NAME

mbm_grid – Create an executable shellscript which will generate a grid (bathymetry or topography) or mosaic (amplitude or sidescan) of swath sonar swath data.

VERSION

Version 5.0

SYNOPSIS

mbm_grid **–I***file* **–F***format* **–O***root* **–R***west/east/south/north* [**–A***datatype* **–B***border* **–C***clip* **–D***xdim/ydim* **–E***dx/dy/units* {**–f***priority_range* | **–f***mode*} **–G***gridkind* **–H** **–J***projection* **–K***background* **–L***lonflip* **–M** **–N** **–P***pings* **–S***speed* **–T***tension* **–U***{azimuth/factor* | *time}* **–V** **–W***scale* **–X***extend* **–Y***priority_file* **–Z***bathdef*]

DESCRIPTION

mbm_grid is a macro to generate a shellscript of MB-System commands which, when executed, will generate a grid or mosaic of the specified swath sonar data. The grid or mosaic may be of bathymetry (positive down, **–A***1*), topography (positive up, **–A***2*), amplitude (**–A***3*), or sidescan data (**–A***4*). The primary purpose of this macro is to allow the simple, semi-automated production of grids and mosaics with a few command line arguments. The macro can determine the area covered by the swath data and set the grid bounds and dimensions accordingly. For users seeking more control over the grid and mosaic parameters, almost the full suite of mbgrid and mbmosaic commands are supported. See the manual pages for **mbgrid** and **mbmosaic** for complete explanations of how these programs work.

By default, **mbgrid** and **mbmosaic** generate grids in Geographic coordinates, meaning that position is defined in longitude and latitude using the WGS84 horizontal datum. The **–J** option can be used to specify an alternate, projected coordinate system (PCS). When a PCS is used, position will be defined in eastings and northings (meters) relative to the origin of the particular PCS. Universal Transverse Mercator is the most commonly used PCS in the oceanographic community, but **mbgrid** supports a large number of other PCS as well. A list of the supported PCS's is provided at the end of the **mbgrid** and **mbmosaic** manual pages.

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OPTIONS

–A *datatype*
Sets the type of data to be read and gridded or mosaiced. If *datatype* = 1, bathymetry data will be gridded (positive downwards). If *datatype* = 2, bathymetry data will be gridded as topography (positive upwards). If *datatype* = 3, amplitude data will be mosaiced. If *datatype* = 4, sidescan data will be mosaiced. Default: *datatype* = 1 (bathymetry).

–B *border*
Sets the border of a smoothly interpolated grid to the value *border* wherever no data exist, provided *border* > 0.0. Default: *border* = 0.0

–C *clip*
Sets the clipping dimension for the spline interpolation. If *clip*=0 no spline interpolation will be done. If *clip*>0

–K *background*
Enables filling in all undefined grid cells with bathymetry or topography from a global or regional database accessed with the **GMT** program **grdraster**. The *background* specifies which locally

defined database is accessed with **grdraster**.
then the spline interpolation will fill data gaps to a distance of *clip* times the grid spacing. Default: *clip* = 0.

–D *xdim/ydim*
Sets the dimensions of the output grid. This option is superceded if the user specifies the grid spacing with the **–E** option. Default: *xdim* = *ydim* = 101.

–E *dx/dy/units*
Sets the grid cell spacing to *dx* in longitude and *dy* in latitude. If *units* is not specified, the *dx* and *dy* values are assumed to be in meters. Valid values for *units* include "km", "meters", and "degrees". By default, the grid spacing is calculated from the grid bounds and the grid dimensions. When the user uses the **–E** option to set the grid spacing, the grid dimensions are calculated using the grid bounds and grid cell spacings. However, slight adjustments to the grid cell spacing values are usually required to keep the grid bounds as specified.

–F *format*
Sets the data format for the input data. If *format* < 0, then the input file specified with the **–I** option will actually contain a list of input swath sonar data files. This program uses the **MBIO** library and will read or write any swath sonar format supported by **MBIO**. A list of the swath sonar data formats currently supported by **MBIO** and their identifier values is given in the **MBIO** manual page. Default: *format* = −1.

