NAME

mbm_plot – Create an executable shellscript which will generate a GMT plot of swath sonar swath data.

VERSION

Version 5.0

SYNOPSIS

mbm_plot **–F***format* **–I***file* [**–A**[*magnitude*[*/azimuth*] **–C***[cont_int/col_int/tic_int/lab_int/tic_len/lab_hgt]* **–D**[*flipcolor/flipshade*] **–G***color_mode[F]* **–H** **–N***[ttick/tannot/dannot/tlen[/nhgt]* | *F* | *FP]* **–O***root* **–P***pagesize* **–S***[color/shade]* **–T** **–U***orientation* **–V** **–W***[color_style*[*/palette*[*ncolors*]] | *cptfile]*]

Additional Options:
[**–B***tickinfo* **–J***projection*[*/scale* | *width*] **–L***title*[*:scale_label*] **–M***misc* **–Q** **–R***w/e/s/n* **–X** **–Y** **–Z***min/max*]

Miscellaneous Options:
[**–MGD***gmtdef/value* **–MGF***scale_loc* **–MGL**[*f*][*x*]*lon0/lat0/slat/length*[*units*][+*llabel*] **–MGQ***dpi* **–MGT***x/y/size/angle/font/just/text* **–MGU[***/dx/dy/***][***label***]** **–MMA***factor/mode/depth* **–MMB***yr/mo/da/hr/mn/sc* **–MMD***mode/scale[/min/max]* **–MME***yr/mo/da/hr/mn/sc* **–MML***lonflip* **–MMN***nplot* **–MMP***pings* **–MMS***speedmin* **–MMT***timegap* **–MMZ***algorithm* **–MNA***[nhgt[/P]* | *P]* **–MNP***[pingnumber_tick/pingnumber_annot/pingnumber_tick_len]* **–MTC***fill* **–MTD***resolution* **–MTG***fill* **–MTI***river[/pen]* **–MTN***border[/pen]* **–MTS***fill* **–MTW***pen* **–MXG***fill* **–MXI***xy_file* **–MXM** **–MXS***symbol/size* **–MXW***pen***]**

DESCRIPTION

mbm_plot is a macro to generate a shellscript of MB-System and GMT commands which, when executed, will generate a Postscript plot of the specified swath sonar data. The plot may include bathymetry color fill (**–G***1*), bathymetry color shaded relief (**–G***2*), bathymetry shaded with amplitudes (**–G***3*), greyshade fill amplitude (**–G***4*), greyshade fill sidescan (**–G***5*), contoured bathymetry (**–C**), or annotated navigation. The plot may also include navigation tracks, text labels, xy data in lines or symbols, and coastlines. Five different color schemes are included. The plot will be scaled to fit on the specified page size or, if the scale is user defined, the page size will be chosen in accordance with the plot size. The primary purpose of this macro is to allow the simple, semi-automated production of nice looking maps with a few command line arguments. For users seeking more control over the plot appearance, a number of additional optional arguments are provided. Truly ambitious users may edit the plot shellscript to take advantage of MB-System and GMT capabilities not supported by this macro.

By default the output plot generation shellscript includes lines which execute a program to display the Postscript image on the screen. The program to be used to display the Postscript is set using **mbdefaults**; the default value can be overridden by setting the environment variable $MB_PS_VIEWER. Invoking the plot generation shellscript with a **-N** command line argument suppresses the screen display of the plot.

The plot scripts generated by this macro will work with GMT version 5.0 and later, and are not compatible with earlier versions of GMT.

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SIMPLE DESCRIPTION OF BASIC OPTIONS

−A *magnitude/azimuth* or *magnitude/median*
Sets the parameters which control how **mbswath** generates simulated illumination of bathymetry, which can be either shaded relief bathymetry or bathymetry draped with amplitude data. If *mode* is set to 2 (shaded relief bathymetry) using the **−G** option, then the value *magnitude* is an effective vertical exageration which modulates the intensity of the shading; typical values are in the 1-5 range. The value *azimuth* is the azimuth from which the bathymetry is illuminated. If *mode* is set to 3 (bathymetry shaded using amplitudes) using the **−G** option, then the value *magnitude* modulates the intensity of the shading; the value *median* sets the amplitude value which serves as the zero or neutral level.

−C Given by itself, the **−C** option produces a contour plot of the bathymetry data with a contour interval chosen according to the data in the file or files. If the **−G** option is used, the default contours will be drawn in black; otherwise, the default contours will be drawn in four colors (black, red, green, and blue) with color changes, annotations, and tickmarks every fourth contour interval. Additional optional parameters are described in the COMPLETE DESCRIPTION OF OPTIONS section below.

−D *[flipcolor/flipshade]*
This option flips the color and shading conventions used by **mbm_plot**. Normally, the color or grayscale tables used for color bathymetry maps run from cool colors (or dark grays) for large depth values to hot colors (or light grays) for small depth values. In contrast, sidescan and beam amplitude data is normally plotted using light grays (or hot colors) for small amplitudes and dark grays (or cool colors) for large amplitudes. If **−D** is given alone or with *flipcolor* = 1, it applies to the color table used for color or gray fill plots, shaded or unshaded. If the plot is to be shaded, either by synthetic illumination (**−G***2*) or by overlaying amplitude data (**−G***3* option), then setting *flipshade* = 1 will cause the shading convention to be reversed (e.g. high amplitudes overlaid as light shading). Using **−D***0/1* will flip the shading convention but leave the default color convention.

−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.

−G *mode[F]*
Turns on color fill swath plot and sets the style of the plot.

mode = 1:	Color fill of bathymetry data.
mode = 2:	Color shaded relief bathymetry.
mode = 3:	Bathymetry shaded using amplitude data.
mode = 4:	Grayscale fill of amplitude data.
mode = 5:	Grayscale fill of sidescan data.

