

# Bathymetry software manual

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Ecosons is a program for processing acoustic data. The bathymetric calculation is one of the options this software allows. The following manual explains the operation of the bathymetric version of ecosons.

Once the `ecosons_bathy.zip` file is extracted into the destination folder (selected by the user), the octave program is run in this folder. The program is called through the “ec” command, opening a menu with 7 options:

- [1] Load transects/survey
- [2] Select working transect
- [3] Bathymetry toolkit
- [4] Plot
- [5] Export
- [6] Other
- [7] Quit

The first two options are common to all the ecosons applications, while the third one is specific to the bathymetric application. In order to perform a bathymetry, we must follow steps 1 to 3 consecutively. However, for large studies the first two can be substituted by [3] Bathymetry toolkit / [2] One-step bathymetry computation, explained below.

## **[1] Load transects/survey**

This option allows the loading of `.raw` files from the echosounder and, optionally, their conversion to binary files `.mat` (Octave format), which allows for a faster loading of the data if those files exist. When selected, the list of echosounder models that can be read by the program will display (currently it only allows reading data acquired with Simrad single beam echosounders.)

- Load data source format:
- [1] Simrad single-beam
- [2] Quit

When selecting this type of echosounder (option [1]), if it is a dual frequency one, the software will ask which channel you wish to work with. Once the channel is selected, the program can retrieve previously read files (transformed from the echosounder's .raw format to .mat)

- Select echosounder channel:
- [1] Chan 1 (38 kHz)
- [2] Chan 2 (200 kHz)
- Select an option: 1
- Use preloaded MAT files if available? (Y/n)

If we have not previously generated a working file, .mat, or we do not want to generate it, we'll click no ("n"). Then we will be asked to select the route for the files we want to read. It is advisable that the files be stored under a subfolder inside the working folder (called, in this case, "data"). The working folder will be by default that in which the ec.m program is located.

The software allows to select all the .raw files from a "data" folder (data/\*.raw), files from different folders, i.e. files from a given day (data1/\*D20060821\*.raw, data2/\*D20060821\*.raw).

- Input file(s) pattern: data/\*.raw

Once the .raw files have been read and .mat files have been generated, we can start to perform the calculations for the generation of the bathymetry.

## **[2] Select working transect**

First we have to select those files we want to analyze among all those we have loaded. Selecting option [2] (Select working transect), the software offers two possible ways to make a selection:

- Choose selection method:
- [1] From transect list
- [2] Nearest transect to a point

- [3] Quit

The first option ([1] From transect list) shows the names of all the loaded files.

- [1] L0001-D20060821-T065551-EA400
- [2] L0002-D20060821-T075632-EA400
- [3] L0003-D20060821-T085057-EA400
- [4] L0004-D20060821-T093835-EA400
- [5] L0005-D20060821-T102441-EA400
- [6] L0006-D20060821-T102620-EA400
- [7] L0007-D20060821-T110338-EA400
- [8] L0008-D20060821-T114410-EA400

The user must select files through their numbers, correlative (1:4), not consecutively (1, 3) or both (1:4, 6).

- Select named transect number: 1:8

Second option ([2] Nearest transect to a point) asks for the GPS coordinates of a given location, that should be written in square brackets and separated by a coma.

- Input latitude and longitude coordinates (as [lat,lon]): [43.6630,-8.08011]

Later on, the program asks for the number of transects closer to the location that is to be selected.

- Input number of transects to select (default, 1): 10

When the program analyzes the selection, it informs of the number of loaded transects that have been finally selected.

### **[3] Bathymetry toolkit**

This option opens the specific application for bathymetry. Each of the options/phases of this application are explained below:

- Bathymetry:
- [1] Bottom detection

- [2] One-step bathymetry computation
- [3] Tide correction
- [4] Bathymetry subsampling
- [5] Bathymetry resampling
- [6] Restore sonar bathymetry
- [7] Quit

### **[3] Bathymetry toolkit / [1] Bottom detection**

The software allows for bottom detection following two different methods:

- Bottom algorithms:
- [1] Averaged bounce
- [2] Max+threshold
- [3] Quit

The first method (Averaged bounce) performs bottom determination for each ping, starting from the end of the near field and calculating the depths, weighed by power (in a linear scale). Thus, an estimation is obtained for the depth from which most of the reflected intensity is received. The user must define the size of the near field, which will work as the minimum distance from which the algorithm will search the bottom (minimum depth).

