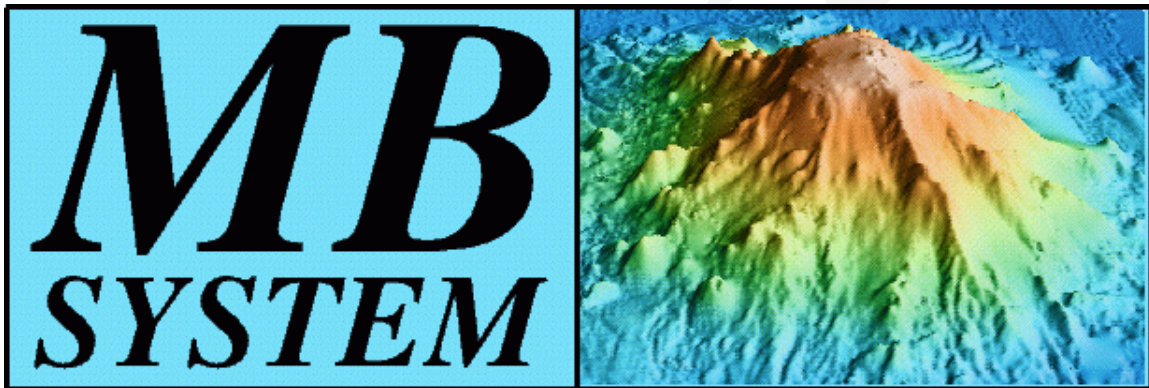


# MB-System Training Course



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**Changelog:**

Version	Date	Changes	Responsible
0.50	09/2012	First draft (still things to be done)	CSF
0.95	10/2013	Expanded version using the workflow version 2013 and including the step-by-step to upgrade MB-System inside Poseidon Linux. Version used at training course done at Girona/Spain during the MARTECH 2013 workshop	CSF
0.96	10/2013	Add missing options for mbkongsbergpreprocess and include a missing command found during the MARTECH 2013	CSF
0.99	01/2014	New items introduced and some improvements made for the 5 days training at PUCV, Chile	CSF
1.00	??/????	Final revision by English native speaker and minor changes/revisions based on comments from the MARTECH workshop users	CSF & ???

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# 1. Intro about MB-System

MB-System is an open source software package for the processing and display of bathymetry and backscatter imagery data derived from multibeam, interferometry, and sidescan sonars. The source code for MB-System is freely available (for free) by anonymous ftp at the page [www.mb-system.org](http://www.mb-system.org).

Similar to GMT, MB-System is mostly a collection of command line tools, but has some few but quite powerful editors with graphical interfaces. For the full list please look here:

[http://www.mbari.org/data/mbsystem/html/mbsystem\\_man\\_list.html](http://www.mbari.org/data/mbsystem/html/mbsystem_man_list.html)

## 1.1. History

MB-System was originally developed at the Lamont-Doherty Earth Observatory of Columbia University (L-DEO) and is now a collaborative effort between the Monterey Bay Aquarium Research Institute (MBARI) and L-DEO. The National Science Foundation has provided the primary support for MB-System development since 1993. The Packard Foundation has provided significant support through MBARI since 1998. Additional support has derived from SeaBeam Instruments (1994-1997), NOAA (2002-2004), and others. Recently MB-System received a new grant from the NSF to support it until 2018.

MB-System's team has been since the origin maintained by Dave Caress (MBARI) and Dale Chayes (LDEO). In the last years it counts with contributions made Val Schmidt (CCOM-UNH), Gordon Keith (CSIRO), Kurt Schwehr (Google), Christian Ferreira (MARUM), Bob Covill (Tekmap Consulting), Hamish Bowman (University of Otago), and others.

# 2. MB-System structure and auxiliary files

## 2.1 The main structure from MB-System

Different from most of the other packages MB-System doesn't has a "project" file, and neither it has to load/open all the data files before you start working with them. What MB-System has is a simply a file called "datalist.mb-1" which store the name from the sonar files and their format (here represent by number with 2 or 3 digits). All tools from MB-System use this list to read and process these files and later create the processed files (by adding the letter "p").

The datalist has no limitations of number of files. Also, files from different formats can be mixed in a single list. Another advantage it that a "master" datalist can simply link to other datalists in the same storage or at remote network drives, and therefore link to an infinite number of files/cruises. These characteristics allow users build a huge topology of files/cruises very similar to a database, and deal with huge quantities of data in several different ways (filtering, extracting metadata, gridding, etc).

## 2.2. Vendor format, editing format and processed files

For basic tasks like plotting user can simply create a datalist contain the raw data files. But some formats require a data translation from the vendor format to an enhanced (and similar) format from MB-System. This is required since (normally) the original format can't hold the edits (flagged data by the user) and additional metadata/comments. Therefore several formats must be converted from the vendor format (raw data) to the editing format. However, even the editing format won't be changed at the end since all the edits/filter made by the user will be stored into what are called auxiliary files.

Later when the user processes the data these files are merged with the editing files and the processed files (the ones with “p” appended to the file name) are created.

### **2.2.1. Understanding the raw/processing format and the auxiliary files**

As you will see in the on section 3, when working with (for example) Kongsberg data we'll have two formats, the .all (raw data), and .mb59 (MB-System's processing data format for the EM122 and other sounders from their 3<sup>rd</sup> generation of equipment). These two formats symbolize MB-System's philosophy where it never modifies the raw data files. To accomplish that MB-System do a partitioning of data into several auxiliary files, so that when you edit something (i.e. clean the multibeam data, apply corrections to the amplitude/sidescan data, edit the navigation, and etc...) those changes are stored inside these auxiliary files that later will be merged together with editing files and create the processed files.

Auxiliary files are normally a subset of a certain information contained inside the original files, therefore they are that they normally are much smaller, so reading them is normally a much faster task. This incredibly accelerates many processes like (for example) reading the sounding records for editing or gridding the processed bathymetry. Another advantage is, if you are unhappy any of the edits done (data cleaning, navigation correction, filters applied, etc...) just simply delete those file where the edits are stored and you're back to the raw data and ready to start again.

Now that you know for what they are for, let's have a closer look at some of them and their function (adapted from MB-System's Cookbook, Schmidt et. al, 2004):

#### *.inf - file statistics*

These files contain metadata about the multibeam data, including geographic, temporal and depth bounds, ship track information, and numbers of flagged or zero beams. They are created automatically by mbkongsbergpreprocess and mbprocess, or by mbinfo via mbdatalist.

#### *.fbt - fast bathymetry*

These files are bathymetry only format 71 files that are intended to provide faster access to swath bathymetry and amplitude data than in the original format. They are created automatically by mbkongsbergpreprocess and mbprocess, or by mbcopy via mbdatalist.

#### *.fnv - fast navigation*

These files are simply ASCII navigation files that are intended to provide faster access to swath navigation than data in the original format. These are created for all swath data formats except single beam, navigation, XYZ. These are created automatically by mbkongsbergpreprocess and mbprocess, or by mblist via mbdatalist.

#### *.par - parameter file*

These files specify settings and parameters controlling how mbprocess generates a processed swath data file from a raw swath data file. These are generated or updated by all of the data editing and analysis tools, including mbedit, mbnavedit, mbeditviz, mbvelocitytool, mbclean, mbackangle, and mbnadjust. They are also directly altered by mbset or using a text editor.

#### *.esf - bathymetry edit flags*

These files contain the bathymetry edit flags output by mbedit, mbeditviz and/or mbclean. The edits are stored in binary format (and not human-readable).

*.nve - edited navigation*

These files contain the edited navigation output by mbnavedit.

*.na0, na1, na2, etc... - readjusted navigation*

These files contain adjusted navigation output by mbnavadjust. These navigation files generally supersede .nve files output by mbnavedit. The latest (highest number) .nv# files are used so .na2 will supersede na1.

*.ata - asynchronous attitude (roll and pitch)*

They contain all attitude data acquired by motion sensor and stored in the multibeam file. While the fast navigation contains only the attitude associated with each ping, here the attitude is complete and asynchronous (from the bathymetry data). The amount of data is set by the rate which the motion sensor sends attitude data to the acquisition software. These files are created by mbkongsbergpreprocess.

*.ath - asynchronous heading*

They same as above but for the heading data. These files are created by mbkongsbergpreprocess.

*.ats - asynchronous sonar depth*

They same as above but for the heave data. These files are created by mbkongsbergpreprocess.

*.sta - synchronous attitude (roll and pitch)*

They contain the attitude data acquired by motion sensor and associated with each ping, so here the attitude is incomplete and synchronous (with the bathymetry data). The amount of data is correlated to the number of pings inside the multibeam file. These files are created by mbkongsbergpreprocess.

*.lck - lock file*

In 2011 MB-System implemented the lock file to allow multiple users work in the same folder. With this feature the user who opens a file(s) for editing automatically locks this file(s) to prevent that another user(s) edit the same file at same time. This feature can be deactivated using mbdefaults.

### **3. Using MB-System**

To illustrate how to use MB-System we will introduce it using a dataset collect with a Kongsberg EM122 system, and which the data ID (format) is specific for 3<sup>rd</sup> generation Kongsberg systems (also, EM302, EM710 and EM2040). PS: For vendor format the files using the .ALL extension (on their file names) are ID 58, while the converted files will be ID 59.

During this tutorial section we used a computer with OSX 10.8 (Mountain Lion) as you will see through the screenshots, however Linux users should remain calm because we avoided all the Mac singularities here to make this tutorial truly universal. Plus, the graphical tools from MB-System look and behave exactly the same on both operating systems.

### 3.1. Basic Intro and Plots

We start with the basics. First we create a project file with our multibeam data files, and after we plot using several ways of presenting these data. So no processing is done and only after (on section 4.2.) we really start really processing something. This approach will introduce you slowly to the common behavior of MB-System, i.e. using most of time the command-line, and later we go for the graphical tools where all the data cleaning, navigation correction and SVP recalculations can be easily and interactively done.

#### 3.1.1. Creating a datalist (the MB-System “project file”) and preparing files

To start using MB-System we must build a catalog file with our multibeam data files listed (that from hereafter called always as “datalist”). To achieve this we’ll be using data from Kongsberg EM122 (1° by 2° degree) dataset here named “PatchSurveyEM122PHINS.zip”. You must download it from:

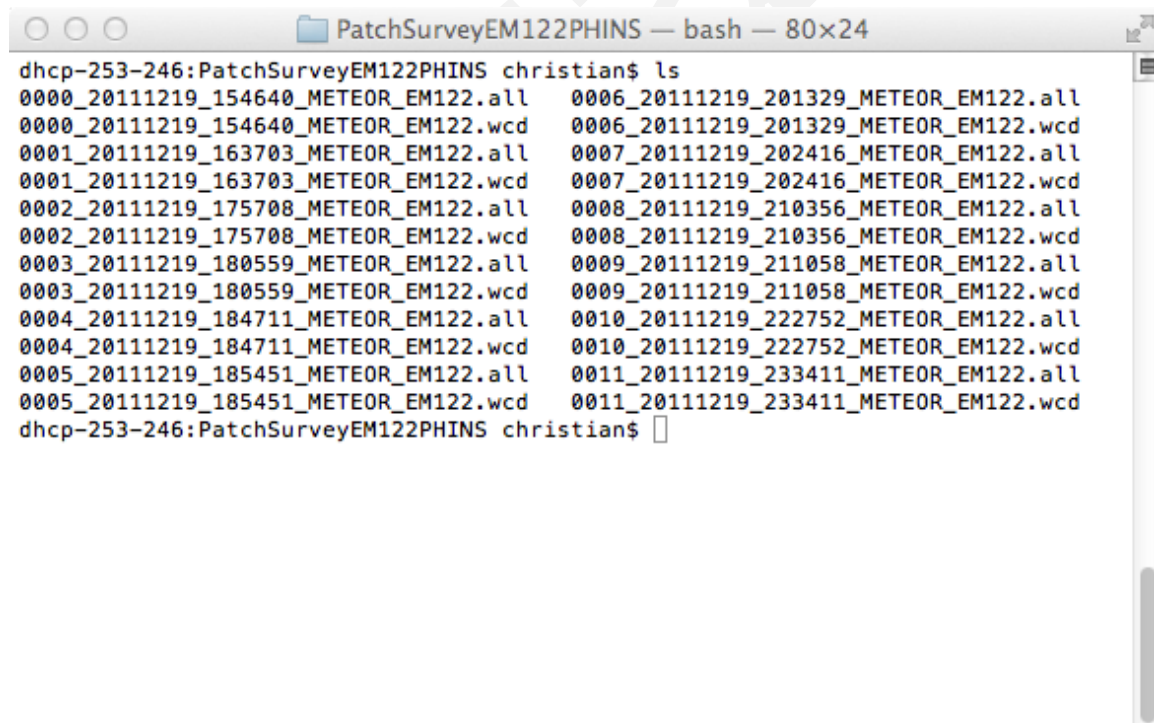
[http://ftp.marum.de/pub/christian/mbsystem\\_sample\\_data/](http://ftp.marum.de/pub/christian/mbsystem_sample_data/)

After you uncompress the .ZIP file open a terminal inside that folder (or navigate with the terminal to it) and type:

```
% ls
```

PS: The “%” symbol is **never** part of any command, it only symbolizes that one is using a terminal for inputting the commands.

