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Chapter 1 About GLOBE

GLOBE (GLObal Oceanographic Bathymetry Explorer) is an application for processing and displaying oceanographic data. GLOBE offers processing and display solutions of multi-sensor data within a single 3D environment represented as a globe.

Developed in Java, GLOBE is multiplatform (Windows, Linux, Mac for PLACA) with architecture that allows users to develop and add new modules for processing and visualizing data.

Developed by IFREMER, the software is used by the European project EMODnet Hydrography for manipulating and creating digital elevation models. GLOBE is available for free under a LGPLv3 license.

See

<https://gitlab.ifremer.fr/fleet/globe/blob/09c55db4017a31158889f7d75b19795c2f1975ba/fr.ifremer.globe.help/documentation/index.adoc#user-content-index-of-globe-software-documentation>.

Software and Installations

Getting started

How to retrieve GLOBE software

1. Go to the GLOBE web site
<https://www.flotteoceanographique.fr/en/Facilities/Shipboard-software/Analyse-et-traitement-de-l-information/GLOBE> (you can change the language with the button on the top right)
2. Go to the download page (on the left-hand side, just below GLOBE entrance)
<https://www.seanoe.org/data/00592/70460/>
3. Choose your version and required platform
4. Log in or create a download account
5. Validate the license and your download should start
6. You will get a zip file.

Requirements

- Operating system: Windows 7/10, Ubuntu, MacOS
- System: 64 bits
- RAM: 16GB recommended (2GB minimum)
- Graphic adapter: minimum 2007 NVIDIA recommended

Important: Using an old version of your graphic driver can lead to a JVM crash as soon as GLOBE tries to display any OpenGL view.

Installation

Windows and Linux

- Unzip the file in a directory of your choice,
- Click on GLOBE.exe (windows) or the GLOBE executable file (Linux)

Tip: Deploy GLOBE in a directory named with the version number, for example 1.5.178

Uninstall procedure

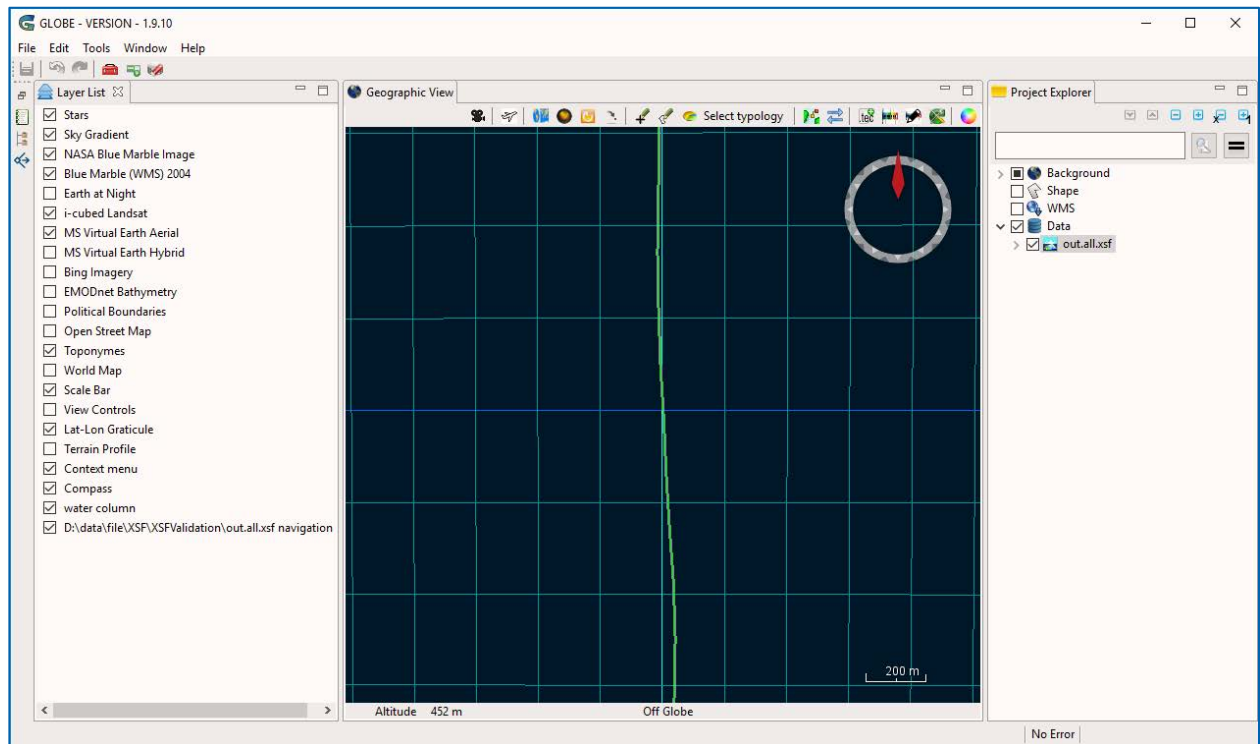
Users just need to delete the GLOBE software directory to uninstall it.

Chapter 2 Concepts and user Interface

Views

The GLOBE interface has a viewer (like the Project explorer) that is displayed by the View tab.

All views can be stored in stack like the three main areas seen by default (for example the Lower Left Area, containing two views: the property view, and the parameter view). The image below gives an example of the display configuration.



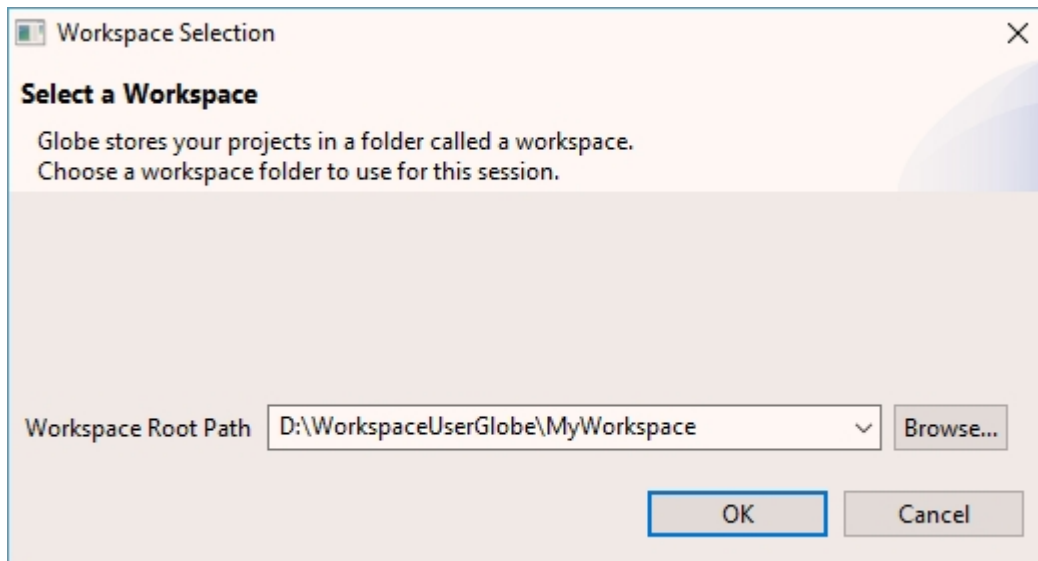
IMPORTANT: Each view can be moved, resized, set as full screen and reduced. The user can configure their own display of view in order to best fit their need and hardware configuration (display count and size) and field of interest.

Layer

A layer is a concept inherited from *NASA Worldwind*. A layer is any single object that is drawn on the 3D GLOBE. It can be a 2D layer like a legend, or a 3D object like a surface map, or a graticule.

Workspace

When a user starts GLOBE, a popup window appears and ask for a workspace location.

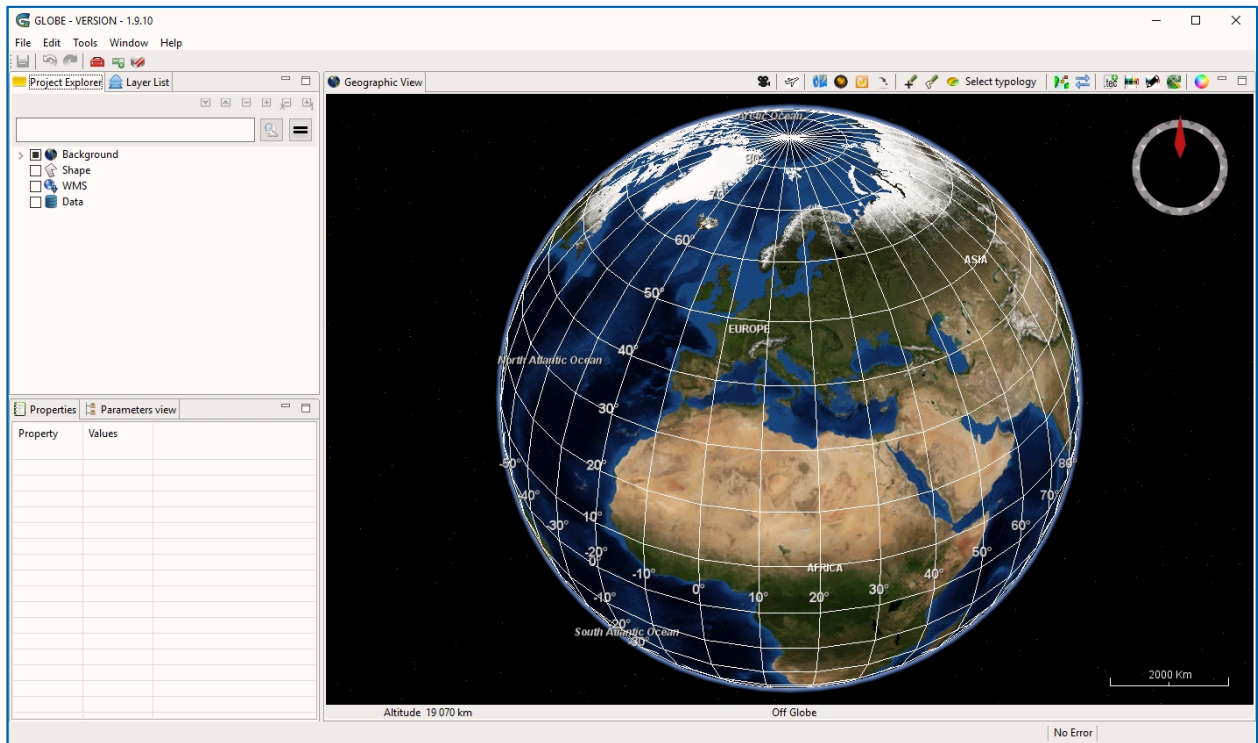


The workspace is the directory used by GLOBE to store some of the data files and settings specifics to a working project.

- In the workspace you have a file called `session.xml` which contains a list of all the opened files and their status (typically visibility, colors and so on). This file is automatically loaded at startup.
- There is a `.cache` directory which is used as a cache for GLOBE intermediate files and indexes. This directory can be safely deleted before a GLOBE startup, if necessary, files will be regenerated.
- The metadata directory is used by the eclipse framework used by GLOBE to store its internal state

User Interface Overview

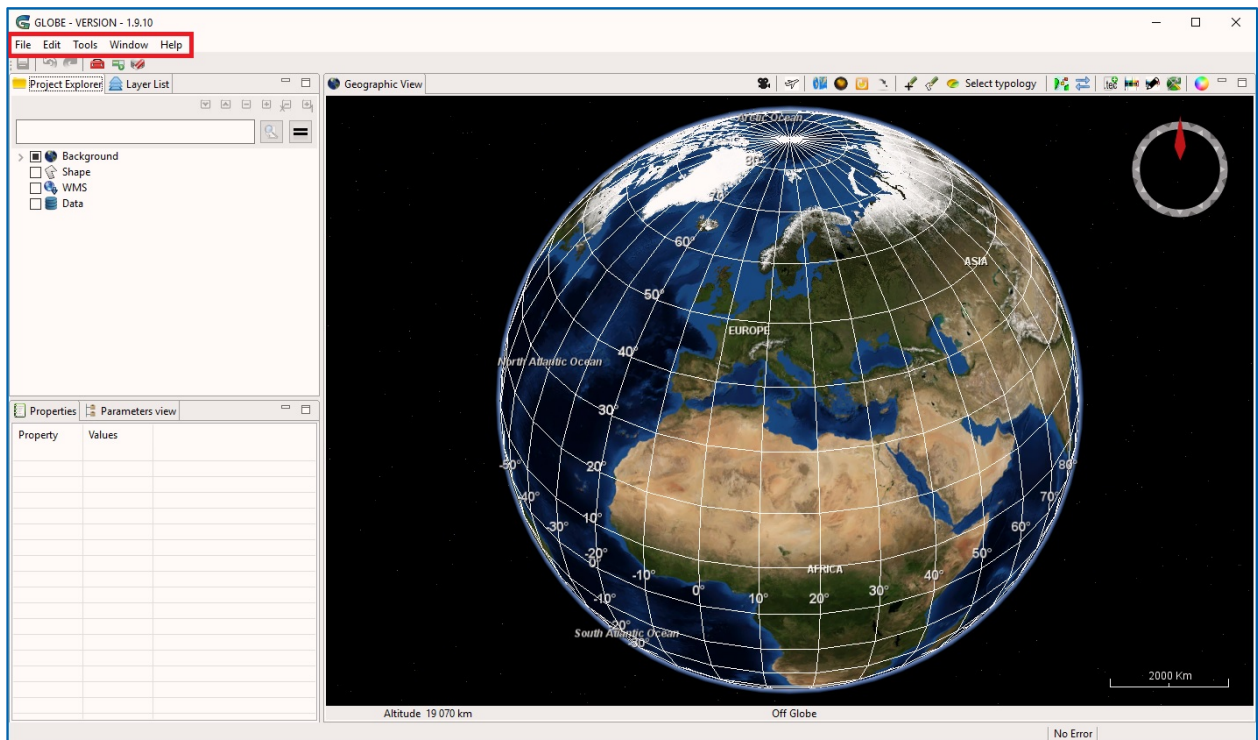
After workspace selection, the software starts and will be displayed as shown below:



The main window is made up of several areas that are described below.

Menu bar functions

At the top of the application, the user can find a classical menu bar containing a set of functions.





-
- The File menu allows you to manage session and main functions of the application (Exit, Restart, etc.)
 - The Edit menu is a classical Edit menu allowing mainly undo redo actions.
 - The Tool menu is a very important entry point, allowing you to start all operations that are not directly linked to a specific file. For example, Batch conversion of files can be found in this menu.
 - The Window menu is a classical application entry allowing you to access preferences settings, and to show specific views.
 - The Help menu displays shortcuts, a link to the active GLOBE forum and the help file.

File Menu Details

- Save session: The user can export a session in an XML file. The session contains the list of all opened files.
- Load session: Load a session saved in an XML file. GLOBE reopens the data files.
- Take a screenshot: Take a screenshot of the application.
- Switch workspace: Switch the application workspace, the user can choose another workspace. If so, the application restarts.
- Quit: Quit the application.

Edit Menu Details

- Undo: This function undoes the last action of the active view. It can be also done with CTRL + Z hot-key or with  icon.
- Redo: This function redoes the last action of the active view. It can be also done with SHIFT + CTRL + Z hot-key or with  icon.

Notice: These two functions can be used only for data modification.

Window Menu Details

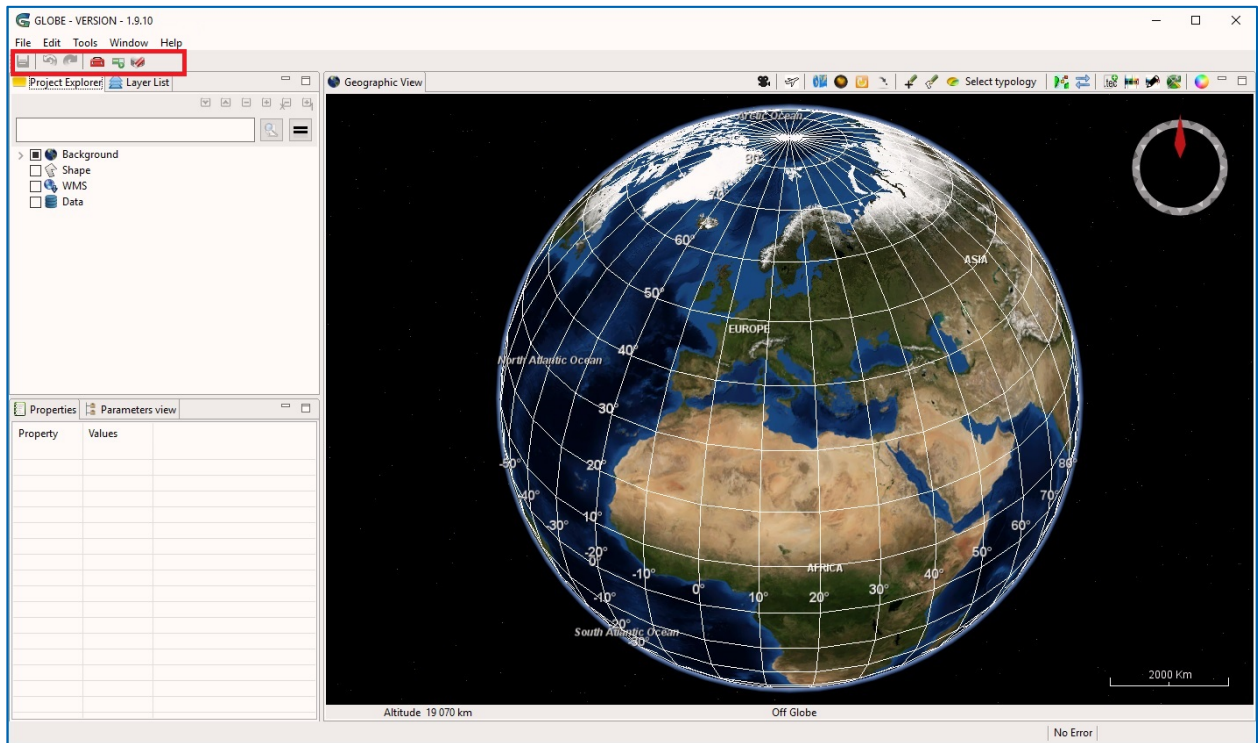
- Reset perspective: If you are in trouble with the different views (e.g. you cannot see some of the views), Window-Reset perspective function closes and restarts the software.

Help Menu Details

- This function opens the help pages and displays the version number.

