkeley.edu/themis/GEONS/) will not know it exists.

The EPOMAG database contains tables with names

> [SITE]_[TYPE]
> [SITE]_[TYPE]_BACKUP
> [SITE]_OLDDS
> [SITE]_OLDXYZ

where SITE = BMLS, CCNV, DRBY, FYTS, HOTS, KIAN, LOYS, MCGR, PINE, PTRS, RMUS, SWNO, UKIA
TYPE = DS123, DSBDH, DSpectra, TS123, TSBDH, TSpectra (see Section 2.1.9 for general information on the EPO JPGS including what these types mean).

The tables record the jpg file paths and the time of the data and of the entry into the database.

6.3 Data use statistics

The database web_usage on astraea2 contains file web download statistics that may be of relevance to GMAG processing.

The information stored in the web usage database is used, for example, by the php script webstats_carisma_summary.php. The CARISMA team accesses the website
http://themis.ssl.berkeley.edu/data_processing_check/ground_data_mirrors/webstats_carisma_summary.php
to check on the use of the CARISMA data (numbers of users and files downloaded via website and via software). This information is important to CARISMA as they require such information for funding.

## 6.4 Information available through the website

There are a number of php scripts in SVN (trunk/src/php) that provide access to database information from the THEMIS website. For example, for the main magnetometer networks you can access tables showing the date of the latest file mirrored or processed to ASCII or CDF.

7. GMAG Website pages

A considerable amount of information about the GMAGs is available through the THEMIS website. This is the place where users are most likely to seek information - although details may appear in documentation, the website should always be keep up to date. Emmanuel has responsibility for maintaining the website, but can only do this if he is given the necessary information.

7.1 GMAG location maps

The GMAG pages currently contain a number of maps showing the locations of the GMAG sites (divided up by network). These maps were produced using IDL, although the colors were later improved by Emmanuel. The IDL routine used to produce the images was based on one Harald Frey wrote to produce the similar ASI map.
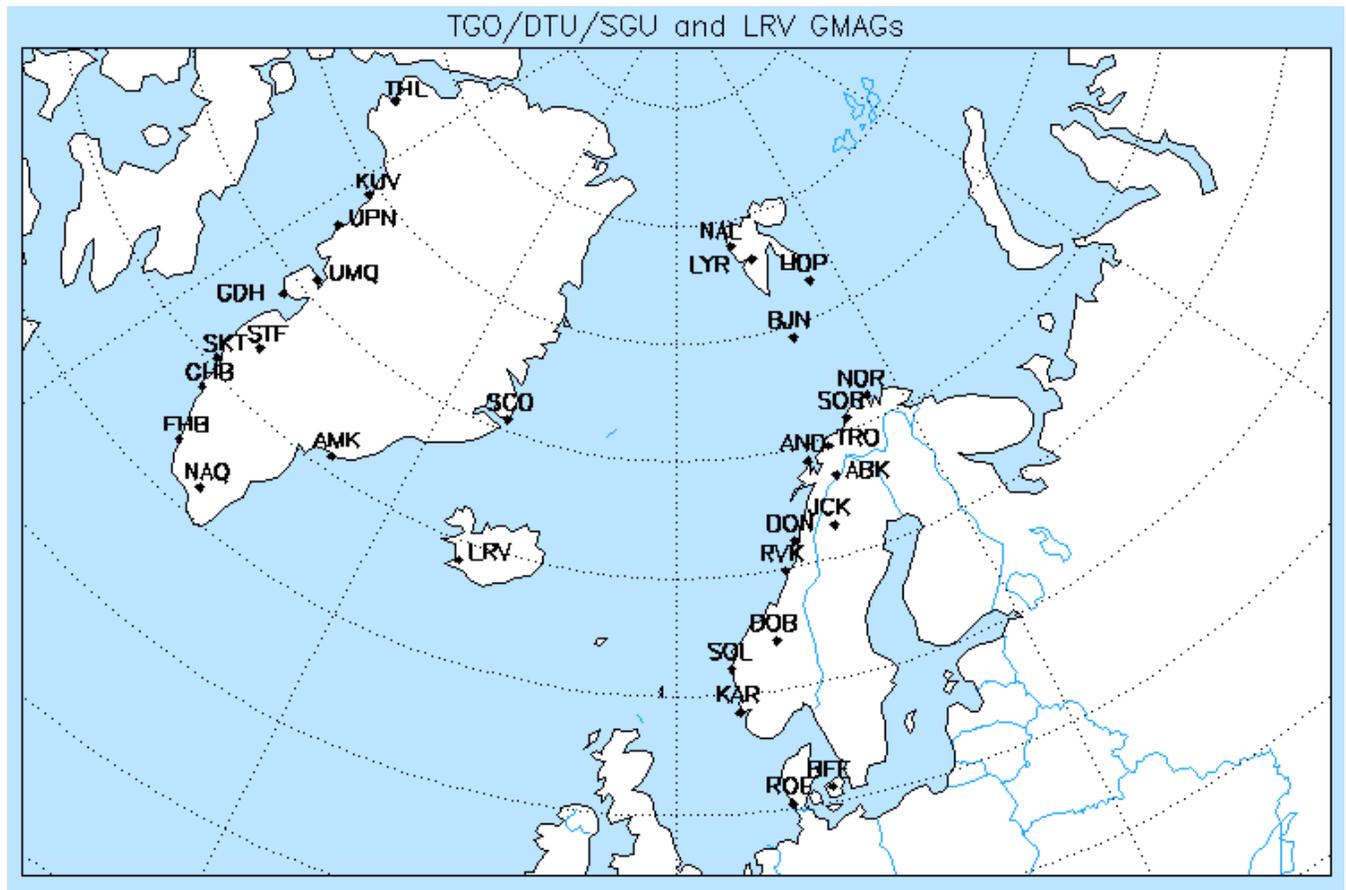
7.a Example of GMAG location map