This will list all the files and the output should look like this:



```
PatchSurveyEM122PHINS — bash — 80x24
dhcp-253-246:PatchSurveyEM122PHINS christian$ ls
0000_20111219_154640_METEOR_EM122.all  0006_20111219_201329_METEOR_EM122.all
0000_20111219_154640_METEOR_EM122.wcd  0006_20111219_201329_METEOR_EM122.wcd
0001_20111219_163703_METEOR_EM122.all  0007_20111219_202416_METEOR_EM122.all
0001_20111219_163703_METEOR_EM122.wcd  0007_20111219_202416_METEOR_EM122.wcd
0002_20111219_175708_METEOR_EM122.all  0008_20111219_210356_METEOR_EM122.all
0002_20111219_175708_METEOR_EM122.wcd  0008_20111219_210356_METEOR_EM122.wcd
0003_20111219_180559_METEOR_EM122.all  0009_20111219_211058_METEOR_EM122.all
0003_20111219_180559_METEOR_EM122.wcd  0009_20111219_211058_METEOR_EM122.wcd
0004_20111219_184711_METEOR_EM122.all  0010_20111219_222752_METEOR_EM122.all
0004_20111219_184711_METEOR_EM122.wcd  0010_20111219_222752_METEOR_EM122.wcd
0005_20111219_185451_METEOR_EM122.all  0011_20111219_233411_METEOR_EM122.all
0005_20111219_185451_METEOR_EM122.wcd  0011_20111219_233411_METEOR_EM122.wcd
dhcp-253-246:PatchSurveyEM122PHINS christian$
```

Figure 1 – Terminal output from command “ls”.

The next step is creating the datalist. To do that we list these files using the command “ls”, and parse then directly into a text file. At the same operation we add a second column where we insert the data ID number specific for this sonar format. And we do that using “ls” in conjunction with an another tool “awk” that is capable of many sorts of text processing via the command-line, and final command should look like this:

```
% /bin/ls -1 *.all | awk '{print $1" 58"}' > datalist_raw.mb-1
```

PS0: I noted that some users often mistype this command. Therefore I would like to recommend that you copy/paste it. Otherwise, please pay attention that there 4 important white spaces that are important: a) the first is between the “ls” and “-1”; b) the second is between “-1” and the “\*.all”; and c) the third is between “awk” and the single quote; d) and the last is inside the double quotes, there is one at the left of the number 58.

PS1: The \* in “\*.all” list the files having that extension, while “|” (pipe) redirects the output from the first command to the second, and “awk” command gets the list of files (symbolized here with the “\$1”) and adds a white space and the number 58 (which corresponds to the raw format for the EM122 data).

PS2: we don’t add the .wcd (water column data) files, they are there only because in the future there will be a tool using the water column data, but for now simply ignore them.

The resulting file looks like this when open using a text editor:

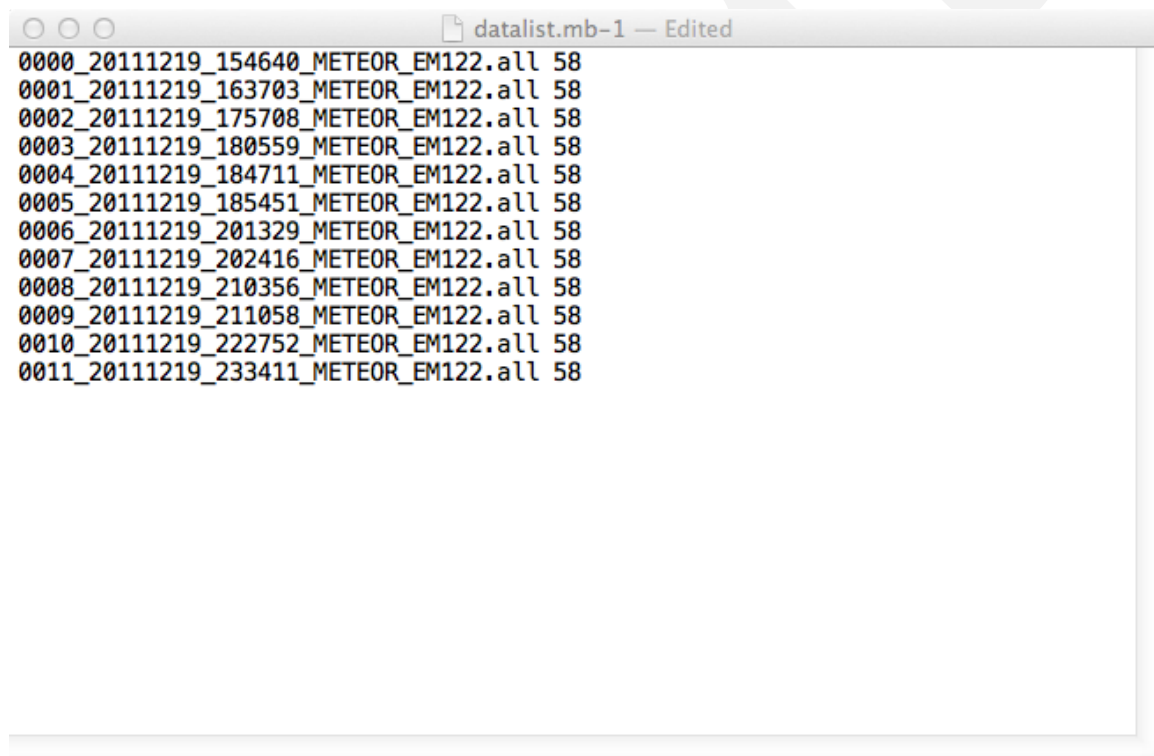


Figure 2 - Content when we open the “datalist.mb-1” file with a text editor.

### 3.2. Vendor and editing formats

Some formats require a data translation from the vendor format to an enhanced (and similar) format used by MB-System. This is necessary since the original formats normally can’t hold edits (records flagged as bad data by the user) and additional metadata/comments. Therefore some formats are divided as “vendor” (raw data) and processing (converted to MB-System format).



MB-System supports a wide range of sonars and data formats (for more details please consult the website): [http://www.mbari.org/data/mbsystem/html/mbsystem\\_formats.html](http://www.mbari.org/data/mbsystem/html/mbsystem_formats.html)

On the next step we convert EM122 data from raw (ID 58) to the processing format (ID 59). This step isn't necessary extremely necessary for plotting tasks, but for processing tasks that we'll see at the next section is **mandatory**. The tool used here is "mbkongsbergpreprocess", and its function here is do a "preprocessing step" of data since the Kongsberg's 58 format is not synchronous, so the bathymetric data, the navigation and attitude (motion) data can be saved with different time stamps, and therefore they must be synchronized before any processing takes places. For that the command is:

```
% mbkongsbergpreprocess -C -V -F-1 -I datalist_raw.mb-1
```

NOTE: for more information on it please consult the manual page in the terminal (by executing the command "man" plus the name of the command you want to know more about) or visit the web man pages here:

[http://www.mbari.org/data/mbsystem/html/mbsystem\\_man\\_list.html](http://www.mbari.org/data/mbsystem/html/mbsystem_man_list.html)

After this is done we must create two new datalist with our mb59 files (next step) and then you have everything prepared to create some plots from our EM122 dataset.

```
% /bin/ls -1 *.mb59 | awk '{print $1" 59"}' > datalist.mb-1
% mbdatalist -Z
```

### 3.3. Basic Plots

Let's start with a plot from navigation records, for that we use the command "mbm\_plot". NOTE: This command is fairly full of options and it's recommended that you invest some time reading its man page and getting to know all the power hidden inside it.

And important aspect to be mentioned that it plots everything on a two steps procedure: a) you call mbm\_plot, which creates the script that will do the plot; b) you run the script that generate the plot.

The first step is (with its output):

```
% mbm_plot -F-1 -I datalist.mb-1 -N
```

*Plot generation shellscript <datalist.mb-1.cmd> created.*

*Instructions:*

*Execute <datalist.mb-1.cmd> to generate Postscript plot <datalist.mb-1.ps>.*

*Executing <datalist.mb-1.cmd> also invokes open to view the plot on the screen.*

Then after comes:

```
% csh datalist.mb-1.cmd
```

And this generates the following output:

*Saving GMT defaults...*

*Setting new GMT defaults...*

*Running mbcontour...*

*Program MBCONTOUR*

Version \$Id: mbcontour.c 1945 2012-05-02 19:11:42Z caress \$  
MB-system Version 5.3.1986

processing data in 0000\_20111219\_154640\_METEOR\_EM122.mb59.fnv...  
processing data in 0001\_20111219\_163703\_METEOR\_EM122.mb59.fnv...  
processing data in 0002\_20111219\_175708\_METEOR\_EM122.mb59.fnv...  
processing data in 0003\_20111219\_180559\_METEOR\_EM122.mb59.fnv...  
processing data in 0004\_20111219\_184711\_METEOR\_EM122.mb59.fnv...  
processing data in 0005\_20111219\_185451\_METEOR\_EM122.mb59.fnv...  
processing data in 0006\_20111219\_201329\_METEOR\_EM122.mb59.fnv...  
processing data in 0007\_20111219\_202416\_METEOR\_EM122.mb59.fnv...  
processing data in 0008\_20111219\_210356\_METEOR\_EM122.mb59.fnv...  
processing data in 0009\_20111219\_211058\_METEOR\_EM122.mb59.fnv...  
processing data in 0010\_20111219\_222752\_METEOR\_EM122.mb59.fnv...  
processing data in 0011\_20111219\_233411\_METEOR\_EM122.mb59.fnv...

3692 pings read and plotted  
Running psbasemap...  
psbasemap: Constructing basemap  
Deleting surplus files...  
Resetting GMT fonts...  
Running open in background...  
[1] 2101  
All done!

The final result will look like this:

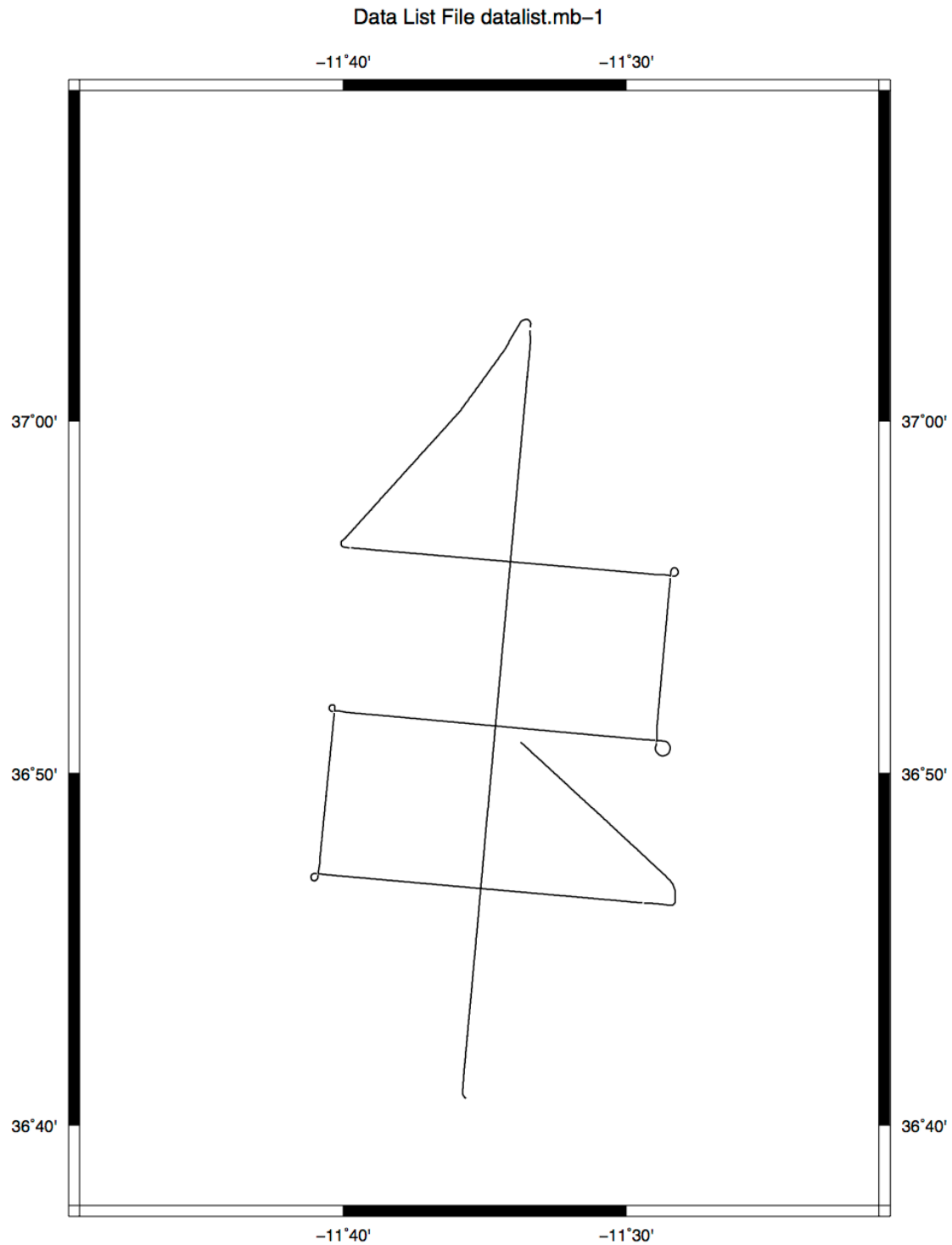


Figure 3 – Navigation plot using *mbm\_plot*.