If "F" is appended to *mode*, then **mbm_plot** will attempt to plot amplitude or sidescan data that have been filtered with **mbfilter**. If the desired filtered data files do not exist, then the plotting script generated by **mbm_plot** will fail when **mbswath** exits with an error message. Filtered amplitude data are stored in ancilliary files ending with ".ffa", and filtered sidescan files end in ".ffs". Filtering of bathymetry data is not supported, and so appending "F" to *mode* values of 1 or 2 will have no effect.

−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. The default input filename is "datalist.mb-1".

–N Given by itself, this option causes a navigation track plot to be generated. Additional optional parameters, including annotation control, are described in the COMPLETE DESCRIPTION OF OPTIONS section below.

–O *root*
Sets the root used to construct the filename of the output shellscript (*root*.cmd) and names of files created when the shellscript is run. By default, the name of the input data file or list file is used as the *root*.

–P *pagesize*
This option sets the size of the page the plot will be centered on. If the user does not set the plot scale, the plot will be sized as large as will fit on the designated page. If the user sets the plot scale such that the plot will not fit on the designated page, a larger page will be used. The supported page sizes include ANSI A, B, C, D, E, F, and E1, as well as most metric page sizes. See the COMPLETE DESCRIPTION OF OPTIONS section below for a complete list of the supported page sizes. The default page size is A.

–S *[color/shade]*
This option enables effective histogram equalization of the color and/or shading of thedata. The equalization is not achieved by changing the data values, but rather by constructing the color or shading tables so that the boundaries in the tables encompass equal fractions of the datapoints. This serves to focus color or shading contrasts in value ranges corresponding to the bulk of the data values, and is particularly useful for enhancing the contrast of sidescan and beam amplitude plots. If **–S** is given alone or with *color* = 1, it enables equalization of the color table used for color or gray fill plots, shaded or unshaded. If the plot is to be shaded, either by synthetic illumination (**–G***2*) or by overlaying amplitude data (**–G***3* option), then setting *shade* = 1 will cause the shading to be equalized. Using **–S***0/1* will equalize the shading without equalizing the color table.

–T If **–T** is given, it causes a coastline to be drawn on the map. The default is to draw the coastline and shade all dry land a uniform gray. To exercise greater control of the coastline plotting, use the **–MTC**, **–MTD**, **–MTG**, **–MTI**, **–MTN**, **–MTS**, and **–MTW** options described in the COMPLETE DESCRIPTION OF OPTIONS section below.

–U *orientation*
Normally the orientation of the plot (portrait or landscape) is selected automatically so as to maximize the plot scale. The **–U** option allows the user to set the plot orientation. If *orientation* = 1, a portrait plot will be produced; if *orientation* = 2, a landscape plot will be produced.

–V Causes **mbm_plot** to operate in "verbose" mode so that it outputs more information than usual.

–W *[color_style*[*/palette*[*ncolors*]] | cptfile]
This option controls the color scheme used for color fill plots.

If *color_style* = 1 [default], then the color scheme used will be a continuous grading of colors. If *color_style* = 2, the color scheme will be a set of discrete color intervals. The color palette used is set using *palette*. Five palettes are available:

palette = 1: Haxby colors [default]
palette = 2: high Intensity colors
palette = 3: low Intensity colors
palette = 4: grayscale
palette = 5: uniform grayscale

A complete description of the color palettes is given in the COMPLETE DESCRIPTION OF OPTIONS section below.

The *ncolors* parameter sets the number of color values used in plotting, whether the colors are represented in a continuous color scale or a stepped, discrete color scale [default is 11].

If the option argument is the path to an existing **GMT** color palette (CPT) file, then that CPT file and its color scheme will be used for the plot

COMPLETE DESCRIPTION OF OPTIONS

–A *magnitude/azimuth* or *magnitude/median*
Sets the parameters which control how **mbm_plot** generates simulated illumination of bathymetry, which can be either shaded relief bathymetry or bathymetry draped with amplitude data. If *mode* is set to 2 (shaded relief bathymetry) using the **–G** option, then the value *magnitude* is an effective vertical exageration which modulates the intensity of the shading; typical values are in the 1-5 range. The value *azimuth* is the azimuth from which the bathymetry is illuminated. If *mode* is set to 3 (bathymetry shaded using amplitudes) using the **–G** option, then the value *magnitude* modulates the intensity of the shading; the value *median* sets the amplitude value which serves as the zero or neutral level.

–B *tickinfo*
Sets map boundary tickmark intervals. See the **psbasemap** manual page for details. By default the program chooses basemap annotations based on the map boundaries.

–C *[cont_int/col_int/tic_int/lab_int/tic_len/lab_hgt]*
Given by itself, the **–C** option produces a contour plot of the bathymetry data with a contour interval chosen according to the data in the file or files. If the **–G** option is used, the default contours will be drawn in black; otherwise, the default contours will be drawn in four colors (black, red, green, and blue) with color changes, annotations, and tickmarks every fourth contour interval. If any of the optional parameters are appended, these values will control the contour interval and other contour characteristics. Contours will be generated at invervals of *cont_int* meters. Color changes will occur at intervals of *col_int* meters. Contours will have downhill facing tickmarks *tic_len* inches long every *tic_int* meters. Contours will have annotations *lab_hgt* inches high every *lab_int* meters.