- Near field approx. (default 1.0 m):

Moreover, this method allows smoothing out the detected bottom through the location of outlier values and their smoothing by averaging neighbor bottom values. The user must define the search window size (number of pings on the right and left of each ping) and the allowed tolerance (in standard deviation units); the higher the tolerance, a higher number of original bottom values will be kept.

- Range smoothing radius (no. pings; default no smoothing): 15
- Smoothing sigmas (default, 3): 3

The second method (Max+Threshold) is based on the search of the value which is  $X$  dB below the ping maximum. In order to do this, the software searches for the bin with the maximum received power and calculates the bottom as that of the first bin (from bottom to surface) over the power value equal to

the maximum power minus the value introduced by the user (“*first threshold*”). In order to prevent rejecting the start of the bottom in those bottoms with a “step”, the bottom point is considered good when subsequently, when advancing towards the surface, the software finds a value below the “*second threshold*”.

- First threshold (default 30 dB):
- Second threshold (default 60 dB):
- Near field approx. (default 1.0 m):

As in the previous case, this method also allows to smooth out the calculated bottoms.

- Range smoothing radius (no. pings; default no smoothing): 15
- Smoothing sigmas (default, 3): 3

After any of the two methods, the bathymetry is generated. The user has the option to perform a later section removing those depths below a defined threshold.

- Minimum depth cutoff (m, default none): 3

### **[3] Bathymetry toolkit / [2] One-step bathymetry computation**

This step is optional. It represents a synthesis of the steps [1] Load transects/survey, [2] Select working transect and [3] Bathymetry toolkit / [1] Bottom detection. It loads the files selected by the user ([1]), assumes all of them are to be analyzed ([2]) and calculates the bottom ([3, 1]).

This option is conceived to speed up the bathymetric calculation for those users that do not have powerful computers and/or do not want to perform any other processing beyond bathymetry. Unlike what happens when following steps [1], [2] and [3, 1], in this case the software stores only the calculated bathymetric data (X, Y, Z) and not all the information contained in the echogram.

The menus in this option are the same as in options [1] and [3, 1].

### **[3] Bathymetry toolkit / [3] Tide correction**

In order to improve the result of the calculated bathymetries, it is necessary to perform tide correction in order to obtain all depth values related to the same tidal point, particularly when working in meso- or macrotidal coasts.

This software tool allows to correct each calculated depth value, knowing the tide value in the moment of data acquisition, and adjusting it to a reference

minimum tide situation in the port where the nearest tide gauge is located (according to which the harmonics to predict the tide have been calculated).

In order to know the date for each ping, either the software can read it directly from the files (which are usually named by the echosounder with the date of acquisition) or the user can add it manually (when analyzing data corresponding to a single day).

- [1] Filename format (eg. Lxxxx-DyyyyMMdd-Tttttt-SSSSS)
- [2] Input DD-MM-YYYY for every transect
- [3] Input YYYY-MM-DD for every transect
- [4] Input [yyyy, mm, dd] for every transect
- [5] Quit

If the first option is selected ([1] Filename format (eg. Lxxxx-DyyyyMMdd-Tttttt-SSSSS)), the program will ask for the file name pattern (providing the Simrad echosounder pattern by default). If this type of echosounder is used it is enough to accept the default option proposed by the software.

- Filename pattern (eg. Lxxxx-DyyyyMMdd-Tttttt-SSSSS):

Selecting the second, third and fourth options ([2] Input DD-MM-YYYY for every transect, [3] Input YYYY-MM-DD for every transect, [4] Input [yyyy, mm, dd] for every transect), the software will ask the user for the date of the loaded files:

- Date of "L0000-D20080503-T084718-EA400" (DD-MM-YYYY): 03-05-2008
- Date of "L0000-D20080503-T084718-EA400" (YYYY-MM-DD): 2008-05-03
- Date of "L0000-D20080503-T084718-EA400" [YYYY, MM, DD]: [2008,05,03]

The information regarding tidal dynamics in the date of acquisition must be added by the user, who can do it in three different ways:

- Tide information:
- [1] Input tide times and heights
- [2] Input day tide height filename (hh, mm; hgt (m))
- [3] Automatically choose a tide height file
- [4] Quit

With the first and second methods ([1] Input tide times and heights), the user must add the data regarding hours, minutes and seconds, and the tidal coefficient for high and low tides for each day.