At first glance it may look a bit too simple since we only see the navigation. So the next step will be plot some multibeam data using a simple color palette. The commands are:

```
% mbm_plot -F-1 -I datalist.mb-1 -N -G1
% csh datalist.mb-1.cmd
```



Ok, the colors are nice, but they don't give us a very good notion of the topography. So let's now try a shaded relief map using option -G2, and draw with some contour lines using -C. The commands are:

```
% mbm_plot -F-1 -I datalist.mb-1 -N -G2 -C  
% csh datalist.mb-1.cmd
```

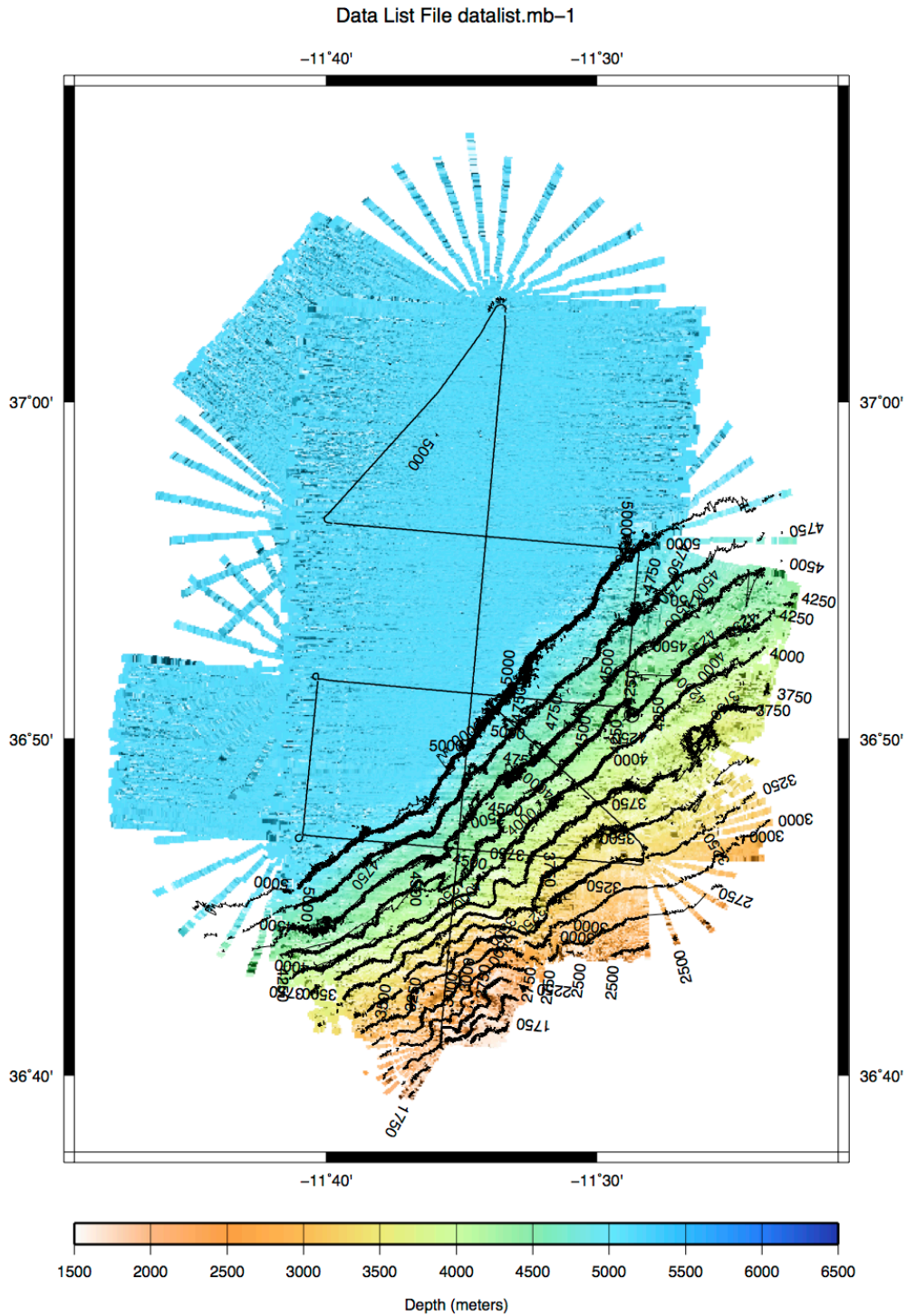


Figure 5 – Shaded relief bathymetry plot using *mbm\_plot* and with contour lines.

Now that we have some bathymetry maps (but honestly they'll look a lot better later on), it's about time to explore the amplitude/backscatter data (with -G4) and the sidescan data (with -G5) from our files. Let's start:

```
% mbm_plot -F-1 -I datalist.mb-1 -N -G4  
% csh datalist.mb-1.cmd
```

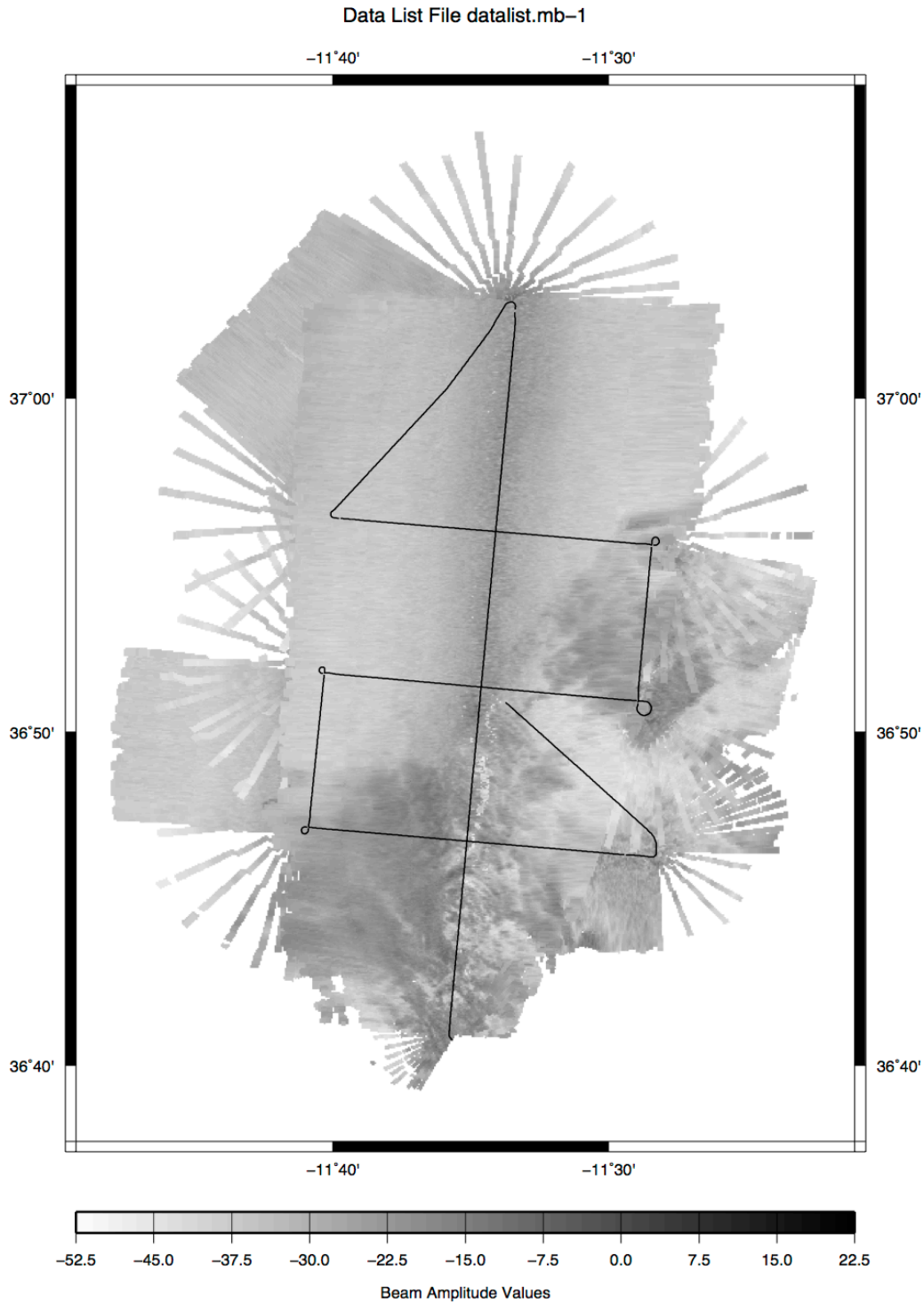


Figure 6 – Raw amplitude/backscatter plot using `mbm_plot` (using a linear scale).

Now it's time to plot the sidescan data with these commands:

```
% mbm_plot -F-1 -I datalist.mb-1 -N -G5  
% csh datalist.mb-1.cmd
```

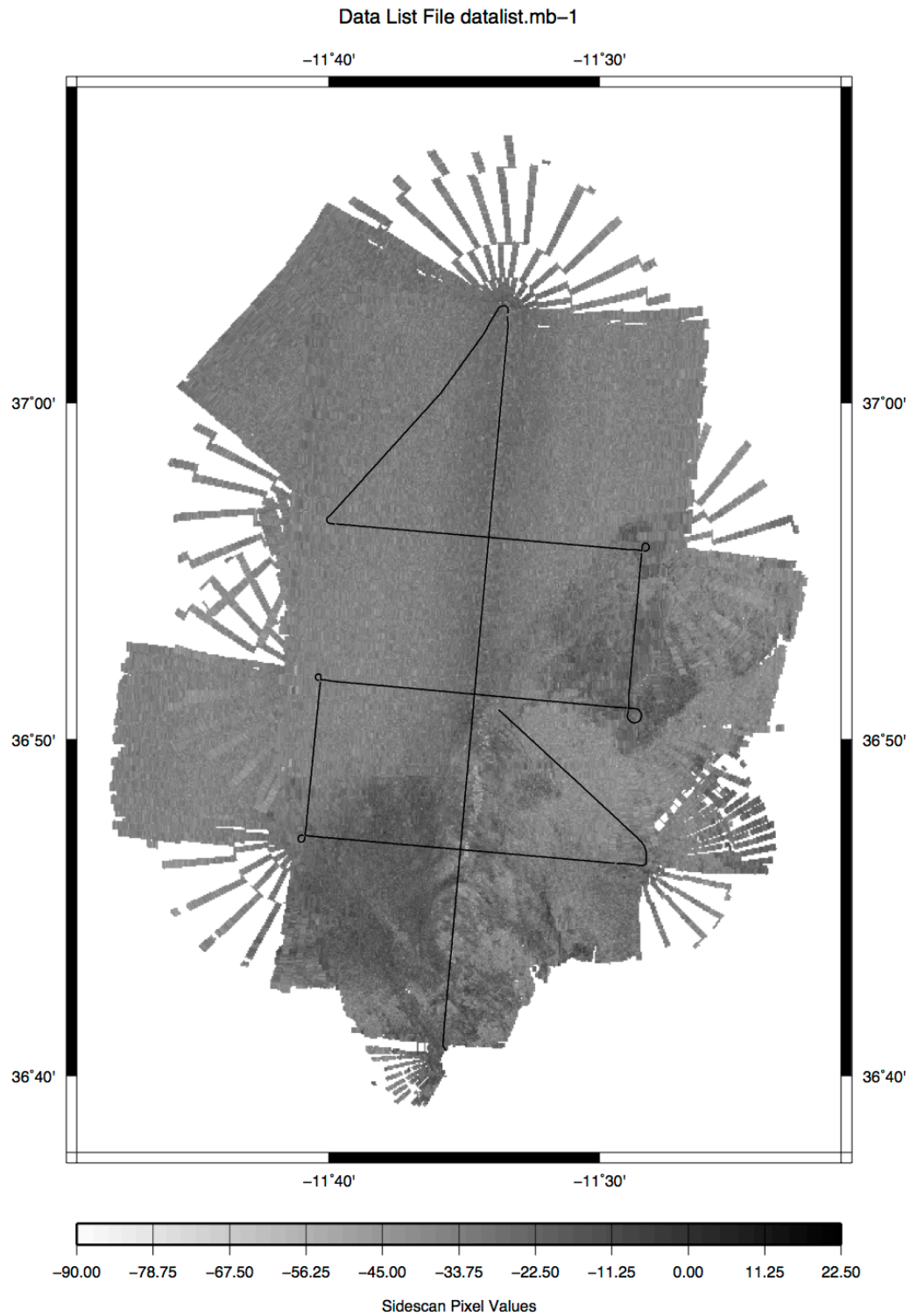


Figure 7 – Raw sidescan plot using `mbm_plot` (using a linear scale).