–D *[flipcolor/flipshade]*
This option flips the color and shading conventions used by **mbm_plot**. Normally, the color or grayscale tables used for color bathymetry maps run from cool colors (or dark grays) for large depth values to hot colors (or light grays) for small depth values. In contrast, sidescan and beam amplitude data is normally plotted using (light grays (or hot colors) for small amplitudes and dark grays (or cool colors) for large amplitudes. If **–D** is given alone or with *flipcolor* = 1, it applies to the color table used for color or gray fill plots, shaded or unshaded. If the plot is to be shaded, either by synthetic illumination (**–G***2*) or by overlaying amplitude data (**–G***3* option), then setting *flipshade* = 1 will cause the shading convention to be reversed (e.g. high amplitudes overlaid as light shading). Using **–D***0/1* will flip the shading convention but leave the default color convention.

–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.

–G *mode*
Turns on color fill swath plot and sets the style of the plot.
mode = 1: Color fill of bathymetry data.

mode = 2: Color shaded relief bathymetry.
mode = 3: Bathymetry shaded using amplitude data.
mode = 4: Grayscale fill of amplitude data.
mode = 5: Grayscale fill of sidescan data.

–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*[*/scale* | */width*]
Selects the map projection. By default the map projection is Mercator and the plot scale is chosen to fit on the selected page size (see **–P** option). The user may specify a different projection to be used, in which case the plot scale is still automatically chosen to fit the page. The user may also specify both the projection and the plot scale. If the projection specifying character is upper case, a plot width rather than a plot scale is used. The scale values are specified in inch/degree or in 1:xxxxx ratios. Plot widths are specified in inches. If the user specifies a plot scale such that the plot will not fit on the default A size page, a appropriately larger page size will be chosen.

CYLINDRICAL PROJECTIONS:

–Jc*lon0/lat0/scale* (Cassini)
–Jm*scale* (Mercator)
–Joa*lon0/lat0/azimuth/scale* (Oblique Mercator – point and azimuth)
–Job*lon0/lat0/lon1/lat1/scale* (Oblique Mercator – two points)
–Joc*lon0/lat0/lonp/latp/scale* (Oblique Mercator – point and pole)
–Jq*lon0/scale* (Equidistant Cylindrical Projection (Plate Carree))
–Jt*lon0/scale* (TM – Transverse Mercator)
–Ju*zone/scale* (UTM – Universal Transverse Mercator)
–Jy*lon0/lats/scale* (Basic Cylindrical Projection)

AZIMUTHAL PROJECTIONS:

–Ja*lon0/lat0/scale* (Lambert).
–Je*lon0/lat0/scale* (Equidistant).
–Jg*lon0/lat0/scale* (Orthographic).
–Js*lon0/lat0/scale* (General Stereographic)

CONIC PROJECTIONS:

–Jb*lon0/lat0/lat1/lat2/scale* (Albers)
–Jl*lon0/lat0/lat1/lat2/scale* (Lambert)

MISCELLANEOUS PROJECTIONS:

–Jh*lon0/scale* (Hammer)

–Ji*lon0/scale* (Sinusoidal)
–Jk*lon0/scale* (Eckert VI)
–Jn*lon0/scale* (Robinson)
–Jr*lon0/scale* (Winkel Tripel)
–Jw*lon0/scale* (Mollweide)

NON-GEOGRAPHICAL PROJECTIONS:

–Jp*scale* (Linear projection for polar (theta,r) coordinates)
–Jx*x-scale*[**l|p***pow*][*/y-scale*[**l|p***pow*]] (Linear, log, and power scaling)
More details can be found in the **psbasemap** manpages.

–L *title:scalelabel*
Sets the title and the label for the colorscale (if used) of the plot. Note that a colon (:) rather than a slash (/) is used to separate the labels. Colons cannot be used in the labels themselves. If this option is not used, then a default title and colorscale label are provided. If the title is supplied alone, a default colorscale label will be provided. To force no title use **–L**" "; to force no title or colorscale label use **–L**" : ".

–M A series of "miscellaneous" options are provided which are given as **–M** followed by a two character identifier, followed by any other parameters associated with that option. The **–M** options may be strung together separated by colons, e.g. "-MGQ100:GU", which is equivalent to "-MGQ –MGU".

–MGD *gmtdef/value*
Allows the user to set the **GMT** default values used as the plot is constructed. This command may be given repeatedly to set as many **GMT** defaults as required. For example, to set the basemap annotation font to Courier, use "-MGDANOT_FONT/Courier".

–MGF *scale_loc*
Sets the location of the color scale. The possible values of *scale_loc* are:

scale_loc = b: bottom of plot
scale_loc = t: top of plot
scale_loc = l: left of plot
scale_loc = r: right of plot

[Default *scale_loc* = b]

–MGL [*f*][*x*]*lon0/lat0/slat/length*[*units*][*+llabel*]
Draws a simple map scale centered on *lon0/lat0*. Use **–Lf** to get a "fancy" scale [Default is plain]. Use **–Lx** to specify the position in inches instead of map units. The scale is calculated at latitude *slat*; if the string "center" is used instead of a numerical value for *slat*, then the macro will set the scaling according to the center of the plot bounds. The scale length value *length* is in km by default, but the units can be specified as one of e|f|k|M|n|u, where e = meters, f = feet, k = kilometers, M = statue miles, n = nautical miles, and u = US survey feet. Append *+l* to label the scale with the relevant units, or append *+l"label"* to set a different label string.

–MGQ *dpi*
Sets the resolution in dots per inch of the raster image used for color fill maps. Larger values of *dpi* produce larger Postscript plot files. [Default is 100].

–MGT *x/y/size/angle/font/just/text*
Causes a text label to plotted on the map. *size* is text size in points, *angle* is measured in degrees counter-clockwise from horizontal, *fontno* sets the font type, *justify* sets the alignment. If *fontno* starts with a leading hyphen, then the remainder of *fontno* is taken to be a textstring with the desired fontname. See the **gmtdefaults** man page for names and numbers of available fonts (or run **pstext –L**). The alignment number refers to the part of the textstring that will be mapped onto the (*x,y*) point: 1 = Lower Left corner, 2 = Lower Center, 3 = Lower Right, 5 = Mid Left, 6 = Mid Center, 7 = Mid Right, 9 = Upper Left, 10 = Upper Center, 11 = Upper Right. This option may be given as many times as needed.