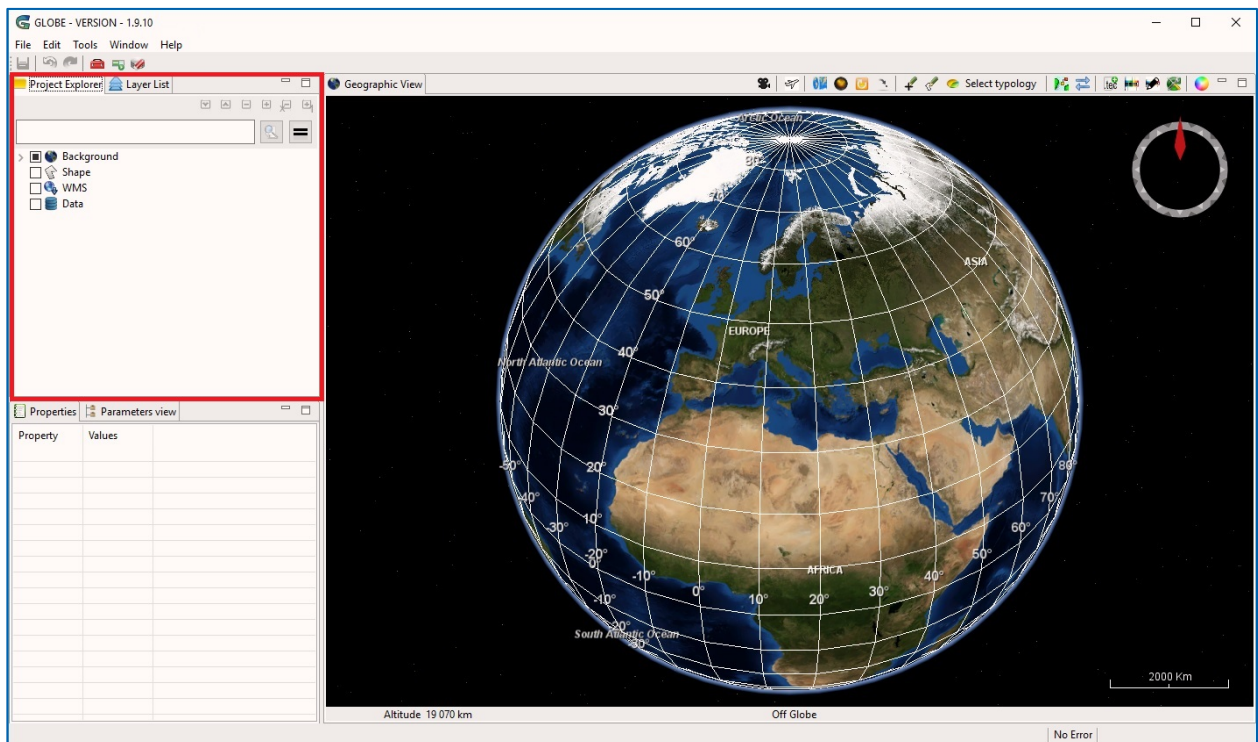
Toolbar functions

- The toolbar displays a few current shortcuts like save, undo, redo, display of the toolbox view, progress view, and the cache management



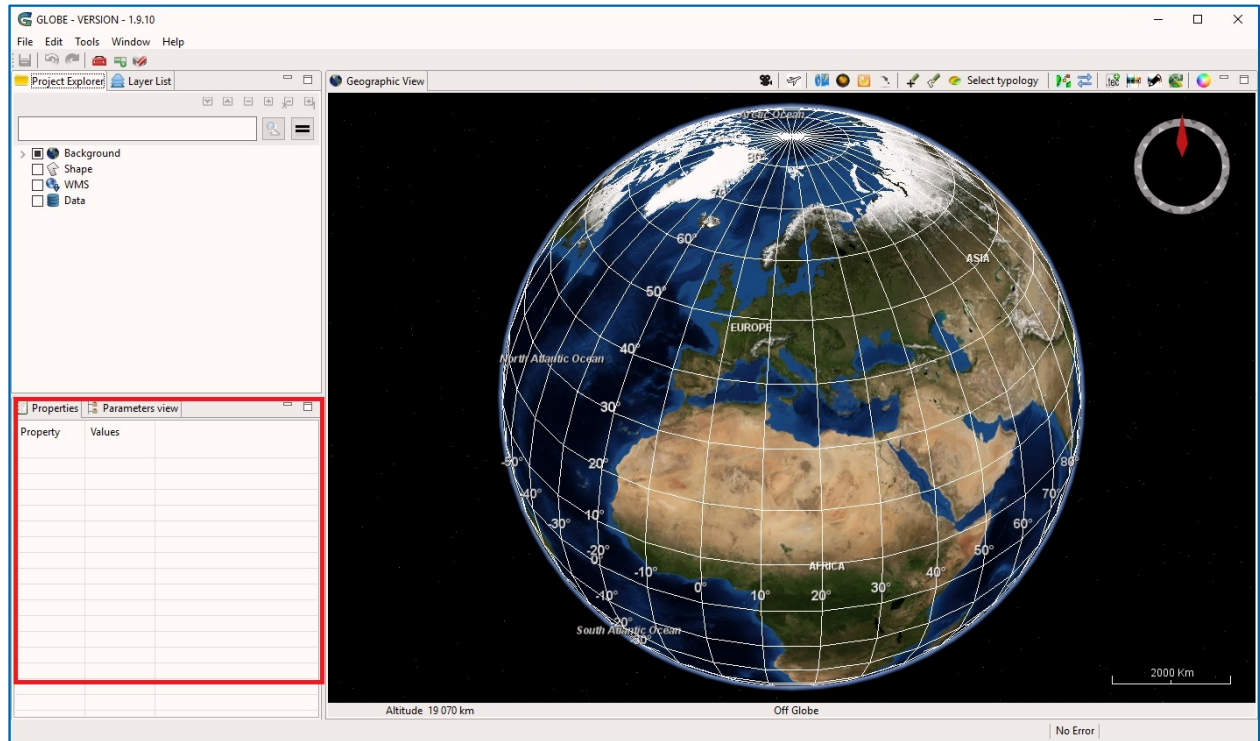
Upper left area

The upper left area is an area dedicated to file and layer management. The two default views for this area are the Project Explorer View and the Layer List View. More details about those view can be found in the dedicated chapter



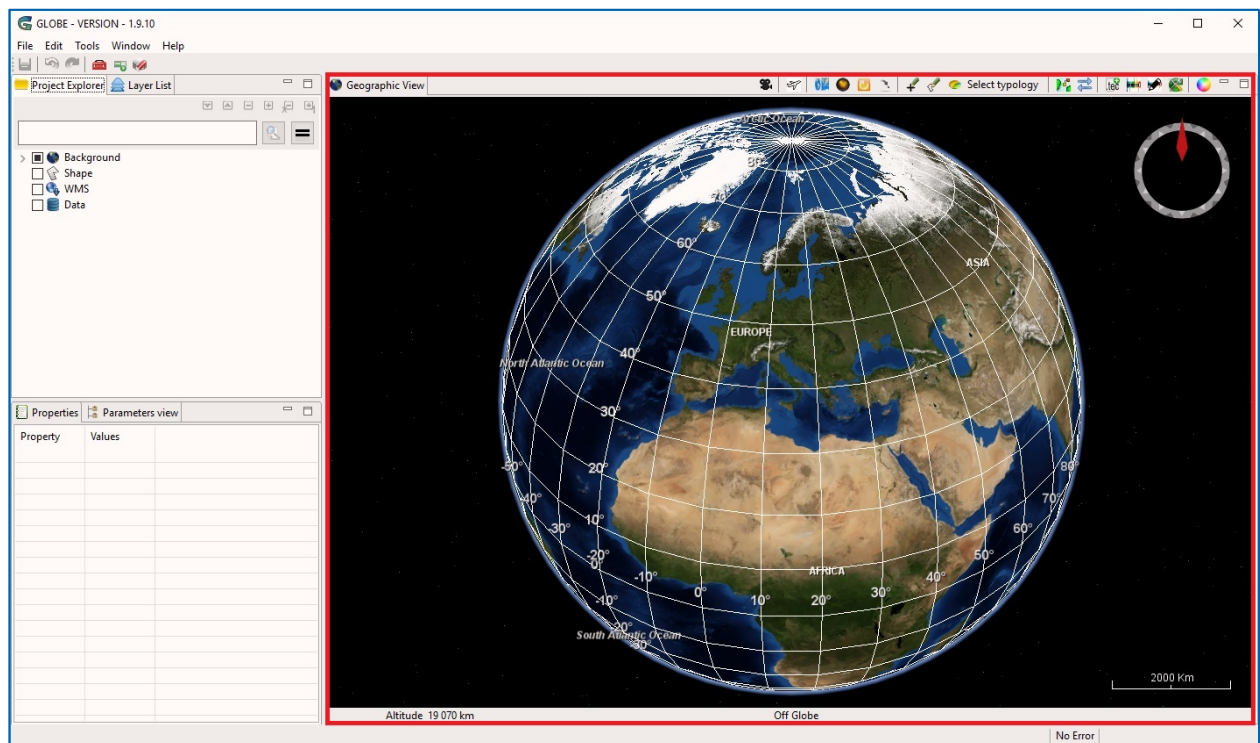
Lower left area

The lower Left area is an area dedicated to displaying information and controls that are contextual to a node or file selected in the upper-left area. The two default views for this area are the Parameter View and the Property View



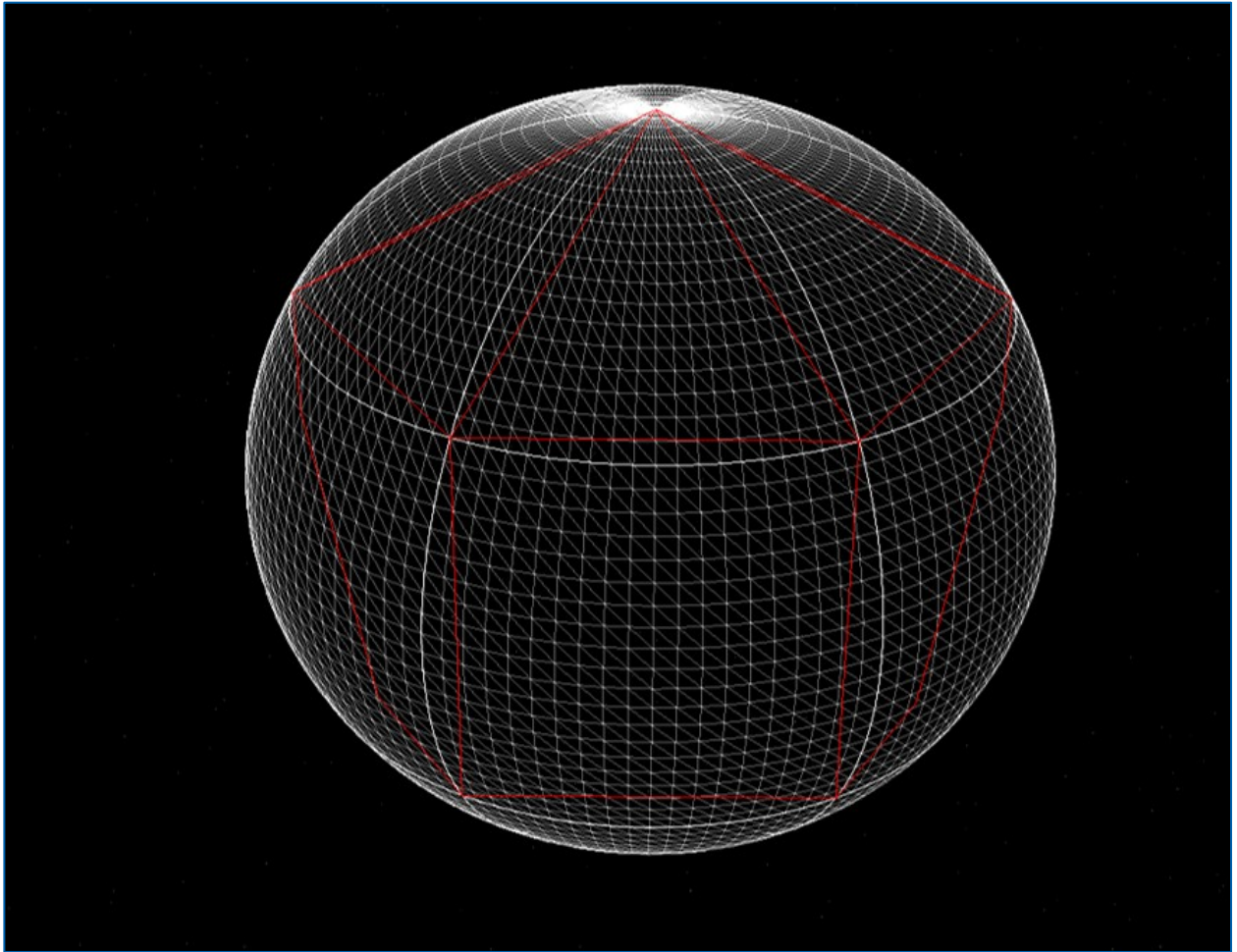
Main Area

The main area is dedicated to all editing and displaying views. It is, by default, used by the geographic view to display all data in the *NASA Worldwind GLOBE*.

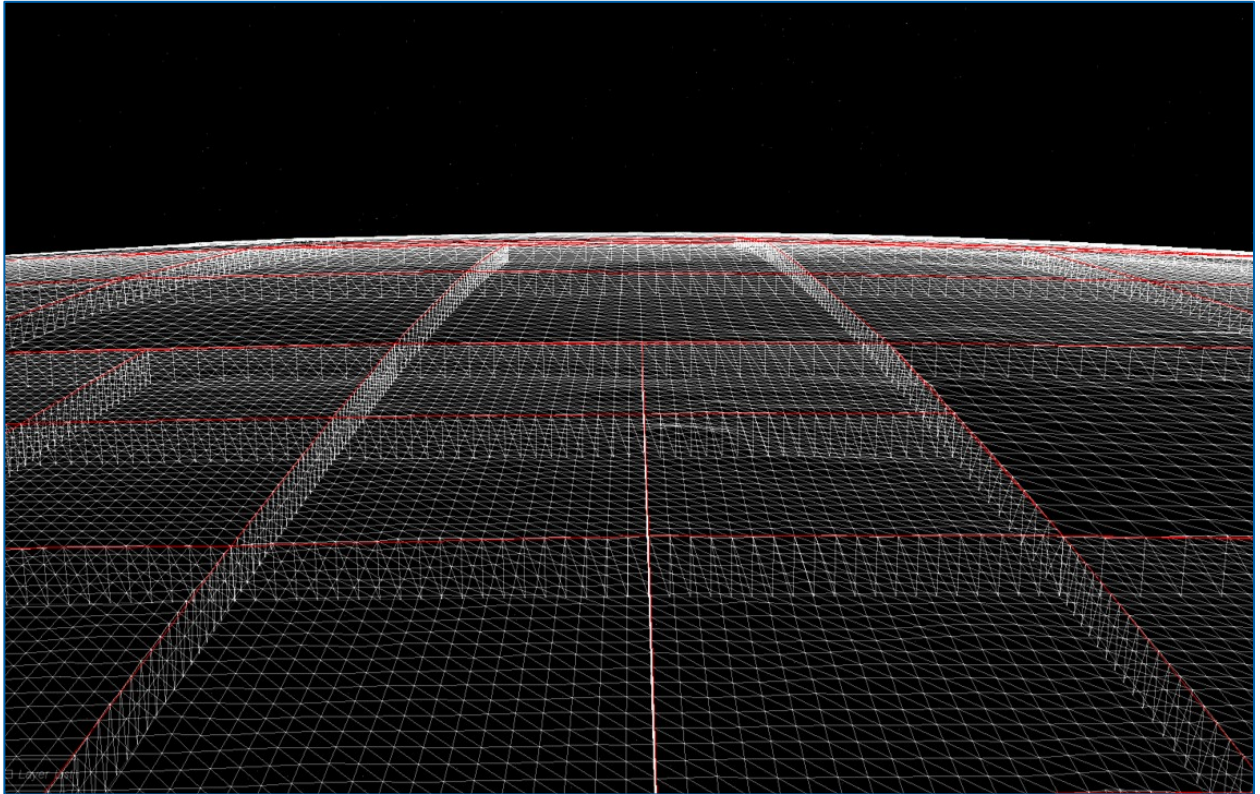


How a Virtual GLOBE works

It starts with a 3D sphere split into tiles.



When zooming, tiles are subdivided according to the distance to the point of view.



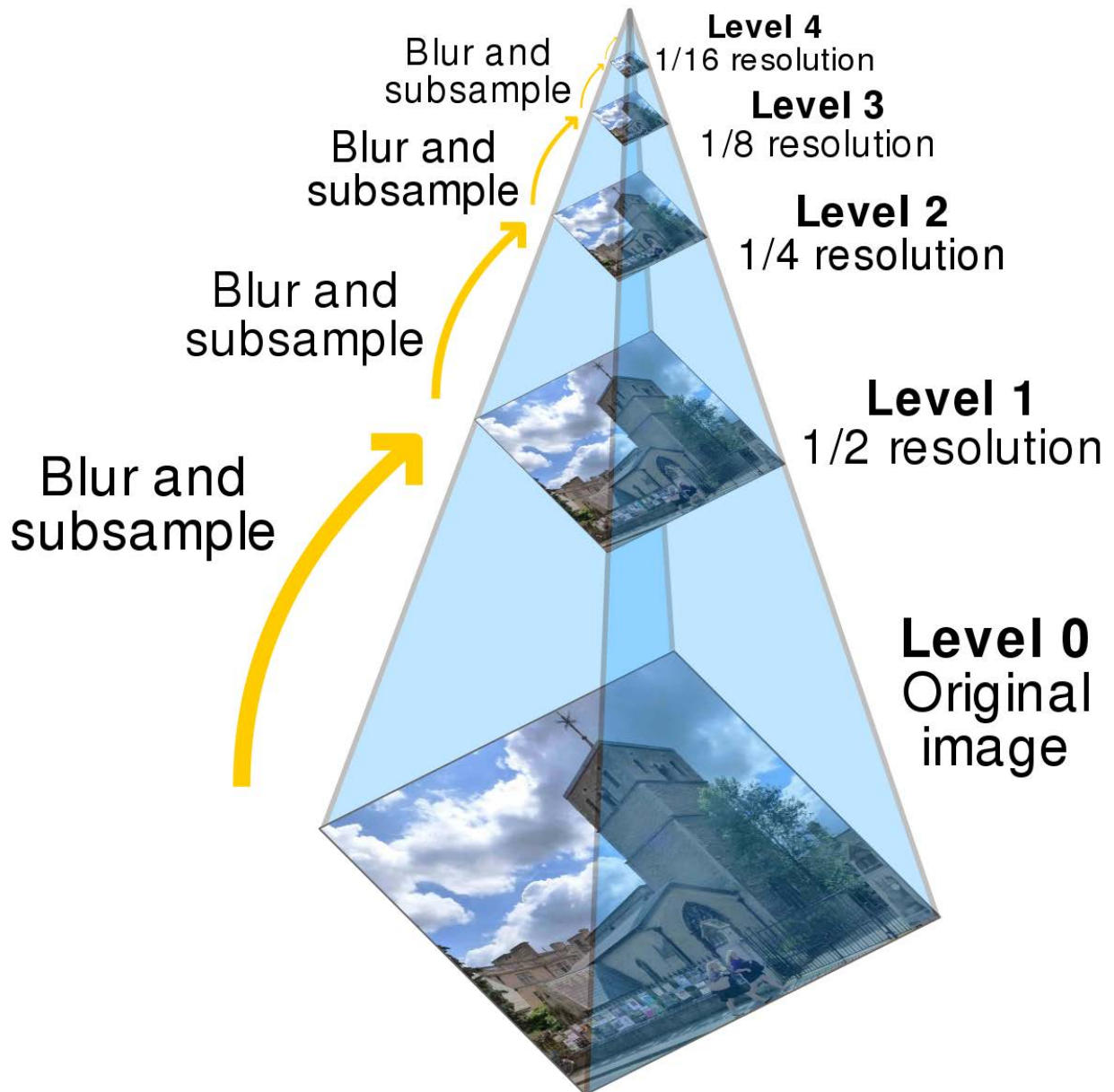
Then an image is associated per tile.



And an elevation image: *Nasa004.jpg*]

Data are organized according this hierarchical approach per tile:

- Computed once
- Stored on cache on disk



[https://en.wikipedia.org/wiki/Pyramid_\(image_processing\)](https://en.wikipedia.org/wiki/Pyramid_(image_processing))

IMPORTANT: Consequence for the file system: The pyramid tiles are stored on the file system in a dedicated directory (for Windows C:\ProgramData\WorldWindData) in two subdirectories Earth (containing NasaWorldwind tiles, and GLOBE data containing GLOBE tile data)

Python in GLOBE

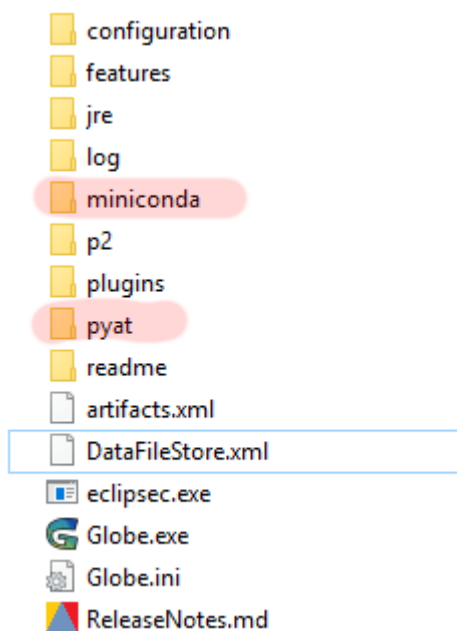
The GLOBE software package embeds a python environment and a set of python scripts.

More specifically:

- The python embedded environment is a miniconda python 3.7 with a set of classical libraries for data science projects (like numpy, scipy, netcdf and so on).
- The set of script is a frozen view of the *Ifremer pyat* project (<https://gitlab.ifremer.fr/fleet/pyat>)

File structure

In a GLOBE directory two folders contain the python software: the miniconda directory matches the anaconda distribution and the required libraries and the pyat directory contains the associated set of python scripts matching this GLOBE version.




NOTE

All integrated processes python code can be found in the pyat/pyat/app directory.