NOTE: just remember that this is raw data. Later we can recalculate the amplitude and sidescan values based on beam angle and topography to enhance these pictures, but for now we leave them like they are. Also, normally these maps use logarithmic scales that enhance the, but here we opted by not doing any stretching.

For more advanced plots we recommend that you adding some of these options:

-*Rwest/east/south/north*: with this option you can set geographical limits for your map region. It's very useful when you want to plot only a subset of the whole survey/area. The values must be in decimal degrees. Suggestion: try increase or decrease the area from one of our previous plots using this.

-*MGQnumber*: set the resolution in dpi, the default is 100, but for publications normally 300 is recommended, however the size from the .PS file proportionally will be bigger.

-*MMSnumber*: set the minimum speed acceptable, the default is 0 (all data) but this could be very useful to exclude data when the vessel was standing on station (with the data acquisition still running), and when the is normally not good or interesting for bathymetric maps. The value is in km/h.

-*MNA*: print each multibeam file name next to the navigation track. Add a "p" at the end to plot the names perpendicular to the navigation track.

-*MTG0/0/0*: draw the land filled with color. The values are in Red/Green/Blue (here is the black color), and the values range from 0 to 254.

-*Oname*: specify the name for the output script that generates the map.

-*T*: plot only the coastline (only if the survey is in a scale that the coast can be seen inside the map area)

-*Unumber*: select the orientation ("1" portrait or "2" landscape)

-*W*: control the color scheme, with -W1/2 is changing the color to high intensity, and -W1/4 is B/W

-*Zmin/max*: set min/max for color palette. Note that since the data here is bathymetry (not topography) the deeper value comes first, and the shallower comes last.

Actually, feel free to play with `mbm_plot` adding/removing options until you get what you have been looking for. And don't forget look inside the man page from it for even more options.

At last and important to note is that the .cmd files are nothing else than a text file where some MB-System and GMT tools are combined, so by knowing GMT commands you can unleash a extraordinary range of plotting possibilities and expand your MB-System plots to do anything GMT can.

## 4. Extracting basic information from your data

Any surveyor sometimes needs some basic information about the multibeam data, either coming from a single file or a survey. The command for that is "mbinfo", and a basic data summary can be easily done for our survey with:

```
% mbinfo -F-1 -I datalist.mb-1
```

The output is (just presenting the end of the extraction process):



```
PatchSurveyEM122PHINS — bash — 87x45

Data Totals:
Number of Records: 3692
Bathymetry Data (432 beams):
  Number of Beams: 1594944
  Number of Good Beams: 1473449 92.38%
  Number of Zero Beams: 0 0.00%
  Number of Flagged Beams: 121495 7.62%
Amplitude Data (432 beams):
  Number of Beams: 1594944
  Number of Good Beams: 1473449 92.38%
  Number of Zero Beams: 0 0.00%
  Number of Flagged Beams: 121495 7.62%
Sidescan Data (1024 pixels):
  Number of Pixels: 3780608
  Number of Good Pixels: 3267846 86.44%
  Number of Zero Pixels: 0 0.00%
  Number of Flagged Pixels: 512762 13.56%

Navigation Totals:
Total Time: 10.9485 hours
Total Track Length: 144.5637 km
Average Speed: 13.2040 km/hr ( 7.1373 knots)

Start of Data:
Time: 12 19 2011 15:46:27.537000 JD353 (2011-12-19T15:46:27.537000)
Lon: -11.562204000 Lat: 36.848203300 Depth: 4931.4829 meters
Speed: 17.6040 km/hr ( 9.5157 knots) Heading: 130.8400 degrees
Sonar Depth: 5.6975 m Sonar Altitude: 5025.2964 m

End of Data:
Time: 12 20 2011 02:43:22.160000 JD354 (2011-12-20T02:43:22.160000)
Lon: -11.594176900 Lat: 36.679362050 Depth: 2047.8806 meters
Speed: 10.3680 km/hr ( 5.6043 knots) Heading: 112.8900 degrees
Sonar Depth: 5.7254 m Sonar Altitude: 2138.7637 m

Limits:
Minimum Longitude: -11.800382599 Maximum Longitude: -11.372491794
Minimum Latitude: 36.652535056 Maximum Latitude: 37.131892368
Minimum Sonar Depth: 4.2445 Maximum Sonar Depth: 7.3838
Minimum Altitude: 2138.7637 Maximum Altitude: 5138.5195
Minimum Depth: 1513.0586 Maximum Depth: 5255.5796
Minimum Amplitude: -59.6000 Maximum Amplitude: 0.4000
Minimum Sidescan: -90.1300 Maximum Sidescan: 2.6600
dhcp-253-246:PatchSurveyEM122PHINS christian$
```

Figure 8 – Summary from our raw test dataset.

Additional to that we can print also extra "notices" from the data by using the flag "-N" (not shown here).

Another capability from mbinfo is plot the metadata inserted into the data (using "-C"), but this normally a more useful extraction for processed files since the MB-System incorporates into the data all the corrections done/applied on these files. However, the community demanded a data extractions compliant with database friendly formats (Generic XML and JSON), so for that there is the flag "-X" converts the summary to one formats already implement into mbinfo. For the future is planned a XML export compliant with ISO-19115 (used at the US), and INSPIRE (a similar standard from Europe).

#### 4.1. Applying metadata into every single file

Another way to keep track from where/when your datasets is insert cruise metadata is using the command "mbset". An example follows:

```
% mbset -PMETAVESSEL:Maria_S_Merian -PMETAINSTITUTION:University_of_Hamburg  
-PMETAPLATFORM:MSM -PMETASONAR:EM1002 -PMETASONARVERSION:SIS_3.7  
-PMETACRUISEID:15-3 -PMETACRUISENAME:MSM15-3_Gela_Basin -PMETAPI:Christian_Ferreira  
-PMETAPIINSTITUTION:MARUM -PMETACLIENT:MARUM -PMETASVCORRECTED:0  
-PMETATIDECORRECTED:0 -PMETABATHEDITMANUAL:1 -PMETABATHEDITAUTO:0  
-PMETAROLLBIAS:0.2 -PMETAPITCHBIAS:0 -METAHEADINGBIAS:0 -PMETADRAFT:6.30
```

And even a single file is queried, the output can be seen as:

```
% mbinfo -C -F57 -I 0000_20100626_143415_MariaSMerianp.mb57
```

```
Swath Data File: 0000_20100626_143415_MariaSMerianp.mb57 MBIO Data Format ID: 57  
Format name: MBF_EM300MBA  
Informal Description: Simrad multibeam processing format  
Attributes: Old and new Simrad multibeam,  
EM12S, EM12D, EM121, EM120, EM300,  
EM100, EM1000, EM950, EM1002, EM3000,  
bathymetry, amplitude, and sidescan,  
up to 254 beams, variable pixels, ascii + binary, MBARI.
```

```
Metadata:  
Vessel: Maria_S_Merian  
Institution: University_of_Hamburg  
Platform: MSM  
Sonar: EM1002  
Sonar Version: Kongsberg_SIS_3.7  
Cruise ID: 15-3  
Cruise Name: MSM15-3_Gela_Basin  
PI: Christian_Ferreira  
PI Institution: MARUM  
Client: MARUM  
Corrected Depths: NO  
Tide Corrected: NO  
Depths Manually Edited: YES  
Depths Auto-Edited: NO  
Roll Bias: 0.200000 degrees  
Pitch Bias: 0.000000 degrees  
Heading Bias: 0.000000 degrees  
Draft: 6.300000 m
```

```
Comments in file 0000_20100626_143415_MariaSMerianp.mb57:
```

```
Swath data modified by program mbprocess  
Version $Id: mbprocess.c 1905 2011-09-13 23:52:36Z caress $  
MB-system Version 5.3.1906  
Run by user <chris> on cpu <mb> at <Fri Oct 21 19:09:49 2011>  
Control Parameters:
```

```
MBIO data format: 57
```

```
Input
```

```
/Users/chris/Work/MB/Sicily/MSM15_3_Survey01/0000_20100626_143415_MariaSMerian.mb57
```

file:

Output file:  
 /Users/chris/Work/MB/Sicily/MSM15\_3\_Survey01/0000\_20100626\_143415\_MariaSMerianp.mb57  
 Roll bias: OFF  
 Pitch bias: OFF  
 Draft: not modified  
 Heave: not modified  
 Travel time: not modified  
 Lever calculation off.  
 Tide calculation off.  
 Merge navigation: OFF  
 Navigation positions not shifted.  
 Merge adjusted navigation: OFF  
 Attitude merging: OFF.  
 Sonardepth merging: OFF.  
 Heading modify: OFF  
 Amplitude Corrections:  
 Amplitude vs grazing angle corrections applied to amplitudes.  
 Amplitude correction file:  
 /Users/chris/Work/MB/Sicily/MSM15\_3\_Survey01/0000\_20100626\_143415\_MariaSMerian.mb57.agam  
 Amplitude correction by subtraction (dB scale)  
 AVGA tables forced to be symmetric  
 Reference grazing angle: 30.000000 deg  
 Amplitude correction uses swath bathymetry in file  
 Amplitude correction ignores seafloor slope  
 Sidescan Corrections:  
 Amplitude vs grazing angle corrections applied to sidescan.  
 Sidescan correction file:  
 /Users/chris/Work/MB/Sicily/MSM15\_3\_Survey01/0000\_20100626\_143415\_MariaSMerian.mb57.sgam  
 Sidescan correction by subtraction (dB scale)  
 AVGA tables forced to be symmetric  
 Reference grazing angle: 30.000000 deg  
 Sidescan correction uses swath bathymetry in file  
 Sidescan correction ignores seafloor slope  
 Sidescan Recalculation:  
 Sidescan not recalculated.  
 Data cutting disabled.  
 Bathymetry edit file:  
 /Users/chris/Work/MB/Sicily/MSM15\_3\_Survey01/0000\_20100626\_143415\_MariaSMerian.mb57.esf

These data copied by program MBcopy version \$Id: mbcopy.c 1839 2010-03-13 08:55:43Z caress \$  
 MB-system Version 5.1.3beta1855  
 Run by user <chris> on cpu <Pro.local> at <Sat Jun 26 23:13:56 2010>  
 Control Parameters:  
 Input file: 0000\_20100626\_143415\_MariaSMerian.all  
 Input MBIO format: 56  
 Output file: 0000\_20100626\_143415\_MariaSMerian.mb57  
 Output MBIO format: 57  
 Ping averaging: 1  
 Longitude flip: 0  
 Longitude bounds: -360.000000 360.000000  
 Latitude bounds: -90.000000 90.000000  
 Begin time: 1962 2 21 10 30 0 0  
 End time: 2062 2 21 10 30 0 0

Minimum speed: 0.000000  
Time gap: 1.000000

Survey between 400 and 600m  
Survey between 400 and 600m

*Data Totals:*

Number of Records: 642

*Bathymetry Data (191 beams):*

Number of Beams: 122622  
Number of Good Beams: 101047 82.41%  
Number of Zero Beams: 2623 2.14%  
Number of Flagged Beams: 18952 15.46%