The routine used is not in SVN as it is necessary to alter settings by hand for each map you want to produce. I use plot_gmag and thm_gmag_stations_fromfile, on my computer. The basic outline of the process is as follows:

1. call thm_gmag_stations to load the longitude and latitude information for the sites. Note that thm_gmag_stations is in SVN, and reads the longitude and latitude from the text file GMAG-Station-Code-19700101.txt (also in SVN). To create a map of a subset of the stations create a new text file with just those stations and edit /trunk/src/tmtools/idl/themis/ground/thm_gmag_stations to load that new textfile.

2. Use the IDL routine map_set to draw a map eg.

```
loadct,1
set_plot,'z'
device,set_resolution=[750,500]
chars=1.0
;Draw borders
map_set,58.5,-108,0.,/stereo,/conti,scale=2.8e7,$
    color=250,title='THEMIS GMAGs'
borders=tvrd()
erase
; Draw country (and state) boundaries
map_set,58.5,-108,0.,/stereo,/conti,scale=2.8e7,$
    /usa,e_continents={COUNTRIES:1},color=100
usaborders=tvrd()
erase
```

```
; Fill
map_set,58.5,-108,0.,/stereo,/conti,scale=2.8e7,$
    color=255,e_continents={FILL:1}
color_map=tvrd()
erase
color_map[where(usaborders eq 100)]=200
color_map[where(color_map eq 0)]=238
color_map[where(borders eq 250)]=1

tv,color_map
```

3. Add points and labels for the stations eg.
```
for i=0.1,0.7,0.1 do$
plots,location[1,*],location[0,*],color=0,psym=4,symsize=i
for i=0,n_elements(label)-1 do xyouts,location[1,i],location[0,i]+0.5,$
      label[i],charsize=chars,charthick=2,color=0,alignment=0.5
```
You may need to tweak the positioning of individual labels to avoid them overlapping.