–MGU [*/dx/dy/*][*label*]
Draw Unix System time stamp on plot. User may specify where the lower left corner of the stamp should fall on the page relative to lower left corner of plot in inch [Default is (-0.75,-0.75)]. Optionally, append a label, or **c** (which will plot the command string.)

–MMA*factor/mode/depth*
This option determines how the along-track dimension of the beam or pixel footprints is calculated. If *mode* = 1, then the fore-aft beam angle width of the sonar is used so that the width increases towards the outer parts of the swath. The fore-aft beam angle width (**MB-System** internally stores a value for each format/sonar) is multiplied by the *factor* value; a *factor* < 1.0 can be useful if the data highly oversamples the seafloor and a *factor* > 1.0 can fill in plots of data which undersample the seafloor. If the data stream does not include depth values (e.g. one is plotting pure sidescan data), then the *depth* value sets the depth value in meters used in the footprint calculations. If *mode* = 2, then the along-track dimension of the beam or pixel footprints is just the along-track distance between pings multiplied by the *factor* value. If mode = 3, then each data point is plotted as a point, and the factor and depth parameters are ignored. Default: *factor* = 1.0, *mode* = 1, *depth* = 3000.0.

–MMB*yr/mo/da/hr/mn/sc*
Sets the starting time for data allowed in the input data; pings with times before the starting time will be ignored. Default: *yr/mo/da/hr/mn/sc* = 1962/2/21/10/30/0.

–MMD*mode/scale[/min/max]*
Sets scaling of beam amplitude or sidescan pixel values which can be applied before plotting. If *mode* = 1 or 2, then a linear scaling of the form:

scaled_value = scale * (value – min) / (max – min)

is applied. If *mode* = 3 or 4, then a log10 scaling of the form:

scaled_value = scale * (20 * log10(value) – min) / (max – min)

is applied. If *mode* = 2 or 4, then the value (or 20*log10(value)) will be clipped to *min* if it is smaller than *min* or *max* if it is greater than *max*; this clipping happens prior to the multiplication by *scale*. Default: *mode* = 1, *scale* = 1.0, *min* = 0.0, *max* = 1.0.

–MME*yr/mo/da/hr/mn/sc*
Sets the ending time for data allowed in the input data; pings with times after the ending time will be ignored. Default: *yr/mo/da/hr/mn/sc* = 2062/2/21/10/30/0.

–MML*lonflip*
If the **–R** option is not used to explicitly set the plot bounds, then the *lonflip* value sets the range of the longitude values used for calculating the desired bounds. 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: **mbm_plot** uses the *lonflip* value set by **mbdefaults**.

–MMN*nplot*
Sets the number of pings to be read in before each contouring episode. See the description of the **–MMZ***algorithm* option for advice on reasonable values Default: *nplot* = 50 unless **–MMZ***1* is specified, in which case the default is *nplot* = 5.

–MMP*pings*
Sets the ping averaging of the input swath sonar data. If *pings* = 1, then no ping averaging is performed. 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 (no ping averaging).

–MMS*speedmin*
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 processed. Default: *speed* = 0.

–MMT
timegap
Sets the maximum time gap in minutes between adjacent pings allowed before the data is considered to have a gap. Default: *timegap* = 1.

–MMZ
algorithm
Sets the contouring algorithm to be used. If *algorithm*=0, a simple ping to ping contouring approach is used; this algorithm is fast but produces poor looking contours when used with data where beams from one ping may lie "behind" beams from previous pings (this happens for sonars that ping at nonnull pitch angles or for the "inside" beams when ships make sharp turns). If *algorithm*=1 then a triangular network is constructed from the available soundings and this network is in turn contoured; this algorithm is slow but produces good looking contours in most cases. It is important to note that the time required for "triangle" algorithm increases with the square of the number of beams to be contoured; thus it is sensible to keep the number of pings contoured at a time small (e.g. use **–N***5*). The time required for the "ping to ping" algorithm varies linearly with the number of pings contoured; thus larger numbers of pings may be reasonably contoured at a time (e.g. use **–N***50*). Default: *algorithm* = 0 unless *format* = 41.

–MNA *[nhgt[/P] | P]*
Turns on filename annotation of navigation tracks. If **–MNA** is given without specifying any controlling parameters, then the lettering height *nhgt* is 0.15 and the filenames are plotted parallel to the navigation track from the start of the track. The lettering height can be specified using either **–MNA***nhgt* or **–MNA***nhgt/P*. If **–MNA***P* or **–MNA***nhgt/P* is specified, the filename will be plotted perpendicular to the navigation track. Filename annotation can also be specified using the **–N** option. Defaults: Filename annotation off.

–MNP *[pingnumber_tick/pingnumber_annot/pingnumber_tick_len]*
Turns on ping number (or shot number) annotation of navigation tracks. Tick marks are made along the shiptrack at *pingnumber_tick* intervals; these are *tlen* inches long. Longer tick marks are made along the shiptrack at *pingnumber_annot* intervals; these are 1.5 times *tlen* inches long. Defaults: Pingnumber annotation off. If the **–MNP** option is given without specifying the controlling parameters, then *pingnumber_tick* = 50, *pingnumber_annot* = 100, and *pingnumber_tick_len* = 0.1.

–MTC *fill*
Coastline plotting option. Set the shade (0-255), color (r/g/b), or pattern (p|Pdpi/pattern; see **–MTG**) for lakes [Default is the fill chosen for "wet" areas (-S)].