–f *mode*
Sets the gridding algorithm to be used by **mbgrid** for bathymetry (**–A***1*) or topography c data.

mode = 1: Gaussian Weighted Mean
mode = 2: Median Filter
mode = 3: Minimum Filter
mode = 4: Maximum Filter The default is *mode* = 1 (Gaussian Weighted Mean).

–f *priority_range*
Turns on Gaussian weighted mean mosaicing in **mbmosaic** for amplitude (**–A***3*) or sidescan (**–A***4*) data. The *priority_range* value determines which data points are used in the mosaicing. The minimum priority threshold for each bin is the highest priority value found among the samples in that bin minus the *priority_range* value. Only samples with priorities greater than this threshold are used in the Gaussian weighted mean mosaicing. The default is to simply set each bin's value equal to the value of the highest priority sample in that bin.

–G *gridkind*
Sets the format of the output grid file.

gridkind = 1: Ascii table
gridkind = 2: binary file (GMT version 1 GRD file)
gridkind = 3: netCDF file (GMT version 2 GRD file)

If *gridkind* = 3, **mbgrid** also outputs shellscripts which run GMT version 3 programs to provide preliminary color fill maps of the gridded data. These shellscripts are generated using the **mbm_grdplot** macro. Default: *gridkind* = 3.

–H This "help" flag cause the program to print out a description of its operation and then exit immediately.

–I *filename*
Sets the input filename. If *format* > 0 (set with the **–f** option) then the swath sonar data contained in *infile* is read and processed. If *format* < 0 (the default), then *infile* is assumed to be an ascii file containing a list of the input swath sonar data files to be processed and their formats. The program will read the data in each one of these files. In the *infile* file, each data file should be followed by a data format identifier, e.g.:

datafile1 11
datafile2 24

This program uses the **MBIO** library and will read or write any swath sonar format supported by

MBIO. A list of the swath sonar data formats currently supported by **MBIO** and their identifier values is given in the **MBIO** manual page.

–J *projection* By default, **mbgrid** and **mbmosaic** generate grids in Geographic coordinates, meaning that position is defined in longitude and latitude using the WGS84 geographic coordinate system. The **–J** option can be used to specify an alternate, projected coordinate system (PCS). When a PCS is used, position will be defined in eastings and northings (meters) relative to the origin of the particular PCS. Universal Transverse Mercator is the most commonly used PCS in the oceanographic community, but **mbgrid** supports a large number of other PCS's as well. The underlying projection functions derive from the **PROJ.4** library written by Gerald Evenden, then of the U.S. Geological Survey.

The *projection* argument for the **–J** option can be either a PCS identifier from the projection definition list provided at the end of this manual page, or simply **–J***U* to specify using UTM in whatever zone is appropriate for the grid bounds specified with the **–R** option.

For instance, to fully specify a particular northern UTM zone, set *projection* = UTMXXN where XX gives the UTM zone (defined from 01 to 60). As an example, a northern UTM zone 12 projection can be specified using **–J***UTM12N*. Southern UTM zones are specified as UTMXXS. The European Petroleum Survey Group (EPSG) has defined a large number of PCS's used worldwide and assigned number id's to each; one can also specify the northern UTM zone 12 projection using its EPSG designation, or **–J***epsg32612*. When the projected coordinate system is fully specified by the **–J** option, then the grid bounds may be specified using **–R** in either longitude and latitude or in eastings and northings.

Alternatively, one may indicate a UTM projection without specifying the zone by using **–J***U*. In this case, the UTM zone will be inferred from the midpoint of the specified longitude and latitude bounds, and then the longitude and latitude bounds given with the **–fR** option are translated to UTM eastings and northings.

All grids and mosaics produced by **MB-System** programs contain identifiers that are recognized by the plotting macros **mbm_grdplot**, **mbm_grd3dplot**, and **mbm_grdtiff**. These plotting macros automatically use a linear map projection whenever they encounter grids and mosaics that are already in a projected coordinate system. Also, the program **mbgrdtiff** automatically inserts the appropriate projection information into the GeoTIFF images it generates. As a result, images generated by **mbgrdtiff** will be properly georeferenced when they are imported into GIS software.