4. Add longitude/latitude grid to the map
```
map_grid, color=0
```

5. Display image
```
image=tvrd()
device,/close
set_plot,'win'
window,5,xsize=750,ysize=500
tv,image
```

6. Save to file if you like
```
write_gif, 'filename.gif',image
```

7.2 Future enhancements

Frequently Asked Questions - A FAQ page is planned for the GMAGS.

8. Maintaining the existing GMAG processes

1. **Monitor downloads and processing to CDF and ASCII**
   Many, but not all, of the automated scripts will issue email warning messages if an error has occurred in the processing. Emails from thmsoc should be monitored daily to catch any potential problems before they become an issue for users of the data.
   Note that some scripts issue warning messages regularly that do not indicate a serious problem. Some examples:
   a) UAtha RSYNC problems occur fairly frequently (particularly error 23). If the data we have is up to date to within a day or two it is unlikely that this is a problem. However, a number of the other rsync processes don't send emails when problems occur. Check to see whether data is up to date for other sites downloaded via rsync (eg Alaska, EPO, Carisma).
   b) EPO-GMAG JPG Processing warnings are issued most days. These are usually just due to data not being available for some particular site. Check the files at http://sprg.ssl.berkeley.edu/themis/GEONS/SCHOOLS/ to see whether there are any files missing that should be there. Check http://themis.ssl.berkeley.edu/data_processing_check/ground_data_processing/gmag_epojpg_table.php to see the latest 'appended' files for each site.
   c) ASI or GMAG script running long warnings: A number of processes regularly issue these warnings. If the time is available perhaps the scripts could be checked for ways to speed them up or removed entirely if they are no longer necessary.

The status pages on the website also offer a useful way to check for potential processing issues. The tables at http://themis.ssl.berkeley.edu/status.shtml check the databases on Astraea for the latest files. The tables for the individual networks (eg GBO UCLA Latest) will tell you the date of the latest data downloaded. The GMAG CDF Files Latest table will tell you the date of the latest data processed to CDF. Note that not all networks have their own table for downloaded data at this point. For sites that do not have their own table for downloaded files, check the GMAG CDF table and manually check the folder the data is mirrored to if there is no recent data processed to CDF.

Note that files are normally up to date to within one or two days. Files from the Greenland/Denmark/Norway sites can take a day or two longer. It is normal for there to be some sites where data is not available - if there is a problem with a magnetometer fixing it can often take many months. Also, some magnetometers on the list may no longer be operating. If there are any particular questions from users about data availability or whether a particular site is down, contact the relevant people for that network or check their websites. For GBO sites it may be useful to check the Calgary status page: http://themis-rt.phys.ucalgary.ca:8080/dataflow/monitor, for EPO sites take a look at what data is available at http://ds9.ssl.berkeley.edu/themis/classroom_geons_data.html#nation.

On other thing is to check the summary plots on the website http://themis.ssl.berkeley.edu/summary.shtml. Ground Mag High Lat and Low Lat stackplots are shown.

NOTE:
1. if a process has stopped running for no apparent reason, check whether it uses a 'lock file' some processes still use this and if the process has been disrupted the lockfile may be in place stopping the process from running again. Lockfiles should be phased out and replaced with a better method of checking process status before starting a job.
2. We had a problem with the range_epoch values in thg_l2_mag_redr_20120602_v01.cdf, reported by Tami (final range_epoch in 2044 rather than 2012). It is uncertain what caused this, but it may have been a glitch at the magnetometer rather than a bug in our code. The range_epoch was manually corrected using CDFedit. Will need to watch this to ensure it doesn't happen again.

2. **Monitor EPO processing to JPG and GEONS website**
   As mentioned above the automated warnings from EPO-GMAG JPG Processing are issued almost constantly so are not a good indication of problems in the process. Every month (or when notified of a problem) the site http://sprg.ssl.berkeley.edu/themis/GEONS/SCHOOLS/ should be checked to ensure the files are up to date. Also, at the beginning of a new year ensure that the new year is added to the list of dates and that files are appearing correctly.