- Time [hh, mm, ss] (empty ends): [05,46,00]
- Tide height (m): 3.25
- Time [hh, mm, ss] (empty ends): [11,42,00]
- Tide height (m): 0.88
- Time [hh, mm, ss] (empty ends): [17,57,00]
- Tide height (m): 3.53
- Time [hh, mm, ss] (empty ends): [24,12,0.76]
- Tide height (m): 0.76
- Time [hh, mm, ss] (empty ends):

The second method ([2] Input day tide height filename (hh, mm; hgt (m))) allows the reading of tide data from a file. Only one file per day can be added using this method.

- File with tide heights (hh, mm, hgt): tides20050806.txt

The third method ([3] Automatically choose a tide height file) allows the user to tell the program to read a series of files, each of which has the tide data corresponding to a single day. In order to do this, the software asks for the pattern in the files, in order to recognize the date corresponding to each one. For example, if the files have names such as “tide2008\_day1308.txt”, the pattern would be “tideyyyy\_dayDDMM.txt”

- Pattern of the date-tide filename (eg. tides-yyyyMMdd.txt): tideyyyy\_dayDDMM.txt

The files used for options [2] and [3] must be .txt or .dat and have the following structure:

Hour	Minute	Height (m)
5	46	3.25
11	42	0.88
17	57	3.53
24	12	0.76

### **[3] Bathymetry toolkit / [4] Bathymetry subsampling**

This option allows to correct the effects of the movement of the boat hull (and of the transducer, if it is bound to it), when these have not been previously corrected by a pitch and roll sensor, through the application of a minimum filter.

Following the direction defined by the sampling points (*pings*) in each transect, the software selects the point with the bathymetric value corresponding to the quantile of the lowest 10% (the one obtained from the most vertical insonification, discarding the absolute minimum in order to prevent the selection of erroneous bottom detection) among those contained in a given length (defined by the user).

- Search radius (m) (default 10 m):

This process is performed for each .raw file; thus, in the file limits within the transects, the density of selected points may be higher.

The latitude and longitude of selected points will be calculated as the average of coordinates of all the points contained in the distance unit defined by the user.

In order to correctly perform this step, a correct bottom detection is required, therefore previous smoothing [3,1,"Range smoothing radius"] is recommended.

### **[3] Bathymetry toolkit / [5] Bathymetry resampling**

This tool performs a Monte Carlo simulation which generates, around each bathymetric point, ten points with a Gaussian distribution, with depth values depending on the slope at each point and on the angle between the slope and the transect direction.

The software has three options for performing this calculation:

- [1] External GIS application
- [2] Kernel derivative method
- [3] No slope computation
- [4] Quit

For the first of options (External GIS application), the software needs the user to introduce a .csv file (derived from an interpolation made by a GIS) with at least 4 columns: ID, slope, orientation (slope direction) and transect direction. The ID in this file must be the same as in the data file imported from GIS, which is generated from the menu [5] Export / [2] Bathymetry data.

If the file has headers, the software will ask for the name of each column (must be introduced without quotation marks):



- Ping ID column:
- Slope column:
- Slope direction column:
- Transect direction column:

If it does not have any name, it will ask for the column number corresponding to each variable.

- Ping ID column no.:
- Slope column no.:
- Slope direction column no.:
- Transect direction column no.:

Once the variables are added, the program uses the slope and orientation to calculate the location of each generated point, following a Gaussian distribution with standard deviation  $\sigma_{xy}$  and the depth value of each of them, following a Gaussian distribution with standard deviation  $\sigma_z$ . Where:

$$\sigma_{xy} = \delta r \times |\sin \Delta\theta|$$

$$\sigma_z = \delta r \times |\sin \Delta\theta| \times |S|$$

Where  $\delta r$  is the r.m.s. error, derived from GPS positioning (which takes a constant value of 5 m),  $|\sin \Delta\theta|$  is the absolute value of the angle between the slope orientation and the transect direction (assumed to be optimal when perpendicular to bathymetric lines or, as orientation, to the coastline) and  $|S|$  is the absolute slope value in each point.