–MTD *resolution*
Coastline plotting option. Selects the resolution of the coastline data set to use ((f)ull, (h)igh, (i)ntermediate, (1)ow, and (c)rude). The resolution drops off by 80% between data sets. [Default is l].

–MTG *fill*
Coastline plotting option. Select painting or clipping of "dry" areas. Append a shade, color, pattern, or c for clipping. Specify the shade (0-255) or color (r/g/b), or **–MTG***pdpi/pattern*, where pattern gives the number of the built-in pattern (1-90) OR the name of a Sun 1-, 8-, or 24-bit raster file. dpi sets the resolution of the image. See **GMT** Cookbook & Technical Reference Appendix E for information on individual patterns.

–MTI *river[/pen]*
Coastline plotting option. Draw rivers. Specify the type of rivers and [optionally] append pen attributes [Default pen: width = 1, color = 0/0/0, texture = solid]. Choose from the list of river types below. Repeat option –I as often as necessary.
1 = Permanent major rivers
2 = Additional major rivers
3 = Additional rivers
4 = Minor rivers

5 = Intermittent rivers – major
6 = Intermittent rivers – additional
7 = Intermittent rivers – minor
8 = Major canals
9 = Minor canals
10 = Irrigation canals
a = All rivers and canals (1-10)
r = All permanent rivers (1-4)
i = All intermittent rivers (5-7)
c = All canals (8-10)

–MTN *border[/pen]*
Coastline plotting option. Draw political boundaries. Specify the type of boundary and [optionally] append pen attributes [Default pen: width = 1, color = 0/0/0, texture = solid]. Choose from the list of boundaries below. Repeat option **–MTN** as often as necessary.
1 = National boundaries
2 = State boundaries within the Americas
3 = Marine boundaries
a = All boundaries (1-3)

–MTS *fill*
Coastline plotting option. Select painting or clipping of "wet" areas. Append the shade (0-255), color (r/g/b), pattern (see **–MTG**), or c for clipping.

–MTW
pen
Coastline plotting option. Append pen attributes [Defaults: width = 1, color = 0/0/0, texture = solid].

–MXG *fill*
Select filling of symbols for xy plotting. Set the shade (0-255) or color (r/g/b) [Default is no fill]. To reset no fill, use *fill* = "N". For polygons, you may optionally specify **–Gp***icon_size/pattern*, where *pattern* gives the number of the image pattern (1-32) OR the name of a icon-format file. *icon_size* sets the unit size in inch. To invert black and white pixels, use **–GP** instead of **–Gp**. See **GMTs** Cookbook & Technical Reference Appendix E for information on individual patterns.

–MXI *xy_file*
Specifies a file containing (x,y) pairs to be plotted as lines or symbols. The line and symbol characteristics are set using the last **–MXG**, **–MXS**, and **–MXW** options used. All of the **–MX** commands can be given multiple times, so by stringing series of these commands together the user can plot different files using different line or symbol characteristics. [Default is a solid black line].

–MXM
Toggles expectation for xy data files having multiple segments, in which each segment is to be plotted separately. Segments are separated by a record whose first character is '>'. By default, unsegmented files are expected. Users may give this command multiple times, allowing some input files to be handled as segmented and others not.

–MXS *symbol/size*
Selects symbol to be used for plotting the next xy data file. Setting *symbol* = "N" causes line plotting. Choose between:

–MXSa
st**a**r. *size* is radius of circumscribing circle.

–MXSb
bar extending from *base* to y. *size* is bar width. By default, *base* = 0. Append /*base* to change this value. Append **u** if *size* is in x-units [Default is inch].

–MXSc
circle. *size* is diameter of circle.

–MXSd
diamond. *size* is side of diamond.

–MXSe
ellipse. Direction (in degrees counterclockwise from horizontal), major_axis (in inch), and minor_axis (in inch) must be found in columns 3, 4, and 5.

–MXSf
fault. Give distance gap between ticks and ticklength in inch. If gap is negative, it is interpreted to mean number of ticks instead. Append **l** or **r** to draw tick on the left or right side of line [Default is centered]. Upper case **L** or **R** draws a triangle instead of line segment.

–MXSh
hexagon. Give side in inch.

–MXSi **i**nverted triangle. Give side in inch.

–MXSl **l**etter or text string. Give size in inch, and append /*string* after the size. Note that the size is only approximate; no individual scaling is done for different characters. Remember to escape special characters like *.

–MXSp
point. No size needs to be specified (1 pixel is used).

–MXSs
square. Give side in inch.

–MXSt
triangle. Give side in inch.

–MXSv
vector. Direction (in degrees counterclockwise from horizontal) and length (in inch) must be found in columns 3 and 4. *size*, if present, will be interpreted as arrowwidth/headlength/headwidth (in inch) [Default is 0.03/0.12/0.1 inch]. By default arrow attributes remains invariant to the length of the arrow. To have the size of the vector scale down with decreasing size, append n*norm*, where vectors shorter than *norm* will have their attributes scaled by length/*norm*.

–MXSV
Same as **–MXSv**, except azimuth (in degrees east of north) should be given instead of direction. The azimuth will be mapped into an angle based on the chosen map projection (**–MXSv** leaves the directions unchanged.)

–MXSx
cross. Give length in inch.

–MXW
pen
Set pen attributes for xy plotting. See chapter 4.12 in the GMT Technical reference for a discussion of GMT pen values. [Defaults: width = 1, color = 0/0/0, texture = solid].

