

VGMO.NET : operating manual

Space Physics Research Laboratory
University of Michigan, Ann Arbor
MI 48105 USA

Valeriy G. Petrov
vpetrov@{engin.umich.edu, izmiran.rssi.ru}

In spite of all effort to introduce universal geomagnetic data format, there is still in use a lot of different format using for geomagnetic data. To combine data from different sources, some intermediate data format must be used. This program uses Flat File Format, introduced by A.Smith, C.R. Clauer [1]. In this format any data set consists of two files: header file, which is ASCII description of data set and binary data file, which is data itself. Such approach allows to use the advantage of ASCII presentations - readable and editable data description as well as binary presentation - compact data storage and fast random access.

Example of a FlatDBMS header file:

name of header and data files: ace2001
date files created: 24-SEP-02
record length of data file, in bytes: 24
number of columns: 5
number of rows: 131400
flag for missing data: -0.10E+33

#	name	units	source	type	loc
1	Time	Days	Modify Julian Day=JD-2400000.5	T	1
2	Xgse	km	satellite position	R	9
3	BxGSE	nT	IMF Bx	R	25
4	Np	1/cc	Plasma Proton density	R	45
5	Vx	km/s	Vx Velocity	R	61

NOTES:

Start time = 01-JAN-01 00:02:00.000
End time = 31-DEC-01 23:58:00.000

CONVERTED FROM ASCII DATA FILE C:\DOWNLOAD\ACE_M2001.DAT
END

Text between NOTES and END line is free format; user can write here any data description. Data file is binary fixed length record file. First data item in the record is real*8 time in days, followed by real*4 data.

Data base directory structure:

DBRoot\YYYY\yearly_files
DBRoot\YYYY\MM\monthly_files
DBRoot\YYYY\MM\MAG\CODYYYMMDD_60pa -groundbase magnetometer data files

Open

Flat File manager allows to open up to three data bases simultaneously. Data base is a separate flat file with up to 150 columns each or ground base magnetometer data set for definite interval, selected by station codes or station position.

"Open" option allows to select separate file. To select magnetometers data set use "Create" option.

When data set is selected, data set info window is created. The window shows a list of data columns, for geomagnetic data corrected geomagnetic latitude and longitude also are shown. There user can select shorter time interval and data subset to work with. To select or unselect column just double click by mouse on requested columns or enter search mask (for example ???X???? to select X-comp.) and click "Use mask" button.

There are five "Sort" switches in the upper part of the window. The switches determine columns ordering during data output. The first (from left) tells do not sort data, the second- sort by selection order (first selected goes first), the third - sort by names, forth and fifth (apply only for geomagnetic data) - sort by latitude or longitude.

There are ">" and "<" buttons, which allow to shift selected interval (if it is shorter, then total file time coverage) back and forth.

Create magnetometer data set

Flat File manager allows to use up to three data bases simultaneously. Data base is a separate flat file with up to 200 columns each or ground base magnetometer data set for definite time interval, selected by station codes or station position.

Ground base magnetometer data are stored in the monthly Flat File, each station separately. If you need just one station, it can be opened through "Open" menu item, but if you need a few station, use "Create magnetometer data set" item. To create data set, desired interval "From" and "To" must be selected. Current version of the program allows selecting data only within the monthly interval, if you need interval crossing month border, you can select data from the first month, save selected data set in the file using "Extract" subitem of the "Action" item, than do the same for the second month, open both files using "Open" and joint them through "Action"->"Merge rows" menu item.

Components checkboxes allow selecting just desired component. Search worldwide checkbox force program to look for data not only in the local data base, but also at the geomagnetic data ftp and http cites (WDC, Intermagnet and some others). If some data for requested interval will be founded there, program will check, if these data already download to local database and, if no, will download, convert to Flat File and add to database.

Stations can be selected by two ways. The first way - by 3 letters station codes, which must be entered at the middle panel and clicking "Select by code" button. Local user can enter instead of station codes the name of the file, which store station codes. The name must be longer then three characters.

The second way - enter logical formula in the lower panel and click "Select by position" button

Close

Close the last open data set. You can not close data set with lower number if there is open data set with higher number.

Plot

Plot selected data on the screen or create Postscript file. Selected data from all open data sets will be plotted together, each data set on the separate panel. Plot option can be adjusted through "Option"->"Plot option" menu item.

Extract

Extract (write to Flat or ASCII file) selected data for selected interval from window #1 (and #2, if selected). If data sampling for data set #1 and #2 are different, the data of data set #2 will be recalculated to times of data set #1. The option can be used to extract data subset to separate file or to combine two data set for the same time interval to one file.