The second method (Kernel derivative method) calculates the slope value for each point using a weighed distance interpolation and, from these, the angle between slope orientation and transect direction. From these slope values, the software applies the previous equations ( $\sigma_{xy}$  y  $\sigma_z$ ). The software allows the user to export slope values calculated using this method.

- Export computed slopes? (y/N)

The last method (No slope computation) ignores the effect of the slope and calculates the new depth points following a Gaussian distribution with a standard deviation equal to the GPS error.

These last two methods work directly with the matrix of bathymetric values, generated in the previous steps; they do not ask for nor admit an external file.

### **[3] Bathymetry toolkit / [6] Restore sonar bathymetry**

This option removes all processes performed on the bathymetry and substitutes data for those originally calculated by the software [3, 1], including bottom detection and smoothing previously carried out. As in the previous case, the user has the option to perform a subsequent step removing those depths smaller than a defined threshold.

- Minimum depth cutoff (m, default none):

### **[4] Plot**

This menu allows the generation of three different graphic outputs of the original data and the generated bathymetry. It features 5 options:

- [1] Echogram + bottom detection
- [2] Transects
- [3] 3-D bathymetry
- [4] Bathymetry transect crosses
- [5] Interpolated bathymetry
- [6] Quit

### **[4] Plot / [1] Echogram + bottom detection**

An image is generated, representing all the values in the selected .raw data (an echogram) along with the calculated bathymetry, represented by a blue line. In order to generate this image it is required to have selected a single .raw file from [2] Select working transect.

The software asks the user for a range of pings and bins (vertical values) for plotting:

- Select ping range (default entire transect):
- Select bin range (default whole range):
- Export figure data? (y/N)
- Output file name (default echobottom.dat): echogram1.dat
- Ping step (default 1):

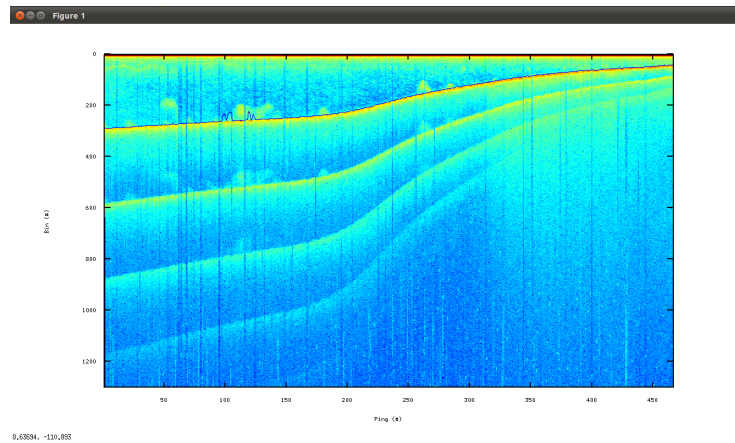


Figure 1:

Moreover, it allows to export bathymetric data represented overlapping the echogram (xyz).

- Export figure data? (y/N)

In order for this option to be available, only a single .raw file must be selected ([2])

#### [4] Plot / [2] Transects

An image is generated, showing the working transects in the study area. The software allows the representation of coordinates in UTM and decimal degrees.

The software allows exporting the represented data:

- Export figure data? (y/N)

#### [4] Plot / [3] 3-D bathymetry

It allows for 3-D visualization of transects: with their coordinates (in UTM or decimal degrees) and their depth value.