–N *[ttick/tannot/dannot/tlen[/nhgt/nperp]] | F | FP]*
This option causes a navigation track plot to be generated, and can also set the start of each swath file to be annotated with the filename. If the **–N** option is given alone, then the navigation track will be plotted without any annotation, The optional parameters allow users to control the details of the navigation track annotation. Time marks are made with "X" marks along the shiptrack; annotated time marks show the time in HH:MM format next to the time mark and annotated date marks show the time and julian day in HH:MM/DDD format. The "X" marks are *tlen* inches high for normal time marks and 1.5 times *tlen* inches high for annotated time or date marks. The interval of time ticks, annotated time ticks, and annotated date ticks are given in hours by *ttick*, *tannot*, and *dannot*, respectively. If the *nhgt* parameter is not given when the other parameters are

specified, then no filename annotation will be done. If given, *nhgt* sets the height in inches of the filename annotation and turns that annotation on. If given as 1, *nperp* causes the filename annotation to be perpendicular to the shiptrack rather than parallel (the default). If the **–N***F* is given, then a navigation track will be generated using the default parameters and also with filename annotation along the shiptrack. If the **–N***FP* is given, then a navigation track will be generated with the default parameters and also with filename annotation perpendicular to the shiptrack. Defaults if annotation is enabled: *ttick* = 0.25; *tannot* = 1.0; *dannot* = 4.0; *tlen* = 0.1; *nhgt* = 0.1; *nperp* = 0.

–O *root*
Sets the root used to construct the filename of the output shellscript (*root*.cmd) and names of files created when the shellscript is run. By default, the name of the input data file or list file is used as the *root*.

–P *pagesize*
This option sets the size of the page the plot will be centered on. If the user does not set the plot scale, the plot will be sized as large as will fit on the designated page. If the user sets the plot scale such that the plot will not fit on the designated page, a larger page will be used. The supported page sizes are:

```
American ANSI sizes:
A     8.5 x 11.0 in.    ( 215.9 x  279.4 mm)
B    11.0 x 17.0 in.    ( 279.4 x  431.8 mm)
C    17.0 x 22.0 in.    ( 431.8 x  558.8 mm)
D    22.0 x 34.0 in.    ( 558.8 x  863.6 mm)
E    34.0 x 44.0 in.    ( 863.6 x 1117.6 mm)
F    28.0 x 40.0 in.    ( 711.2 x 1016.0 mm)
E1   44.0 x 68.0 in.    (1117.6 x 1727.2 mm)

Metric ISO A sizes:
A0   841.0 x 1189.0 mm  (33.11 x 46.81 in.)
A1   594.0 x  841.0 mm  (23.39 x 33.11 in.)
A2   420.0 x  594.0 mm  (16.54 x 23.39 in.)
A3   297.0 x  420.0 mm  (11.69 x 16.54 in.)
A4   210.0 x  297.0 mm  ( 8.27 x 11.69 in.)
A5   148.0 x  210.0 mm  ( 5.83 x  8.27 in.)
A6   105.0 x  148.0 mm  ( 4.13 x  5.83 in.)
A7    74.0 x  105.0 mm  ( 2.91 x  4.13 in.)
A8    52.0 x   74.0 mm  ( 2.05 x  2.91 in.)
A9    37.0 x   52.0 mm  ( 1.46 x  2.05 in.)
A10   26.0 x   37.0 mm  ( 1.02 x  1.46 in.)

Metric ISO B sizes:
B0   1000.0x 1414.0 mm  (39.37 x 55.67 in.)
B1   707.0 x 1000.0 mm  (27.83 x 39.37 in.)
B2   500.0 x  707.0 mm  (19.68 x 27.83 in.)
B3   353.0 x  500.0 mm  (13.90 x 19.68 in.)
B4   250.0 x  353.0 mm  ( 9.84 x 13.90 in.)
B5   176.0 x  250.0 mm  ( 6.93 x  9.84 in.)
B6   125.0 x  176.0 mm  ( 4.92 x  6.93 in.)
B7    88.0 x  125.0 mm  ( 3.46 x  4.92 in.)
B8    62.0 x   88.0 mm  ( 2.44 x  3.46 in.)
B9    44.0 x   62.0 mm  ( 1.73 x  2.44 in.)
B10   31.0 x   44.0 mm  ( 1.22 x  1.73 in.)

Metric ISO C sizes:
C0   914.4 x 1300.5 mm  (36.00 x 51.20 in.)
```

```
C1   650.2 x  914.4 mm  (25.60 x 36.00 in.)
C2   457.2 x  650.2 mm  (18.00 x 25.60 in.)
C3   325.1 x  457.2 mm  (12.80 x 18.00 in.)
C4   228.6 x  325.1 mm  ( 9.00 x 12.80 in.)
C5   162.6 x  228.6 mm  ( 6.40 x  9.00 in.)
C6   114.3 x  162.6 mm  ( 4.50 x  6.40 in.)
C7    81.3 x  114.3 mm  ( 3.20 x  4.50 in.)

     MB-System large format sizes:
m1  1371.6 x 1828.8 mm  (54.00 x 72.00 in.)
m2  1371.6 x 2133.6 mm  (54.00 x 84.00 in.)
m3  1371.6 x 2438.4 mm  (54.00 x 96.00 in.)
m4  1524.0 x 1828.8 mm  (60.00 x 72.00 in.)
m5  1524.0 x 2133.6 mm  (60.00 x 84.00 in.)
m6  1524.0 x 2438.4 mm  (60.00 x 96.00 in.)
```

The default page size is A.

−Q Normally, the output plot generation shellscript includes lines which execute a program to display the Postscript image on the screen. This option causes those lines to be commented out so that executing the shellscript produces a Postscript plot but does not attempt to display it on the screen. Alternatively, invoking the plot generation shellscript with a **-N** command line argument also suppresses the screen display of the plot. The program to be used to display the Postscript is set using **mbdefaults**; the default value can be overridden by setting the environment variable $MB_PS_VIEWER.