   NOTE: **To do, beginning of 2013**: The new process for creating the list of jpg files looks only at the current year. The website http://themis.ssl.berkeley.edu/data_inventory/ground_data/mag/epo_jpg_lists/ has symbolic links to that location. At the beginning of 2013 new symbolic links need to be added so that the 2013 file lists appear on the website (the whole directories shouldn't be linked because there are a lot of unrelated file lists).

3. **Update web/server addresses**
   Changes to the web/server addresses of data providers are not uncommon. Provided it does not involve a change in the download process (i.e. a change from wget to rsync or vice versa), the only change that should be necessary is an update to the address given in the configuration files. Check the relevant section in the Administrators Guide for the given data provider.

4. **Check for changes to the UCLA gmag calibration files (every six months, or when notified of an issue)**

All gmag sites that we receive in RMD format (EPO, GBO, Athabasca sites) are processed to CDF using calibration files. The EPO calibration files are maintained by the UCLA gmag team. The master versions of the files are at http://www-ssc.igpp.ucla.edu/themis_data/calib_files/. It has been requested that the UCLA gmag team inform the TDAS team if any changes are made to calibration files, but in case this is forgotten, the files in the UCLA_Cal directory noted above should be checked against the master copies regularly and updated if there are any changes. See also the readme file in the UCLA_Cal directory. If there are any calibration file changes reprocessing will be necessary. If there are concerns about the GBO or Athabasca calibration files it is probably best to contact the person responsible for those sites.

5. **Ensure the website/station list is up to date**
   If there are any changes to station availability etc. the website and GMAG station excel spreadsheet should be updated.
   The GMAG station spreadsheet should be updated in SVN and sent to Emmanuel to update the version on the website. Any website changes necessary should also be sent to Emmanuel.

6. **Ensure the Administrators Guide is up to date**
   If any existing scripts are changed, or any new scripts are added, the Administrators Guide should be updated in SVN. Any other relevant information, such as a change in the contact name for a GMAG network, should also be included in the Administrators Guide.

9. Adding new magnetometers and networks

Occasionally users request that data from other magnetometer networks be included in TDAS. There are many steps involved in adding new sites, beginning with obtaining permission to mirror the data, and involving writing new scripts and idl routines, updating documentation, modifying the website and database tables. The exact process is unlikely to be the same for any two magnetometer networks, but most of the work can be done by looking at existing processes. Full details of all the existing scripts and processes can be found in the THEMIS-ARTEMIS Administrators' Guide. The informal document 'Adding a new magnetometer site to TDAS' (included here as Appendix A) contains a detailed list of the steps involved in adding a new site, and can provide a useful checklist to avoid missing anything important.

10. Coordinate systems

The coordinate systems that magnetometer data is provided in can cause much confusion as the same symbols are often used to mean different things. The most common coordinate systems seem to be local magnetic coordinates, and geographic coordinates. The following contains general information about magnetometer coordinate systems. For specific information about the coordinate system of data from a particular network see the relevant section in Section 2 above.

THEMIS gmag data is in local magnetic coordinates. The THEMIS gmags were set up with sensors aligned with one axis along the local horizontal field (the 'mean' direction to the magnetic north pole at that site, i.e. local magnetic north) and the others perpendicular (pointing to 'local magnetic east' and vertically down). The components are referred to as H, D, Z, and all are measured in nanoTeslas. Infrequently you may see the same components referred to as XYZ (such as on the GEONS website), however XYZ is usually reserved for data in geographic coordinates.
   H_{THEMIS} - field magnitude in local magnetic north direction in nT
   D_{THEMIS} - field magnitude in local magnetic east direction in nT
   Z_{THEMIS} - field magnitude in vertical down direction in nT
In the horizontal plane, the total magnetic field magnitude is $H_{total}^2 = H_{THEMIS}^2 + D_{THEMIS}^2$. Referring to Figure 10.b below, H_{THEMIS} and D_{THEMIS} correspond to h and e.