*Amplitude Data (191 beams):*

Number of Beams: 122622  
Number of Good Beams: 101047 82.41%  
Number of Zero Beams: 2623 2.14%  
Number of Flagged Beams: 18952 15.46%

*Sidescan Data (1024 pixels):*

Number of Pixels: 657408  
Number of Good Pixels: 538771 81.95%  
Number of Zero Pixels: 0 0.00%  
Number of Flagged Pixels: 118637 18.05%

*Navigation Totals:*

Total Time: 0.4995 hours  
Total Track Length: 4.6340 km  
Average Speed: 9.2768 km/hr ( 5.0145 knots)

*Start of Data:*

Time: 06 26 2010 14:34:13.118000 JD177  
Lon: 14.2042 Lat: 36.7550 Depth: 716.8400 meters  
Speed: 0.0000 km/hr ( 0.0000 knots) Heading: 10.3300 degrees  
Sonar Depth: 6.2800 m Sonar Altitude: 710.5600 m

*End of Data:*

Time: 06 26 2010 15:04:11.416000 JD177  
Lon: 14.2198 Lat: 36.7948 Depth: 544.0100 meters  
Speed: 9.2880 km/hr ( 5.0205 knots) Heading: 7.7500 degrees  
Sonar Depth: 6.3300 m Sonar Altitude: 537.6800 m

*Limits:*

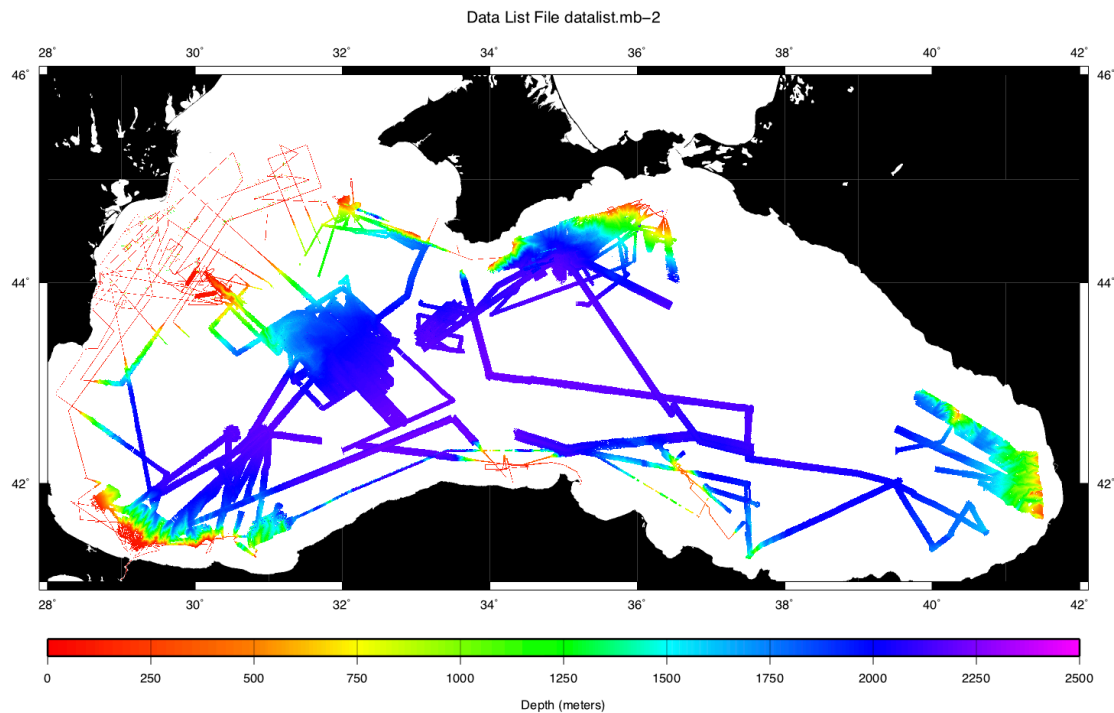
Minimum Longitude: 14.1903 Maximum Longitude: 14.2296  
Minimum Latitude: 36.7523 Maximum Latitude: 36.7962  
Minimum Sonar Depth: 6.2200 Maximum Sonar Depth: 6.4500  
Minimum Altitude: 527.2300 Maximum Altitude: 718.9000  
Minimum Depth: 508.7900 Maximum Depth: 743.0300  
Minimum Amplitude: -54.0000 Maximum Amplitude: -14.5000  
Minimum Sidescan: -71.8300 Maximum Sidescan: -9.4000

## 5. Multiple surveys in a single datalist

In a normal work situation your group may collect data (and get it from the hydrographic databases, NOAA-NGDC, SISMER, BSH, etc) and you won't be normally working using only a single survey. Another scenario is when during a single cruise people decide split data over multiple folders/surveys. To connect them is simple, you just must create a "master" datalist that points out to all the other datalists. At the example we show a datalist with 22 cruises (and their subdivisions too):

1996_BlackSea_TTR6/CentralBS/datalist.mb-1	-1	10	
1996_BlackSea_TTR6/Sorokin_Trough/datalist.mb-1	-1	10	
1998_BlackSea_BLASON/datalist.mb-1	-1	20	
2001_BlackSea_M51-4/datalist.mb-1	-1	10	
2001_BlackSea_KN162L17/datalist.mb-1	-1	20	
2002_BlackSea_BLASON2/datalist.mb-1	-1	20	
2002_BlackSea_M52-1/datalist.mb-1	-1	1	
2003_BlackSea_KN172L05/datalist.mb-1	-1	20	
2003_BlackSea_KN172L06/datalist.mb-1	-1	20	
2003_BlackSea_KN172L07/datalist.mb-1	-1	20	
2003_BlackSea_KN172L08/datalist.mb-1	-1	20	
2003_BlackSea_KN172L09/datalist.mb-1	-1	20	
2003_BlackSea_KN172L15/datalist.mb-1	-1	20	
2004_BlackSea_PO317-3/datalist.mb-1	-1	5	
2004_BlackSea_PO317-4/survey1_area4/datalist.mb-1	-1	10	
2004_BlackSea_PO317-4/survey2_area3/datalist.mb-1	-1	5	
2004_BlackSea_PO317-4/survey3_transit_3to2/datalist.mb-1	-1	5	
2004_BlackSea_PO317-4/survey4_area2-1/datalist.mb-1	-1	5	
2004_BlackSea_PO317-4/survey5_area2-2/datalist.mb-1	-1	5	
2004_BlackSea_PO317-4/survey6_transit_back/datalist.mb-1	-1	5	
2007_BlackSea_M72-1/EM120_Max/datalist.mb-1	-1	20	
2007_BlackSea_M72-2/EM120/crimea/datalist.mb-1	-1	20	
2007_BlackSea_M72-2/EM120/sorokin/datalist.mb-1	-1	20	
2007_BlackSea_M72-2/EM120/transit/datalist.mb-1	-1	10	
2007_BlackSea_M72-3/EM120/M723a-1/Transit/datalist.mb-1	-1	20	
2007_BlackSea_M72-3/EM120/M723a-1/Georgia/datalist.mb-1	-1	20	
2007_BlackSea_M72-3/EM120/M723a-1/Ukraine/datalist.mb-1	-1	20	
2007_BlackSea_M72-3/EM120/M723b-1/Georgia/datalist.mb-1	-1	20	
2007_BlackSea_M72-3/EM120/M723b-2/datalist.mb-1	-1	20	
2007_BlackSea_M72-3/EM120/M723b-3/datalist.mb-1	-1	20	
2007_BlackSea_M72-4/EM120/M724-2/datalist.mb-1	-1	10	
2007_BlackSea_M72-5/EM120/Area2/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area2a/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area2b/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area2c/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area3a/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area4a/datalist.mb-1	-1	5	
2007_BlackSea_M72-5/EM120/Area4b/datalist.mb-1	-1	5	
2010_BlackSea_MSM15-1/datalist.mb-1	-1	10	
2010_BlackSea_MSM15-2/EM120/datalist.mb-1	-1	20	
2011_BlackSea_M84-2/M84-2_EREGLI/datalist.mb-1	-1	100	
2011_BlackSea_M84-2/M84-2_GEORGIA/datalist.mb-1	-1	100	
2011_BlackSea_M84-2/M84-2_KERCH/datalist.mb-1	-1	100	
2011_BlackSea_M84-2/M84-2_SAMSUN/datalist.mb-1	-1	100	

This datalist example comes from a compilation of data from the Black Sea. Have you noted an extra column? So, with MB-System you can attribute data quality factors for each cruise. These ranking must be done by the user, and bigger the number the higher is the influence from these data over the gridding calculations when they overlap. This won't make a huge difference on plots, but when gridding this will play a major rule. NOTE: there is not minimum or maximum value, and the classification is totally done by the user, so he/she must know and ponder how the cruises must be ranked.



*Figure 9 – Black Sea compilation done by MARUM (still under revision before final release). This is an old version from 2010. New cruises have added after this picture was produced.*

## 6. Corrections

Even the best multibeam system is not completely immune problems. And the environment that we are surveying is sometimes very dynamic (waves, water masses, complex topography, etc). So the process of applying corrections is always necessary even if they are minimal.

Through this next section we will cover the most common corrections for multibeam data.

### 6.1. Amplitude/Sidescan correction

Most sonar brands (not like Kongsberg) normally don't apply many corrections to the backscatter/sidescan records, and therefore it's necessary for the user performs some corrections before the characteristics from the surface sediments & morphology can be interpreted.

To do that with MB-System we use the command "mbbackangle". The most common example would be:

```
% mbbackangle -A -Q (-Tgrid) -V
```

Where:

-A: is set to apply a grazing angle correction to both amplitude (-A1) and sidescan (-A2) records. The algorithm uses a reference beam that can be specified by the user. The default is at 30° (off nadir) and calculated for groups of 2° degrees;

-Q: this calculates within a single ping the slope across-track, and applies it to the calculations from option "-A";

-Tgrid (optional): if a grid with the morphology from the area is provided (normally it could be the processed multibeam data from the same survey) the program calculates the slopes also along track, and applies them on the calculations from option -A;

-V: this is only the regular verbose mode.

NOTE: MB-System normally calculates the corrections from option -A for groups of 50 pings. But normally the best approach is applying the overview values calculated for the whole survey. You can do that by applying these two commands:

```
% mbset -PAMPCORRFILE:datalist.mb-1_tot.aga  
% mbset -PSSCORRFILE:datalist.mb-1_tot.sga
```

Please note that all these corrections will be applied only when the command "mbprocess" is called to merge the raw with the modified auxiliary files, and produce the processed files.

## 6.2. Sound Velocity correction with mbvelocitytool

Normally a good SVP (Sound Velocity Profile) should be taken and applied at the beginning of a survey. In reality every time you suspect that outer beams of multibeam look bended up/down it's probably time to take a new SVP. However, sometimes cruises are under big time constraints and you can take a new one SVP only a few hours/days later.

Using MB-System you can apply a SVP file to your datalist by using this command:

```
% mbset -F-1 -I datalist.mb-1 -PSVPFILE:My_File.svp
```

The only thing users should take care is providing a text file (like the one from our example "My\_File.svp"). This file is a simple ASCII file with two columns: depth and sound velocity. It can be space or tab separated. Files that have used SIS (Seafloor Information System) normally work, but one just must pay attention to the ASCII-encoding since \*NIX systems and MS Windows use a different system for <CR> (Carriage Return, AKA, New Line). The solution for that is open the SVP ASCII file in any text editor on \*UNIX system, copy and paste it to a new file and save it again.