The software allows exporting the represented data:

- Export figure data? (y/N)

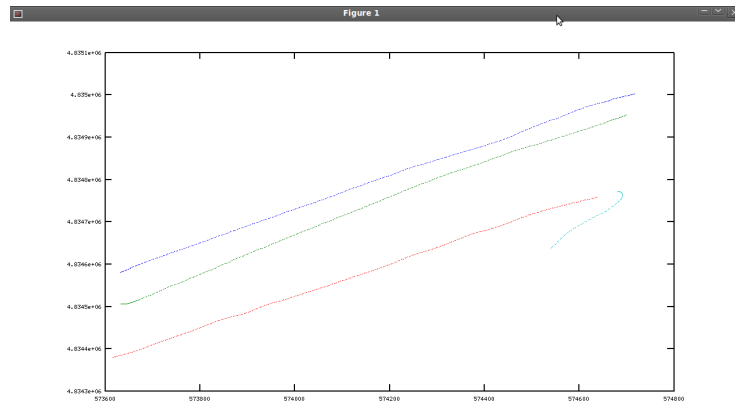


Figure 2:

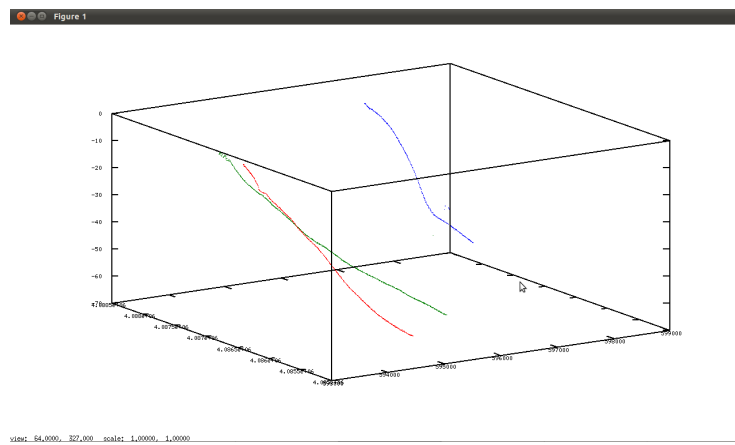


Figure 3:

#### [4] Plot / [4] Bathymetry transect crosses

It allows representing the bathymetric differences in the crossings between transects. The user can define the spatial resolution at which the transects are examined for crossings (in bathymetric point units).

- Point subsampling (default 5)

It only shows an image if the transects included in the bathymetry have any crossing.

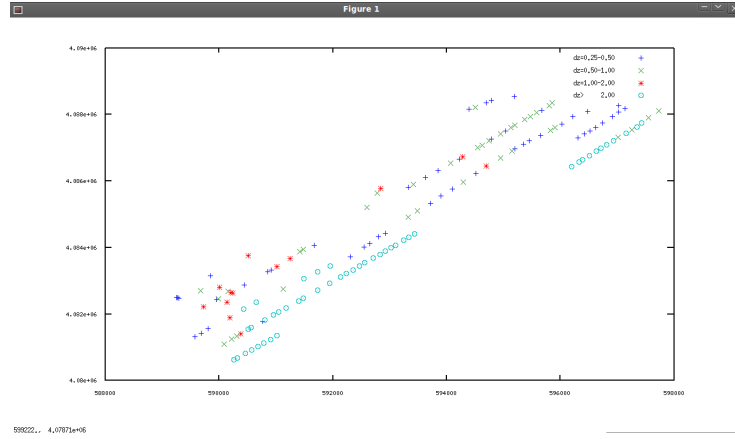


Figure 4:

#### [4] Plot / [5] Interpolated bathymetry

This section presents several options for generating images, all of them as a result of an interpolation process based on weighed distances.

- [1] Colored map representation
- [2] 3-D elevation map
- [3] Contour map
- [4] Quit

**[4] Plot / [5] Interpolated bathymetry / [1] Colored map representation** It represents the interpolated bathymetry from the processed bathymetry data (or from the original data, if no subsequent processing was applied) in a 2D image. The user can define the pixel size of the generated raster, the interpolation radius and the image coordinates (UTM or decimal degrees).

- Output map cell size (default, 10 m): 50
- Interpolation radius (default, 10 m): 50
- Use UTM coordinates? (y/N)

The program returns the average difference between the bathymetric value of each point and the value of the interpolation surface corresponding to those points, as well as the standard deviation for that difference.

