MIKE C-MAP

Extraction of World Wide Bathymetry Data and Tidal Information

User Guide

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1 Preface

1.1 Introduction

Setting up digital model bathymetries has always been a tedious, expensive and yet crucial part of numerical modelling projects, e.g. for MIKE 21.

Thanks to collaboration with C-MAP, it is possible to greatly reduce the efforts needed for this part of your modelling works.

With MIKE C-MAP and a license to a user specified chart coverage of C-MAP world-wide Electronic Chart Database Professional+, you will be able not only to extract depth data but also tidal information.
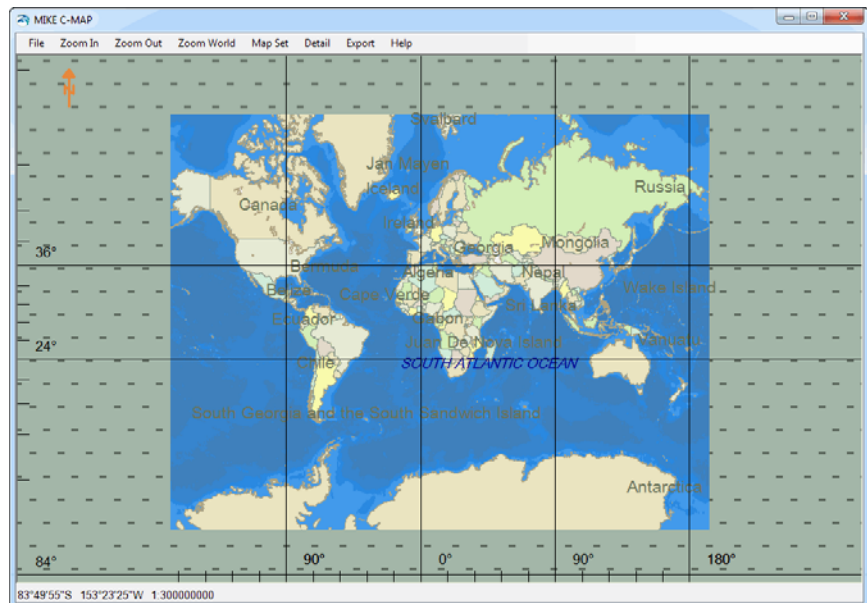
Figure 1.1   C-MAP is the leading provider of digital charts

The fast access to information combined with MIKE C-MAP's easy to use facilities implies significant time savings on many parts of your modelling work from planning to set-up, calibration and verification. A quick start to get on with any model application that requires depth and tidal information.

NOTE:
The extraction of digital bathymetry information from the C-MAP charts are encrypted in accordance with C-MAP regulative. The encrypted data can only be handled by MIKE Zero's Bathymetry Editor and Mesh Generator.

1.2   About this Document

This document provides a guide to getting started with MIKE C-MAP with emphasis on the basic features and functionalities.

A step-by-step guide shows how to utilize the functionalities in MIKE C-MAP in relation to common tasks necessary to carry out a marine study using the DHI models within the MIKE Zero Framework.

2 Before You Begin

2.1 Product Support

If you have questions concerning MIKE C-MAP or problems with the MIKE C-MAP software, please consult the present document or the Online Help

If you have access to the Internet, you may also have a look at the MIKE Powered by DHI software Home Page.

The MIKE software Home Page can be accessed from

http://www.mikepoweredbydhi.com

and by clicking on the product name you want to learn more about.

If you cannot find the answer to your queries, please contact your local agent. In countries where no local agent is present you may contact DHI directly, by mail, phone, fax or e-mail:

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If you wish to upgrade or purchase additional modules for an existing installation, please contact your local agent or DHI.

The most efficient way of communicating is by e-mail, allowing us to optimise services to our clients. Under normal circumstances, all e-mail messages received at DHI will be answered within 24 hours (working days).

When contacting your local agent or DHI, please make sure that you have the following information at hand:

- the version number of your MIKE C-MAP installation and any possible service pack
- the exact wording of any message that appears on the monitor (in case of software problems)
- preferably, also submit the log file (if any) produced by the task

- a description of what happened and what you were trying to do when the problem occurred

- a description of how (if at all) you tried to solve the problem

- the type of hardware you are using including available memory

2.2   DHI Training Course

DHI software is often used to solve complex and complicated problems, which requires a good perception of modelling techniques and the capabilities of the software.

Therefore DHI provides training courses in the use of its products. A list of standard courses is offered to our clients, ranging from introduction courses to courses for more advanced users. The courses are advertised via DHI Software News and our web site on the Internet. Upon request training courses on other products may be arranged.

We can adapt training courses to specific subjects and personal wishes. If you have any questions regarding DHI training courses, please do not hesitate to contact us.

2.3   Hardware Requirements

The recommended minimum hardware requirements are described in the Release Notes for MIKE C-MAP.

Note: the MIKE C-MAP functionalities cannot be accessed via remote login.

2.4   Installation

To install MIKE C-MAP please follow the instructions given in additional documentation.

3 Welcome to MIKE C-MAP

3.1 What is MIKE C-MAP

MIKE C-MAP is a tool for:

- Extracting depth data from C-MAP Professional+ Electronic Chart Database

- Extracting predicted tidal elevation from numerous tidal stations

- Extracting Mean Sea Level (MSL) relative to chart datum from several stations

- Analysing and planning the set-up of models in coastal and marine areas

3.2 Chart Database

MIKE C-MAP works on the Global Electronic Chart Database Professional+ (CM-93 Edition 3.0 technology) provided by C-MAP.

The Electronic Chart Service divides the world into 9 zones. Each zone is subdivided into areas. In addition each zone is subdivided into a grid of 4x4 degree cells. All charts are in WGS 84.

Figure 3.1   The 9 main zones of the world in the Electronic Chart Service

Further details on area coverage and sub-division of areas can be found on the home-page of C-MAP: http://commercialmarine.c-map.com/en/charts-and-publications/c-map--professional/zone-map/

3.3   Chart Basis

Based on an in-depth analysis of the paper charts published by the various Hydrographic Offices in the world, C-MAP's cartography and navigation experts applied the following categorization in the Professional+ database:

W, Global overview scale ranging from 1:20,000,000

A, World scale ranging from 1:3,500,000 to 1:1,500,000

B, General nautical scale ranging from 1:1,500,000 to 1:500,000

C, Coastal scale ranging from 1:500,000 to 1:150,000

D, Intermediate coastal / approach scale ranging from 1:150,000 to 1:50,000

E, Approach scale ranging from 1:50,000 to 1:15,000

F, Harbour scale ranging from 1:15,000 to 1:5,000

G, Plan scale, larger than 1:5,000

Data from charts belonging to the same scale level are merged together in order to create continuous, homogeneous coverage for each level. Virtually all areas of interest to merchant marine navigation, fishing and pleasure boating are currently covered by the Professional+ (CM-93/3) database, which includes at present data from more than 7,000 nautical charts. The database is however, being continuously increased both in terms of area coverage and chart detail.