To have a SVP for playing, extract the SVP inside the 0000 from our dataset. The command is:

```
% mbsvplist -F59 -I 0000_20111219_154640_METEOR_EM122.all > my_SVP.svp
```

Alternatively, users can use the mbvelocity tool to interactively see the effect of new SVP over the data without really applying it. For that open the tool using the command:

```
% mbvelocitytool
```



That open a window and on it select "File => Open swath sonar data" and grab the first .mb59 file (here is 0000...), click on it and press "OK". You will see this window:

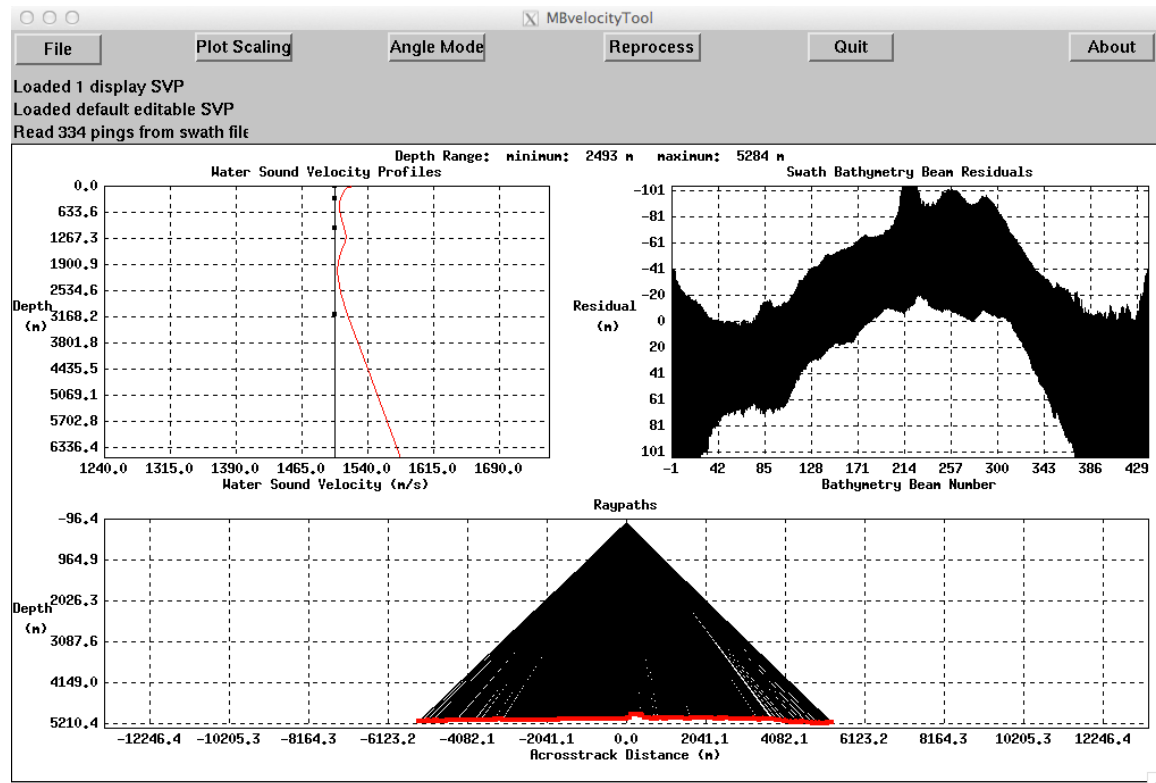


Figure 10 – The mbvelocity tool UI and displaying one multibeam file residuals and raypaths. The red line represents the profile queried using the command "mblevitus", and it's an annual average SVP for the area.

This sample dataset was not acquired over a flat bottom area, so the "Swath Bathymetry Beam Residuals" will look grotesque. So please, don't pay attention to that and pretend that this is your dataset. Now open your SVP file (at "File => Open display/editable profile") if you can see it's because MB-System can understand it.

About using mbvelocitytool please look at the man page, or access out YouTube video that highlights the basic features:

<http://www.youtube.com/user/MBSystem1993>

Notes:

- the difference between "display" and "editable" is that display is not applied to the data when you click "Reprocess", while the second option do.
- pay attention that mbvelocitytool works only with a single file, however once you have found a SVP that works for your data you can apply to a whole dataset/survey using mbset with a datalist.
- you shouldn't maximize the mbvelocitytool window, because that won't produce any effect.

d) to close these or any other graphical from MB-System do not close the windows, unless you want to loose everything you did on that file. The proper way is by using the buttons "Quit" and/or "Dismiss".

### 6.3. Tide correction

When working at deep sea (>2000 m) with ship multibeam data the influence of tides won't be perceptible. But for those not working at deep sea, the tides can play an important rule since the affects over the depths measurements will be contaminated by the tide signal creating artificially shallower or deeper area depending when on the tide cycle they were surveyed.

But with MB-System is rather simple (if you have OTPSnc installed and mbopts compiled during installation). The example is:

```
% mbotps -F-1 -I datalist.mb-1 -D60 -M
```

The relevant thing to understand here are:

- a) by setting a datalist you calculate the tide correction for all your files inside the datalist.
- b) the interval is set by the "-D" flag, and is in seconds. Change it according your will.

### 6.4. Lever arms offsets and biases

New lever arms and biases can be applied. They are extensively explained in the man page from "mbset". A quick way to get and overview of what could be changed is accessible if you open a .par (parameter file) from any of your files that have been "touched" by any of the MB-System tools. The way to apply changes to an individual file is edit the .par directly, and to groups of files is using "mbset" as shown at section 6.2 (SVP correction).

## 7. Cleaning data

Cleaning data is always necessary unless you have a perfect echosounder and vessel, if you do skip this section and go to section 8.

### 7.1. Automatically

Some people sometimes simply don't have time to clean data manually. For them MB-System has two specialized tools, one for multibeam data, and another for sidescan data. Just keep in mind that filters are sometimes able to delete not only spikes, but also good data. And some filter settings that work for one dataset not necessarily work on another. So, finding the best settings for a filter can sometimes consume a lot of time. That been said, use filters as much as you want.

#### 7.1.1. Multibeam data (mbclean)

The automatic filter for multibeam data inside MB-System is called "mbclean". This tool has lots of options, but the more frequently used by the author are only clipping out major outliers and zapping out some outer beams. This is done with the command:

```
% mbclean -X20 -Z-3000/-1000 -V
```

PS: the version of MB-System used during this tutorial seams has a bug, the slope filter is now mandatory and not optional as it used to be. So don't use it. Sorry. However I similar filter could be applied using mbedit (we'll see it later).

### **7.1.2. Sidescan data (mbfilter)**

To filter sidescan the tools is called "mbfilter". The man page explains the usage, and an article published during the GLORIA project describes the filters implemented inside it. And example is:

```
% mbfilter -ldatalistp.mb-1 -S2/5/3
```

The command "mbfilter" with the desired settings should be applied over processed data, so wait until you have finished section 8. No strong emphasis is placed over sidescan during this tutorial due to the complexity involved, and it will be separate document in the future.

## **7.2. Manually**

No data can be perfectly cleaned using automatic filters (author's opinion... feel free to disagree and prove your opinion). Therefore one should master the two editors from MB-System for achieving the final goal... a very good map!

### **7.2.1. Editing data with the 2D editor (mbedit)**

The most in-detail editor is also the simplest, while the one we'll see after that the 3D editor (mbeditviz) can be very fast, the 2D editor is also quite powerful and useful for data investigations and a good/extreme fine cleaning. So don't underestimate its powers. A look at interface of the 2D is bellow:

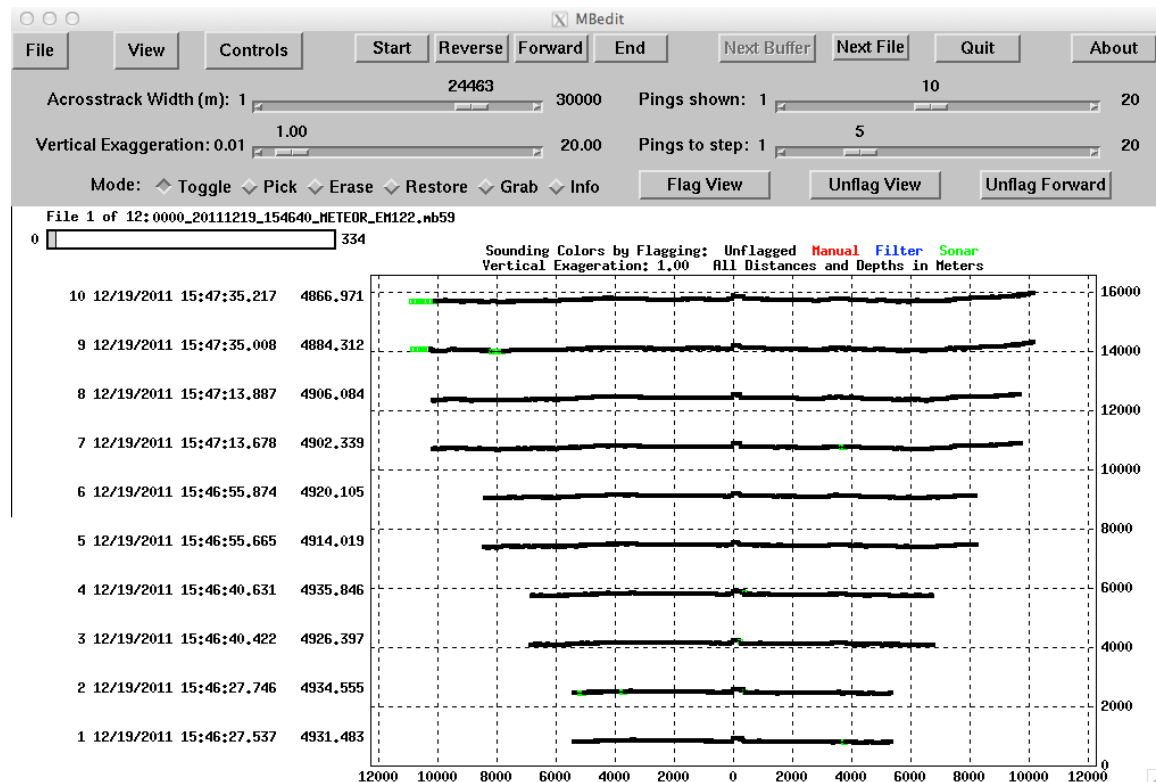


Figure 11 – A typical mbedit showing some pings.

To start the 2D data editor and load the first file from our datalist we call it at the terminal using this command:

```
% mbedit -F-1 -I datalist.mb-1
```

While the usage of mbedit is quite well described at its man page, we prepared a video that easily highlights its features here:

<http://www.youtube.com/user/MBSystem1993>

Notes:

a) it's not deeply described, but mbedit has dozens of keyboard shortcuts that can make the editing task much faster. The list is described inside the man page.

b) pay attention that mbedit works only with a single file, however when working with a datalist is possible to jump for next file by pressing the button "Next File".

c) you shouldn't maximize the mbedit window, because that won't produce any effect.

d) to close these or any other graphical from MB-System do not close the windows, unless you want to loose everything you did on that file. The proper way is by using the buttons "Quit" and/or "Dismiss".

### 7.2.2. Editing data with the 3D editor (mbeditviz)

The 3D editor is the faster editor to get your get ready for a good map. With this editor you can load a single file or a group of them and interactively flag (as bad or even back as good) visualizing the soundings as a 3D cloud of points.

To start the 3D data editor and load our datalist we call it at the terminal using this command:

```
% mbeditviz -F-1 -I datalist.mb-1
```

This opens the window bellow, there the user has 3 options: 1) "View All Files"; 2) "View Selected Files" (use SHIFT or CONTROL to select them); and finally 3) "Remove Selected Files".

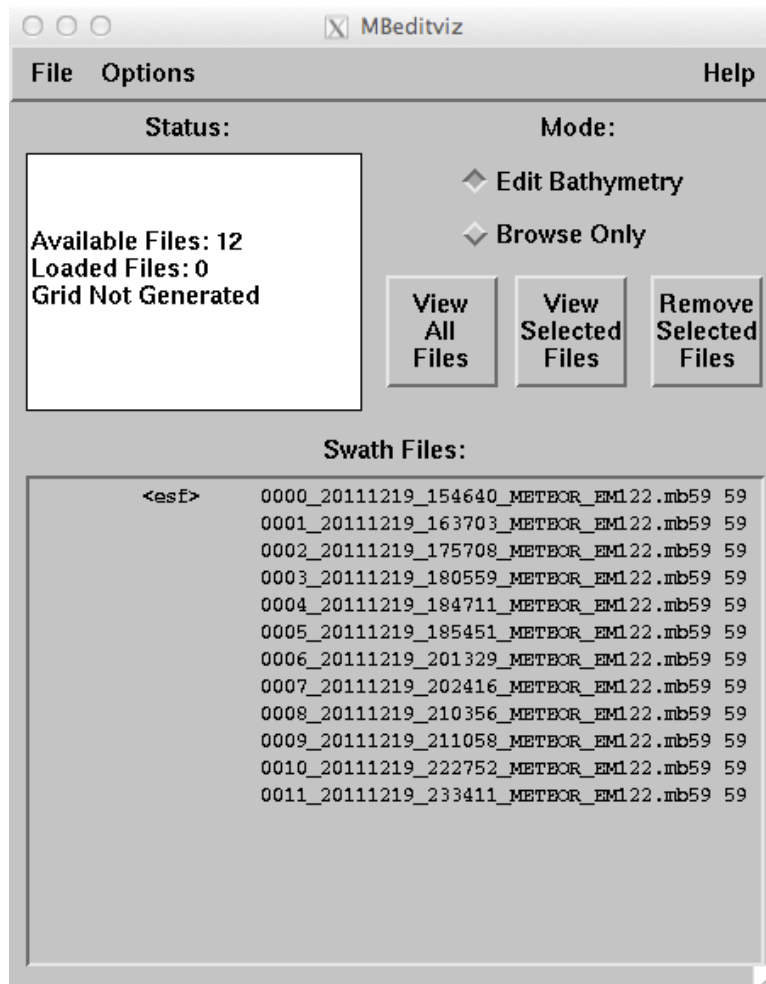


Figure 12 – Start window of mbeditviz with a datalist loaded.