Process call

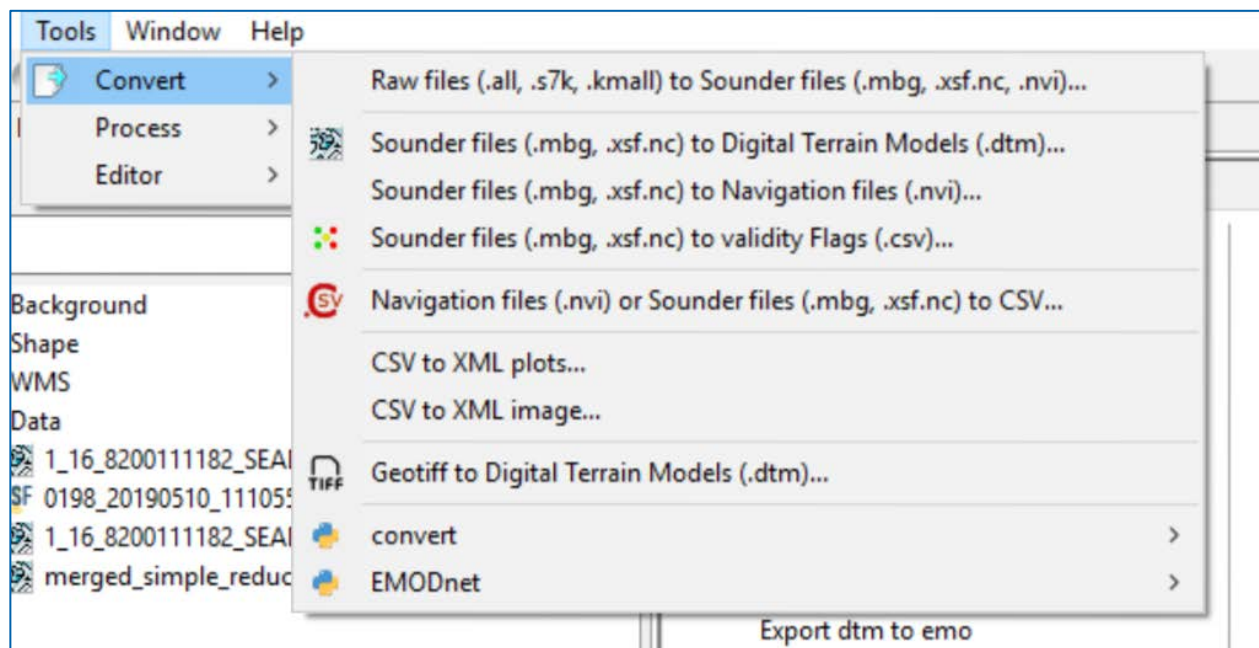
Scripts are integrated within the GLOBE software and can be called from the GLOBE software through different means:

- Either from the *pyToolBox*.

The *pyToolBox* is a view showing all python scripts. It is callable from the  entry in the toolbar or through the menu Windows → Show View

- Or from the Tools menu like any other GLOBE processes.

One can recognize the python nature of a process with the  icon



- Finally, through right click in Project explorer

All processes taking a typed file as an input can be called classically with a right click on the input files

The screenshot shows a GIS application window with a tree view on the left and a properties table at the bottom. A context menu is open over a data layer named '1_16_8200111182_SEADOME.dtm.nc'. The menu options are:

- Open with >
- Execute with >
- Export to >
- Rename
- Delete
- Go to
- Reload
- Load
- Unload

The 'Execute with' sub-menu is expanded, showing the following options:

- Execute with operating system
- Convert reproject dtm
- Reduction
- Geobox update
- Reset cell
- Set cdi
- Modify existing cdi
- Merge simple
- Merge fill
- Gap filling
- Gdal fill nodata
- Heighmap interpolation process
- Smoothing
- Linear transform
- Create default layers
- Split by cdi
- Sanity check
- Compare Dtm

The Properties table at the bottom contains the following data:

Property	Values
Group Name	1_16_8200111182_SEADOME.dtm.nc
Loaded	Loaded
File	D:\ValidationEMODnet\1_16_82001
Name	D:\ValidationEMODnet\1_16_82001
North Latitude	N 44°05'00"
West Longitude	E 005°45'00"
South Latitude	N 41°14'00"
East Longitude	E 008°53'00"
Projection	+proj=longlat +ellps=WGS84 +no
X spatial resolution	3.75"
Y spatial resolution	3.75"

Chapter 3 Views

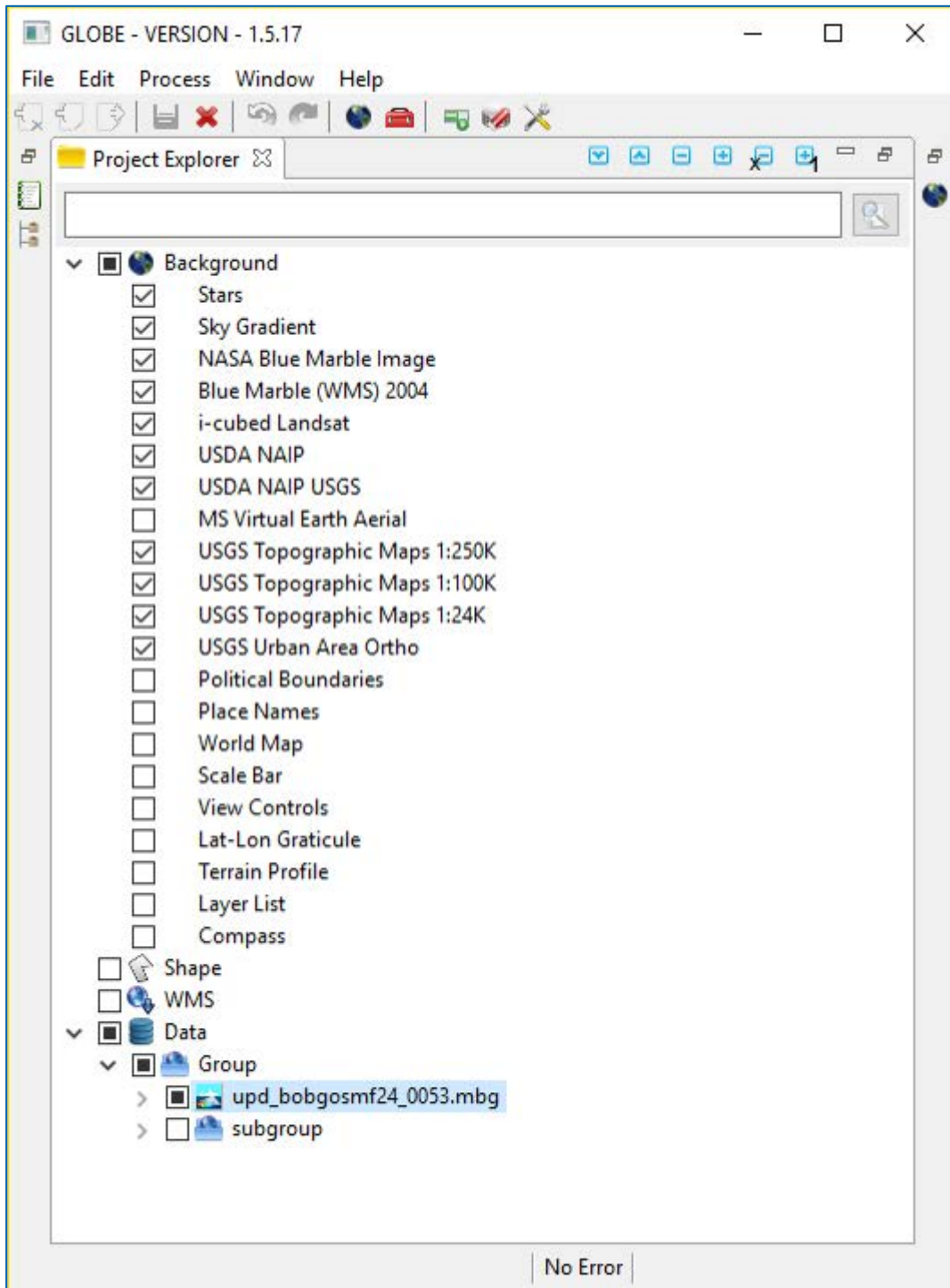
Project Explorer

The project explorer is a view representing all the data managed in GLOBE in a hierarchical tree structure made of nodes and groups.

Each final node represents most of the time layer displayed in the geographic view, or in some rare cases a reference to a user file that is recognized by the software. In case of data displayed, the visibility of the layer is controlled by the associated checkbox.

High level nodes serve as a group handling specific kinds of layers.

- Background Node handles generic NASA layers. Users can choose the GLOBE's aspect in the Geographic View by selecting or not selecting a layer in Background node of the project explorer (for example enable or disable the visibility of the compass).
- Data Node handles imported user files and associated layers (i.e. your data). In this node, a file is represented as a node called a *StoreNode* and each *StoreNode* can have multiple layers. The best example can be a sounder file node, which is represented by several layers (for example one for the navigation line, the other for the water column data).
- Group Node are folder like structures that regroup data in order to facilitate organization. These can be created in the Data Node only.
- Web Map Service (WMS) Node handles the WMS layers displayed in GLOBE.
- Shape Node handles surfaces and shapes drawn by the user on the GLOBE surface (for more information, see the chapter *HOW TOs* in the official manual)

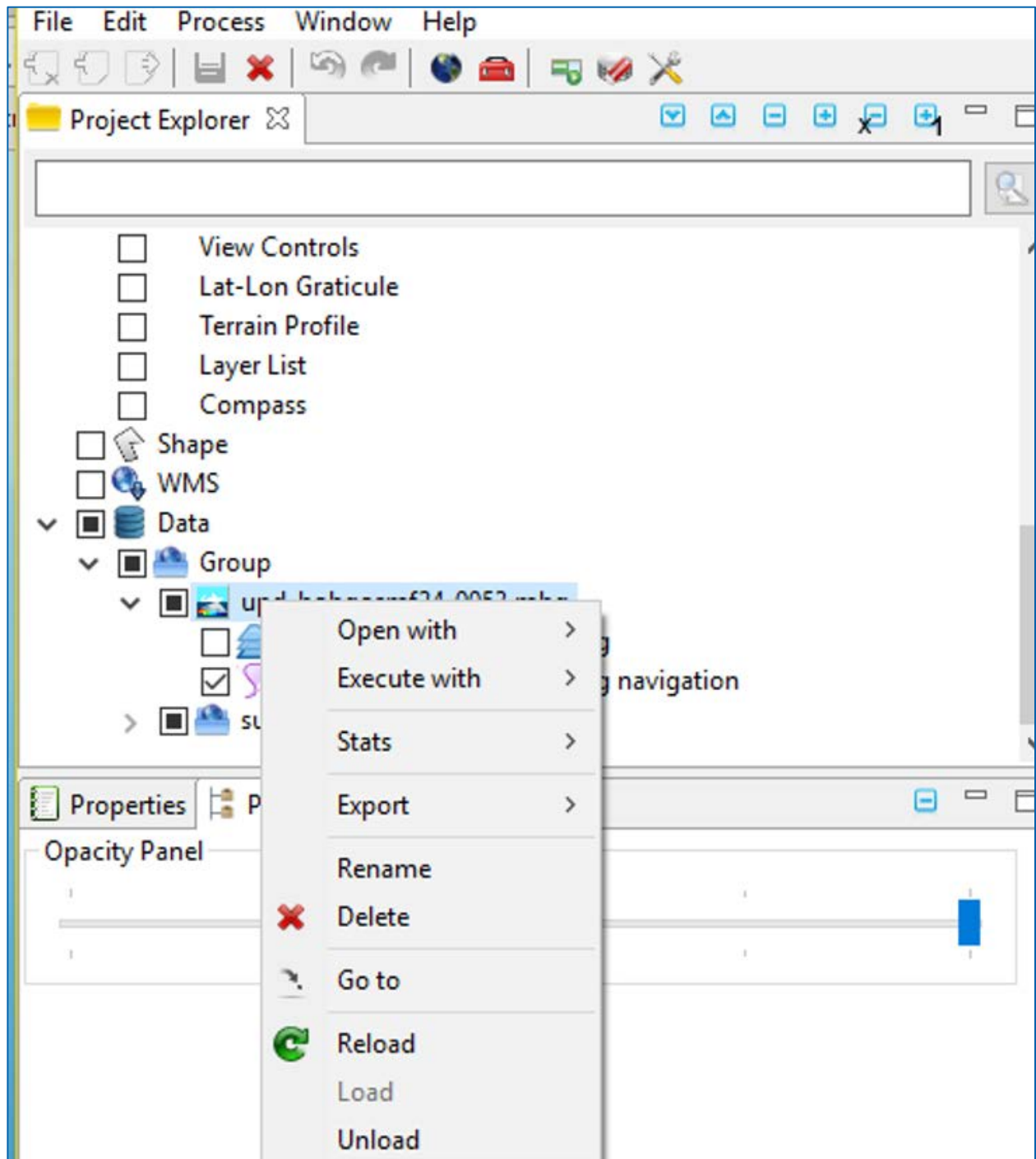


Action

In project explorer, actions available are contextual to the node(s) selected. The list of available actions can be retrieved through a right click on a node. This will:

- Display available actions specific to that very node
- Allow load/unload : details about loading status in layer explorer are given in the chapter *How to manage loading status in Project Explorer* in the official manual.
- Allow *Go To* that will zoom the eye point of view to the selection area.

- Allow some action like rename or delete the note (mind that renaming a node does not rename the associated file).



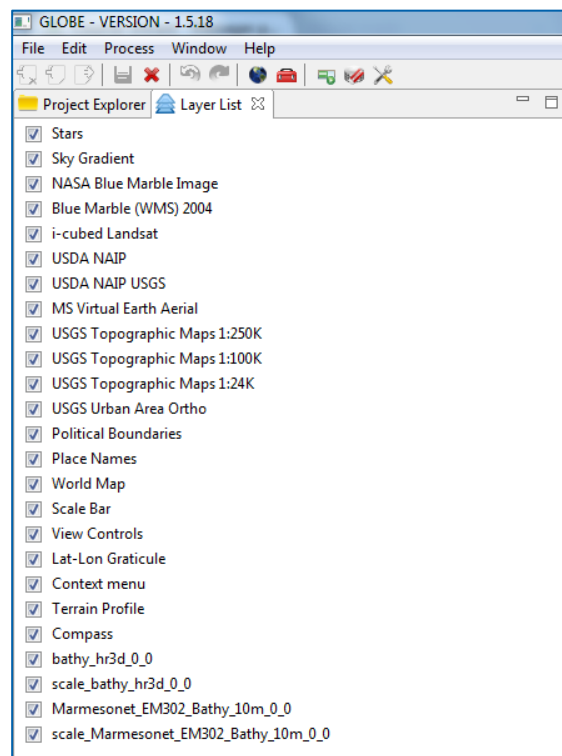
Advanced topics

Specific action and filters are available on project explorer view in the top-level filter area or the blue buttons. See the chapters *How to re organize my data in the project explorer* and *How to use node filtering to set visible a large bunch of files* in the official manual for more details.



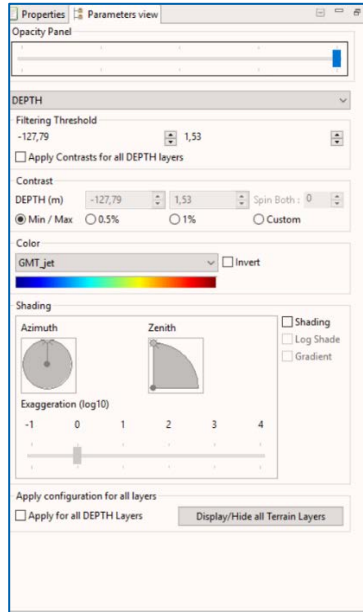
Layer List

You can visualize the layer list of the *treeViewer* in "Layer List" tab. Each layer comes from *NASA Worldwind* and are superposed over each other. This tab allows the user to change the ordering of layers through drag and drop. The lowest layer in this list is displayed over the other layers.



Parameter View

The parameter view gives an entry point to all actions specific to a single selected Node. Controls are specific to each node, it could be management of color for Digital Terrain Model (DTM) files, to water column control or display configuration for a specific layer.



Example of a DTM Parameter View

Property View

All properties associated with the selected node in Project Explorer are available on this view (name, path, file type, file format, ship name, survey name, geographic coordinates, etc.)

Property	Values
Group Name	366_14mlrishSeaSouth.dtm
Loaded	Loaded
File	F:\366_14mlrishSeaSouth.dtm
Driver	fr.ifremer.viewer3d.loaders.ElevationLoader
Name	F:\366_14mlrishSeaSouth.dtm
North Latitude	53°22'59,99"N
West Longitude	6°42'0,00"W
South Latitude	51°17'59,99"N
East Longitude	5°47'59,99"W
History	
Minimum depth (m)	-1.5399999999999992
Maximum depth (m)	127.795000000000002
Projection	+datum=WGS84 + ellps=WGS84 + no_defs= + proj=kr
Ellipsoid	WGS-84
a, b (meters)	6378137.0 , 6356752.314245179
e2, 1/flatness	0.00669437999014133 , 298.25722356300156
X spatial resolution	0.4687500244472176 arcsec
Y spatial resolution	0.4687500244472176 arcsec
Number of row	16000
Number of columns	6912
> linked ID values	[SDN:CDI:LOCAL:366_TON_15_03_Wexford_7m_WGS
Projection	-1.0

Example of Property View for a DTM file

Geographic View

The geographic view is a geographical 3D Viewer, providing an innovative and high-performance 3D viewer for data types such as DTM and WMS which are plugged into a virtual GLOBE. This view is based on *NASA Worldwind API* (<https://github.com/NASAWorldWind/WorldWindJava>)

It has been designed to provide:

- In-depth evaluation of data set content to assess the quality of a DTM (resolution, coverage, quality) using basic GIS functionalities.
- Combining data layers such as sample location, sediment properties etc. Using WMS from other data sources to assist end-users searching for data or analyzing interactions between processes on the seabed or between the water column and topographic features.
- Demonstrating the concept of making this type service available to end-users without them requiring specific skills to install or to use the service.

General Controls and Mouse commands

Left Mouse Button = Hold this button down and move the mouse to rotate the earth to the right or left, top or bottom.

Right Mouse Button = Hold and drag your mouse to tilt the earth to see the 3D views of an area that has the NASA Shuttle Radar Topographic Mission (SRTM) data. You will not really notice this function till you zoom in closer to a point on the earth.

Both Mouse Buttons = Zoom in and out of the Earth.

Scroll Wheel = Use this to zoom in and out of the Earth.

Keyboard commands

The help menu details all shortcuts available in the geographic view

Background layers

All background layers can be enabled/disabled by clicking on their respective node in the Background entry in the *ProjectExplorer* View

Earth image

Background layers feature the Earth with the World Wind default layers:

- Stars background and atmospheric effects.
- Images of the Earth which are draped on the elevation layer:
 - The Blue Marble (WMS) Next Generation May 2004, necessary to be able to zoom in and view the Earth at each tier (further details can be found on the NASA website as below:
http://earthobservatory.nasa.gov/Features/BlueMarble/BlueMarble_history.php
 - I Cubed Landsat 15m, Landsat images of the Earth which benefits from i3 algorithms, gives better resolution than Blue Marble, only visible when zoomed into 50km <http://worldwindcentral.com/wiki/Landsat>

- United States Department of Agriculture NAIP images, only visible when zoomed into 20km and is only visible over the United States as US Geological Survey topographic maps
- MS Virtual Earth aerial : [Microsoft](<http://en.wikipedia.org/wiki/Microsoft>) has allowed World Wind to incorporate [Virtual Earth](http://en.wikipedia.org/wiki/Virtual_Earth) high resolution data for [non-commercial](http://en.wikipedia.org/wiki/Non*commercial), uses *DigitalGLOBE* very high-resolution world imagery derived from satellite and aerial imagery, is only visible when zoomed into 50km. Can take a long time to display. <http://www.microsoft.com/maps/>
- Political boundaries: yellow country borders (not very accurate)
- Place names: adds place names to the GLOBE.
- Continents are in white capital letters, oceans are in white letters, countries are in white letters, bodies of water other than oceans are blue letters, physical features (mountains, deserts, etc.) are labeled with orange letters, cities are labeled with yellow letters. As you zoom in more features are labeled.
- Other layers: in addition, several tools can be displayed as background layers to better locate the user in space and to assess the elevation or depth:
 - World Map: small map seen in the upper left corner of the GLOBE display, with a cross indicating the location the Earth where you click and zoom in.
 - Scale bar: in the bottom right corner of the GLOBE display the scale at which you are zoomed in.
 - Compass: displays a compass in the upper right corner, with a red arrow heading north.
 - Lat-Lon graticule: network of parallels of latitude and meridians of longitude overlain on the GLOBE's surface using the Military Grid Reference System (MGRS) to show location in geographic coordinates.
 - Terrain Profile: displayed in the lower right corner, the terrain profile graph of the visible elevation layer along a (yellow) line. The line is located in the middle of the view unless the line is specified by the operator using the Measure tool of the tools panel.

Elevation terrain Layers

Elevation data of the global DTM have been collected by the SRTM, the National Elevation Dataset (NED) and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). World Wind (WW) uses the SRTM 30 Plus for the bathymetry of oceans and seas, which includes a combination of soundings and altimetric data at 30 Arc Seconds resolution (approximately 1km).¹

¹ J. J., Sandwell, D. T., Smith, W. H. F., Braud, J., Binder, B., Depner, J., Fabre, D., Factor, J., Ingalls, S., Kim, S-H., Ladner, R., Marks, K., Nelson, S., Pharaoh, A., Trimmer, R., Von Rosenberg, J., Wallace, G. and Weatherall, P.(2009) \Global Bathymetry and Elevation Data at 30 Arc Seconds Resolution: SRTM30_PLUS', *Marine Geodesy*, 32:4,355 * 371), <http://dx.doi.org/10.1080/01490410903297766>

Geographic View tools

- Vertical exaggeration

The *Geographic perspective* enables a user to apply vertical exaggeration to the terrain layers. The vertical exaggeration is common to both the WW global and the user terrain models. Vertical exaggeration can be applied up to 20x which should suffice for most sea floor representation.