−R *west/east/south/north*
Sets the longitude and latitude bounds within which swath sonar data will be read. Normally the bounds are automatically chosen to include all of the input data.

−S *[color/shade]*
This option enables effective histogram equalization of the color and/or shading of thedata. The equalization is not achieved by changing the data values, but rather by constructing the color or shading tables so that the boundaries in the tables encompass equal fractions of the datapoints. This serves to focus color or shading contrasts in value ranges corresponding to the bulk of the data values, and is particularly useful for enhancing the contrast of sidescan and beam amplitude plots. If **−S** is given alone or with *color* = 1, it enables equalization of the color table used for color or gray fill plots, shaded or unshaded. If the plot is to be shaded, either by synthetic illumination (**−G***2*) or by overlaying amplitude data (**−G***3* option), then setting *shade* = 1 will cause the shading to be equalized. Using **−S***0/1* will equalize the shading without equalizing the color table.

−T If **−T** is given, it causes a coastline to be drawn on the map. The default is to draw the coastline and shade all dry land a uniform gray. To exercise greater control of the coastline plotting, use the **−MTC**, **−MTD**, **−MTG**, **−MTI**, **−MTN**, **−MTS**, and **−MTW** options described in the

−U *orientation*
Normally the orientation of the plot (portrait or landscape) is selected automatically so as to maximize the plot scale. The **−U** option allows the user to set the plot orientation. If *orientation* = 1, a portrait plot will be produced; if *orientation* = 2, a landscape plot will be produced.

−V Causes **mbm_plot** to operate in "verbose" mode so that it outputs more information than usual.

−W *[color_style*[*/palette*[*ncolors*]] | cptfile]
This option controls the color scheme used for color fill plots.

If *color_style* = 1 [default], then the color scheme used will be a continuous grading of colors. If *color_style* = 2, the color scheme will be a set of discrete color intervals. The color palette used is set using *palette*. Seven palettes are available:
palette = 1: Haxby colors [default]

palette = 2: high Intensity colors
palette = 3: low Intensity colors
palette = 4: grayscale
palette = 5: uniform grayscale
palette = 6: uniform black
palette = 7: uniform white

The RGB definitions of the color palettes are:

```
color palette 1 – Haxby Color Table
  red:   255 255 255 255 240 205 138 106  50  40  37
  green: 255 186 161 189 236 255 236 235 190 127  57
  blue:  255 133  68  87 121 162 174 255 255 251 175

color palette 2 – High Intensity Colors
  red:   255 255 255 255 128   0   0   0   0 128 255
  green:   0  64 128 255 255 255 255 128   0   0   0
  blue:    0   0   0   0   0   0 255 255 255 255 255

color palette 3 – Low Intensity Colors
  red:   200 194 179 141  90   0   0   0   0  90 141
  green:   0  49  90 141 179 200 141  90   0   0   0
  blue:    0   0   0   0   0   0 141 179 200 179 141

color palette 4 – Grayscale
  red:   255 230 204 179 153 128 102  77  51  26   0
  green: 255 230 204 179 153 128 102  77  51  26   0
  blue:  255 230 204 179 153 128 102  77  51  26   0

color palette 5 – Uniform Grayscale
  red:   128 128 128 128 128 128 128 128 128 128 128
  green: 128 128 128 128 128 128 128 128 128 128 128
  blue:  128 128 128 128 128 128 128 128 128 128 128

color palette 6 – Uniform Black
  red:     0   0   0   0   0   0   0   0   0   0   0
  green:   0   0   0   0   0   0   0   0   0   0   0
  blue:    0   0   0   0   0   0   0   0   0   0   0

color palette 7 – Uniform White
  red:   255 255 255 255 255 255 255 255 255 255 255
  green: 255 255 255 255 255 255 255 255 255 255 255
  blue:  255 255 255 255 255 255 255 255 255 255 255
```

The Haxby colors have been adapted from a palette developed by Dr. William Haxby of the Lamont-Doherty Earth Observatory; this palette is pleasing to the eye and well suited for shading. The high intensity colors describe linear paths through RGB space from red to blue to green to purple; because the colors are high intensity they are not well suited to shading. The low intensity colors are similar to the high intensity, but muted and thus well suited to shading. The grayscale palette runs linearly from white to black and is commonly used for plots of sidescan and amplitude data. The uniform grayscale is useful for non-color shaded relief plots.

The *ncolors* parameter sets the number of color values used in plotting, whether the colors are represented in a continuous color scale or a stepped, discrete color scale [default is 11].

If the option argument is the path to an existing **GMT** color palette (CPT) file, then that CPT file and its color scheme will be used for the plot

–X Normally, **mbm_plot** creates an executable shellscript and then exits. This option will cause the shellscript to be executed in the background before **mbm_plot** exits.

–Y Normally, **mbm_plot** generates nicely rounded numbers for the boundaries of the color palette. Often, the resulting color bounds extend well outside the range of the gridded data. This option causes the color boundaries to be uniformly distributed between the minimum and maximum values of the grid.

–Z *min/max*
This option overrides the minimum and maximum values of bathymetry data, affecting the color palette and the contour interval if those parameters are not specified by the user.