- Bathymetry mean deviation: -1.557 m

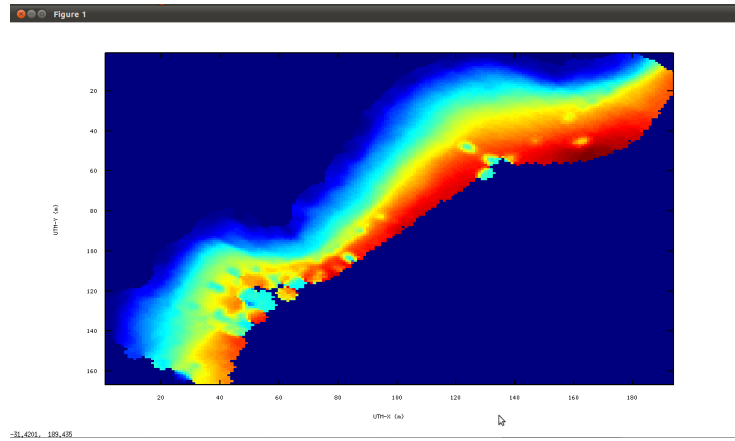


Figure 5:

- Bathymetry standard error: 2.9513 m
- UTM-zone: 30

It also allows exporting the data from the interpolated surface to a text file.

- Export figure data? (y/N)

**[4] Plot / [5] Interpolated bathymetry / [2] 3-D elevation map** It represents the interpolated bathymetry from the processed bathymetry data (or from the original data, if no subsequent processing was applied) in a 3D image. The user can define the pixel size for the generated raster, the interpolation radius and the coordinates of the image (UTM or decimal degrees).

- Output map cell size (default, 10 m): 50
- Interpolation radius (default, 10 m): 50
- Use UTM coordinates? (y/N)

The software returns the average difference between the bathymetric value of the points and the value of the interpolation surface corresponding to those points, as well as the standard deviation for that difference.

- Bathymetry mean deviation: -1.557 m
- Bathymetry standard error: 2.9513 m
- UTM-zone: 30

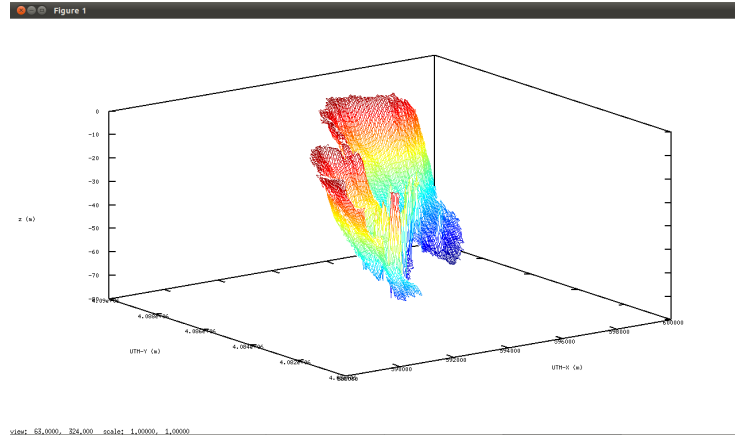


Figure 6:

It also allows exporting the data from the interpolated surface to a text file.

- Export figure data? (y/N)

**[4] Plot / [5] Interpolated bathymetry / [3] Contour map** It represents the bathymetric lines extracted from the bathymetric surface generated by interpolation.

- Output map cell size (default, 10 m): 50
- Interpolation radius (default, 10 m): 50
- Use UTM coordinates? (y/N)

The software returns the average difference between the bathymetric value of the points and the value of the interpolation surface corresponding to those points, as well as the standard error for that difference.

- Bathymetry mean deviation: -0.25712 m
- Bathymetry standard error: 1.6087 m

It shows the maximum range of bathymetric values and asks for the value of bathymetric lines to be represented (0:5:70, from 0 m to 70 m every 5 m).