- Measurement tool

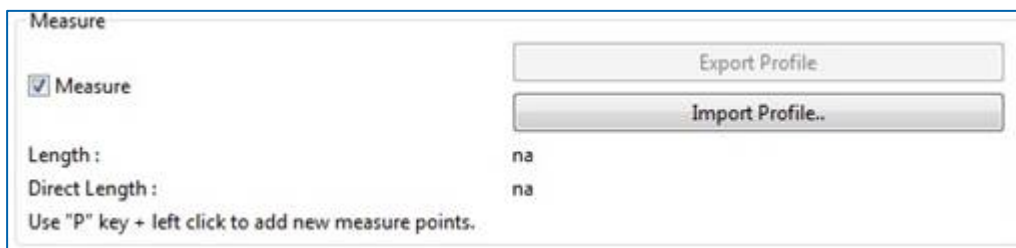
The measurement tool can be used to retrieve the distance between two points on the spheroid.

This tool is activated once you have checked the corresponding check box. The user can point to profiles by clicking simultaneously on "P" key and click in the Main Panel. The pointer then changes to a cross, and user can left-click points anywhere on the GLOBE. When "P" is released, the user can change the position of one point of the path by left clicking on it and drawing it to a new position. The same with "Alt" pressed will result in the translation of the path.

The measure gives the approximate orientation and direct lengths of the segments. If Terrain Profile Layer is selected, the cross section of the terrain along the path is displayed in the lower right corner. When a user DTM is overlain on the GLOBE, the section displays the elevation/depth of the DTM.

Once the measuring process is finished, the Elevation profile can be exported as a csv file (Comma Separator Value readable by Excel) by clicking on the Export Profile button.

To erase and redo the measure, just uncheck and recheck the check box.



Measure Tool

- Skirts activation

This function must be kept activated to eliminate artifacts sometimes observed using WW (see in the square below).



After activation



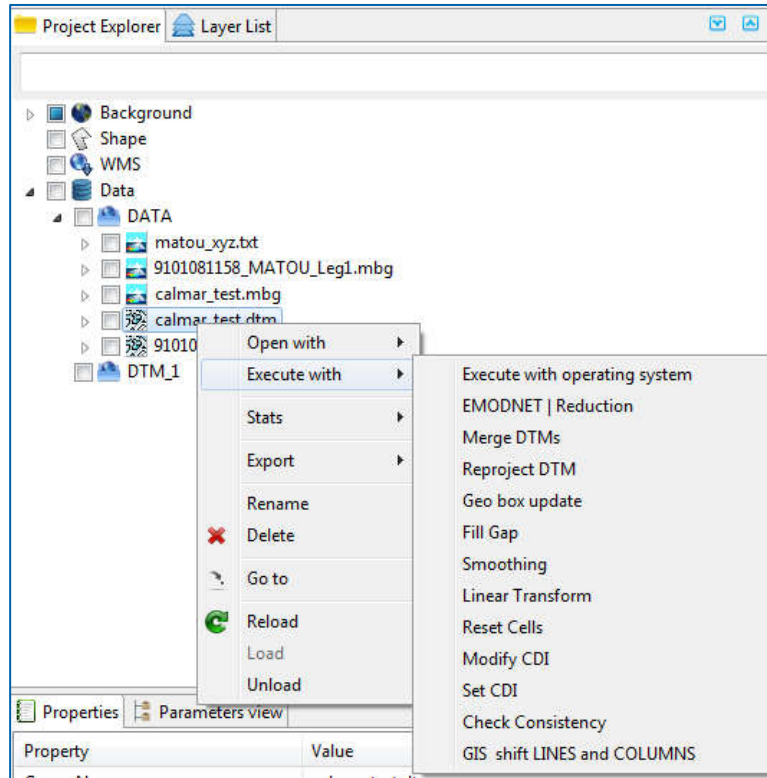
Before activation

- Information retrieval
 - *Depth*: Depth (or elevation) of the DTM is displayed for each position of the mouse together at the bottom of the screen.
 - *Coordinates*: Geographical coordinates are displayed for each position of the mouse together at the bottom of the screen.

Chapter 4. Processes

Overview of DTM Tools in GLOBE software

When DTM are loaded in GLOBE software some operations can be applied. This chapter give details about the available operations for DTM. These tools are accessible by right clicking on the DTM file from the *Project Explorer*.

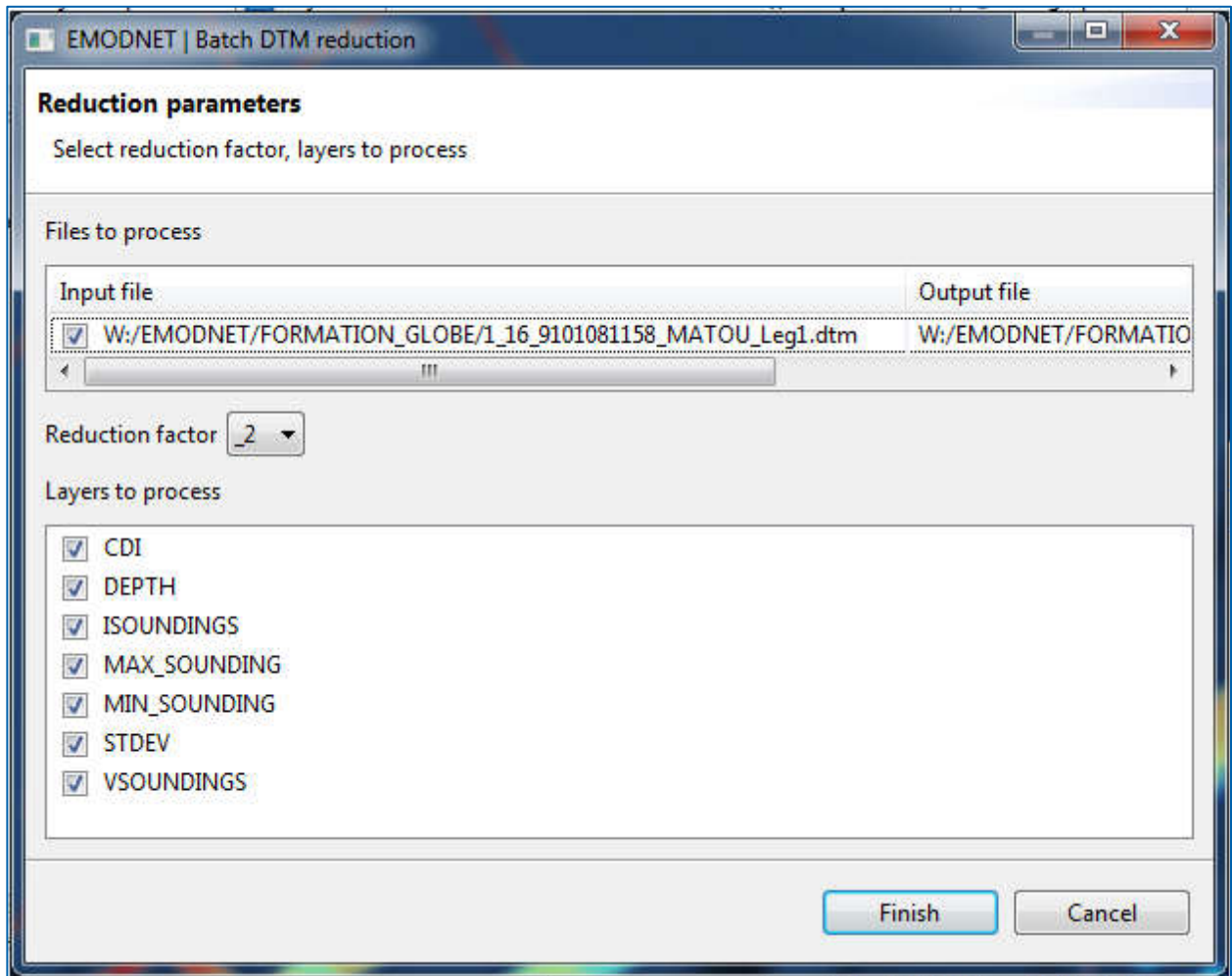


EMODNET | Reduction

This tool reduces the DTM Cell size using a coefficient.

NOTE It is possible to select more than one input file.

- Choose the factor of reduction (2 to get a 1/16 DTM resolution from a 1/32 DTM).



- And click on Finish.

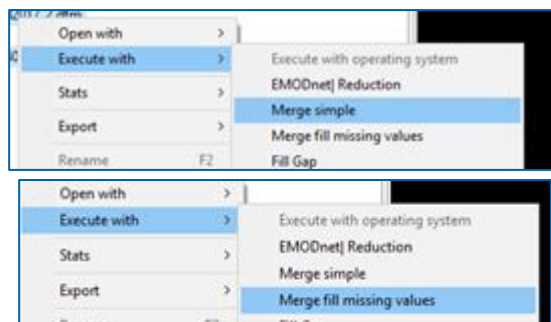
The resulting name gets the extension *-Reduced_2* and is created in the same folder as the input DTM.

The output file is created in the chosen folder.

Merge DTMs

When several DTMs need to be merged into one. For this tool more than one DTM is then selected before right clicking to access the "execute" tools.

Two options are possible: *Simple average* or *Fill missing values*.



Option1: Simple average

Window 1: Merge parameters

Choose the merging option (here *Simple average*).

DTMs merge parameters

Merge parameters
Select layers to process, spatial

Layers to process

- CDI
- ISOUNDINGS
- MAX_SOUNDING
- MIN_SOUNDING
- STDEV
- VSOUNDINGS
- INTERPOLATION_FLAG

Merge type: Simple average

Output file: W:\EMODNET\02_MNT2017_Contributions\07_Med_West\DTM_16\IFREMER\merged.dtm

Spatial resolution: 3.75 arcseconds

< Back Next > Finish Cancel

For this option, the resulting cell depth is the average of the input DTMs cell depths.

In case of overlap of DTMs in the cell:

The CDI Id is set to the CDI Id of the most dominant dataset in the cell.

Vsoundings: Sum of all Vsoundings.

STDEV is reprocessed using STDEV and VSounding layers of each DTM which are present in the cell.

Min and Max soundings are deducted from the Min and Max layers of the DTMs which are present in the cell.

Define the name of the *output merged DTM*.

The *spatial resolution*, or cell size, is automatically detected from the input *Reference DTM*.

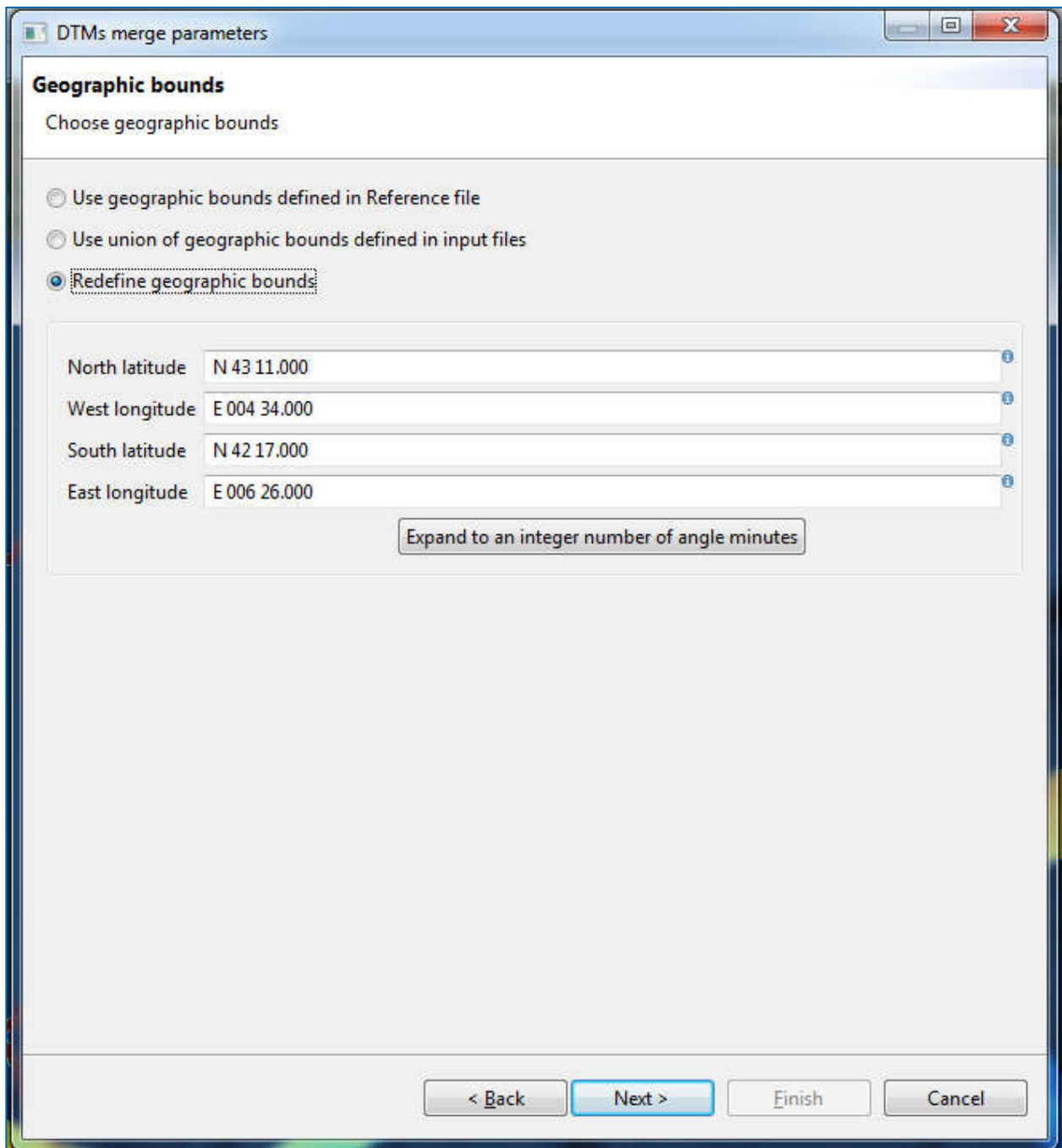
NOTE

All layers must be selected (default).

And then, click Next ->

Window 2: Geographic boundaries

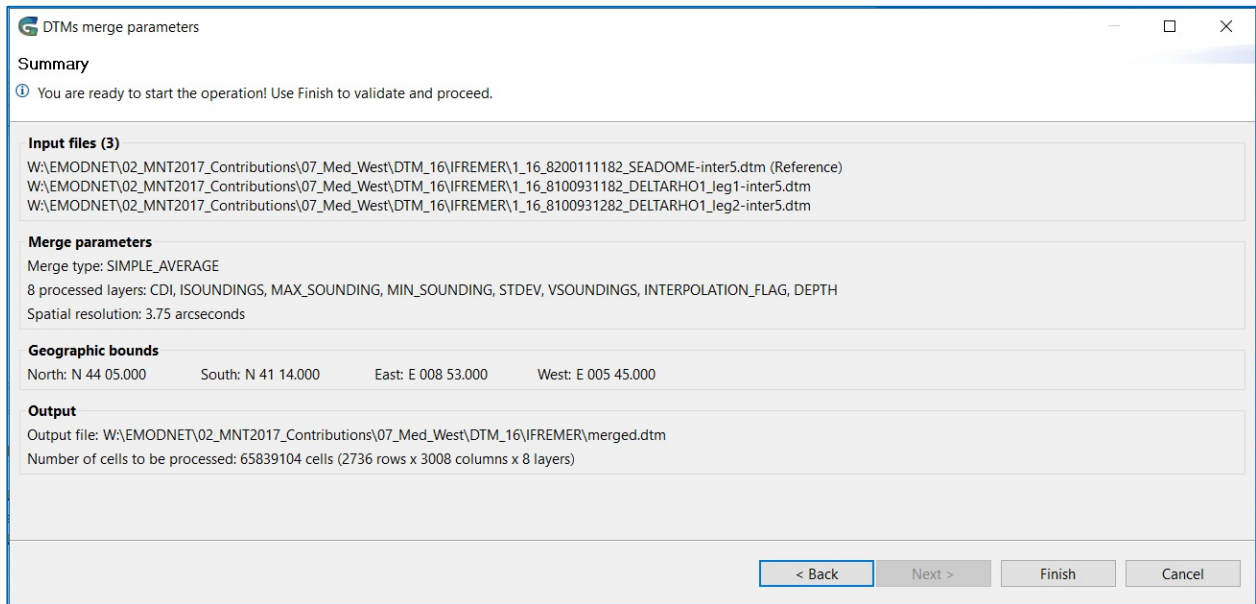
Defines the geographic bounds of your region. These limits can be rounded.



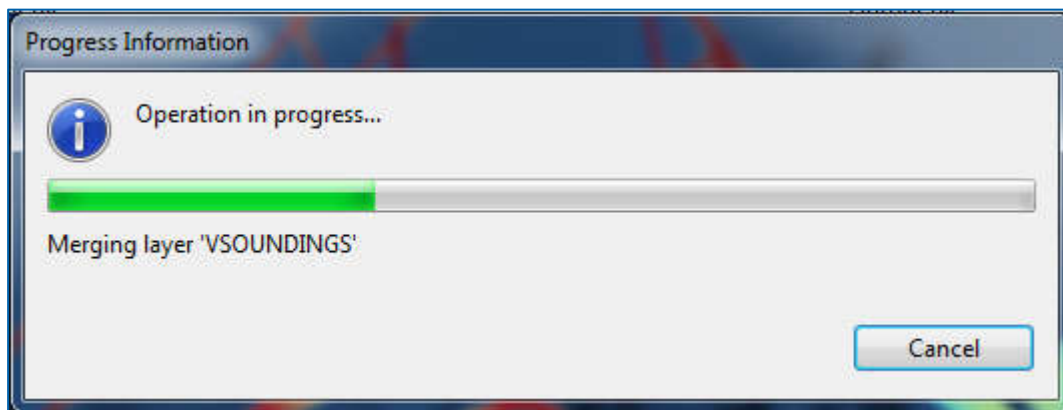
And click Next ->

Window 3: Operation summary

The window summarizes the output parameters (*number of input files, merge parameters, geographic bounds, output file with numbers of cells processed*).



Then, click Finish ->

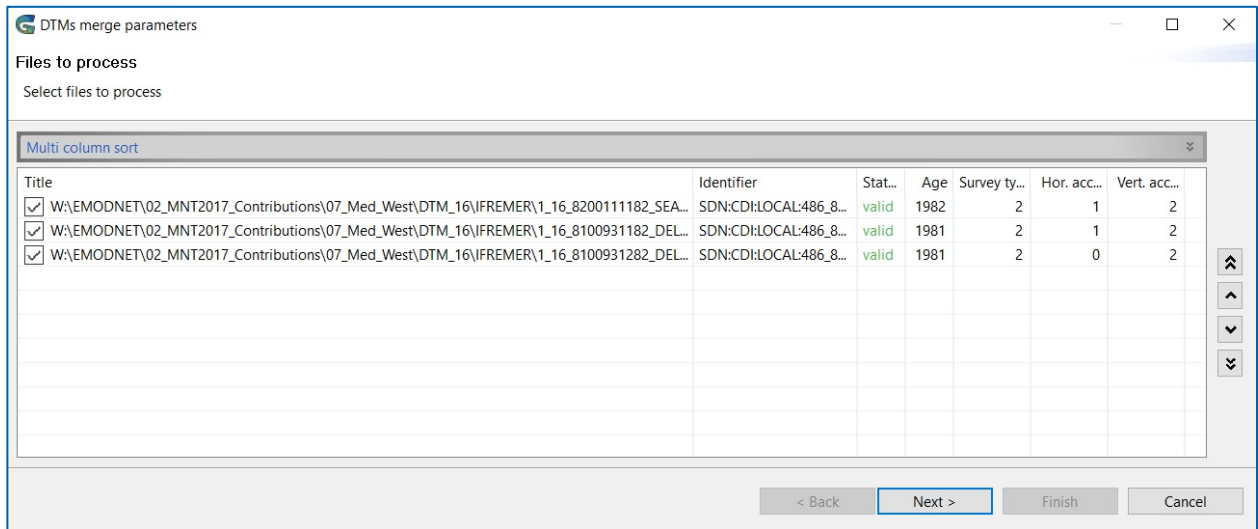


The output file is created in the chosen folder.