Further technical information can be found on the home-page of C-MAP:
http://commercialmarine.c-map.com/en/charts-and-navigation/c-map--professional/

3.4   Chart Datum

The depths shown on Sea Charts (and thereby the depths extracted by the extraction program) are, in areas with considerable tidal variation relative to a "Chart Datum", loosely defined as a level below which the tide rarely falls. The so defined "Chart Datum" is not horizontal, and the difference between "Chart Datum" and MSL varies from location to location. In areas with low tides, the depths on Sea Charts are normally relative to MSL.

The C-MAP data does not include information the datum relative to which the extracted depths are measured. This information has to be looked up on the maps on which the digitized data is based. The reference to chart title can be found right clicking on the displayed map. In the window that appears information about the chart basis is given and among this the chart title. If the selected area covers several charts it must be checked whether they refer to the same datum.

In order to avoid different datum in a single extraction file select several sub areas and convert the files according to the individual datum. The Bathymetry Editor in MIKE Zero can handle multiple data files.

4   Getting started

1. Start the MIKE C-MAP programme

2. Find the area of interest by zooming in or out (menu bar buttons) and move around using the cursor centering the map by clicking anywhere on the map. If you get lost in the navigation you can use the Zoom World button to view the entire world.

3. You can also select the specific area of interest by placing the cursor in one of the corners of the area and drag the mouse until the displayed frame fits your area.

4. To export the selected area, press the 'Export' button in the menu bar. A new window with indication of depths and land contours is displayed. Use the Export Land and 'ExportWater' in this window to extract the bathymetric data into a file defined by the user.

Processing extracted data

The extracted and encrypted xyz-files can be imported into MIKE Zero´s Bathymetry Editor or Mesh Generator as geographical coordinates in LONG/LAT map projection.

Using the output files directly with other Mike Zero products assumes that your Regional Settings is configured with decimal symbol as punctation, which can be changed in 'Start', 'Control Panel', 'Regional Settings', 'Numbers'.

5 Toolbar Functions

The operation of MIKE C-MAP is handled through the toolbar functions.

5.1 File

This entry gives you opportunity to close down MIKE C-MAP. The same result can be obtained by closing the window directly.

5.2 Zoom facilities

You have three zoom options

- Zoom In
  The map display is zoomed in using the previously used zoom factor. You can also click and drag a rectangle on the display to zoom into a smaller area.

- Zoom Out
  The map display is zoomed out using the previously used zoom factor.

- Zoom World
  The map display will return to the initial setting of world overview.

5.3 Map Set

This gives you the opportunity to select which chart the pixel map in the display is to be based on. Default is to let the software decide the appropriate class that will provide full coverage in the selected area. However by selecting a specific class of maps (listed in section 3.3) it is possible to increase (or reduce) the amount of detail displayed on the pixel map (and thereby the amount of detail extracted from the pixmap using the Export Button).

When specifying the Class of maps, full coverage is not ensured.
Note that multiple chart areas are indicated by red lines.

However, use this option with care because if you select a very detailed level when being in a global view or large area it will take considerable time to update the screen and take a lot of disc memory. Start with a reasonable or low resolution and increase step by step until the desired detail is achieved.

5.4 Detail

A way of determining the amount of data extracted is the size of the pixel map drawn in the display by the software. The size of this pixmap is, in the extraction program, controlled by the factor specified by pressing the "Detail" button on the toolbar. Specifying a detail factor of e.g. 2 result in a pixmap which is

twice as large as the map window (of which the upper left quarter is displayed in the map window). Scroll bars buttons control the part of the pixmap shown in the map window. The software imposes a limit to the size of the pixmap it can produce to 120.000 by 120.000.

5.5 Export

This entry gives you the option to export data for your chosen area from the database to your harddisk.

It is possible to export bathymetric information (land contours, water points and mean sea level (MSL)) to xyz files.

You have three options for selecting the amount extracted data:

- Displayed data only (includes option for land contour)
- All data (includes option for land contour)
- Data by filter

For options 'Displayed data only' and 'All data' you will be presented with the opportunity to select if the exported land contour is to be interpolated. In case the displayed land contour line contain information from overlaps of sub-areas or you have selected to export ALL data, the extracted information may result in multiple different land contours, essentially representing the same area.
Note that the choice of interpolation will not be reflected in the outline of the land contour in the Export Level window.

You save the selected data to files from the Export Level window.

Figure 5.1   Example of defined area for data extraction

5.5.1 Displayed data only

This gives you the data available from the chart that is displayed, e.g. if the chart displayed is from scale level C, you will have data from the corresponding chart.
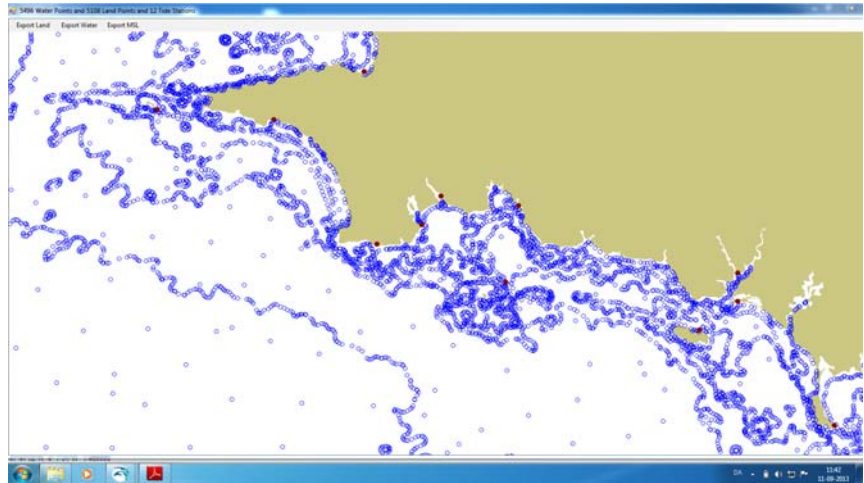

Figure 5.2   Export level: Data to extract choosing 'Displayed data only'

5.5.2 All data

This gives you the data available from all charts in the area, i.e. both from the displayed chart and from rest of the database. However, use this option with care because if you select a large area for export it may take considerable time to create the export window and take a lot of disk memory. Also note that the vertical datum may be different for the different map sets.
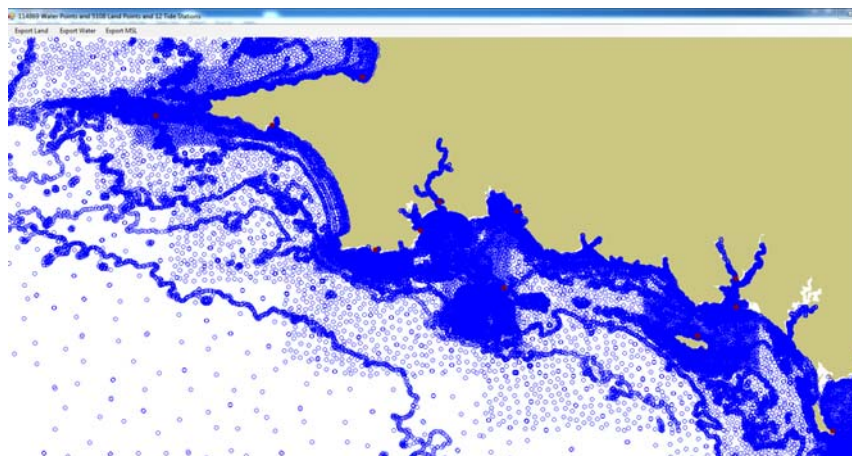
Figure 5.3   Export level: Data to extract choosing 'All data'