Note: See that at least on file has "<esf>", this was the file we opened with mbedit, and even if we do nothing this file will be created (but with 0 edits).

By clicking "View All Files" the software will read the .inf files and estimate a reasonable resolution based on the depth and footprint cell size of the shallowest point in the dataset.

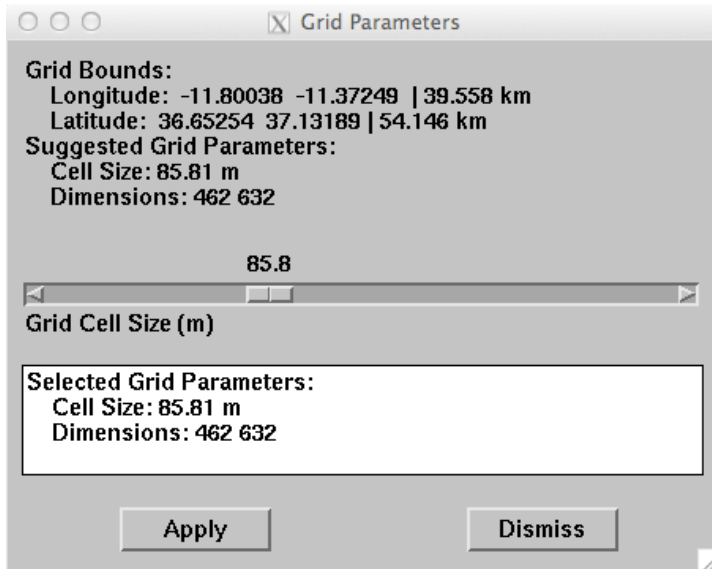


Figure 13 – Selecting the resolution for the display grid.

However, the dialog allows you choose a custom resolution, but keep in mind that the highest the resolution the longer the interpolation will take, and the interpolation method used by mbeditviz is equivalent to the type -F5 at mbgrid, so the resulting surface will look great (or the best it can) since this is a very robust model, but the process can take quite a long time with a large dataset. Our suggestion choose the resolution based on what you aim the final map, but don't forget that if you did open a extensive survey with hundreds of files or a AUV dive with very high resolution data this process can take dozen of minutes to a couple hours to finish. So, if you need a very high resolution but the process takes too long, consider open just a smaller amount of data to speed up things. With the EM122 dataset is quite OK to change the resolution to 50 meters. After that click "apply" and the interpolation will start...

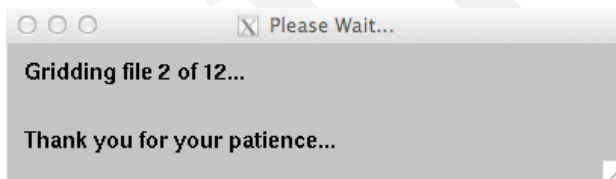
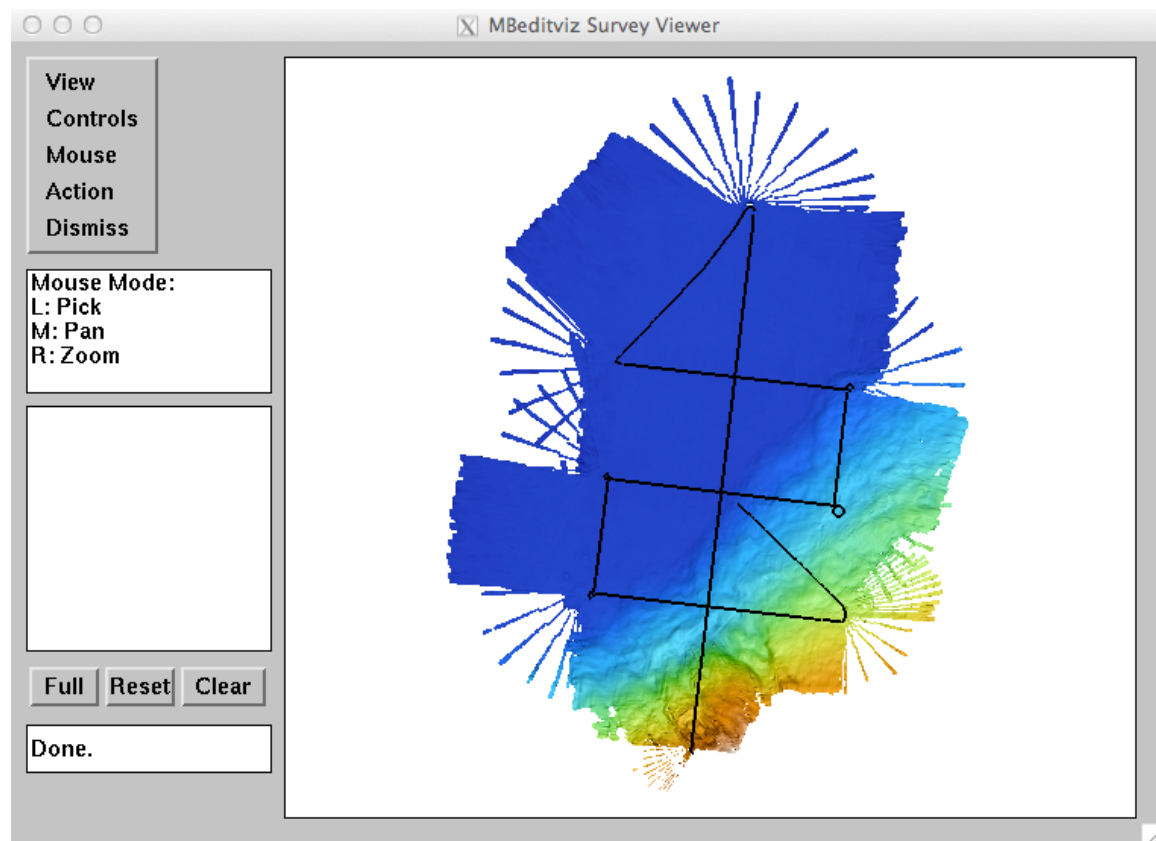


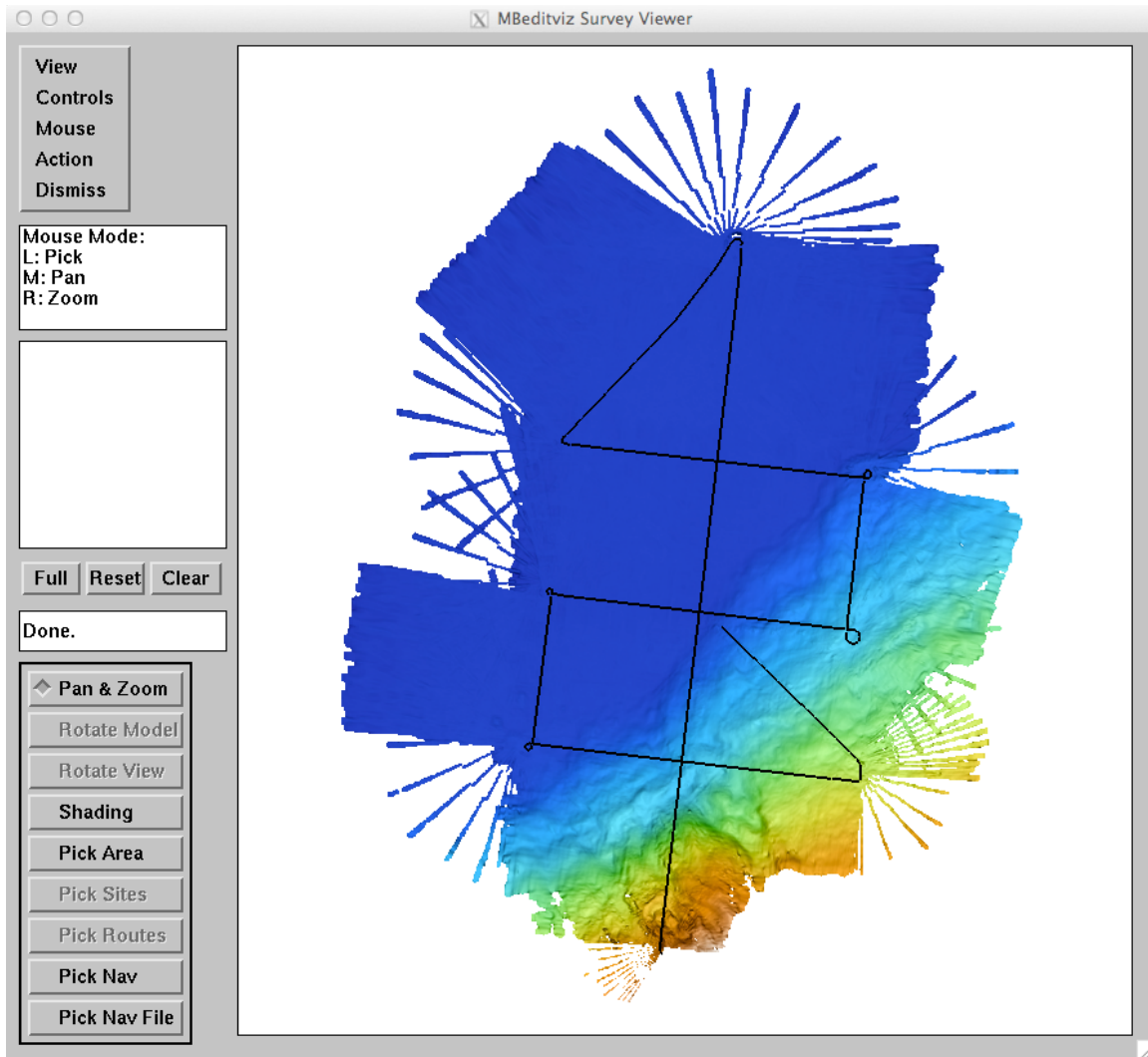
Figure 14 – Gridding the files.

Once done the main windows from mbeditviz will open...



*Figure 15 – The Survey Viewer window showing our multibeam dataset and navigation data.*

It's recommended that you maximize the window because parts of the UI (user interface) only appear when the window size is bigger than 700-750 pixels at the vertical axis. By doing that the extra buttons are revealed...



*Figure 16 – When the window is maximized and the resolution is high enough some extra buttons will appear.*

To finally start cleaning the data you must select an area. For that click on "Pick Area" and with a left click define a area (it will be a yellow box), that will open the 3D soundings window as seen on Figure 17:



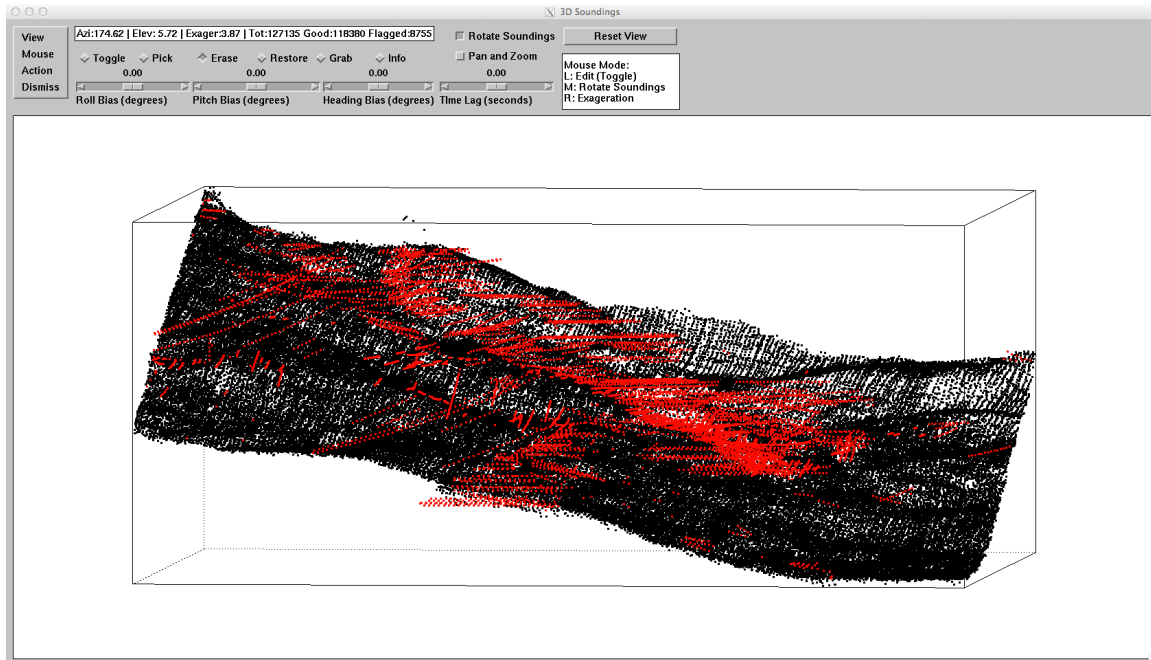


Figure 17 – The 3D Soundings window. The red dots represent the data rejected by the system.