Option2: Fill missing values

A reference data set is defined (see window1). Each layer of the new grid is filled by the reference grid. Then, the empty cells will be filled in successively by the other grids. The priority order is defined by the list of the input DTMs.

The priority order of the DTMs can be also defined with the Quality Index (QI) factor. Option for sorting the DTMs are proposed in the "multi column sort" tool and with the arrows on the right of the windows. These allow the user to modify the priority ranking.



Then, the following windows and parameters are the same as seen previously for the Option 1. case of merging with a composite grid like the GEBCO grid. In that case, we select Depth and CDI as the 2 layers to be processed as the others are not significant for the GEBCO grid. The output file is created in the chosen folder.

Reproject DTM

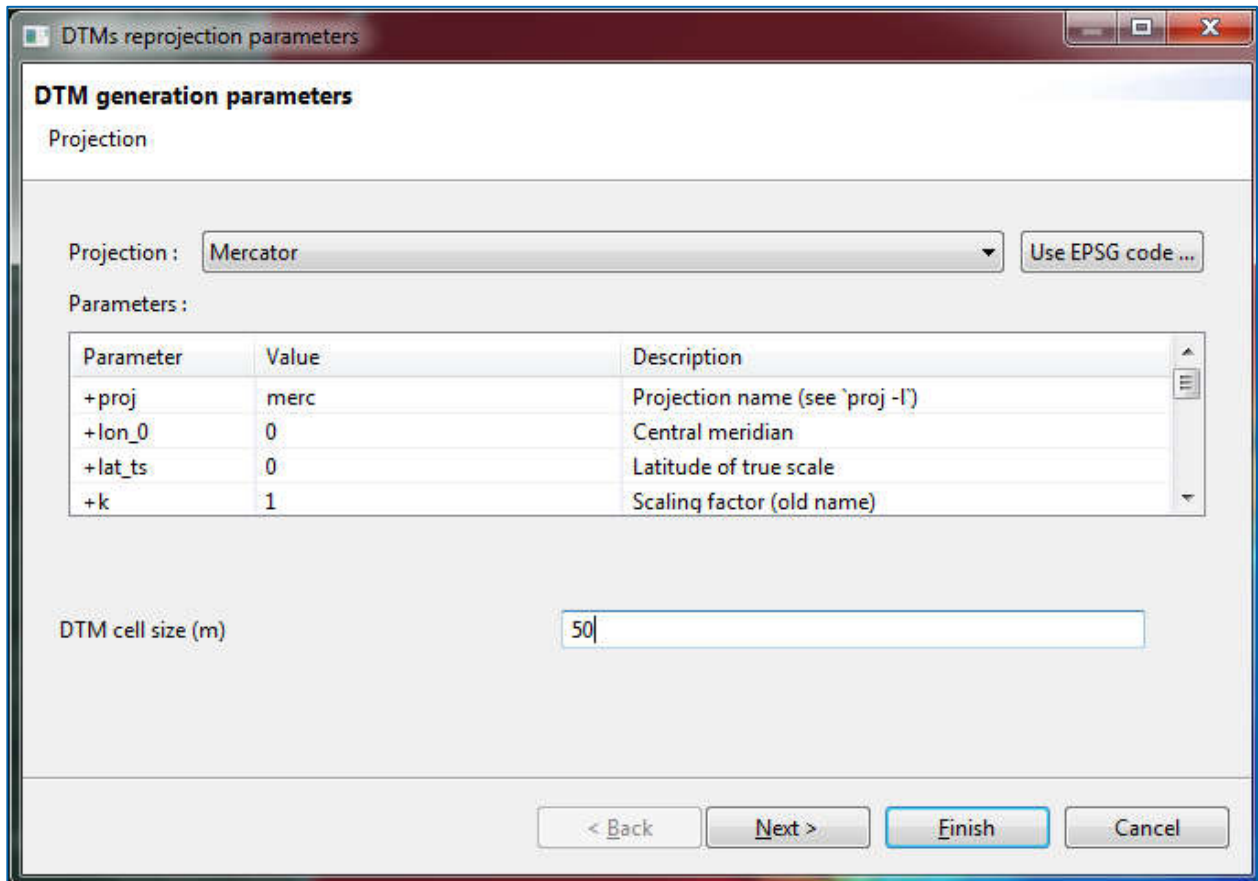
When the projection of the DTM needs to be modified.

NOTE

The output DTM is totally recomputed with the new projection.

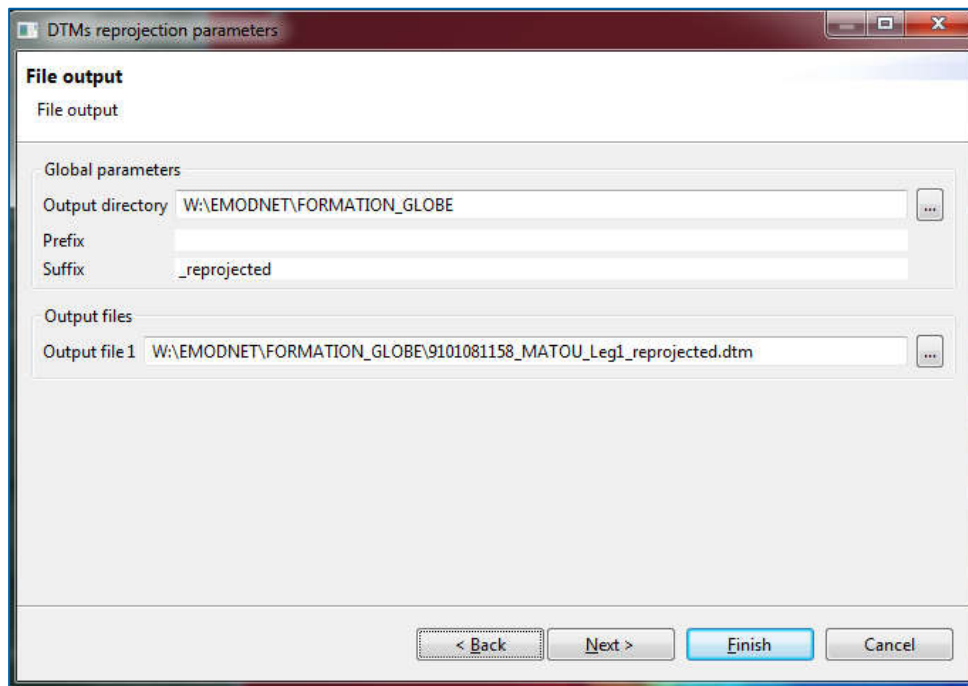
Choose the new projection and modify its parameters if needed.

Choose the cell size of the output DTM.



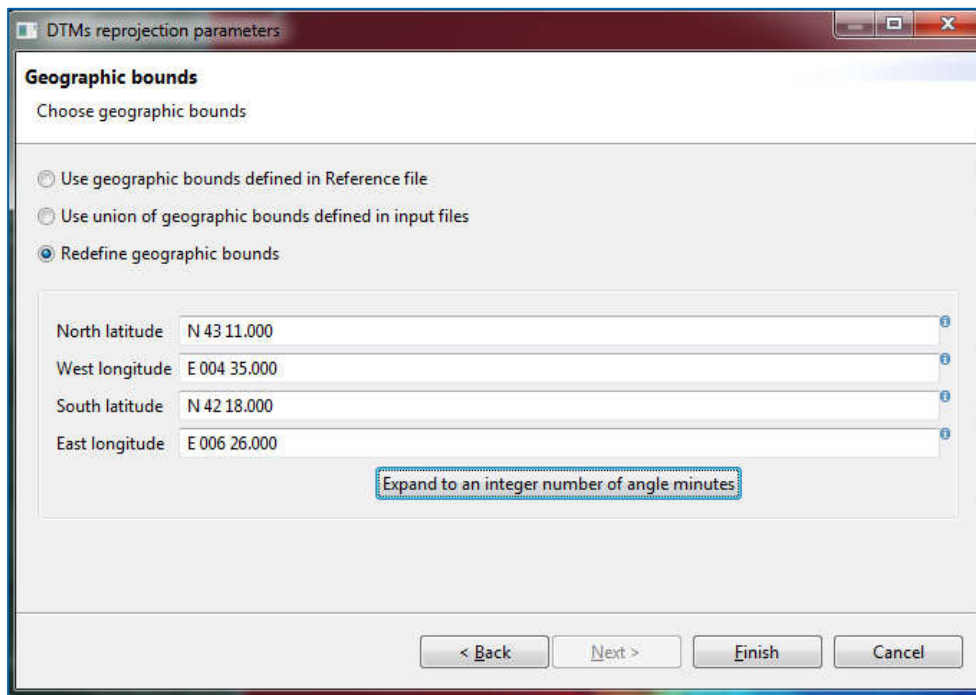
Click Next ->

Choose the name of the output file (*reprojected*) and the destination folder.

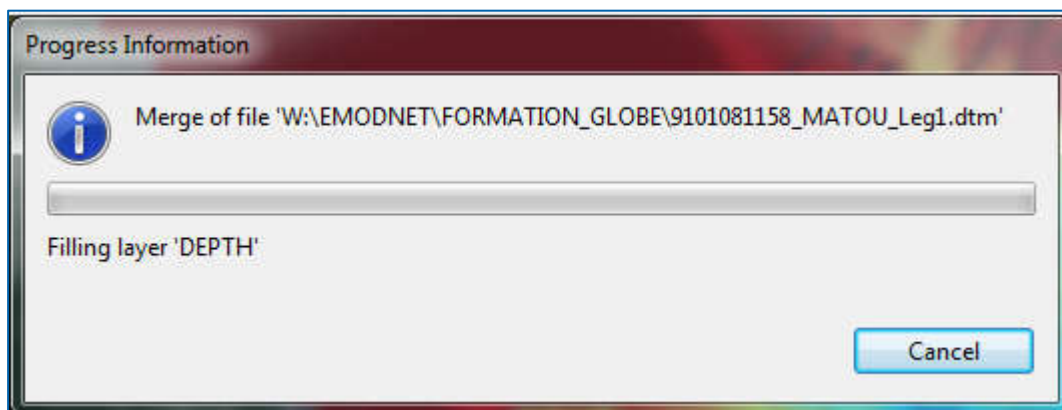


Click Next ->

Define the geographic extent of the output file (possible to round the values).



Click Finish ->



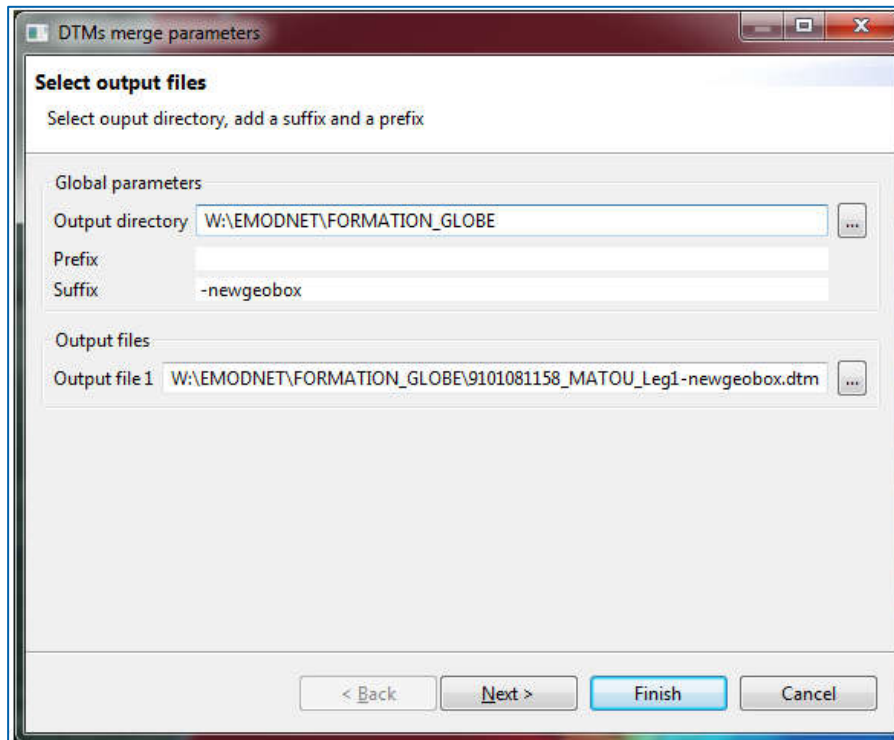
The output file is created in the chosen folder.

Geobox update

When the geographic extent of the DTM needs to be modified.

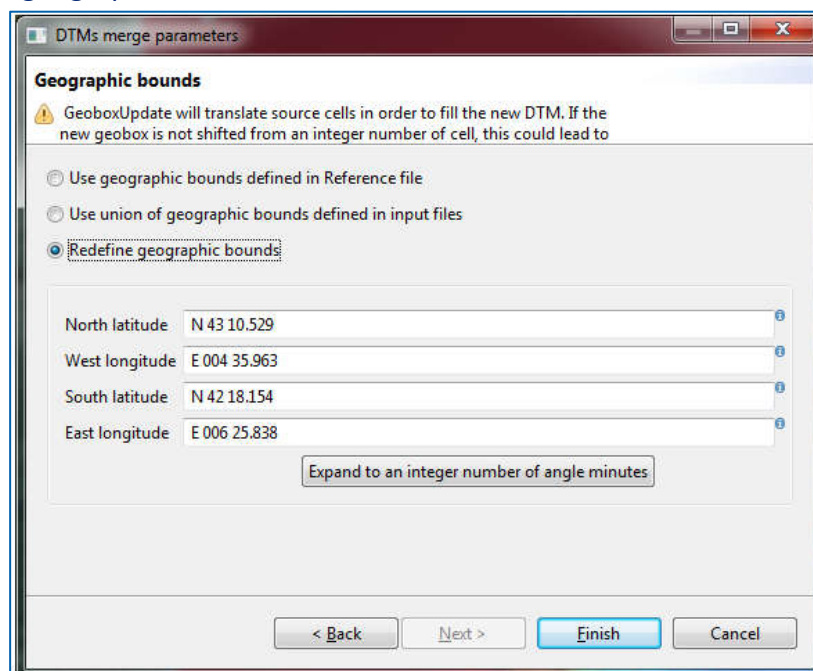
WARNING: Geobox update will translate source cells in order to fill the new DTM.

If the new geobox is not shifted from an integer number of cell, this could lead to a slight shift of the data. In that case you should rather consider using the Re-project tool. Choose the name of the output file (*-newgeobox*) and the destination folder.



Click Next ->

Define the new geographic extend.



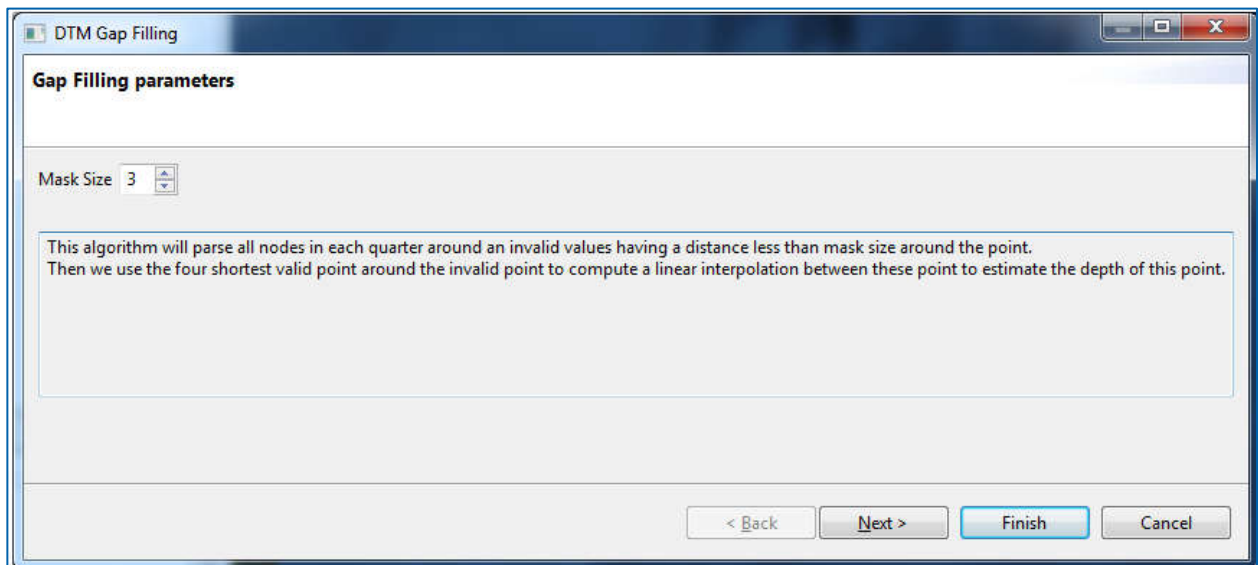
Click Finish ->

The output file is created in the chosen folder.

Gap filling

When some cells of the DTM are empty and isolated, an interpolation can fill in these gaps.

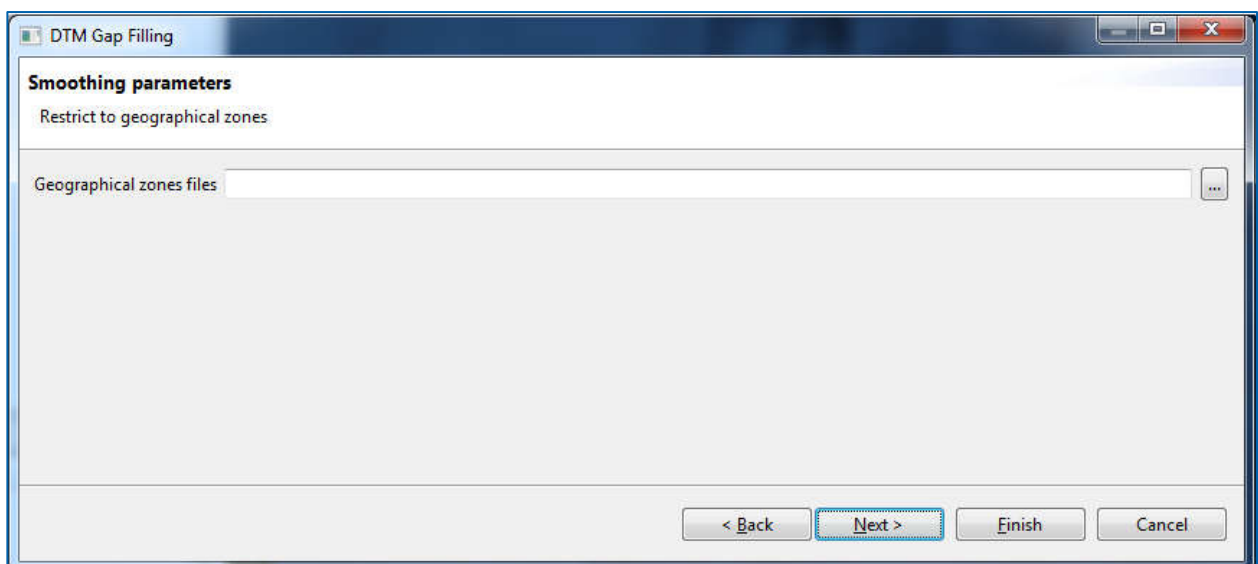
The algorithm will fill every node in each quarter around an empty value having a distance less than mask size around the point. Then the four shortest valid points around the empty cell are used to compute a linear interpolation to estimate the missing depth.



WARNING: The mask size defines the size of window centered on the interpolated grid node. This value must be an odd number. It is better not to set it with a value greater than 7 (3 rows/columns around the center point - see the following figure).

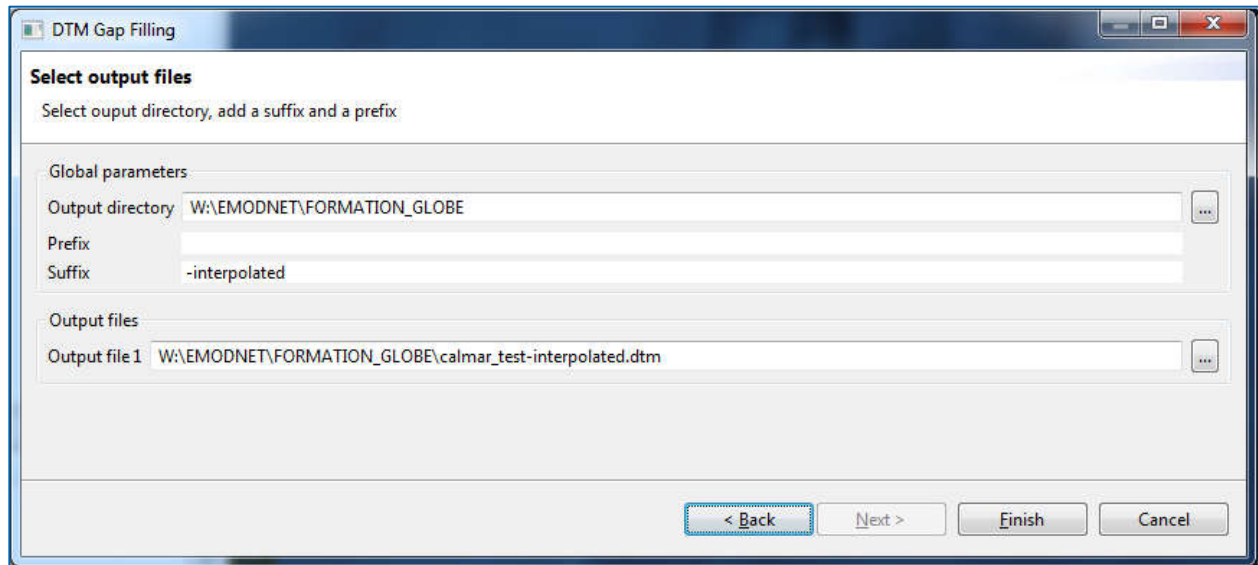
Click Next ->

It is possible to apply this operation on a specific zone only. A .kml file gives the extent of this area.