Some (non-THEMIS) magnetometers are aligned such that their sensors point to geographic north, east, and vertically down. The data provided by such magnetometers is usually in XYZ geographic coordinates.

In general, even HDZ can have a slightly different meaning to that used by THEMIS, and the meaning may vary depending on whether the data is provisional or definitive. Always clarify the coordinate system for any given site with the provider. Note that the data may be measured in one set of components but provided to the user in a different set.

The 'standard' definitions (*not* THEMIS definitions) of magnetic field components, used for example by INTERMAGNET are:

> H - total horizontal magnetic field magnitude in nT
>
> D - declination angle in arc minutes (this is the angle between *geographic* north and the horizontal field direction)
>
> Z - vertical field magnitude in nT
>
> X - magnitude of field in geographic north direction in nT
>
> Y - magnitude of field in geographic east direction in nT

Other components you may find reported are

> E - the declination D converted to nT (variation data, see discussion below)
>
> I - the inclination angle (angle of magnetic field above or below horizontal plane)
>
> V - the inclination angle converted to nT
>
> F - total field intensity in nT
>
> G - Apparently "G represents the difference between a measured 'Scalar' F and a computed 'vector' F: G = F(vector) - F(scalar)" (INTERMAGNET Technical Manual, Appendix E-3).

Geog N

X

H

D

Geog E

I

Y

F

Z

Vertical down
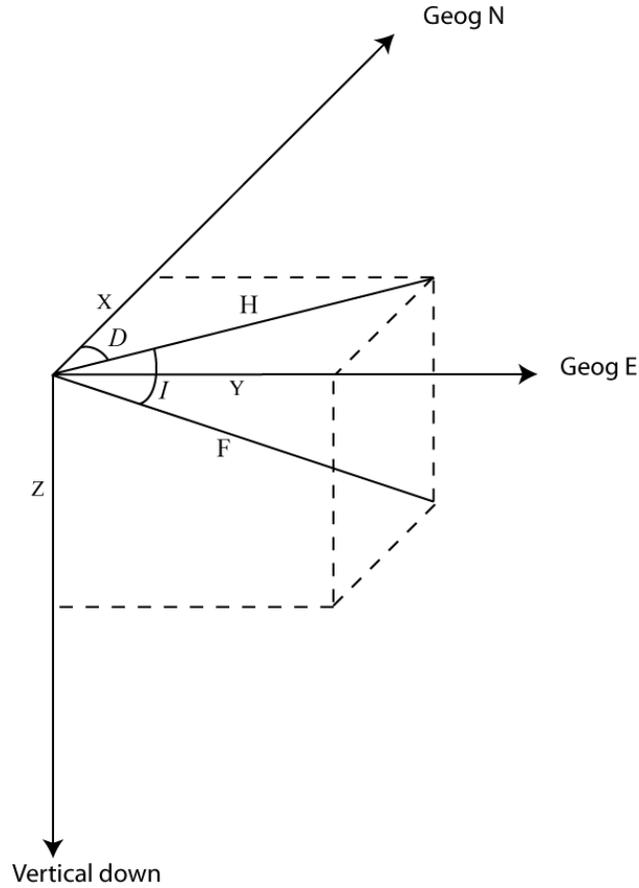
10.a Standard definitions of magnetic field components

The basic components of the magnetic field are illustrated in Figure 10.a below.

Receiving a data file with components labeled HDZ is not necessarily an indication that the components need to be rotated or decomposed to match THEMIS definitions - neither does it mean your data is already in the right components. The data from the magnetometer at Barrow (US Geological Survey), provides a good example. The following explanation was given by Duff Stewart at the US Geological Survey. Although the following relates in particular to the data from BRW it may also be applicable in other cases.