5.5.3   Data by filter

It is possible to limit the amount of extracted water points by filtering the data into a defined grid with one single data point per grid cell, see Figure 5.4.
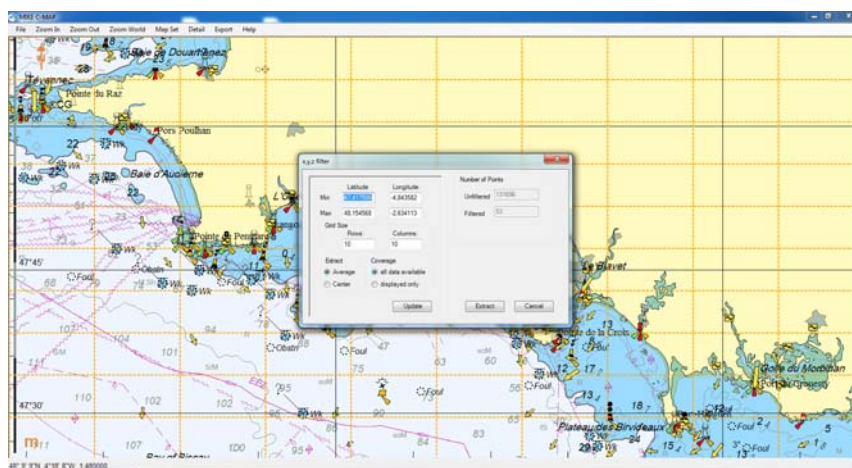

Figure 5.4   Filter settings for extracting data from database

You may define the extraction area explicitly. Per default the area will be set to the display area. You must define the grid size by setting the number of rows and columns for the area. The extracted data can be chosen as the mean value or the center value of all the available points within the grid cell. The basis of the data may be either Displayed data only or All data. By clicking 'Update' the right hand side of the dialog gives you information about the total number of water points that will be extracted. Click the 'Extract' button to see the generated points are shown in a new window.
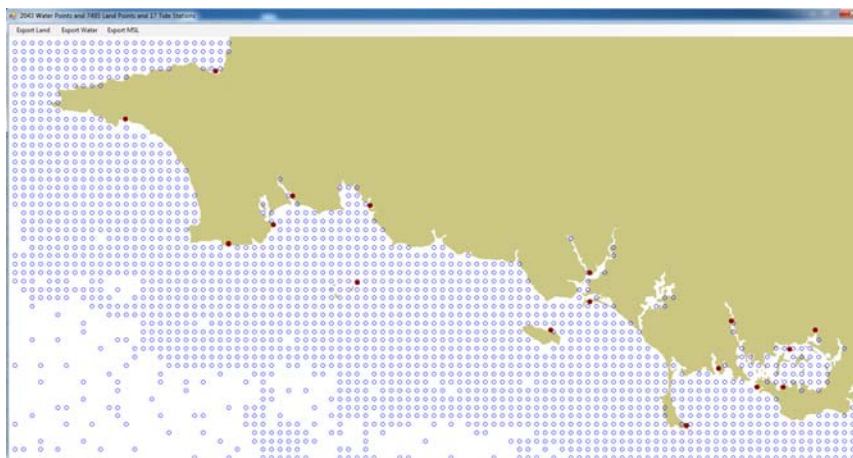
Figure 5.5   Export level: Data to extract choosing 'Data by filter'

5.5.4   General description

Land contours

The land contours are extracted from the selected map(s).

The optimal output will be a clearly defined land contour, however in some cases the extracted land data will show overlapping lines:

- If you have selected to export 'All data' the exported file will probably contain several land contours describing the same coastal stretch because the information is derived from several data sets.

- If you have selected to export 'Displayed data only' the displayed area may contain multiple data sets that overlaps within the same map set.

Multiple overlaying land contours are always a consequence of having two or more charts overlapping each other in a view. It cannot be avoided automatically, but the problem can be eliminated by user interaction.

One option to avoid overlapping land contours in the exported data is to select to interpolate the land data from all the charts. This will result in one land contour only, but may result in insufficient accuracy of the land contour.

Another option is to select the smallest possible scale and ensure only one chart is displayed at a time. The user must select neither "Export all data" by the menu nor select "all data" in the Filter dialogue, because data is then usually extracted from more than one chart.

Water points

The depths extracted by the extraction program are relative to a "Chart Datum". The so defined "Chart Datum" is not horizontal, and the difference

between "Chart Datum" and MSL varies from location to location. In areas with low tides, the depths on Sea Charts are normally relative to MSL.

In order to avoid different datum in a single extraction, extract water data from charts with different datums to individual files and convert the files according to the individual datum.

Mean sea level

The mean sea level is extracted from tidal stations in the selected area. The extracted data also contain information about the time zone for the individual tidal station.

5.6   Export Level

Once you have pressed the Export button in the toolbar and considered if to interpolate the land contours a new window opens with a display of land outline, extracted water points and position of water level stations. This is the socalled 'Export Level'. The number of land points, water points and mean sea level (MSL) points (tidal stations) included in the selection is highlighted in the top frame of the window. The land contour outlines are shown as shaded polygons, the water points are shown by blue circles and the tidal stations are shown as red dots.
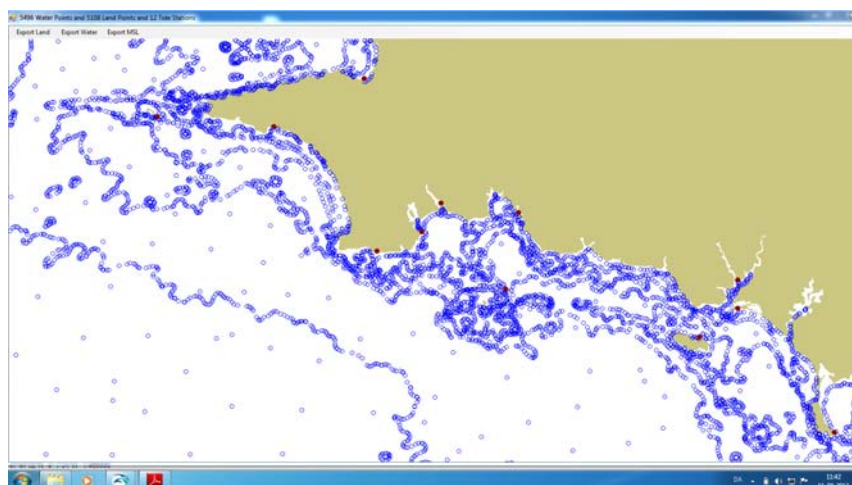

Figure 5.6   Example of Export Level window

Use the 'Export Land' and 'Export Water' button in the toolbar to extract the respective bathymetric information to a user-specified file.

Use the 'Export MSL' button to export mean sea level information to a user specified ascii file. By selecting the individual tidal station in the display you furthermore have the option to view and export time series data of Tidal information for the station.