–K *background*
The **–K***background* option is used to underlay a bathymetry or topography grid with a global or regional topography model. The background data model is accessed from a database using the **GMT** program grdraster. The *background* value is an identifier number used to specify which dataset to extract using **grdraster**. These identifiers are user defined and vary with installations. When the **–K***background* option is invoked, **grdraster** is used to extract all of the longitude, latitude, and topography values within the specified database that lie within the desired grid. These values are interpolated onto the desired grid locations using the thin plate spline algorithm, and then mapped onto the grid wherever the values are undefined by either swath data or the spline interpolation invoked with the **–C** option.

–L *lonflip*
Sets the range of the longitude values returned. If *lonflip*=−1 then the longitude values will be in the range from −360 to 0 degrees. If *lonflip*=0 then the longitude values will be in the range from −180 to 180 degrees. If *lonflip*=1 then the longitude values will be in the range from 0 to 360 degrees. Default: *lonflip* = 0.

–M Causes two additional grids to be output. One is a grid containing the standard deviation of the data within each grid cell relative to the grid value, the other contains the number of data points in each grid cell. This option is ignored when the minimum or maximum filter gridding algorithms are used (see the **-F** option).

–N Causes grid cells with no data and no interpolation to be set to a value of NaN instead of the default value of 99999.9. The NaN value is expected by **GMT** programs such **grdview**.

–O *root*
Sets the character string to be used as the root of the output filenames. For example, if the grid is output as a GMT version 2 GRD format (netCDF) file (the default), then its filename is "root.grd". If the **–G***1* option is used to specify an ascii format grid, then the output grid filename will be "root.asc". If the **–G***2* option is used to specify a version 1 GRD format (binary) grid, then the output grid filename will be "root.grd1". If the output grid is in the GMT version 2 GRD format, a shellscript which will allow the contents of the grid to viewed using GMT programs is also output with the filename "root.grd.cmd".

–P *pings* Sets the ping averaging of the input data. If *pings* > 0, then that number of input pings will be averaged to produce one output ping. If *pings* = 0, then the ping averaging will automatically be done so that the along-track ping spacing is equal to the across-track beam spacing. Default: *pings* = 1.

–Q Normally, bathymetry or topography data is gridded in meters. If this option is used, bathymetry or topography data is gridded in feet.

–R *west/east/south/north*
Sets the longitude and latitude bounds of the output grid. If the user uses the **–E** option to set the grid spacing, then the dimensions will be calculated from the grid bounds and spacing. In these circumstances rounding errors will usually require that the eastern and northern bounds be adjusted to fit exactly with the grid dimensions and spacing.

–S *speed*
Sets the minimum speed in km/hr (5.5 kts ˜ 10 km/hr) allowed in the input data; pings associated with a smaller ship speed will not be output. Default: *speed* = 0.

–T *tension*
Sets the *tension* value used in the thin plate spline interpolation.

A *tension* of 0 gives a minimum curvature surface with free edges; this is a pure Laplacian solution. A nonzero *tension* tends to suppress spurious oscillations and flatten the interpolation toward the edges; a *tension* of infinity yields a pure spline solution. The *tension* must be zero or greater. Default: *tension* = 1.0e10 (pure spline solution).

–U *time*
Forces **mbgrid** to avoid averaging overlapping swaths by ignoring the data from later swaths. "Later" data is identified using the *time* value. The time of the first data point is saved for each bin in the grid; any other data points which are more than *time* minutes before or after the initial data point in the relevent bin are ignored. If *time* is negative, the last data in a bin (within the time lag criterea) will be saved and used instead of the first data.

–U *azimuth/factor*
Enables prioritizing data points according to their look azimuth (data on the port side of the swath have a look azimuth equal to the heading – 90 degrees, and data on the starboard side have a look azimuth equal to the heading + 90 degrees). Here *azimuth* is the preferred look azimuth, and *factor* modulates how rapidly the priority degrades away from the preferred look azimuth. The priority (p) for a data point is assigned as follows:

p = cos(f * (Ap – Al))

when –90 < (f * (Ap – Al)) < 90 and

p = 0

otherwise, where f = *factor*, Ap = *azimuth*, and Al is the look azimuth of the data point. If *factor* = 1.0, the priority will be 1.0 at *azimuth* and will fall to zero for look azimuths more than 90 degrees away from *azimuth*. If *factor* > 1.0, the range of nonzero priorities will shrink to azimuths closer to *azimuth* (e.g. if *factor* = 2.0, nonzero priorities will be restricted to look azimuths within 45 degrees of *azimuth*). If *factor* < 1.0, the range of nonzero priorities will expand (e.g. if *factor* = 0.5, only look azimuths 180 degrees away from *azimuth* will have a zero priority).