EXAMPLES

Suppose we have obtained a swath sonar data file called sb2112_example.mb41 collected using a SeaBeam 2112 sonar. This file contains bathymetry, beam amplitude, and sidescan data. In order to obtain initial views of the data in the file, we use **mbm_plot** to generate shellscripts which in turn generate plots when executed. The following five commands generate plotting shellscripts for color fill bathymetry overlaid with contours, color shaded relief bathymetry, color fill bathymetry overlaid with amplitudes, grayscale amplitudes, and grayscale sidescan, respectively:

```
mbm_plot –F41 –I sb2112_example.mb41 –G1 –C   \
          -N –V –Obathcont
mbm_plot –F41 –I sb2112_example.mb41 –G2      \
          -N –V –Obathshade
mbm_plot –F41 –I sb2112_example.mb41 –G3 –S0/1 \
          -N –V –Obathamp
mbm_plot –F41 –I sb2112_example.mb41 –G4 –S   \
          -N –V –Oamp
mbm_plot –F41 –I sb2112_example.mb41 –G5 –S   \
          -N –V –Oss
```

When the following shellscripts are executed, each will generate a postscript plot file and then display the plot on the screen:

```
bathcont.cmd
bathshade.cmd
bathamp.cmd
amp.cmd
ss.cmd
```

Note that we use the **–S** option to apply histogram equalization to the amplitude and sidescan data, but not the bathymetry data. Also note that by specifying **–N** we obtain a track plot of the ship's navigation overlaid on the color or grayscale file plots.

Now suppose we have a set of SeaBeam 2112 data files comprising a short survey and that we want a plot of all the data together. We create an ASCII text file which has a list of the filenames, each followed by the appropriate **MBIO** format id number, e.g.:

```
sb2112_example_1.mb41 41
sb2112_example_2.mb41 41
sb2112_example_3.mb41 41
```

If the name of the data file list is "datalist", then using "**–F**-*1* **–I***datalist*" will cause the macro to operate on all of the files together. We desire a plot including color fill bathymetry overlaid with 25 meter contours and the ship's navigation. For this plot, we want a very bright colortable and we would like the colors to be discretely stepped rather than continuous; thus we use **–W***2/2*. We also choose to use the **–X** option, which causes **mbm_plot** to execute the shellscript it creates in the background before exiting. The **mbm_plot** command is:

```
mbm_plot –F-1 –Idatalist –G1 –C25 –N \
        -X –V –Obathtest
```

As an example, the contents of the plotting shellscript "bathtest.cmd" are:

```
#
# Shellscript to create Postscript plot of swath sonar data
# Created by macro mbm_plot
#
# This shellscript created by following command line:
# mbm_plot –F-1 –Idatalist –G1 –C25 –N –V –Obathtest
#
# Save existing GMT defaults
echo Saving GMT defaults...
gmtdefaults –L > gmtdefaults$$
#
# Set new GMT defaults
echo Setting new GMT defaults...
gmtset ANOT_FONT Helvetica
gmtset LABEL_FONT Helvetica
gmtset HEADER_FONT Helvetica
gmtset ANOT_FONT_SIZE 8
gmtset LABEL_FONT_SIZE 8
gmtset HEADER_FONT_SIZE 10
gmtset FRAME_WIDTH 0.074999999999999997
gmtset TICK_LENGTH 0.074999999999999997
gmtset PAGE_ORIENTATION LANDSCAPE
gmtset COLOR_BACKGROUND 0/0/0
gmtset COLOR_FOREGROUND 255/255/255
gmtset COLOR_NAN 255/255/255
#
# Make color palette table file
echo Making color palette table file...
echo   2975 255 255 255   3150 255 186 133 > bathtest.cpt
echo   3150 255 186 133   3325 255 161  68 >> bathtest.cpt
echo   3325 255 161  68   3500 255 189  87 >> bathtest.cpt
echo   3500 255 189  87   3675 240 236 121 >> bathtest.cpt
echo   3675 240 236 121   3850 205 255 162 >> bathtest.cpt
echo   3850 205 255 162   4025 138 236 174 >> bathtest.cpt
echo   4025 138 236 174   4200 106 235 255 >> bathtest.cpt
echo   4200 106 235 255   4375  50 190 255 >> bathtest.cpt
echo   4375  50 190 255   4550  40 127 251 >> bathtest.cpt
echo   4550  40 127 251   4725  37  57 175 >> bathtest.cpt
#
# Run mbswath
echo Running mbswath...
mbswath –f-1 –Idatalist \
        -Jm22.198543775528325 \
```

```
        -R114.210795/114.430905/-31.91322/-31.62458 \
        -Cbathtest.cpt \
        -p1 −A1 −Z1 \
        -p1 \
        -P −X1.8069392647842304 −Y2 −K −V > bathtest.ps
#
# Run mbcontour
echo Running mbcontour...
mbcontour −f-1 −Idatalist \
        -Jm22.198543775528325 \
        -R114.210795/114.430905/-31.91322/-31.62458 \
        -A50/100000/100000/100000/0.01/0.1 \
        -D0.25/1/4/0.15 \
        -p1 \
        -P −K −O −V >> bathtest.ps
#
# Make color scale
echo Running psscale...
psscale −Cbathtest.cpt \
        -D2.4431/-0.5000/4.8861/0.1500h \
        -B":.Depth (meters):" \
        -P −K −O −V >> bathtest.ps
#
# Make basemap
echo Running psbasemap...
psbasemap −Jm22.198543775528325 \
        -R114.210795/114.430905/-31.91322/-31.62458 \
        -B5m/5m:."Data List File datalist": \
        -P −O −V >> bathtest.ps
#
# Delete surplus files
echo Deleting surplus files...
rm −f bathtest.cpt
#
# Reset GMT default fonts
echo Resetting GMT fonts...
mv gmtdefaults$$ .gmtdefaults
#
# Run xpsview
echo Running xpsview in background...
xpsview −ps a −maxp 4m bathtest.ps &
#
# All done!
echo All done!
```

SEE ALSO

mbsystem(1), **mbcontour**(1), **mbswath**(1), **mbdefaults**(1), **mbm_grdplot**(1), **mbm_grd3dplot**(1), **mbfilter**(1)

BUGS

By making this macro more useful, we have also made it more complex.