NOTE:
The extraction of land and water points from the C-MAP charts are encrypted in accordance with C-MAP Norway regulative. The encrypted data can be handled by MIKE Zero's Bathymetry Editor and Mesh Generator.

NOTE:
The depths shown on Sea Charts (and thereby the depths extracted by the extraction program) are, in areas with considerable tidal variation relative to a "Chart Datum", loosely defined as a level below which the tide rarely falls. The so defined "Chart Datum" is not horizontal, and the difference between "Chart Datum" and MSL varies from location to location. In areas with low tides, the depths on Sea Charts are normally relative to MSL.

5.6.1 Tidal information

From the Export Level it is possible to get information on tidal elevation by right clicking on the individual tidal stations shown in red. By default the predicted tide is shown for the present day. To show another day simply select the day of interest.
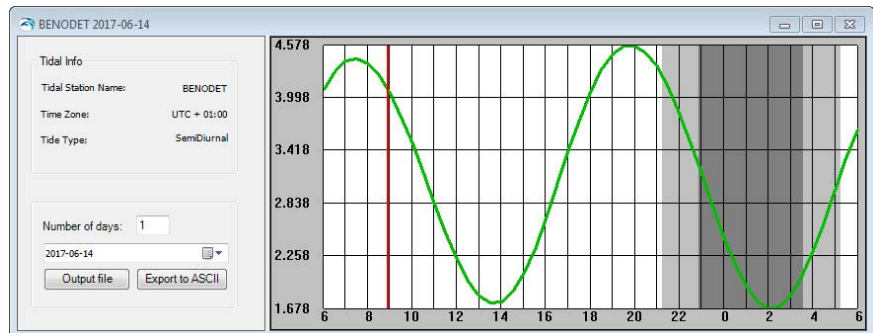

Figure 5.7   Tidal data from Benodet, France

You may export the tidal information to a dfs0 file or an ascii file the following way; select the start date and specify the number of days to be exported and then press the respective button. This will give you the opportunity to specify a user-defined name and path of the output.

6 Working With MIKE C-MAP

Using MIKE C-MAP is easy. In this chapter the following tasks are demonstrated:

1. How to Extract Data
2. How to Generate a Model Bathymetry Using the Extracted Data
3. How to Generate a map of Mean Sea Levels
4. How to Use the MSL Map to Adjust the Model Bathymetry
5. How to Extract and Export Time Series of Tidal Elevations
6. How to Enhance the Resolution Using the MapSet and Detail Button

6.1 How to Extract Data

1. Zoom to area

With MIKE C-MAP you can zoom into any area of interest covered by your chart data- base license. When the approximate area of interest is identified it is a good idea to write down the coordinates, e.g. to form the basis for defining the work area for creating a model bathymetry at a later stage.
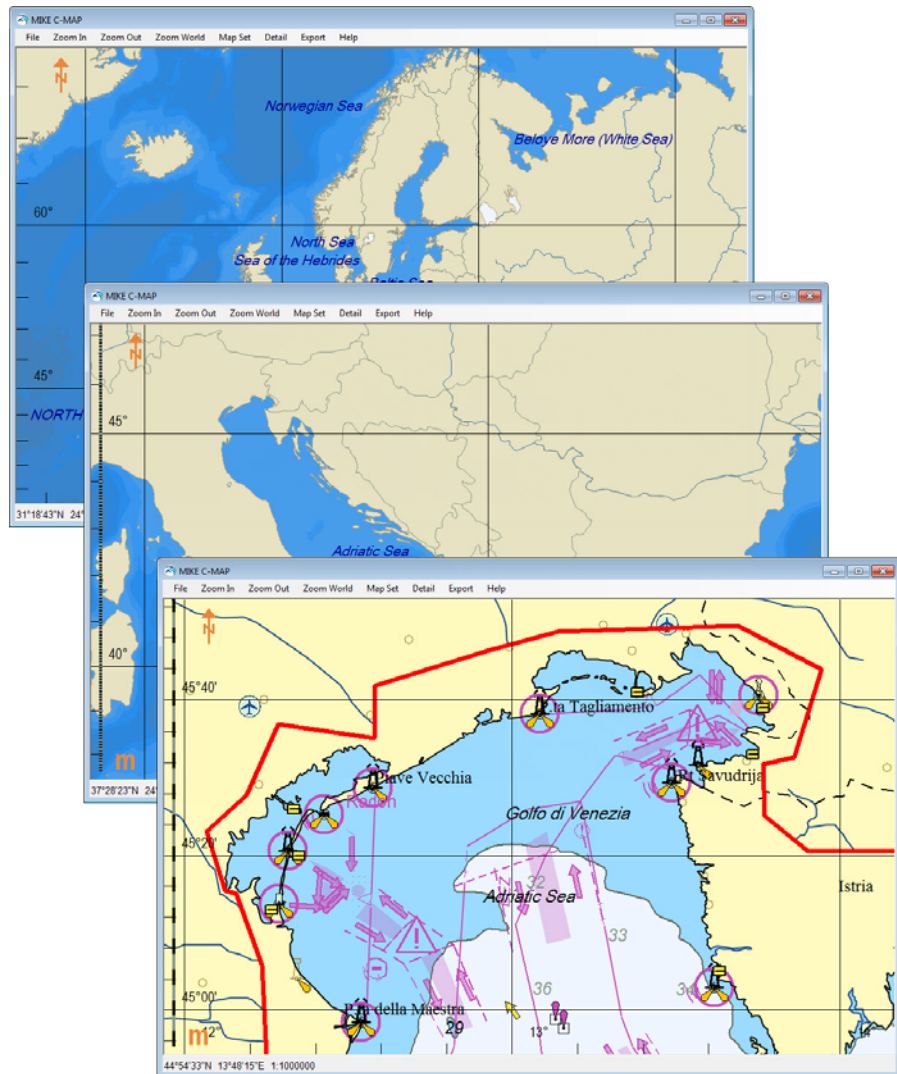
Figure 6.1   You can view different details of information by zooming

2. Evaluate display

Evaluate the displayed map to determine if it will deliver the required contents and accuracy. If the data is to be extracted by *Displayed data only*, choose the map with the best coverage. One can potentially increase the accuracy of the extracted geographical points by increasing the Map windows size using the *Detail* button.

Often the optimal data set is obtained by extracting values from a number of different map sets.

3. Select data to extract

To initiate the extraction of depth values, land contours and MSL press the *Export* button in the menu bar. This will give you three options for extraction:

- Displayed data only
- All data
- Data by filter

Furthermore you will be given the opportunity of selecting if the land contours are to be interpolated into one representative contour.