Setting for extract data can be adjusted through "Option"->"Extract option" menu item.

Download data

Download data from server to remote user. It is the same as Extract, but after creating, output file will be compressed by pkzip and ftp session will be initiated on the client computer to download zip file. User will be prompted where to save downloaded file. So, to download data, user must select or create data set, select desired or all columns and click "Action"->"Download data" Format of the downloaded file is determined through "Option"->"Extract options". Default format is Flat File, if you need ASCII, change extract options.

Merge rows

Merge two data set (#1 and #2) for different time intervals to one file. User must select columns which he want to merge in the #1 dataset, the same columns will be added from the #2 data set. If time intervals of two data set are overlapping, data from the first in time data set will be used. In case of absolutely identical (the same columns in the same order) files, more than 2 files can be merged manually:

- 1) copy /b f1.dat+f2.dat[+f3.dat..] fmerged.dat
- 2) copy f1.hed fmerged.hed
- 3) edit number of rows field in fmerged.hed (must be sum of the number of rows for all files) and end time field (take it from the last file).

Filter

Apply low, high or band pass filter to selected columns of the #1 data set Filtering option can be adjusted through "Option"->"Filter option". It is recommended to run filter the first time through "Option"->"Filter option".

Calculate

Create new columns on the base of data set #1 columns using arbitrary formulas. User must enter formulas for calculation in the form:

$$\text{NewCol}=\text{Function}(\text{Col1}, \text{Col2},\dots)$$

where,

Col1,Col2,.. - names of the columns in the file

NewCol - the name of new calculated column

Function - mathematical expression including existing columns, functions and mathematical signs: +,-,*,/,^ (power),cos,sin,tan,acos,asin,atan, (in radians),cosd,sind,tand,acsd,asind,atand (in degrees),log,log10,exp,sqrt, abs,aint (integer part),anint (round to integer). Logical expressions >,<,&(and), (or) also can be used, they will have value 0 if false, 1 if true.

Examples:

Suppose we have file with columns V (solar wind speed in km/sec), Np (proton density (1/cc), Bx,By,Bz (magnetic field in nT). We can calculate dynamic pressure Pd:

$$\text{Pd}=0.00000168*\text{Np}*V*V$$

Electric field, which is V*Bz when Bz<0 and 0 when Bz>0:

$$\text{E}=0.001*V*Bz*(Bz<0)$$

Total magnetic field

$$\text{Bt}=\text{sqrt}(\text{Bx}^2+\text{By}^2+\text{Bz}^2)$$

Results of calculation will be writed to a new file, if there are selected columns in data set #1, they also will be copied to the output file.

Warnings:

columns names are case sensitive (Bx and BX are different). There may be problem when column name coincide with function name or some column name contain another column name inside (for example there are columns Bx and B in the file). Better to rename such columns before calculation (just edit header file). Program does not know in which units new values are measured and written (the unit field of the header file). Use any text editor to insert correct units into resulting header file.

Plot options

Output to - make plot on Display or create Postscript file (landscape or portrait). If you select PS, there is option to plot color (default) or B/W (check Ps mono). Plot type for each data set - each trace is plotted in his own box (default) or all traces are plotted in one box (stack plots, set check box). If stack plot is selected, instead of Y scale axes scale arrows are drawn.

CharSize - character scale factor for labels and text.

Upper and lower titles - enter any text here, will be writen on plot

Y -scale options:

Common - all plots have the same scale.

Independed -each plot is scaled independently.

Fixed -use the same fixed scale for all plots.

Mark LMM -used only for ground based geomagnetic data, if checked, local magnetic midnight is marked on plot.

Plotting can be started by Plot button or by Action->Plot menu item

Extract options

Output to Flat file - write selected data to flat file, two files ??????.dat and ??????.hed will be created.

ASCII file - write to ASCII File

IAGA 2002 file -also ASCII file, but fixed format

For ASCII file time and data format can be selected, DOY -day of the year, 1-366

Data Format - FORTRAN format descriptor, used for data columns. For other formats do not implemented.

If Apply averaging is checked, data will be averaged for selected time (in seconds)

Filter options

Long and short cutoff period - variations with period more then long and less then short will be suppressed. If long cutoff period is 999 - low pass filter (smooth) is used. If short cutoff period is 0 high pass filter (only high frequency variation retain) is used. It has no sence to set short cutoff period less then double period of data sampling (2 min for 1 min data).

Filter length - if set to 1.0, filter window is selected as double cutoff period, larger values give more rectangle filter shape, but takes more time to do filtering. 1.0 is reasonable choice. Window parameter Alfa - larger values give more rectangle filter shape, but increase alising. 0.5-0.54 is common choice.