Figure 10.b illustrates the field as it might be measured in the horizontal plane, with sensors aligned with local magnetic north and local magnetic east.
Current Barrow data provided to us is *raw* HDZF data in IAGA2002 format. The Barrow magnetometer was set up with sensors aligned magnetic north, east, vertical, and the data provided is the raw output from those sensors, except that the magnitude of the field in magnetic east direction has been converted to a declination angle. The 'H' component in the data files is actually the lowercase h in the figure below: this is the field component in the mean magnetic north direction, rather than the true horizontal field magnitude (H_{total} in the diagram below). The 'D' component provided is calculated from the measured field magnitude in the magnetic east direction ('e' in the diagram below), and is more accurately the variation in the declination (labeled δ in the diagram below), in arc minutes. The value of δ is simply $\delta = \arctan(e/h) \approx 3437.7468 \ e/h$, where e and h are measured in nT and δ is measured in arc minutes (this is simply a small angle approximation). When converting Barrow data to CDF format we simply reverse this equation and record h,e,Z values, matching H_{THEMIS}, D_{THEMIS},

Z_{THEMIS}. The 'true' declination of the magnetic field at any time is simply the baseline declination (D_{base} in the diagram below) + the declination variation δ. As mentioned above, the Barrow data is raw, or 'variation' data. Data provided in HDZF components in a 'definitive' IAGA2002 file would likely be H_{total} = sqrt(h^2+e^2), D_{total} = $D_{base} + \delta$, Z.
NB: The 'baseline declination' reported in some IAGA2002 files is not D_{base} below, instead it is an offset allowing observatories to report D values greater than 166 degrees (see the INTERMAGNET manual http://intermagnet.org/publications/im_manual.pdf for details).
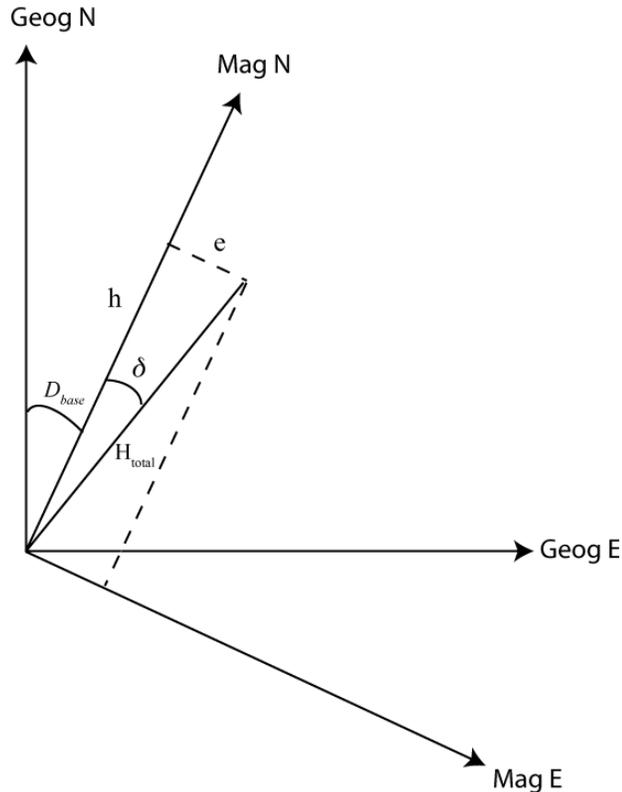
10.b Possible measured components in horizontal plane

10.1   Conversion from geographic to local geomagnetic components

The conversion from geographic to local geomagnetic components is a simple rotation:

$H_{THEMIS} = X_{geog} \cos(D) + Y_{geog} \sin(D)$

$D_{THEMIS} = Y_{geog} \cos(D) - X_{geog} \sin(D)$,

where D is the declination angle at the site. An approximate declination angle can be obtained using IGRF11 and choosing an appropriate date. For sites that are currently transformed we have chosen the THEMIS launch date 2007-02-17. See the declination angle calculator at http://www.ngdc.noaa.gov/geomag-web/#igrfwmm. As the declination angle at a site varies over time, this is only an approximation. A more complicated approach might involve rotating the data by an angle that minimizes the magnetic east component over some time period (such an approach is employed by Supermag (http://supermag.uib.no/info/coordinates.html) to make the data they provide consistent).