Disregarding the choice for interpolation the screen display will be similar to the one shown in Figure 6.2. The number of data points and tidal stations included in the selection is highlighted in the top frame of the window. The number of land points depends on the choice of interpolation as well as the option for extraction.
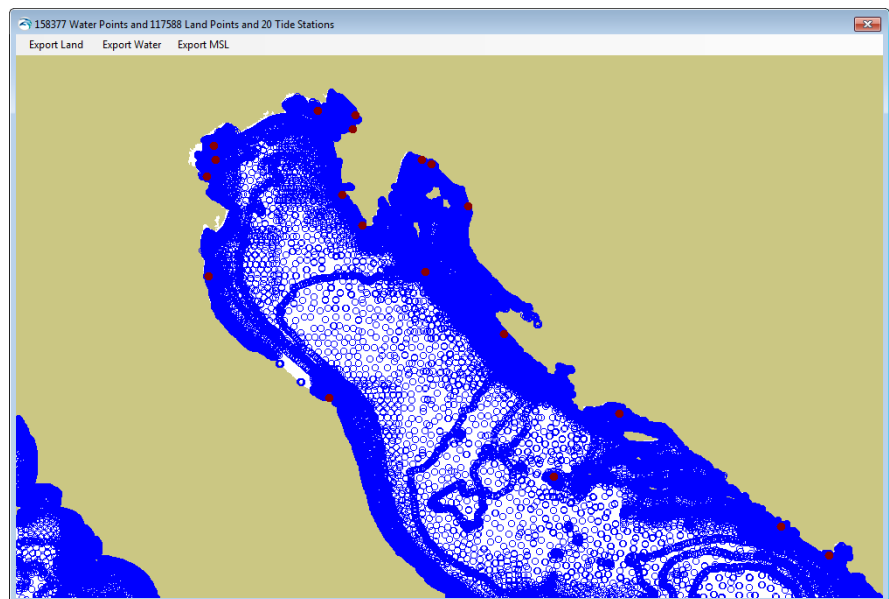

Figure 6.2   Display of water points, land points and tidal stations

4. Extract data

To extract and export land contour values and sea bed elevations from the area simply use the *Export Land* and *Export Water* buttons in the menu bar and save the data as .xyz files.

The extracted land data will be stored as a bunch of (x,y,connectivity) values indicating the geographical position and connection of the land points to form land contours.

The extracted water data will be stored as a bunch of (x,y,z) values indicating the geographical position and the corresponding bathymetry level.

NOTE:
The extraction of land and water points from the C-MAP charts are encrypted in accordance with C-MAP Norway regulative. The encrypted data can be handled by MIKE Zero's Bathymetry Editor and Mesh Generator. When importing the data to the Bathymetry Editor/Mesh Generator it is important to specify that conversion should take place between longitude and latitude and the selected projection.

If your area of interest is located in or partly include areas with high tides you should take this into consideration when creating your model bathymetry.

Press the *ExportMSL* button to export the MSL values to an ascii file with extension xyz. Contrary to exported land and water points, the file with MSL values and not encrypted and can be read by a standard text editor. The file will contain7 columns (longitude, latitude, Mean Sea Level, '3', name of tidal station, 'TimeZone', hours relative to GMT).

6.2 How to Generate a Model Bathymetry Using the Extracted Data

6.2.1 Dfs2 file

1. Open Bathymetry Editor
Open the MIKE Zero Bathymetry Editor and use the area information you wrote down to define the new workspace area, the model grid and type of projection system. (How to e.g. define the map projection of your area is explained in the Online Help of the Bathymetry Editor).

2. Import land contours and water points
Use the Background Management system to import the extracted land contours as geographical co-ordinates (longitude, latitude).
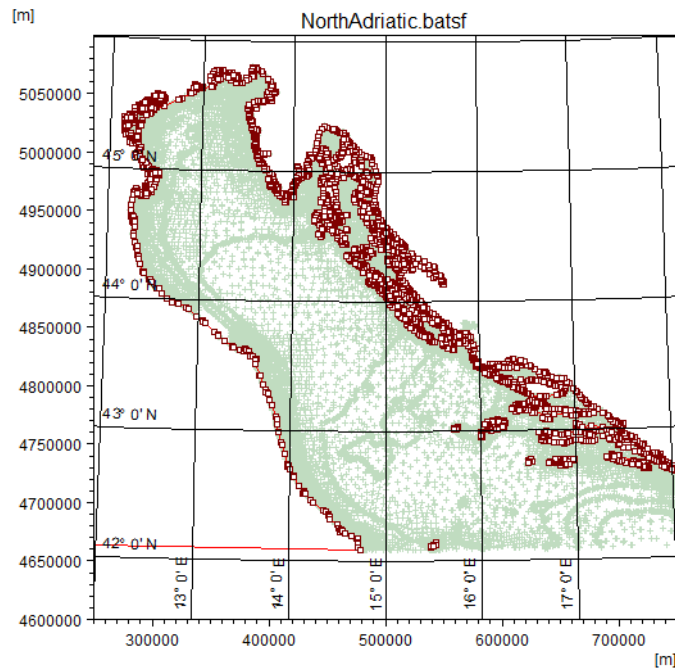
Figure 6.3   Land contours and water points in background

You may want to change the size of the work space area and/or location of origin. This is done for example as a frame selection using the cursor.

3. Import water points
Use the Background Management system to import the extracted water points as geographical co-ordinates (longitude, latitude).

4. Specify model grid and interpolate bathymetry
Use the Bathymetry Management to specify the position and size of the model bathymetry and the grid resolution. The defined model outline will be shown in the workspace.
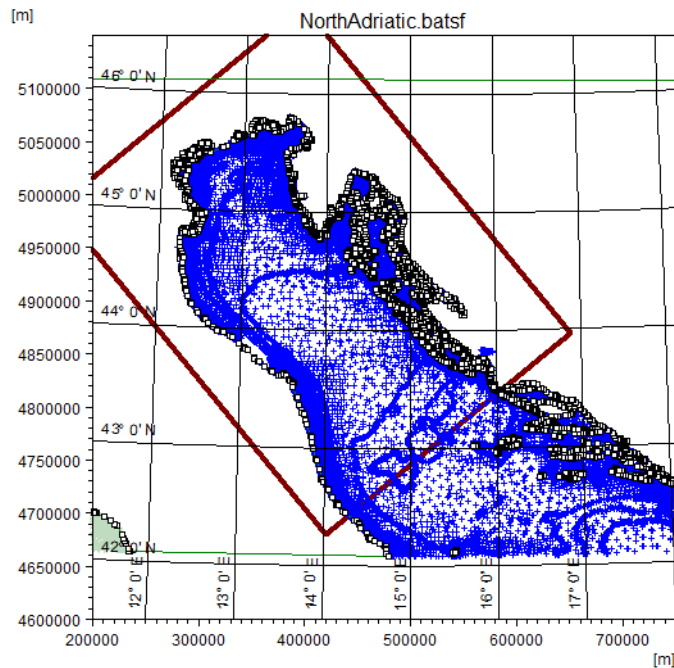
Figure 6.4   Model grid outline shown in workspace in Bathymetry editor

5. Interpolate bathymetry

Interpolate your extracted data to the fixed grid and save the bathymetry file.

You may now have obtained the final model bathymetry. However, as Sea Charts are made mainly for navigation purposes where minimum water depths are in focus, different vertical datum apply depending on the local tidal conditions. You will learn how to make the appropriate adjustments in sections 6.3 and 6.4.

6.2.2   Mesh file

1. Open the Mesh Generator

Open the MIKE Zero Mesh Generator and define the map projection to use for the model domain. Use the area information you wrote down to define the new workspace area.