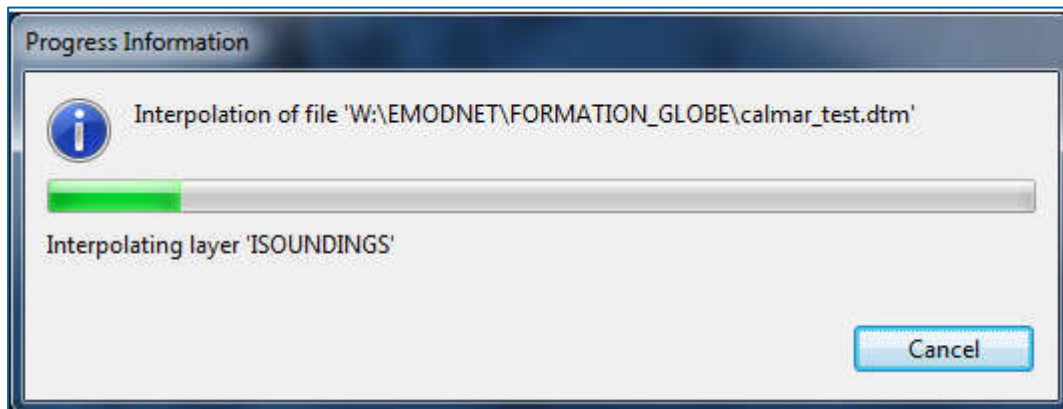
Click Next ->

The name (with the suffix *-interpolated*) and destination folder of the resulting DTM file are set up in this window:

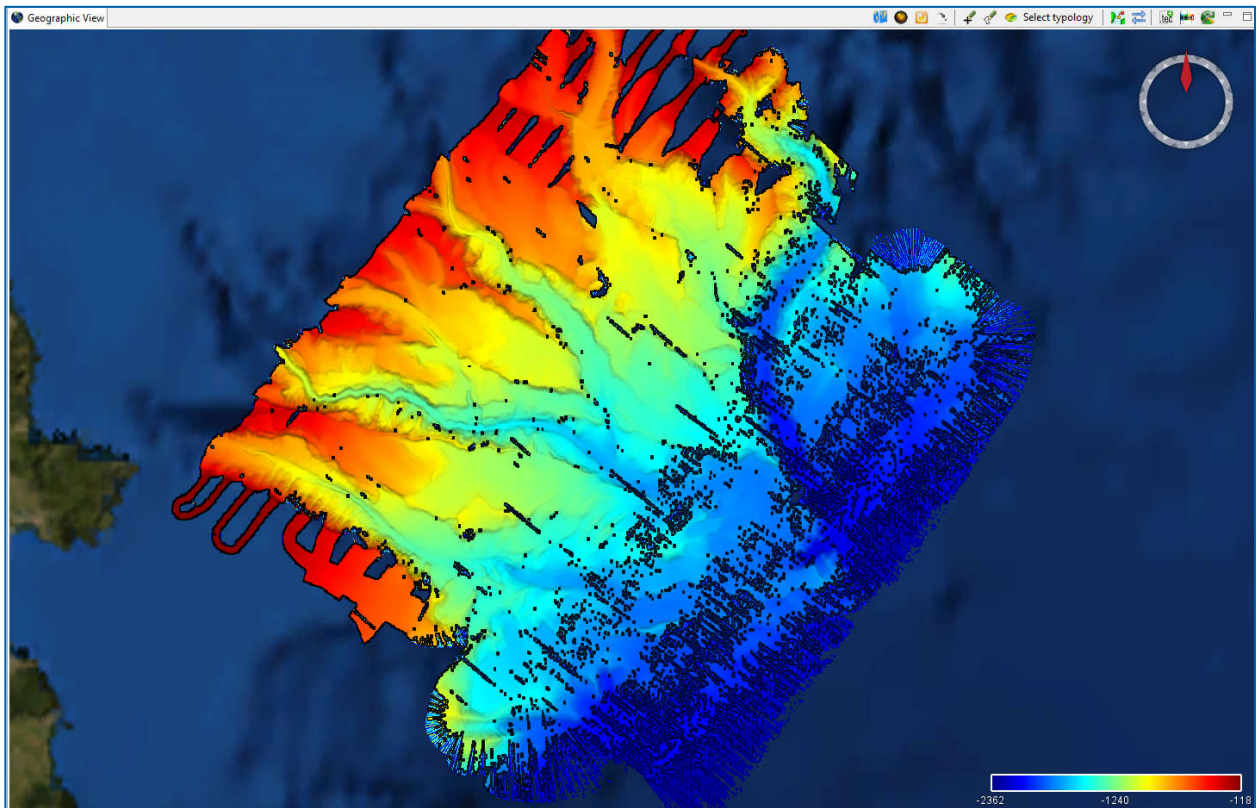


Click *Finish* ->

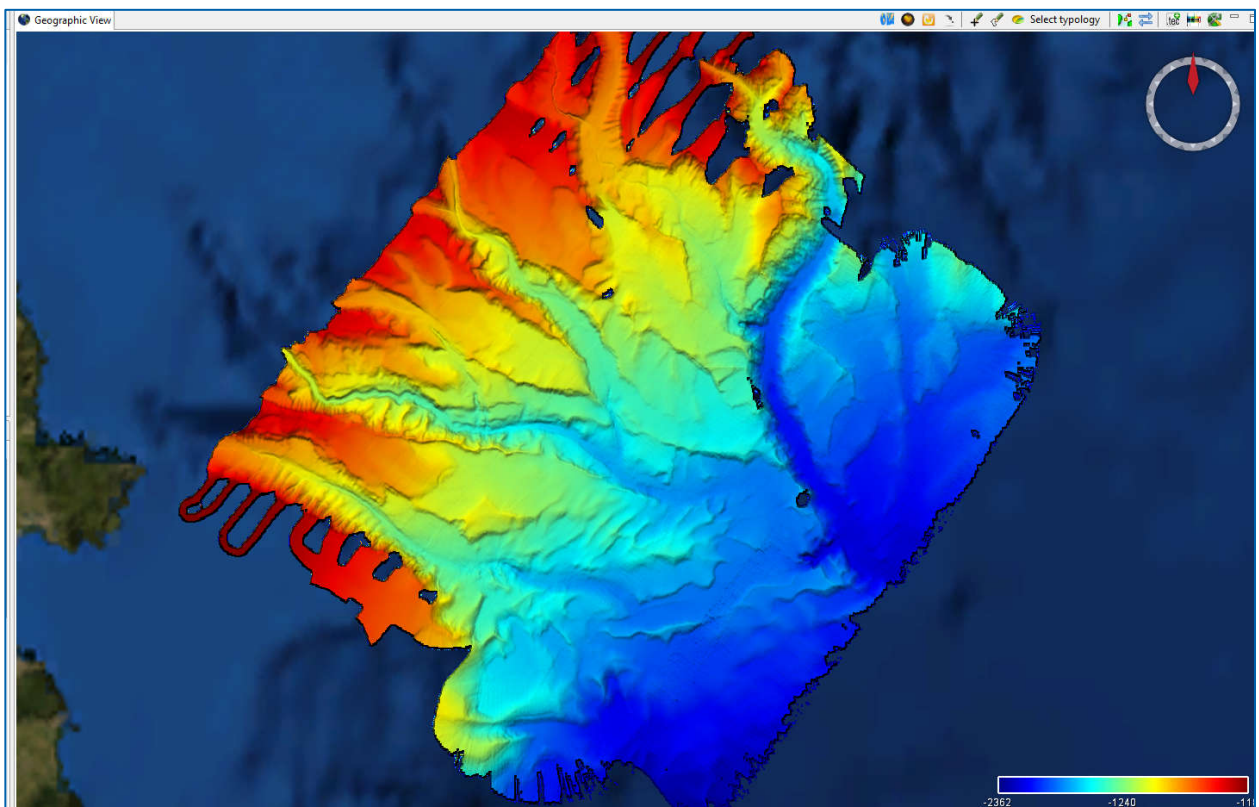
The interpolation starts. All the layers will be interpolated.



The output file is created in the chosen folder.



The DTM before interpolation (CALMAR survey / cell size = 3.75 arcsec).



The DTM after interpolation (mask size = 3).

NOTE

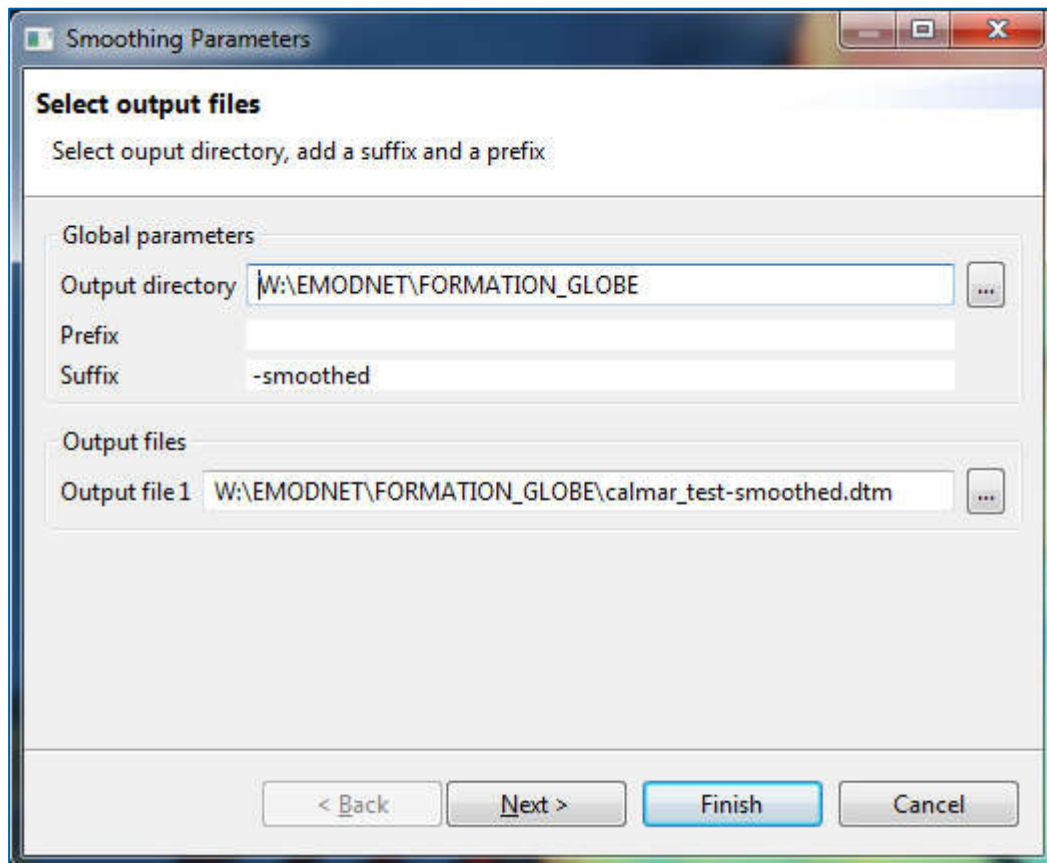
Depending on the result the operation can be run several times.

Smoothing

This tool averages the depth values in a box, which size is defined by the user.

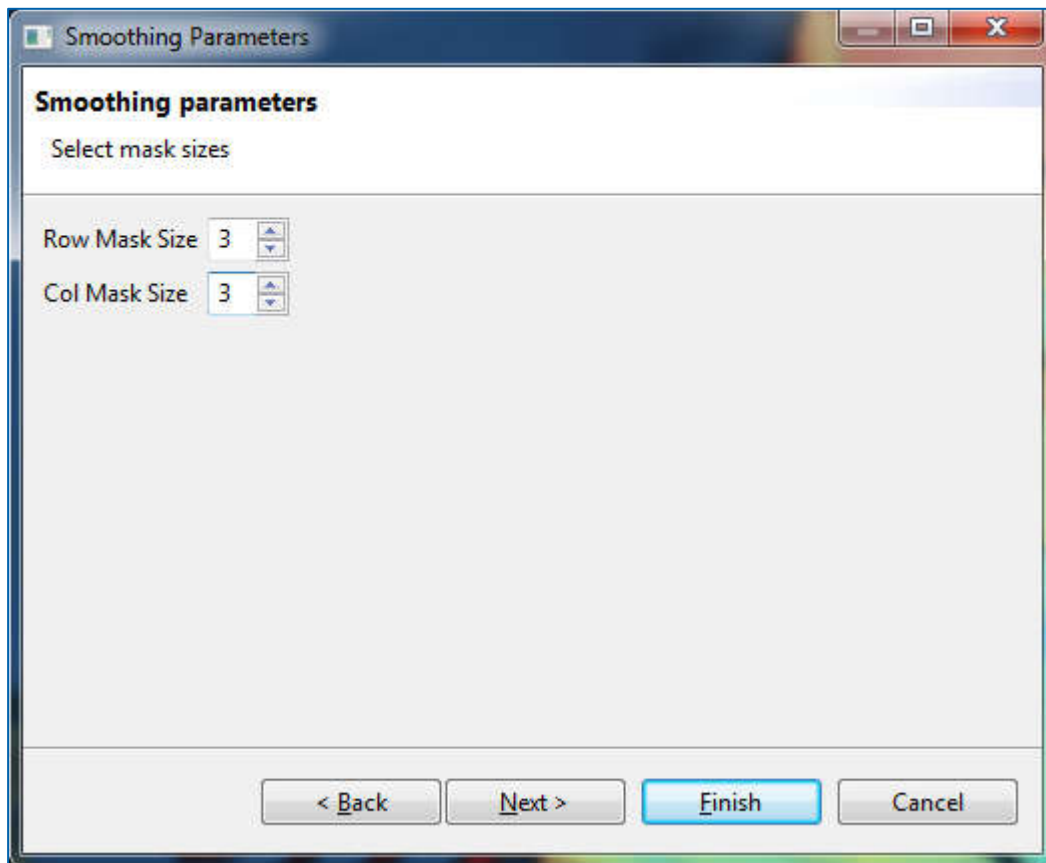
NOTE | No layer is modified. New layers are created in the DTM.

Choose the name of the output file (smoothed) and the destination folder ->

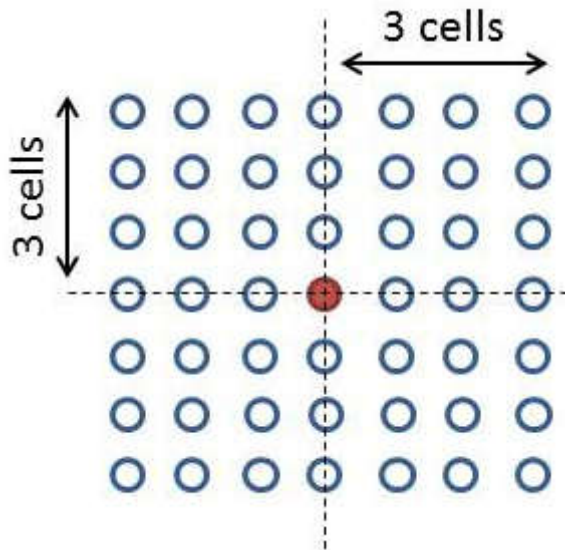


Click Next ->

Define the mask size, which is the size of the moving window for smoothing.



The window/mask size is defined as follow:

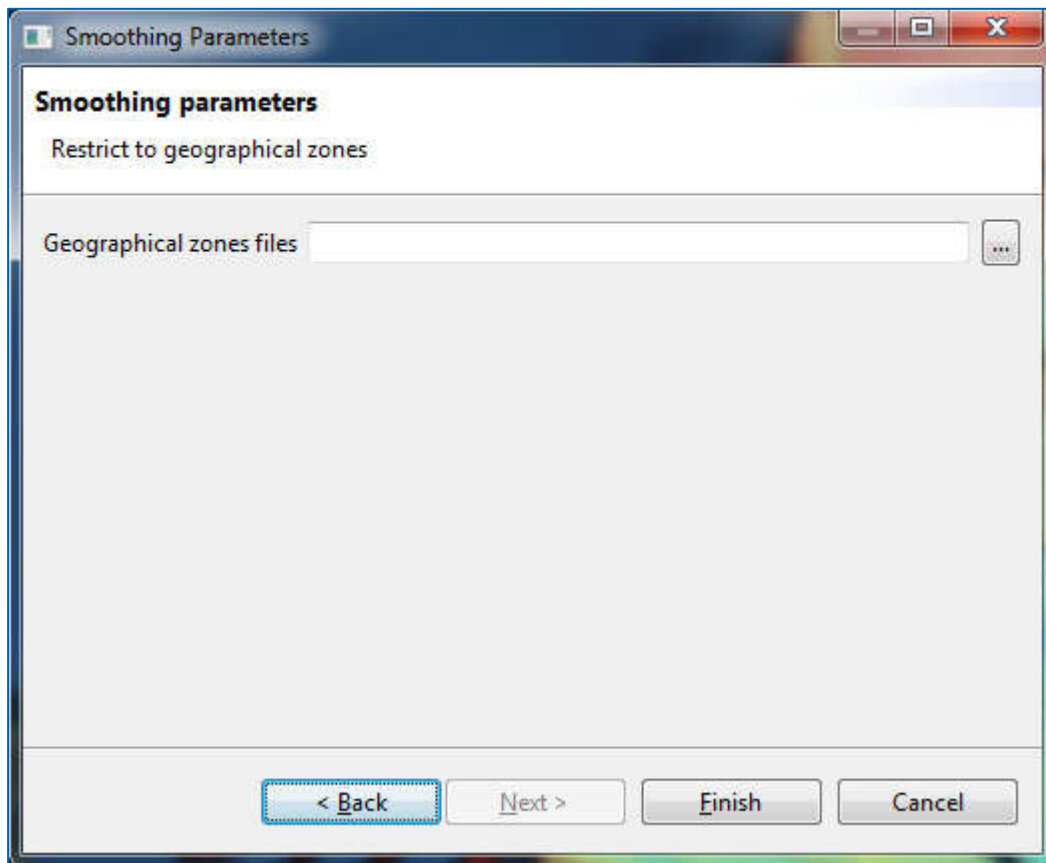


NOTE

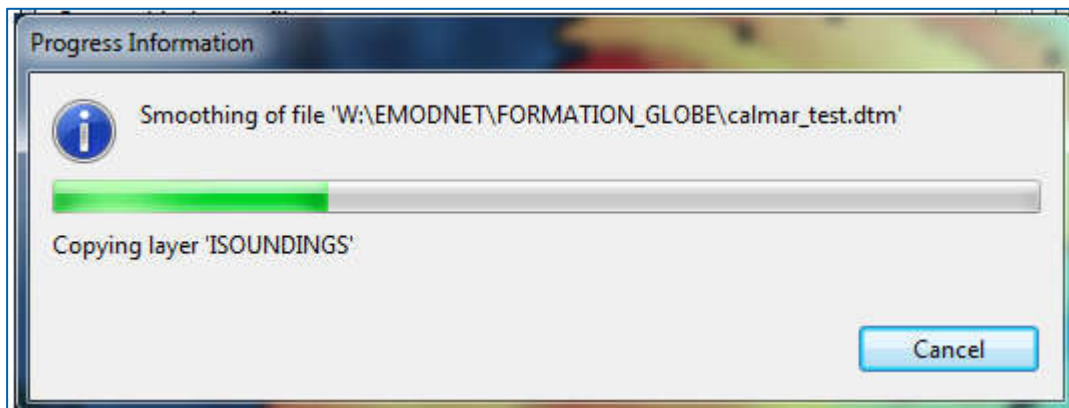
The suggested size is 7. It means that 3 lines and 3 columns are considered all around each smoothed grid node.

Click Next ->

It is possible to apply this operation on a specific zone only. A *.kml* file then gives the extent of this area.