–V The **–V** option causes **mbm_grid** to print out statements indicating its progress.

–W *scale*
Sets the width of the gaussian weighting function in terms of the grid spacing. The distance to the 1/e point of the weighting function is given by half of the grid spacing times *scale*. Default: *scale* = 1.0

–X *extend*
Extends the size of the internal grid so that the output grid is a subset from the center of a larger grid. This allows data outside the output grid to guide the spline interpolation of data gaps which happen to lie at the the edge of the output grid. The amount of extension is *extend* times the grid width/height to each side. Thus, if *extend*=1.0, then the internal grid will have dimensions three times the output grid. Default: *extend* = 0.0

–Y *priority_file*
Enables priortization of data points based on their apparent grazing angle (this angle is the arctan(x/z) where x is acrosstrack distance and z is depth, so that the center of the swath has an apparent grazing angle of zero, the port swath edge has a large negative angle, and the starboard swath edge has a large positive angle). The file *priority_file* must contain a list of data priorities as a function of apparent grazing angle. The first line of the file should contain the minimum, or portmost grazing angle followed by the associated priority. The following lines should contain increasingly large grazing angles (and associated priorities) up to the maximum, or starboard-most, grazing angle. The highest priority assigned should be one, and the lowest zero. Priorities for grazing angles less than the minimum or greater than the maximum will be zero. See the examples below for a further explanation of the use of *priority_file*.

–Z *bath_default*
Sets the default depth used for calculating grazing angles for amplitude or sidescan values where depths are not available. Default: *scale* = 1000.0

EXAMPLES

Suppose we have obtained a swath sonar data file called example_hs.mb24 collected using a SeaBeam 2112 sonar. This file contains bathymetry, beam amplitude, and sidescan data. In order to obtain a first cut bathymetry grid and first cut amplitude and sidescan mosaics, we use **mbm_grid** to generate shellscripts which in turn run **mbgrid** or **mbmosaic** to generate grids and mosaics. The following four commands generate gridding shellscripts for bathymetry, topography, amplitude, and sidescan, respectively:

```
mbm_grid –F24 –I example_hs.mb24 \                -A1 –V –Obath
mbm_grid –F24 –I example_hs.mb24 \
        -A2 –V –Otopo
mbm_grid –F24 –I example_hs.mb24 \
        -A3 –V –Oamp
mbm_grid –F24 –I example_hs.mb24 \
        -A4 –V –Oss
```

When the following shellscripts are executed, each will generate a both a grid (or mosaic) file and an additional shellscript which in turn will (when run) generate and display a postscript plot file:

```
bath_mbgrid.cmd
topo_mbgrid.cmd
amp_mbmosaic.cmd
ss_mbmosaic.cmd
```

The program **mbinfo** is executed by **mbm_grid** to obtain the file statistics used to determine the grid bounds and bin size. The macro **mbm_grdplot** is executed by **mbgrid** or **mbmosaic** to generate the initial plots of the gridded data.

As an example, the contents of the gridding shellscript "bath_mbgrid.cmd" are:

```
#! /bin/csh −f
#
# Shellscript to grid or mosaic swath sonar data
# Created by macro mbm_grid
#
# This shellscript created by following command line:
# mbm_grid −F24 −I example_hs.mb24 −A1 −V −Obath
#
# Define shell variables used in this script:
set REGION       = −49.316085/-49.096415/12.06972/12.18588
set INPUT_FILE   = example_hs.mb24
set INPUT_FORMAT = 24
set ROOT         = bath
#
# Make datalist file
echo Making datalist file...
echo $INPUT_FILE $INPUT_FORMAT >! datalist$$
#
# Run mbgrid
echo Running mbgrid...
mbgrid −Idatalist$$ \
        -R$REGION \
        -O$ROOT \
        -A1 −N \
        -E363.3/363.3/meters \
#
# All done!
echo All done!
```

SEE ALSO

mbsystem(1), **mbgrid**(1), **mbmosaic**(1), **mbinfo**(1), **mbm_grdplot**(1)

BUGS

This macro is new and hasn’t been tested in serious usage yet − let us know what to fix, add, or change!.