11.Cronjobs

Cronjobs run on astraea2, gaia2, and auxo. See the Administrators Guide for a complete list and explanation of all the magnetometer cronjobs.

Some helpful crontab commands:

```
Crontab –e              (to edit)
:set fileformat=unix    (to make sure the file is in the correct unix format
:w  gaia2           (to save the crontab for release to the respository
:wq                 (to write (save) changes and quit
:q                  (to quit)
i                   (to insert text)
esc                 (to exit insert mode)
```

Appendix A

Adding a new magnetometer site to TDAS:

Below is a list of steps that may be helpful if a new magnetometer site or sites from an external network is to be added to TDAS. This list is intended as a guide - it may not be exhaustive, and not all steps necessarily apply in all circumstances. Details of the existing processes can be found in the Administrators' Guide.

Steps	Notes
1. Obtain permission from the relevant institute to mirror the data.	
2. Write a script to download the data from the provider to the THEMIS data directory (existing scripts use rsync or wget). Test script and add to SVN.	
3. Create a mastercdf for the site(s). Add to SVN.	(Edit an existing mastercdf or edit a skeleton table and use this to generate a new mastercdf NB: 1. It is mostly easier to just edit an existing mastercdf using skteditor (http://sscweb.gsfc.nasa.gov/skteditor/) 2. If you prefer to edit the skeleton table use the CDF tools to generate the skeleton table and convert to cdf afterwards. Note that for some reason fillval=1.#QNAN gets read to CDF as 1.0. You will need to select reset fill value to NAN in SKTEditor for any affected variables. 3. Also note that if you need to edit the axis label information in the master cdf, do this under the variable thg_mag_SITE_labl values rather than thg_mag_SITE Axis information, if you are editing an existing file the label should have 21 characters (add trailing spaces if necessary). If it truncates your label check the skt file to see whether it has been set to a shorter number of elements) 4. Mastercdfs include the station longitude, latitude, elevation, and recently declination if needed. Edit these in the Attributes Editor in Skteditor (they are attributes of the main variable rather than global attributes).
4. Write an IDL routine to generate the CDFs. Add to SVN.	If data is provided in geographic XYZ components, check if it was originally