Click Finish ->

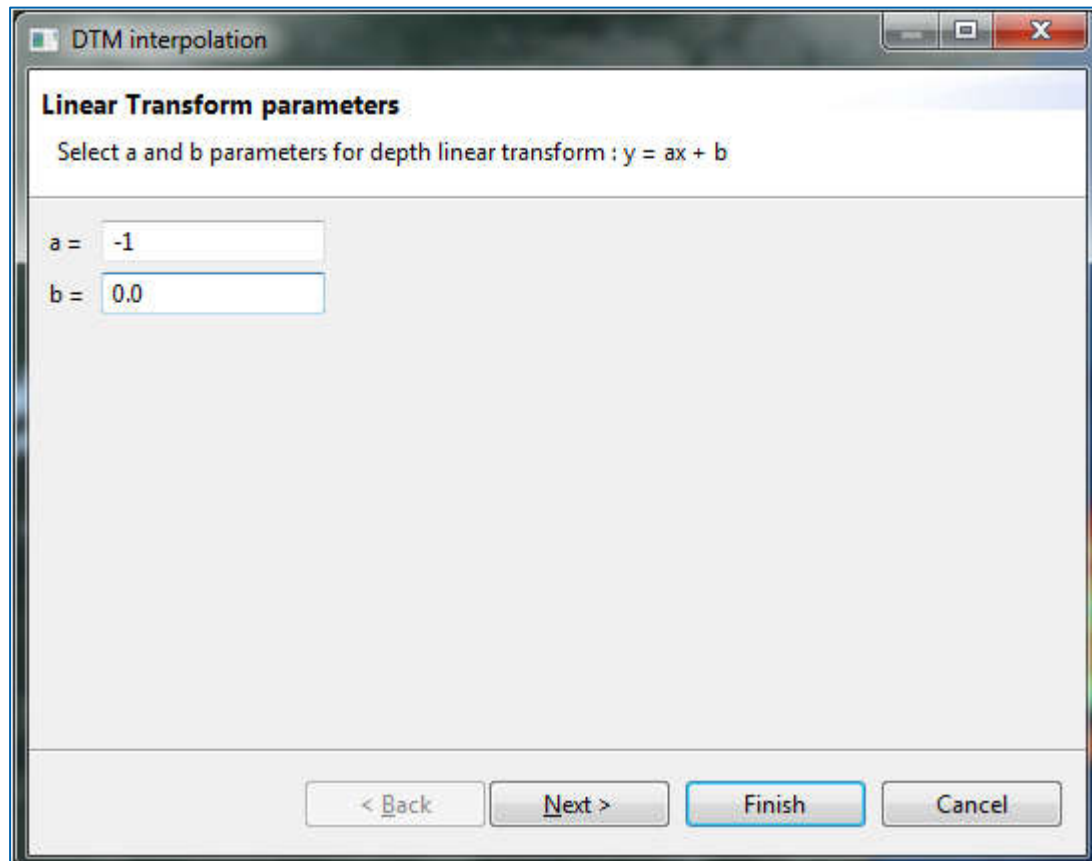


The output file is created in the chosen folder.

Linear transformation

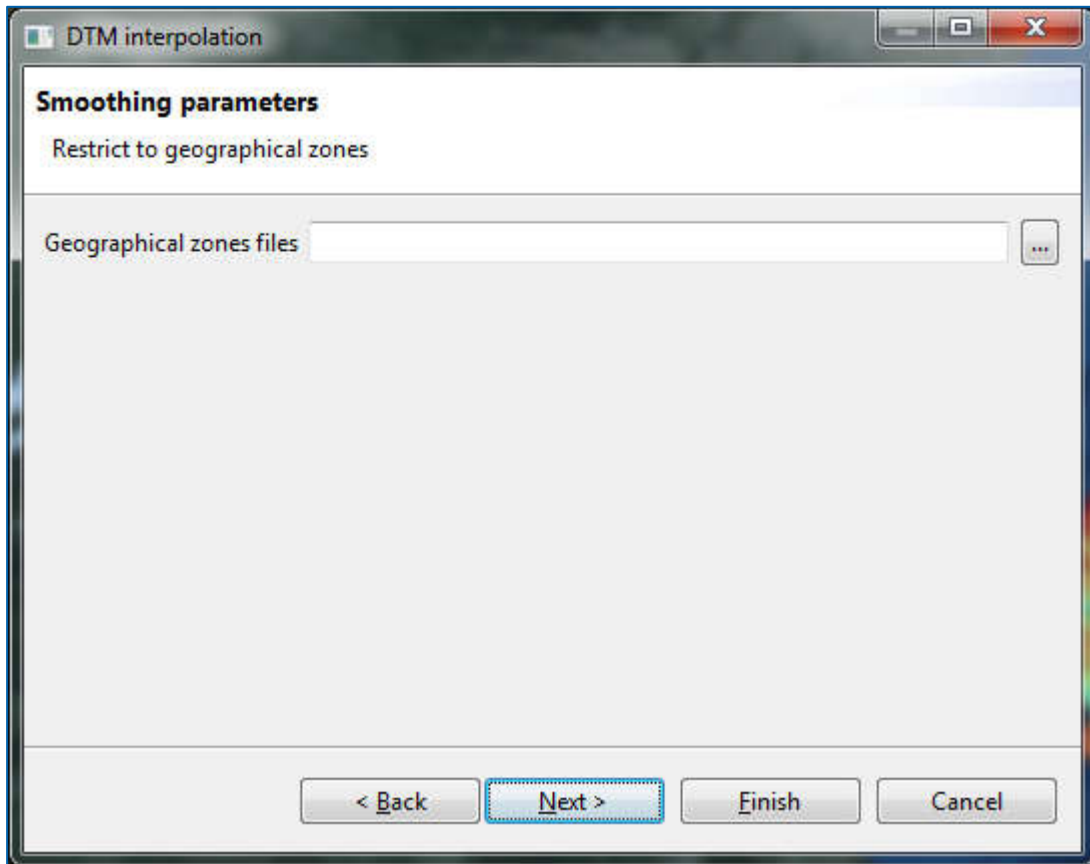
When the DTM depth values need to be modified according to a linear function $f(x)=ax+b$ (e.g. the depth values of the DTM are *positive* and GLOBE software needs them to be *negative*).

Choose the linear function parameters ($a=-1$) if the depth value sign needs to be changed).



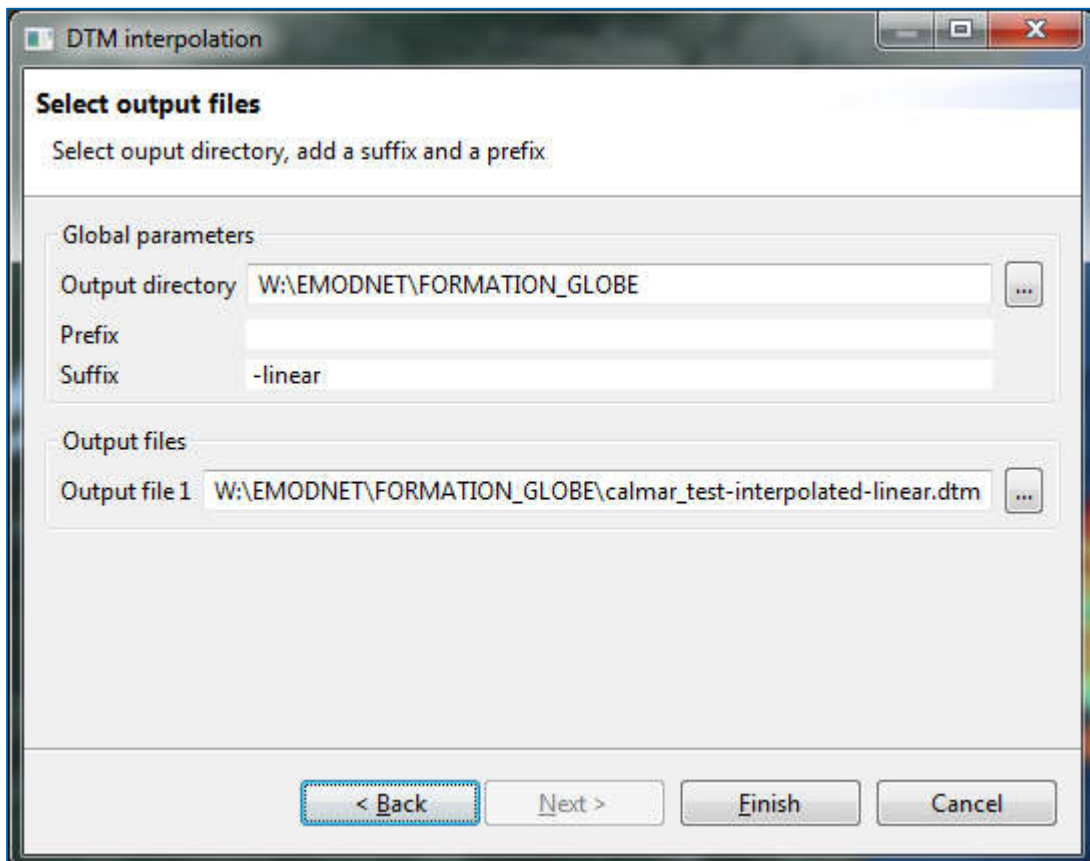
Click Next ->

It is possible to apply this operation on a specific zone only. A *.kml* file then gives the extent of this area.

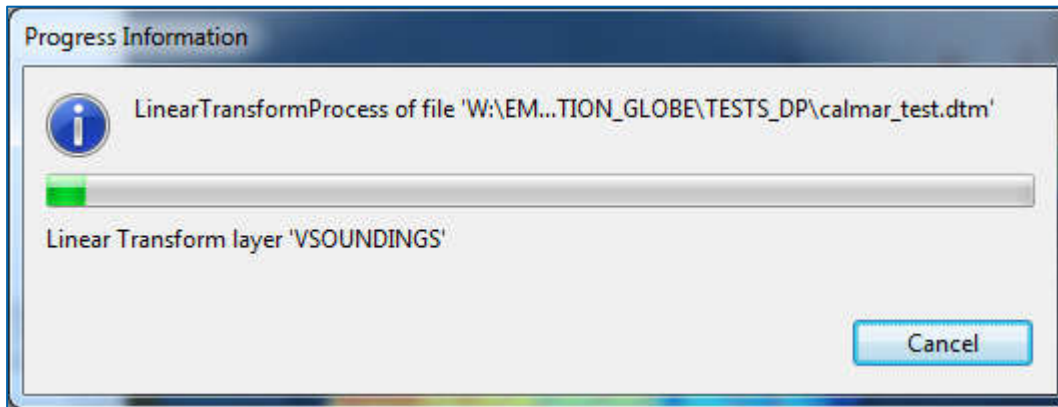


Click Next ->

Choose the name of the output file (-linear) and the destination folder.



Click Finish ->

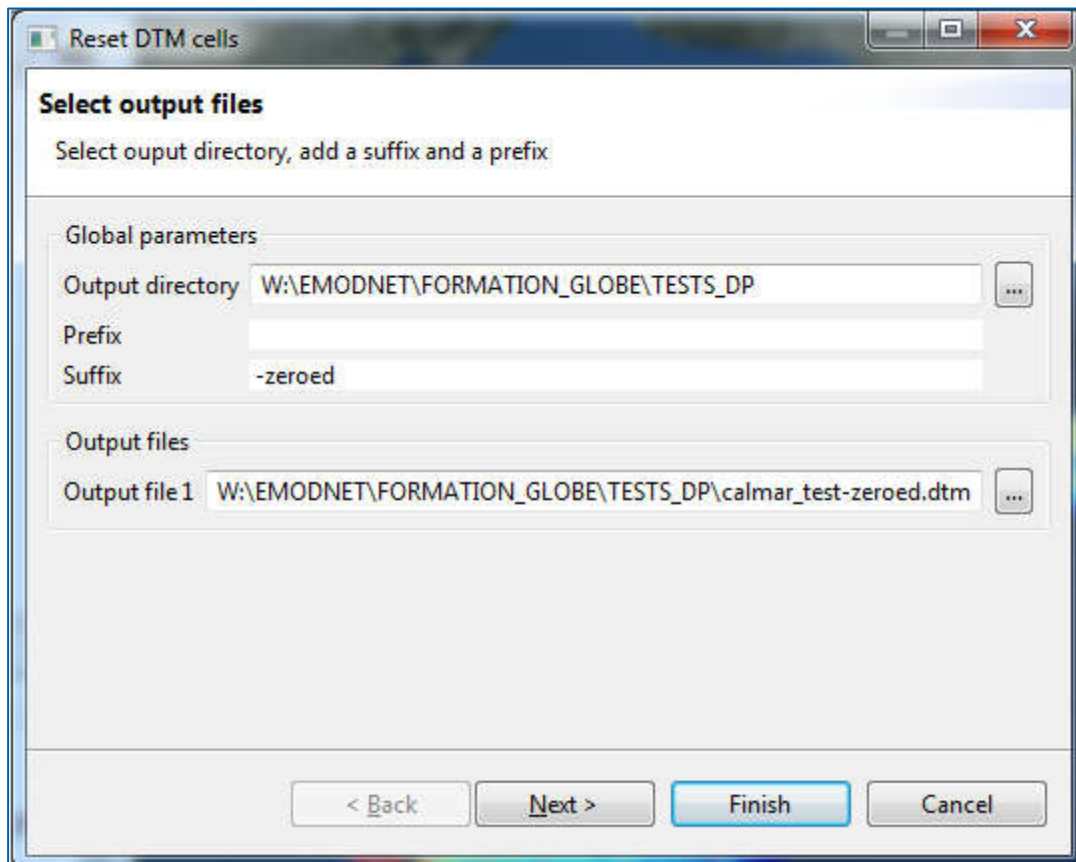


The output file is created in the chosen folder.

Layers invalidation (reset cell)

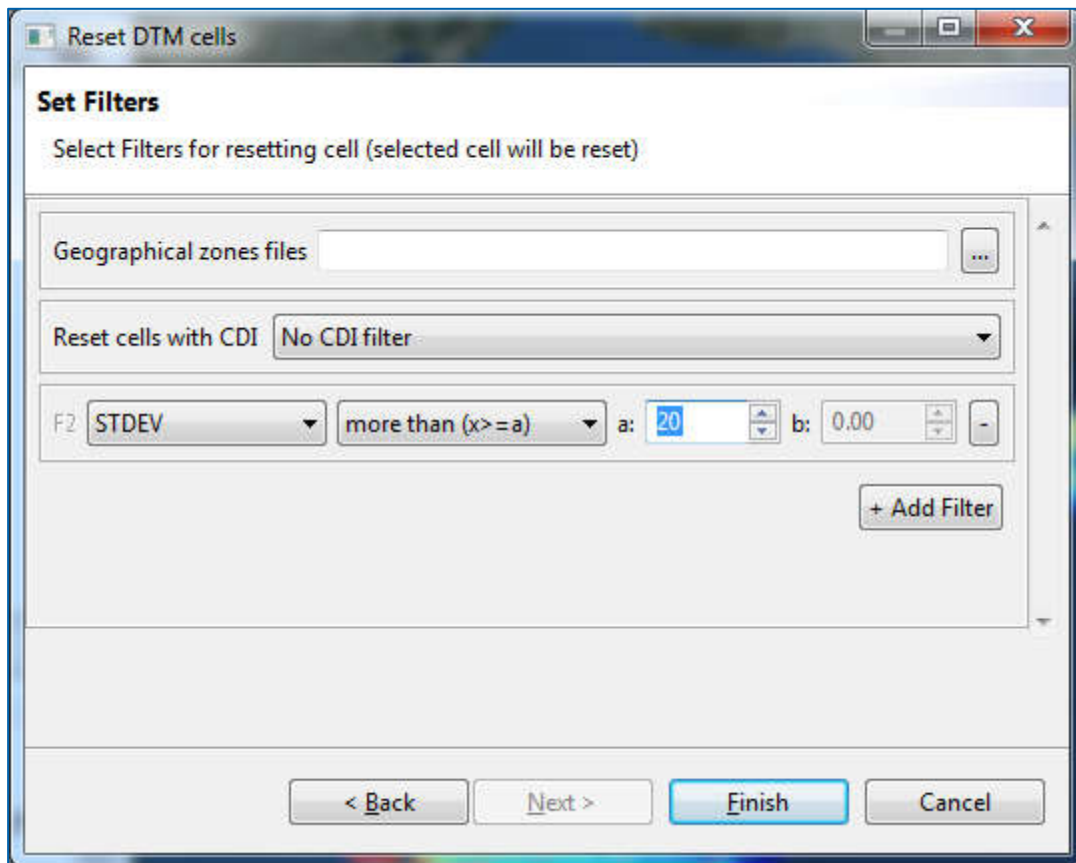
Used when some depth values of the DTM cells are in error and need to be erased from the grid. This tool resets the depth value of these cells.

Choose the name of the output file (*-zeroed*) and the destination folder.



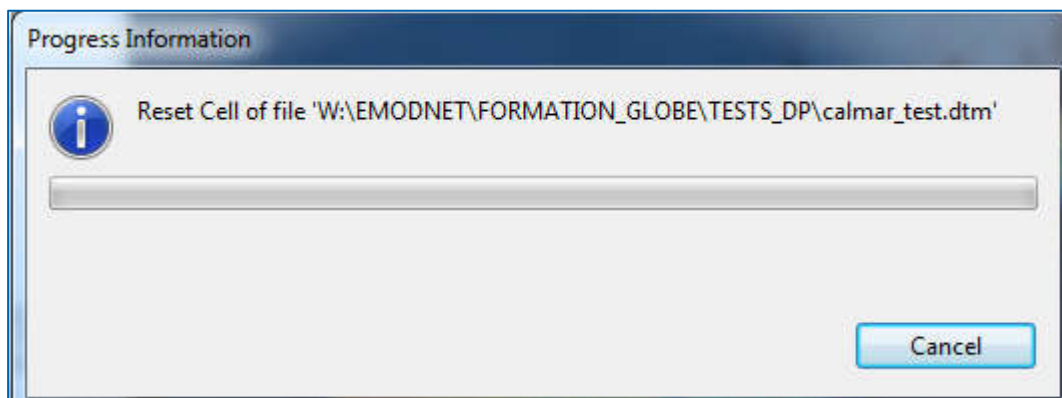
Click Next ->

- a *.kml* file, gives the area of extent.
- one or more filter (s) which can be set up as shown on the following figure.



Here, if the standard deviation is more than 20m, the cells will be reset.

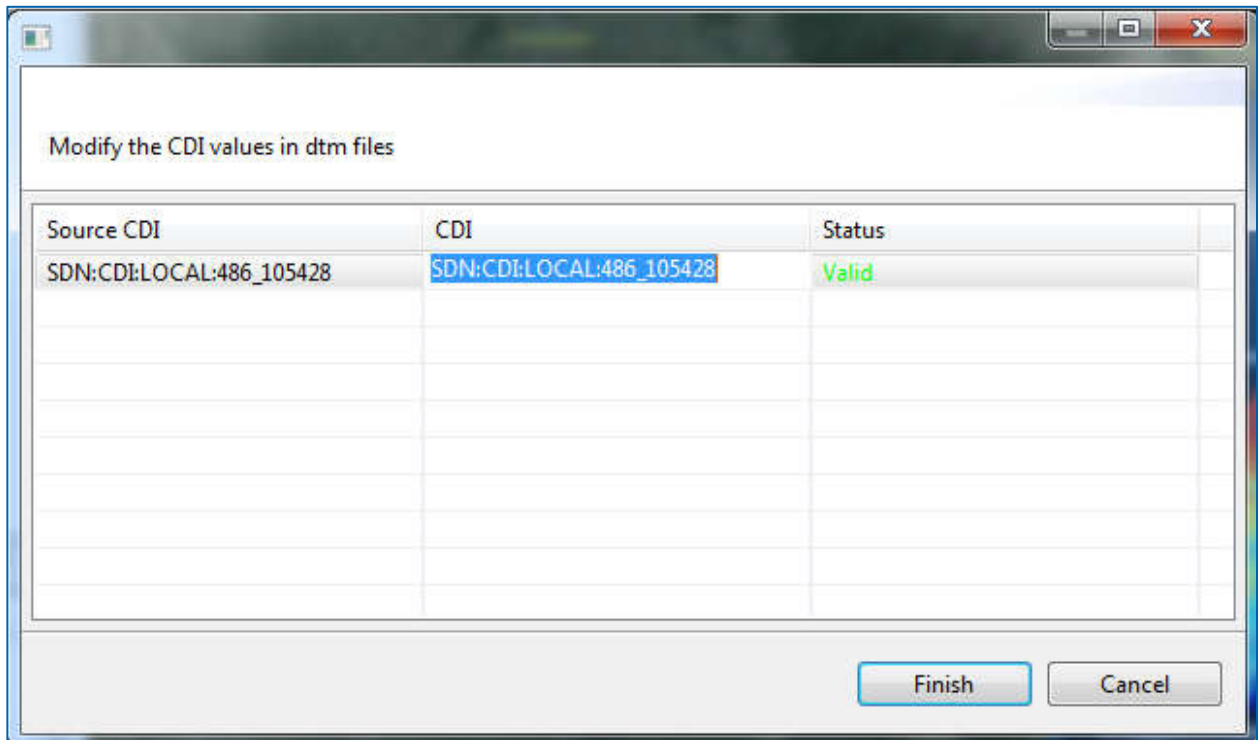
Click *Finish* ->



The output file is created in the chosen folder.