While the usage of mbeditviz is also well described at man page, we prepared a video that more easily highlights its features here:

<http://www.youtube.com/user/MBSystem1993>

Notes:

a) this tool requires a 3 buttons mouse or a mouse that can at least emulate. Mac users may a bit of trouble when using Apple mouses like Magic/Mighty Mouse. However there is 3rd party software that allow you set a 3rd button very easily.

b) mbeditviz can sometimes crash. When that happens at next you open the same datalist the files will be locked since mbeditviz didn't exit normally (and had time to liberate then again for editing). To deal with this you must delete the locks manually, and the easiest way is using the terminal with this command:

```
% rm *.lck
```

c) to close these or any other graphical from MB-System do not close the windows, unless you want to loose everything you did on that file. The proper way is by using the buttons "Quit" and/or "Dismiss".

### 7.2.3. Editing the navigation (mbnavedit)

In general the GPS data is constant and reliable, but no GPS reception is 100% good all the time, so eventually the GPS may feed the multibeam system with some spurious GPS data. When that happens you must edit the navigation data. For that MB-System has the tool mbnavedit, and you can call it using the command:

```
% mbnavedit -F-1 -I datalist.mb-1
```

While the usage of mbnavedit is also described at the man page, we prepared a video that more easily highlights the basic features here:

<http://www.youtube.com/user/MBSystem1993>

Notes:

a) inside mbnavedit you can see the attitude data, but while other software allow you edit also the attitude data, the philosophy of MB-System is that these data should not be edited. One should instead make sure that the motion sensor is properly installed and set, and not try gimmicks to compensate a bad motion sensor. The only option in this case is replace the attitude data with data from another sensor (in case your ship/AUV has two motion sensors). But a work-around for those who don't have a second attitude stream is extracting the bad attitude data with mbnavlist, smooth it (using R/Matlab), and reply it using mbset/mbprocess.

b) pay attention that mbnavedit works only with single files. However, when working with a datalist is possible to jump for next file by pressing the button "Next File".

c) you can maximize vertically (only) the mbnavedit window to see more.

## 8. Creating processed files

Once all your basic data processing is done now is time to merge all these changes stored inside the auxiliary files with the raw data, and create processed files. It's important note that the cleaning done with mbedit or mbeditviz is simply flagging the bad data out from your view/maps. That means, the flagged data are switch off in the processed files and won't participate on any map/grid done with these files.

To process the files you simply must run:

```
% mbprocess -F-1 -I datalist.mb-1
```

Alternatively, if you have installed the Perl module Parallel::ForkManager inside Poseidon Linux, and you can make us of multi CPU macro and fire several mbprocess at the same time. But don't worry, MB-System is smart enough to know which files have been changed (or processed), and only the ones changed or still not processed will be computed. To use this macro run:

```
% mbm_multiprocess -F-1 -I datalist -X4
```

Note: the flag "-X" is followed by a number, which specifies how many CPUs mbprocess can use. It's recommended not use a number bigger than the actual number of cores available at you machine. Even for machines with Octa-core (8 CPUs) like the Intel Core i7 informal tests have proved that even with a very fast Solid State Drive (SSD) things may get slower to read/write data when 8 cores instead of 4. For Hard Disk Drives (HDD) the data output is much slower, and normally a number of between 2 and 4 is the maximum recommended. For a bit more information about this topic read my informal benchmark study here:

[http://ftp.marum.de/pub/christian/mbsystem\\_benchmarks/](http://ftp.marum.de/pub/christian/mbsystem_benchmarks/)

Once mbprocess is done, now is time to prepare the final maps!

## 9. Gridding and producing final maps

### 9.1. Gridding the processed files

To interpolate the data we call the command `mbgrid` using the processed datalist:

```
% mbgrid -A2 -N -I datalistp.mb-1 -Omygrid_50m -F5 -E50/50m!
```

In detail we do this:

a) "-A2" set the grid as "topography" mode. So the values are treated as all negative and are positive upwards. Alternavily, one can use -A3 for amplitude data or -A4 for sidescan.

b) "-N" make that cells that remain empty after the interpolation is done are set the Not-a-Number (NaN) values. If this option is omitted these cells are set as 99999,9.

c) "-I datalistp.mb-1" tells `mbgrid` to use the processed files.

d) "-O" sets the name for the output grid (here as "mygrid\_50m", a good advice is make the names meaningful, otherwise you may spend some time trying to figure out what did you do at that time. The format is NetCDF.

e) "-F5" chooses the interpolation method. Please look the `mbgrid` man page for more explanations. If this option is omitted the default is "-F1".

f) "-E50/50m!" sets the X-Y resolution for our grid. Here is 50 meters.

For more information please consult the man page for `mbgrid`.

### 9.2. Plotting your final grid

Once our grid is created now is time to plot it and have the final map. For that we use the "cousin" from `mbm_plot`, the `mbm_grdplot`! This command is very similar to `mbm_plot` and an easy way to plot your final grid is:

```
% mbm_grdplot -G2 -I mygrid_50m.grd
```

After as with `mbm_plot`, you must run the `.cmd` file that executes the script and create the final `.PS` file. Therefore do:

```
% csh mygrid_50m.grd.cmd
```

The final map will look like this (but note that this map was done the raw data, and a really processed dataset will produce a much better map):

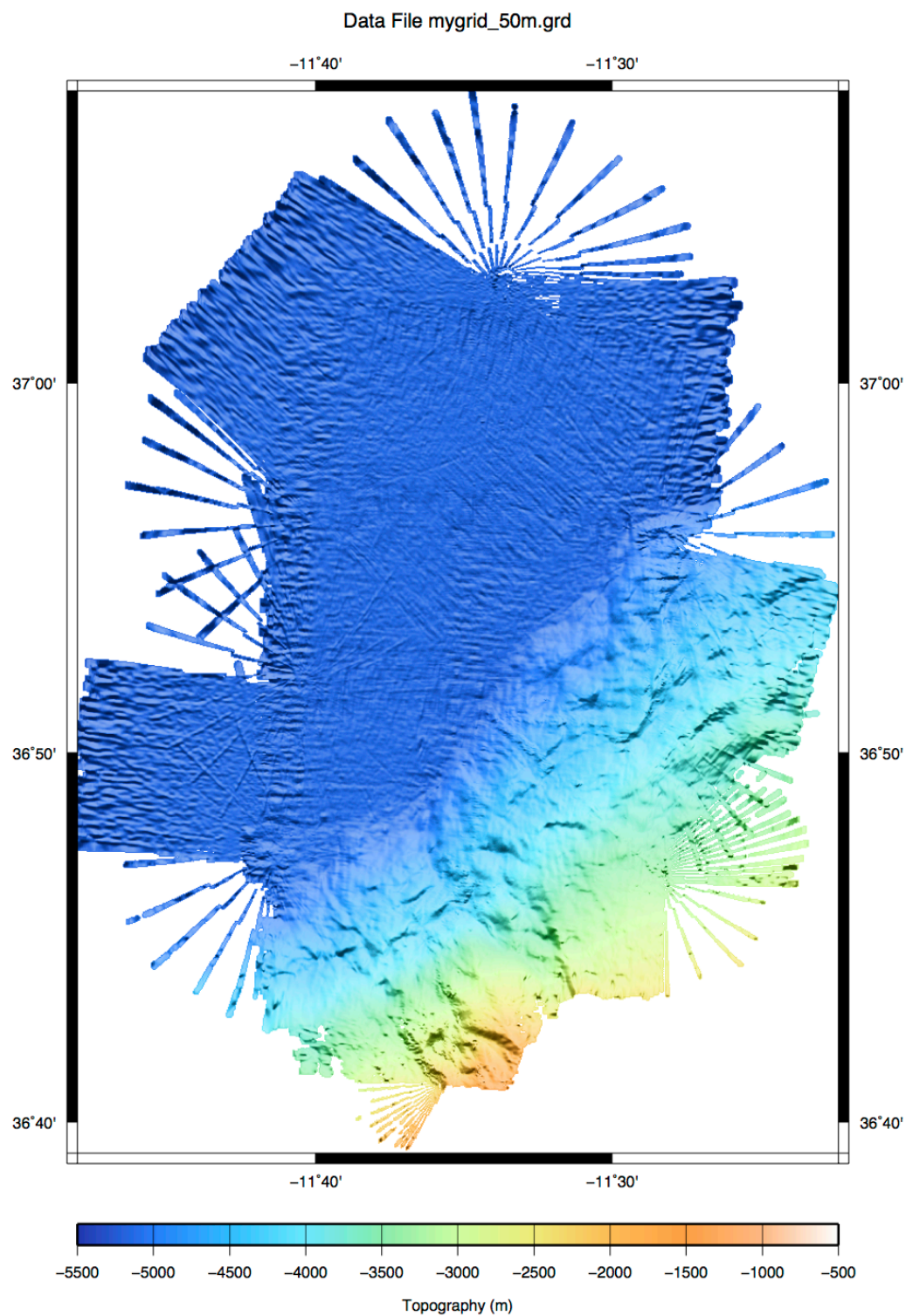


Figure 18 – Final grid plot produced by `mbm_grdplot`.

For more information please consult the man page for `mbm_grdplot`.

# Appendixes

## Appendix A

### MB-System “tricks & tips”

These are things learned through several years using MB-System:

- 1) The more times you use the option “-V” the more verbose output you get from the programs. The minimum is 0 and the maximum is 5. The usual ways are: zero (almost no messages) and 1 (necessary messages). Any option equal or bigger than 2 turns on the debugging modes from each tool inside MB-System.
- 2) Avoid using/processing your data on volumes using Windows filesystem (like FAT32 or NTFS). The can cause sometimes problems regarding permissions and file locking. Any filesystem from Linux or Mac OSX is infinitely better.
- 3) NEVER use folder(s) name(s) that contain white spaces, because this will always cause problems.
- 4) Don't play alone. MB-System has a community. Subscribe the mailing list and post your questions to a group of nearly 300 registered users. Please don't mail Dave Caress, Dale Chayes or me directly.
- 5) RTFM. Read The “Friendly” Manual before your post questions. At least try, okay?
- 6) Be curious and don't stick always only with the commands you learned from me. Because we are only covering here the most basic or important commands.
- 7) Learn also GMT (Generic Mapping Tool). This software and MB-System play really well together, and GMT can vastly enlarge your set of tools when working with the final grids. Actually all MB-System's scripts can be enhanced by knowing GMT commands and syntax.
- 8) When you don't know the format from your data try compare the extension from the file names with the list at:  
[http://www.mbari.org/data/mbsystem/html/mbsystem\\_formats.html](http://www.mbari.org/data/mbsystem/html/mbsystem_formats.html)  
If you still can't find, think more about finding (and later creating) the metadata that describes these files better. Future generations will thank you.
- 9) The mouse resolution greatly affects your cleaning when using tools like mbeditviz. Normally a laser mouse should be preferred because of the much more higher accuracy when compared to regular optical mice.
- 10)

## Appendix B

### Upgrade MB-System inside Poseidon Linux (version 2147 or later)

- 1) download the latest svn version from (at "trunk" hit the "download" button on the right side)
- 2) open a terminal and type "*sudo nautilus*" and hit "enter"
- 3) navigate with Nautilus to the folder where you downloaded MB-System
- 4) copy the file from there to /usr/local
- 5) uncompress the file
- 6) rename the folder "mbsystem" to "mbsystem\_OLD" to have your older installation as a backup

7) rename the uncompressed folder (normally named "trunk-SOMETHING") to "mbsystem"

8) inside that folder press right mouse click and select "Open in Terminal"

9) inside the terminal execute the following commands:

```
% ./configure --prefix=/usr/local/mbsystem --with-gmt-include=/usr/local/gmt459/include --with-gmt-lib=/usr/local/gmt459/lib --disable-static
```

```
% make
```

```
% make install
```

10) after these 3 commands you have now the latest MB-System installed and ready!

## **Appendix C**

### **Common MB-System workflow for Kongsberg data**