- Interpolation depths range from 2.032 m to 70.176
- Input depths of bathymetric lines (m): 0:5:70

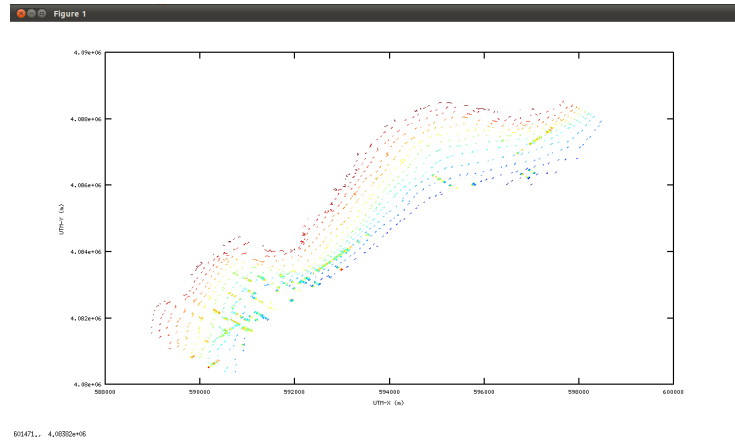


Figure 7:

In this case it also allows exporting the data from the interpolated surface to a text file.

- Export figure data? (y/N)

## [5] Export

This option allows the user to export files (with different data types) for the generation of bathymetries in a GIS or the statistical analysis of the data.

- [1] Echogram bottom detection
- [2] Bathymetry data
- [3] Bathymetry slopes
- [4] Bathymetry transect crosses
- [5] Interpolated bathymetry
- [6] Current figure as image
- [7] Quit

## [5] Export / [1] Echogram bottom detection

It exports latitude, longitude and depth values for each ping to a text file (.dat), along with the transect name and the corresponding ping number, for the working transects. The bathymetric values exported are those obtained directly from



the echogram and bottom calculation ([3, 1]). It allows users to define if they want to export all the bathymetric data or subsample them.

- Output file name (default echobottom.dat):
- Ping step (default 1):

#### **[5] Export / [2] Bathymetry data**

It exports latitude, longitude and depth values for each ping to a text file (.dat), along with the transect ID.

It allows users to define if they want to export all the bathymetric data or subsample them.

- Point subsampling (default 1):

#### **[5] Export / [3] Bathymetry slopes**

This option allows exporting the slopes in a text file. The result is the same as that obtained when exporting data through option [3] Bathymetry toolkit / [5] Bathymetry resampling / Kernel derivative method.

#### **[5] Export / [4] Bathymetry transect crosses**

This option allows exporting the nearest bathymetric points to crossing areas, with their coordinates, bathymetric value and corresponding transect. Moreover, for each point its depth difference regarding the nearest crossing point is calculated.

- Point subsampling (default 5)

#### **[5] Export / [5] Interpolated bathymetry**

This option allows exporting the raster generated through bathymetry interpolation to Envi or ArcGIS formats.

- [1] ENVI format
- [2] ArcMap ESRI ASC II format
- [3] Quit

The user can define cell size and interpolation radius.

- Output map cell size (default, 10 m):
- Interpolation radius (default, 10 m):

## **[5] Export / [6] Current figure as image**

This option allows saving the current figure in different image formats.

- [1] EPS: Encapsulated PostScript
- [2] PDF: Portable Document Format
- [3] EMF: Windows Enhanced Metafile
- [4] FIG: FIG Format
- [5] PNG: Portable Network Graphics
- [6] JPEG: Joint Photograph Experts Group

## **[6] Others**

This menu includes every other option that doesn't fit in the rest of the menus: create and restore back ups, define variables manually, etc. Este menú incluye todas aquellas opciones que no encajan en el resto de menús: crear y restaurar copias de respaldo, definir variables manualmente, etc.

- [1] Set plot char
- [2] Set canonical sound velocity
- [3] Plot data from file
- [4] Save SONAR\_DATA
- [5] Restore SONAR\_DATA
- [6] Save BATHYMETRY
- [7] Restore BATHYMETRY
- [8] Quit

## **[6] Others / [1] Set plot char**

This option allows the user to chose the plot symbol characteristics.