2. Import land contours

Import the extracted land contours as a boundary. Remember to specify the data by the LONG/LAT map projection.

3. Specify domain area and create mesh

Now modify and connect the boundary lines to form a closed polygon that defines the domain area. This enable you to generate a mesh.

4. Import water points

Add the extracted water points as scatter data. Remember to specify the data by the LONG/LAT map projection.

Figure 6.5   Model mesh with scatter data shown in Mesh Generator

5. Interpolate mesh bathymetry

Interpolate the bathymetry and export the mesh.

You may now have obtained the final model mesh bathymetry. However, as Sea Charts are made mainly for navigation purposes where minimum water depths are in focus, different vertical datum apply depending on the local tidal conditions. Thus it may be necessary to adjust the bathymetry values by adding a map of Mean Sea Levels.

6.3   How to Generate a map of Mean Sea Levels

If your area of interest is located in or partly include areas with high tides you should take this into consideration when creating your model bathymetry.

The depths shown on Sea Charts (and thereby the depths extracted by the extraction program) are, in areas with considerable tidal variation relative to a "Chart Datum", loosely defined as a level below which the tide rarely falls. The so defined "Chart Datum" is not horizontal, and the difference between "Chart Datum" and MSL varies from location to location. In areas with low tides, the depths on Sea Charts are normally relative to MSL

6.3.1   dfs2 file

Open the bathymetry editor setup (.batsf) you used previously to generate a dfs2 bathymetry and use a similar methodology. Instead of the extracted water points, import and use the extracted MSL values as scatter data and

interpolate the data (it may be most convenient to delete the existing land and scatter data first).

Once interpolated export the data to a dfs2 file. Note that you have to post-process the file and manually change the item name, item type and item unit to reflect that the data specifies surface levels (select item type as 'Surface elevation' and unit to e.g.'meter'). You can do this by opening the file in Grid Editor.

6.3.2   mesh file

Open the mesh generator setup (.mdf) you used previously to generate a mesh bathymetry. Instead of the extracted water points, import and use the extracted MSL values as scatter data and interpolate the data.

Once interpolated you can choose to export the data to a mesh file or a dfsu file.

- In case you export the data to a dfsu file you have to specify the item name, item type and unit manually (select item type as 'Surface elevation' and unit to 'meter'). The MSL values will be contained in the mesh elements.

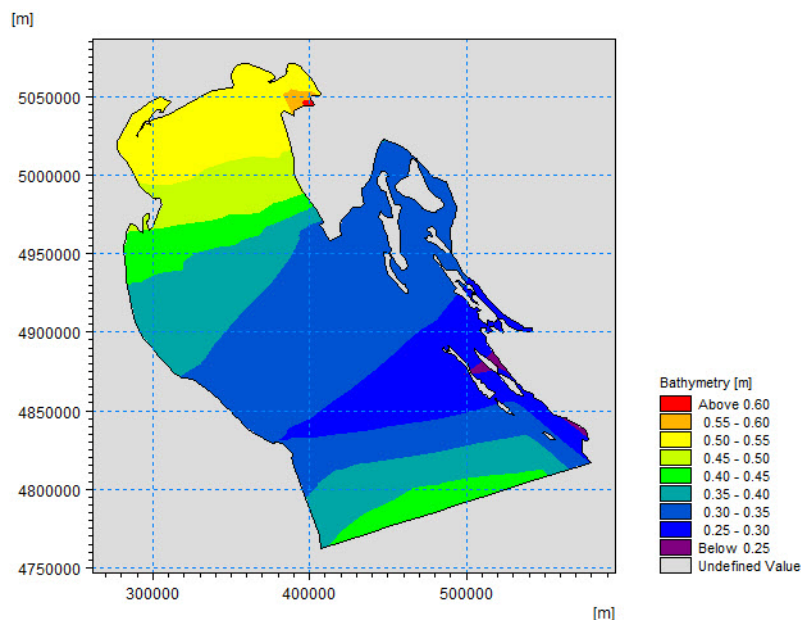- In case you export the data to a mesh file, the MSL values will be stored in the node points.

Figure 6.6   MSL water level in the model area interpolated to mesh

6.4   How to Use the MSL Map to Adjust the Model Bathymetry

You can ensure that the model bathymetry values is referring to the same datum by subtracting the mean sea level from the basic bathymetry data:

Bathymetry relative to MSL = Bathy - MSL

6.4.1   dfs2 file

1. Import bathymetry into MIKE Zero Grid Editor
Get the model bathymetry file you have generated and select water area only (e.g. z values ranging from -999 to 9 meters).

2. Generate land matrix
Generate the land matrix and copy this to the MSL grid made in a previous task and save the data.

Step 1 & 2 ensures that you have identical land and water areas in the two grids that is going to be merged.

3. Create new bathymetry file
Open the original bathymetry file in Grid Editor and save the file under a new name.

4. Subtract MSL
Use the tool 'Copy file into data' and select to copy the MSL grid. The items are automatically mapped. For Operation select the type '-' to subtract the two files and press OK.

5. Update bathymetry
Save the file. The resulting dfs2 file now holds the bathymetry relative to MSL.

6.4.2   mesh file

1. Copy the original mesh bathymetry to a new file
Copy the mesh to a new dfsu file, e.g. Bathy_X.mesh.

2. Import the new file into Data Manager
Open the mesh file in Data Manager (right-click file and select 'Open with MIKE Zero Data Manager')

3. Import the MSL file as variable in the Calculator
Open the Calculator and add the mesh file representing the MSL values as a variable (e.g. Var3).

4. Subtract MSL

Use the following expression to subtract the two files:
Current item = CurrItem - void(Var3)

5. Update bathymetry

Save the file. The resulting mesh file now holds the bathymetry relative to MSL in the mesh nodes.
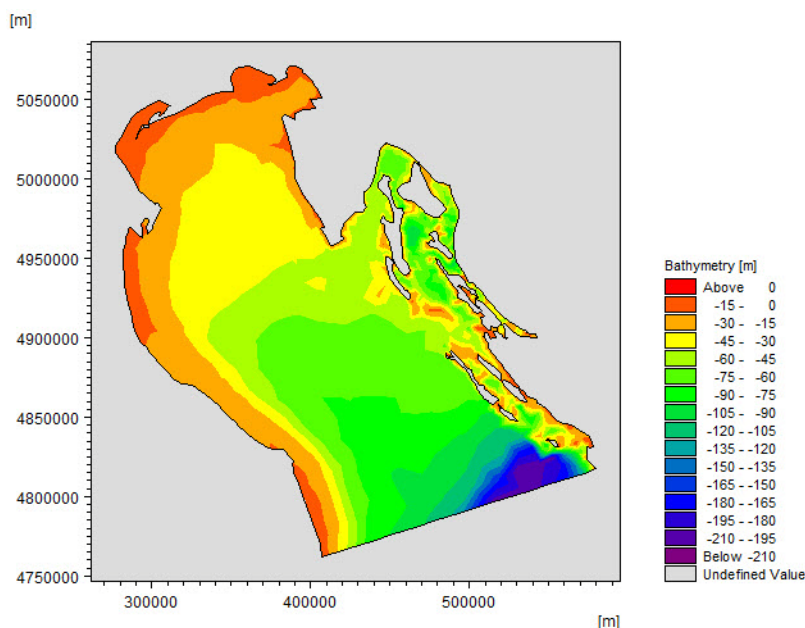

Figure 6.7   Bathymetry relative to MSL as shown by MIKE Zero

6.5   How to Extract and Export Time Series of Tidal Elevations

In the following you can learn how to extract predicted tidal elevations.