Steps	Notes
Take a look at existing routines. Note that if the data is provided in IAGA2002 format existing helper functions may be useful to you. Take careful note of the coordinate system and units the data has been provided in, convert to local geomagnetic coordinates HDZ if possible.	measured as such or has been rotated. If original data was local geomagnetic components try to obtain this instead. If sensor orientation is geographic XYZ calculate the declination angle for the site and rotate the data before writing to CDF. **See** further information about coordinate systems in the unofficial magnetometer processing notes document.
5. Write a script to convert data from provided format into CDF (and ascii txt file) (ie call the IDL routine above). Test script and add to SVN.	Note: make sure to change the properties of the script to make it executable. If using TortoiseSVN on windows for example, right-click and choose TortoiseSVN->Properties and add a property.
a. Add tables to the gmag_ascii_files and gmag_cdf_files databases to keep record of the ascii and cdf files produced. These records are used to create the website tables mentioned in 8 below.	It is simplest to label new tables gbo_SITE_cdffiles and gbo_SITE_asciifiles. As it is at the moment EPO have epo prefix and Athabasca have ath prefix, but adding more prefixes makes the script that references the database more and more complicated.
b. Have conversion script call the php scripts gmag_cdf.php and gmag_ascii.php to write info on CDF and ASCII files produced to database.	
6. Add the scripts to crontabs (download script on gaia2, CDF script on astraea, unless there are reasons for them to operate on other machines in particular - eg scripts running on auxo do so for particular reasons).	
Update svn versions of crontabs.	
7. Document the scripts in the Administrators' Guide.	Keep this documentation up to date if any changes are made.
8. Website tables:	
a. Add to the gmag_ascii_table and gmag_cdf_table (retrieves from databases).	
b. *OBSOLETE: This summary list has been replaced with an excel spreadsheet on the web page. Add to the raw data list (modify necessary scripts to generate list). - would need a new script list_gmag_INTERMAGNET etc, then include on the lc_site_list.txt*	*NB: The ascii raw and cdf lists on the website are unwieldy. Unless specifically requested new sites are **not** being added to these lists. It is easier for users to look at the gmag_cdf_table and the raw tables for each network, or actually look for a file if they want to know about availability on a specific date.*
c. *OBSOLETE: Same as above. Add to the gmag cdf list (modify necessary scripts to generate list).*	
9.	
a. Load routines: add site(s) to valid sites listed in thm_load_gmag, add a new keyword to load data from new network if relevant (eg if particularly requested), write new load routine (cf thm_load_greenland_gmag) if relevant (needed for greenland as path to data is slightly different).	

Steps	Notes
b. Add to the station list GMAG-Station-Code-19700101.txt c. GBO Site List with Years (xcel) d. THEMIS_GMAG_Station_List(_May 2014)	This list was added by Harald Frey, for use with thm_gmag_stations.pro. It allows the user to load in the coordinates for the gmag stations. Fill in the excel spreadsheet (Step 13 d) first so that you have all the numbers to enter. To get conjugated latitude and longitude, mlt, etc see bottom of xcel spreadsheet for website name that does the calculations.
10. GUI Load: Make sure stations appear in the gmag load list. Make any other changes that are necessary to ensure data loads correctly.	(NOTHING should be necessary. Should be added automatically to list)
11. Ensure data is plotted with appropriate labels, depending on the coordinate system of the data (if XYZ add to list in thm_load_gmag_post)	All data should be in local magnetic coordinates HDZ. Currently 'Greenland' data is labeled dH,dD,dZ because data has arbitrary baseline (not calibrated). This is changing as of May 2012 - calibrated Greenland data will be downloaded in geographic coordinates and rotated to HDZ.
12. Modify relevant testsuites to test data load, labels etc.	Particularly important if the data is loaded from a different location or is somehow unlike standard themis data.
13. Website updates:	
a. Add acknowledgement information to the website: http://themis.ssl.berkeley.edu/roadrules.shtml	
b. Update the gmag instruments page http://themis.ssl.berkeley.edu/instrument_gmags.shtml to reflect total number of magnetometers available. c. You may also want to update the maps on this page that show the location of the gmags.	The maps are generated with the help of the idl routine thm_gmag_stations. There is an example at the end of thm_crib_gmag. To plot only some stations on each map create a text file with the data for those stations and set longitude, latitude, and scale of maps appropriately. (NB: there is also my personal routine plot_gmag which was used to generate the existing maps. This routine is not in svn).
d. Update the gmag data description page http://themis.ssl.berkeley.edu/gmag_desc.shtml with total number of sites and full list of names of sites.	
e. Update excel list of sites (on web and svn) with full details of new site(s) including coordinates etc .	
f. Stations txt file?	
14. Download files back to 2007 where possible.	
15. Process files back to 2007 where possible	
16. Include in the generation of AE indices?	Unless otherwise requested, new sites are not added to the list used to generate THEMIS 'pseudo AE indices'. A new AE index is intended that will include both the stations from the pseudo AE index and the stations used to generate the standard Kyoto WDC AE index. If the station belongs to the list

Steps	Notes
	used to generate Kyoto AE Index then check whether you need to add it to the list.