The symbol shape:

- [1] . (dots)
- [2] ^ (impulses)
- [3] + (symbol)

- [4] x (symbol)
- [5] \* (symbol)
- [6] o (symbol)
- [7] - (line)
- [8] +- (line-point)

The symbol color:

- [1] black
- [2] red
- [3] green
- [4] blue
- [5] magenta
- [6] cyan
- [7] (default)

#### **[6] Others / [2] Set canonical sound velocity**

This option allows the user to input a specif speed, instead of reading it from the .raw file.

- Input canonical sound velocity (1500 m/s):

To apply this setting, it is needed to have previously selected working files with [2] Select working transect. Once the new velocity is introduced, all bathymetric computations will be performed with this and not with those recorded in the .raw files.

#### **[6] Others / [3] Plot data from file**

This option allows the user to introduce a file (x,y,z) previoulsy generated with this tool, or originally from other, and to represent the data in a graphic way .

- Input data file name:

The file has to have a plain text format CSV or TSV, with at least two columns (with or without heading): latitude and longitude. It has to be saved in the working folder.

When the working folder is loaded (with the full name and the extension of the document) the program asks, firstly, what type of file it is (what is the field separator used) and secondly if it has a heading; in the case it does have a heading, the program will ask for the label of the latitude (x) and longitude (y) fields, and whether there is another field to be represented as z. If the file does not have a heading, it will ask which column number corresponds to each variable.

- Data file type:
- [1] CSV (comma separated values)
- [2] TSV (tab separated values)
- [3] Quit

- Column headers? (Y/n) y
- X column: lon
- Y column: lat
- Data is categorized? (N/y) y
- Category column: depth

- Column headers? (Y/n) n
- X column no.: 1
- Y column no.: 2
- Data is categorized? (N/y) y
- Category column: 3

#### **[6] Others / [4] Save SONAR\_DATA**

This option allows the user to save a .mat file with all the data that have been loaded in the application until that moment: loaded files and selection of the working files.

- SONAR DATA file name (default: SONAR\_DATA.mat):

The file will be saved in the working folder. This option is used to save the session and be able to restore is, avoiding the time it takes to load all data again.

#### **[6] Others / [5] Restore SONAR\_DATA**

This option allows to restore the previous work session data that was saved in a back up file with [6] Others / [4] Save SONAR\_DATA. The loaded and selected files will be restored.

- SONAR DATA file name (default: SONAR\_DATA.mat):

#### **[6] Others / [6] Save BATHYMETRY**

This options allows to save a .mat file with a previously generated and processed bathymetry (every filter that was applied, or the external data loaded).

- BATHYMETRY file name (default: BATHYMETRY.mat):

The file will be saved in the working folder. This option is used to save the current session and be able to restore it later without having to spend the time in processing the data again (it is advised if you want to perform any process that might be necessary to revert/undo later on).

#### **[6] Others / [7] Restore BATHYMETRY**

This option allows to restore the bathymetric data from a previous session that was saved in a back up file using [6] Others / [6] Save BATHYMETRY. The bathymetric data that were calculated in the previous session and the subsequent postprocesses will be restored.

- BATHYMETRY file name (default: BATHYMETRY.mat):

## [6] Others / [8] About ecosons\_bathy

This options gives the user the information related to the *ecosons* tool.

Ecosons is free software released under GNU-GPL license

(see <http://www.gnu.org/copyleft/gpl.html>)

Octave version 3.2.3 (required  $\geq 3.0.1$ )

Ecosons for Octave: 1.0 beta

Bathymetry toolkit: 1.0 alpha

<http://www.rekursosmarinos.net>

## A Appendix

Alternatively, the following lines can be added to the octave user configuration file, a file called `.octaverc` that can be found in the user's directory:

```
global ECOSONS_BATHY_HOME
ECOSONS_BATHY_HOME='c:/ecosons_bathy';
addpath(ECOSONS_BATHY_HOME);
addpath([ECOSONS_BATHY_HOME, '/procs']);
addpath([ECOSONS_BATHY_HOME, '/utils']);
addpath([ECOSONS_BATHY_HOME, '/formats']);
```

It is supposed that the *ecosons* distribution has been unzipped to a directory/folder called `c:/ecosons_bathy`, and that it is in that folder where the file `ec.m` can be found. When performing this installation, the *ecosons* will run from any directory octave can be run.