1. Displaying detail levels information

In the MIKE C-MAP view of a selected area of interest the amount of details displayed can be adjusted by selecting different class of maps, i.e. using the *MapSet* button. At the more detail levels information about names of locations including tidal stations appears, see Figure 6.8.
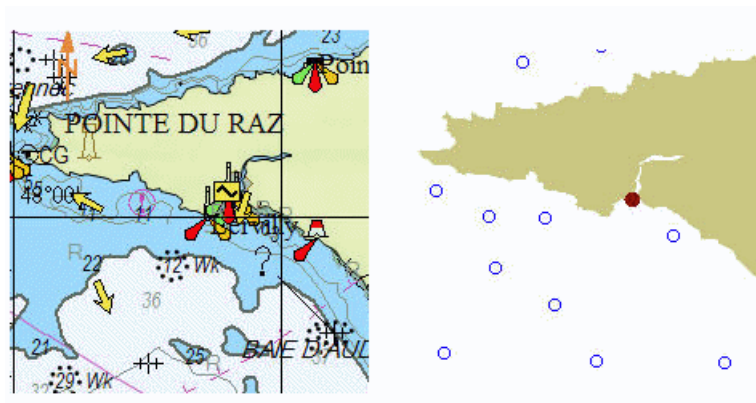
Figure 6.8   Detail information about tidal stations

2. Get tidal elevation information

From the export level it is possible to get information on tidal elevation by right clicking on the individual tidal stations shown in red. By default the predicted tide is shown for the present day, see Figure 6.9. To select another day simply select the day of interest.
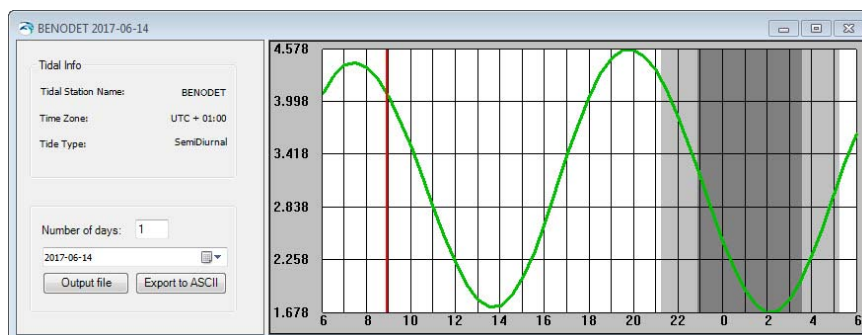

Figure 6.9   TIdal prediction for Benodet tidal station

NOTE:
Tidal information can only be extracted from 1970 and onwards.

3. Export tidal data

In the tidal day selection box shown in Figure 6.9 select the start date and specify the number of days to be exported and then press the relevant button. Then specify the name and save the file.

4. Import tidal information to MIKE Zero

You can open a generated dfs0 file in the MIKE Zero Time Series Editor. It is often useful to modify the time axis description to be an equidistant calendar axis, see Figure 6.10.
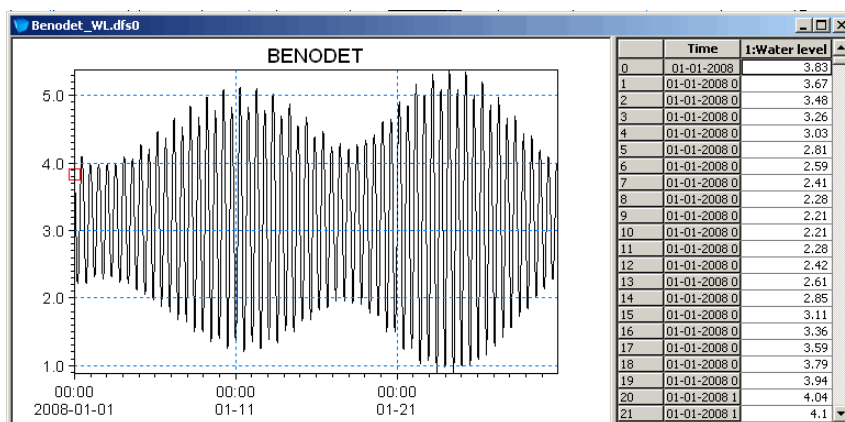
Figure 6.10   Tidal information as visualised in MIKE Zero

NOTE:
Before you use the tidal time series as boundary data note the following: If your model bathymetry has been adjusted relative to MSL then remember to adjust the tidal time series accordingly.

6.6   How to Enhance the Resolution Using the MapSet and Detail Button

The example below illustrates the effect of using the 'Detail' item for the view area.

In a MIKE C-MAP view the amount of details displayed can be adjusted by selecting different class of maps, i.e. using the *MapSet* button.

By default it uses the 'Best Full Coverage' (BFC), see Figure 6.11.
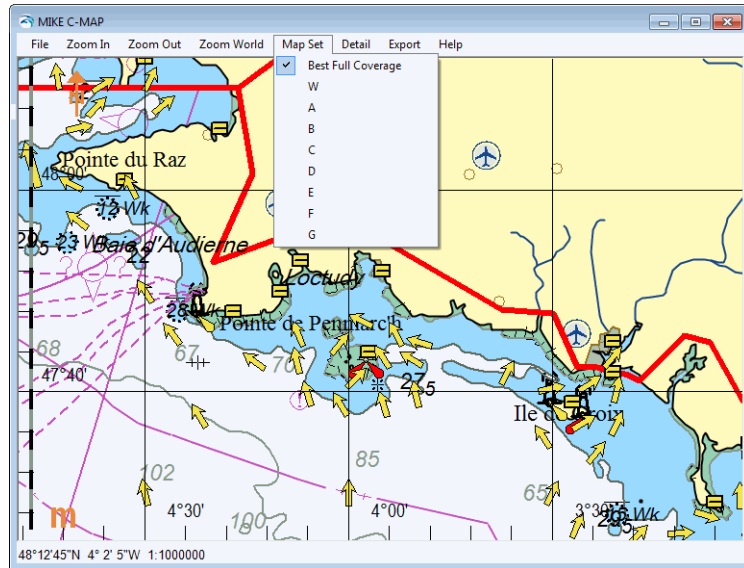
Figure 6.11   Area view with BFC

However, the displayed data in a given view are necessarily not all the data in the database, but a subset of data required to draw a 'decent' map on the screen. This 'data reduction' has been introduced to avoid the plotting of points that ultimately would end up in the same pixel size on the screen.
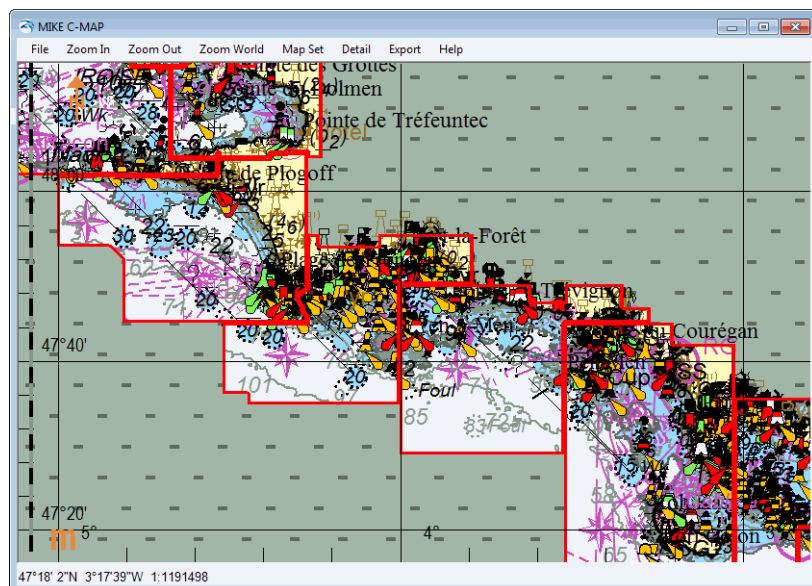

Figure 6.12   Area view with Mapset E

To increase the number of data to be extracted and further exported for bathymetry generation the "Detail" menu item can be used, see Figure 6.13, Figure 6.14 and Figure 6.15.
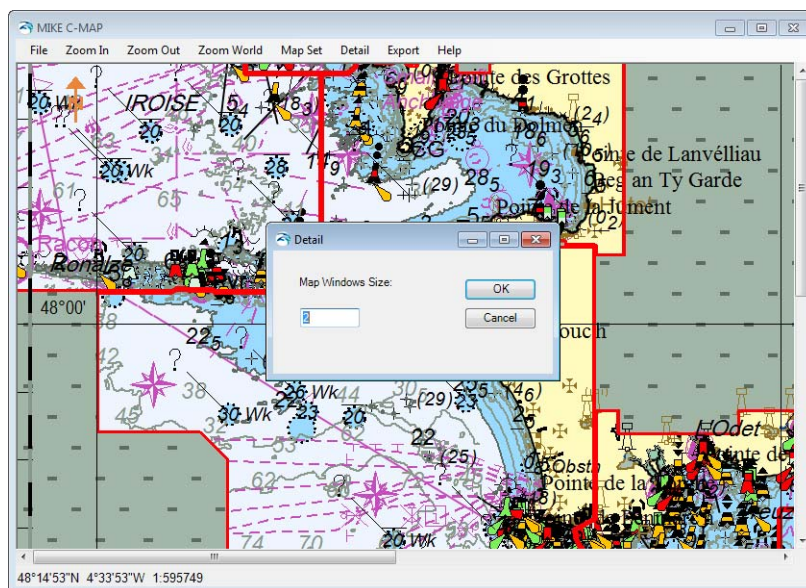

Figure 6.13   Selection of display of map detail

If you, in the "Detail" menu, specifies a detail factor, f >1 then the selected area is "plotted" on a bitmap which is f times as large as the one shown in the window (and the window then only displays the upper left part of the entire bitmap).

This feature is limited by the fact that there is a limit to the size of the bitmap (and thus to the detail factor, f). This implies that in case of large areas in which you want to export data of great detail, it can be necessary to export data from sub-areas and then, subsequently, merge the exported data.

For the area view shown in Figure 6.11 various selections of Detail factor and MapSet will give the number of land points and water points as shown in Table 6.1 and Table 6.2 (The land points are extracted without interpolation).
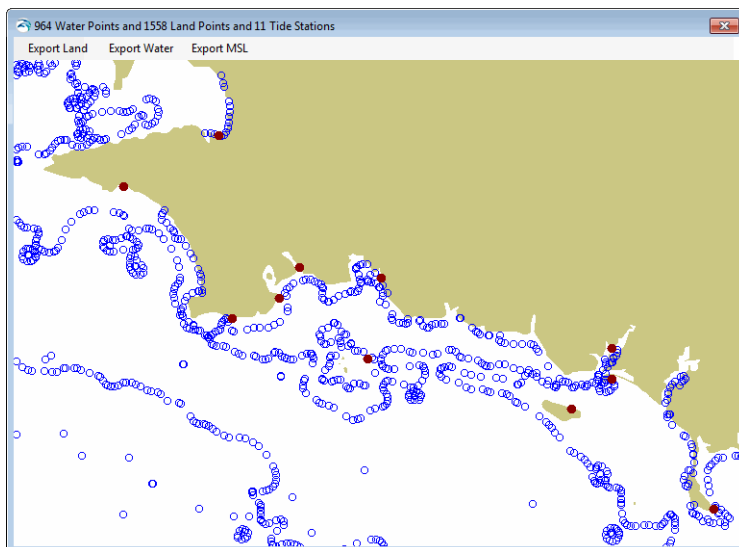
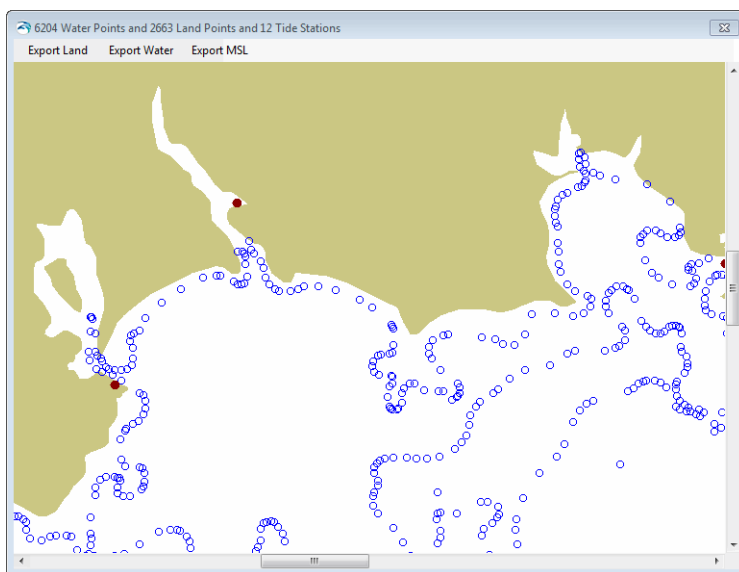Figure 6.14   'Detail' factor = 1, water points = 964, land points = 1558

Figure 6.15   Detail' factor = 6, water points = 6204, land points = 2663

Table 6.1   Number of extracted data points for fixed MapSet (here BFC) and varia-
ble detail

Detail factor	Water points	Land points
1	1558	964
2	5428	2081
3	5978	2387
4	6127	2537
5	6185	2633
6	6204	2663

Table 6.2   Number of extracted data points for fixed Detail factor (here 6) and vari-
able MapSet

MapSet	Water points	Land points
BFC	6204	2663
W	0	87
A	4	430
B	1067	1282
C	6204	2663
D	28119	8587
E	88722	18513

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