CDI modification

If the CDI information is incorrect and needs to be updated, the CDI information is edited in the second column.

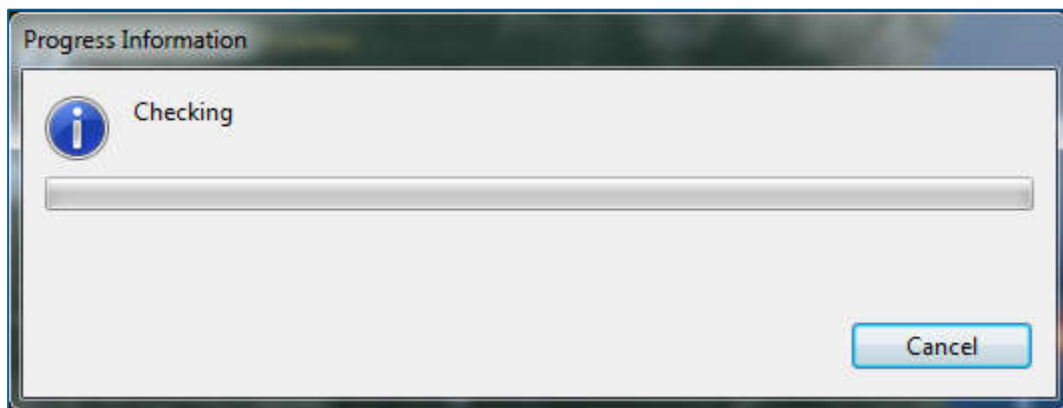


Click Finish

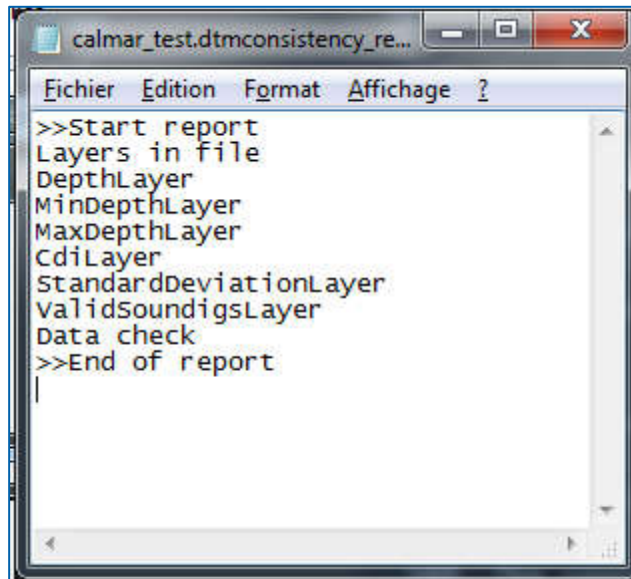
The DTM file is updated (see its properties).

Consistency checking

To check the consistency of the new DTM created in GLOBE software some tests are conducted on the grid layer values (e.g. *Is the mean depth value between the max value and the min one?*).



When the check process is achieved, a text report is created:

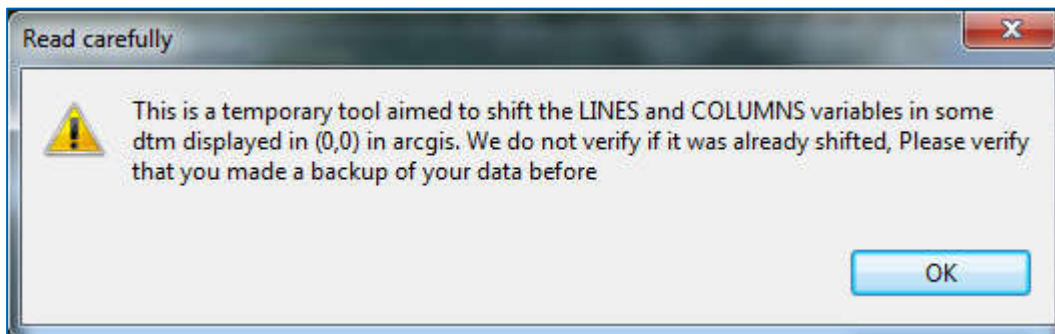


If there is no error message (as shown on the previous figure), it means that the DTM values are consistent.

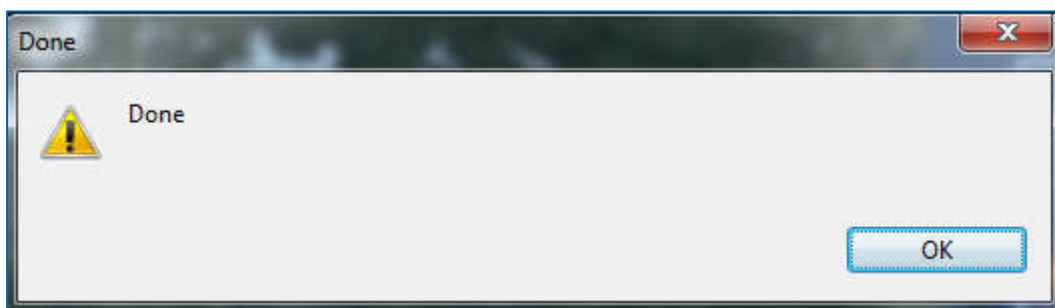
GIS Lines/columns shifting

The coordinates of the grid are checked to identify if the GLOBE DTM NetCDF format is coherent with ArcGIS format. This operation validates the ability to drag and drop the GLOBE DTM into ArcGIS to further study it.

A warning message appears to warn the user about the DTM format modification.



The process is achieved.



Exporting DTM to Ascii file (e.g. EMODNET format)

(For more information, see the chapter *HOW TOs* in the official manual)

Export the *final DTM* to emodnet ascii format using Execute with > export to ascii.

- Window 1: Unselect export missing value to minimize the size of the resulting file and choose emodnet ascii format. Then execute.

A *.emo* file is created.

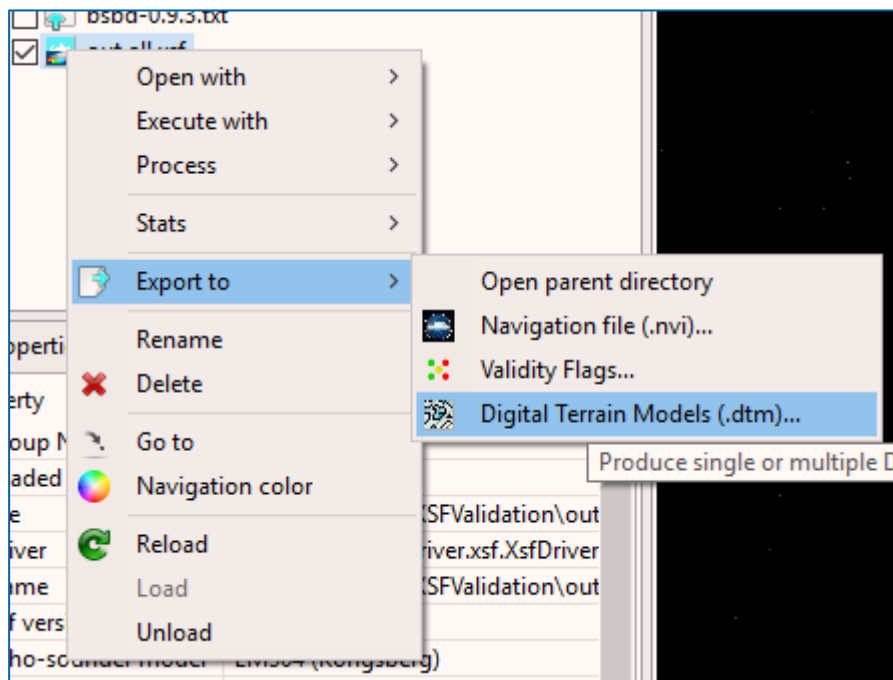
Export to a DTM

GLOBE allows users to export soundings source files (*mbg*, *xsf*, *txt*) to *.dtm*.

This section gives a deep overview of the wizard options and parameters available.

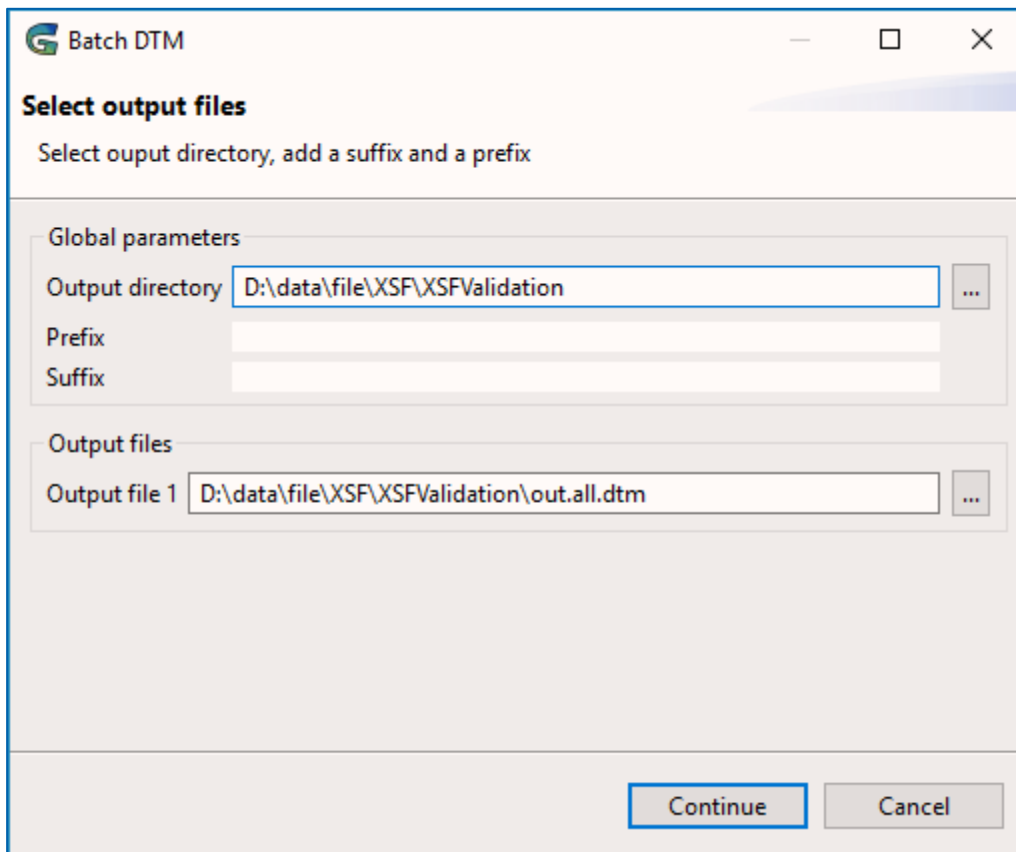
Two entry points exists to create a DTM:

- Either through the menu Tools → Convert → Sounder Files to DTM
- Or select a *.mbg* or *.xyz* file in the Layer explorer, then right-click this file and select Export to →DTM.



When selecting more than one file, the user can choose to create one DTM per sounder file or one DTM for all selected file.

- The first wizard is then displayed, which allows the user to set the output file names.



- Then a second wizard is displayed for DTM parameters computation.
- On the first page you have to configure the spatial representation you want to use, and the cell size.

DTM generation parameters

Choose projection, ellipsoid, parameters, spatial resolution, layers

Projection:

Parameters:

Parameter	Value	Description
+proj	merc	Projection name (see `proj -l`)
+lon_0	0	Central meridian
+lat_ts	47.5	Latitude of true scale
+k	1	Scaling factor (old name)
+x_0	0	False easting

DTM cell size (m)

Finest layer size (row x col) : 290 x 306

Force recompute (clear existing caches)

- On the second page, you can configure the default geographic zone on which you define your DTM.
By default it is the exact bounding box computed from the input data.
If you use multiple input for one output, the default bounding box is the union of input bounding boxes.
You can also manually define the bounding box. In this case, you can ask the application to define a bounding box which is stuck to integer number of degrees arc minutes.
In case of multiple input files and one DTM per file, the bounding box of each output can be reviewed.

DTM generation parameters

DTM generation parameters

Choose geographic bounds

out.all.dtm

Use geographic bounds defined in Reference file
 Use union of geographic bounds defined in input files
 Redefine geographic bounds

North latitude: N 47 32.068
 West longitude: W 008 34.522
 South latitude: N 47 28.942
 East longitude: W 008 29.654

Expand to an integer number of angle minutes

Finest layer size (row x col) : 290 x 306

- On the third page, you can configure:
 - the minimum and maximum depths taken in account,
 - interpolation after computation, or not,
 - limitation of the position of soundings to a contour given in a *.kml* file.

DTM generation parameters

Choose : DTM cells affected, across angle filter, min/max range filter, interpolation

DTM cells assigned by a sounding Nearest

Z soundings min-max filter


Minimal depth (m, positive down)

Maximal depth (m, positive down)

Fill gap after computation

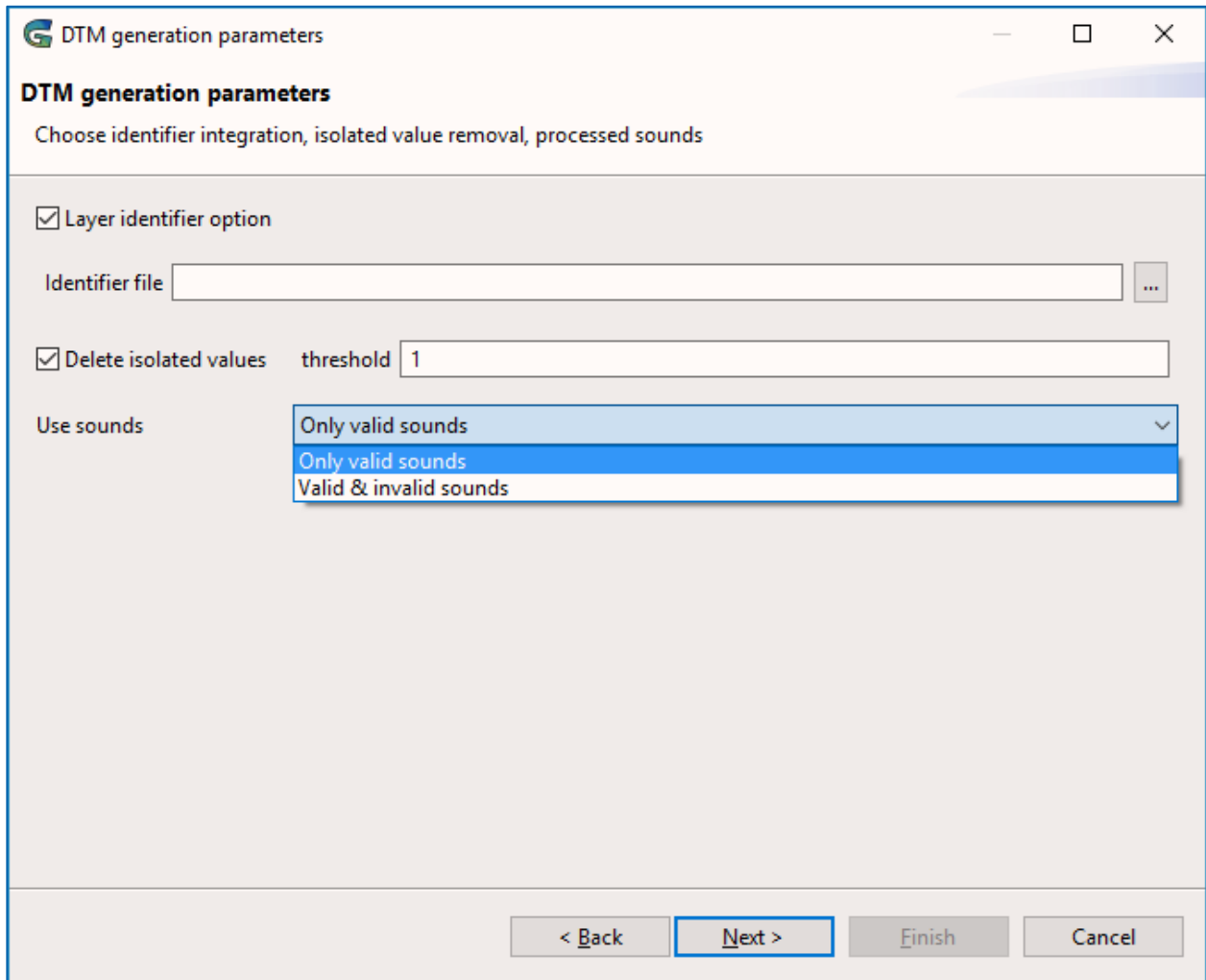
Mask Size (row/col)

Limit to contour

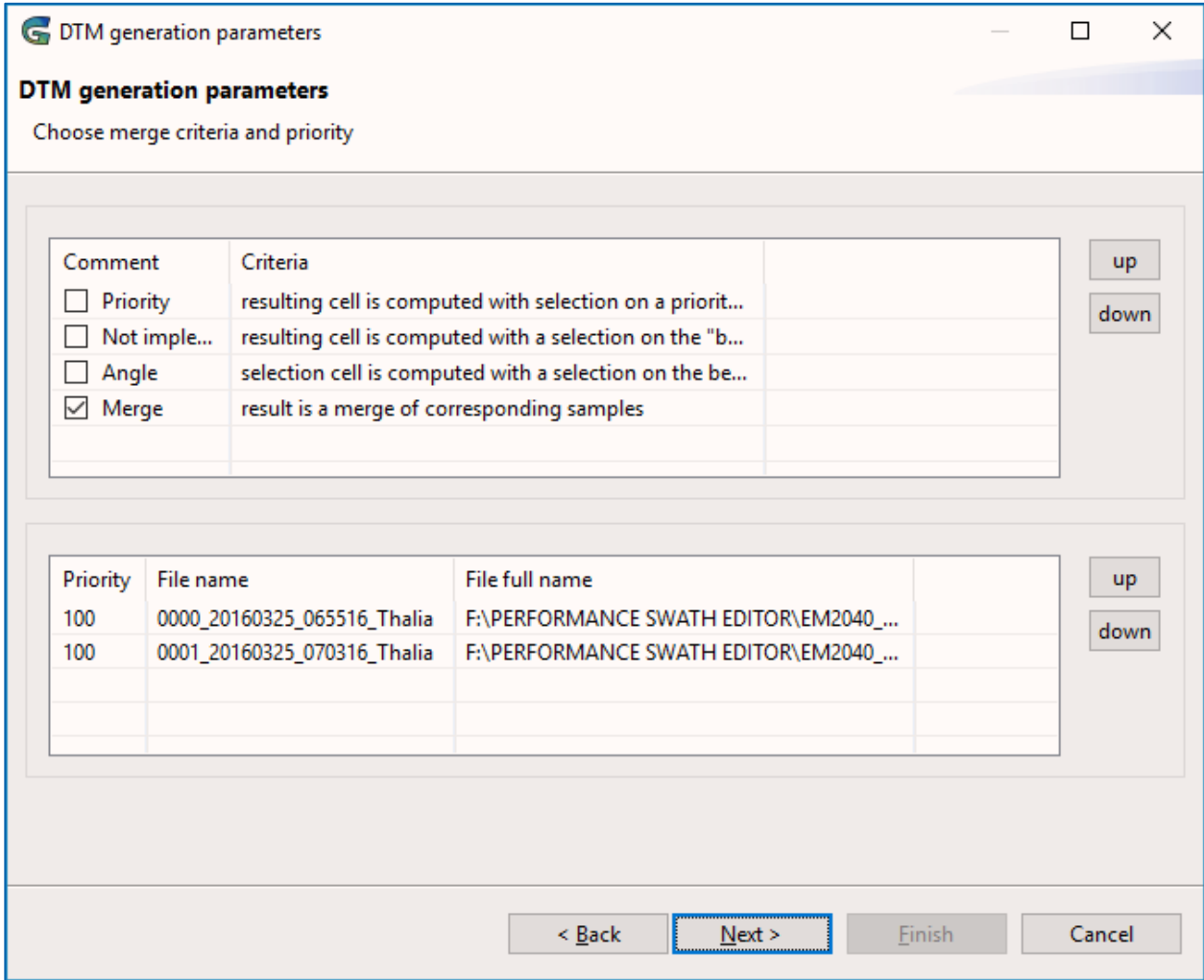
Contour file 

< Back Next > Finish Cancel

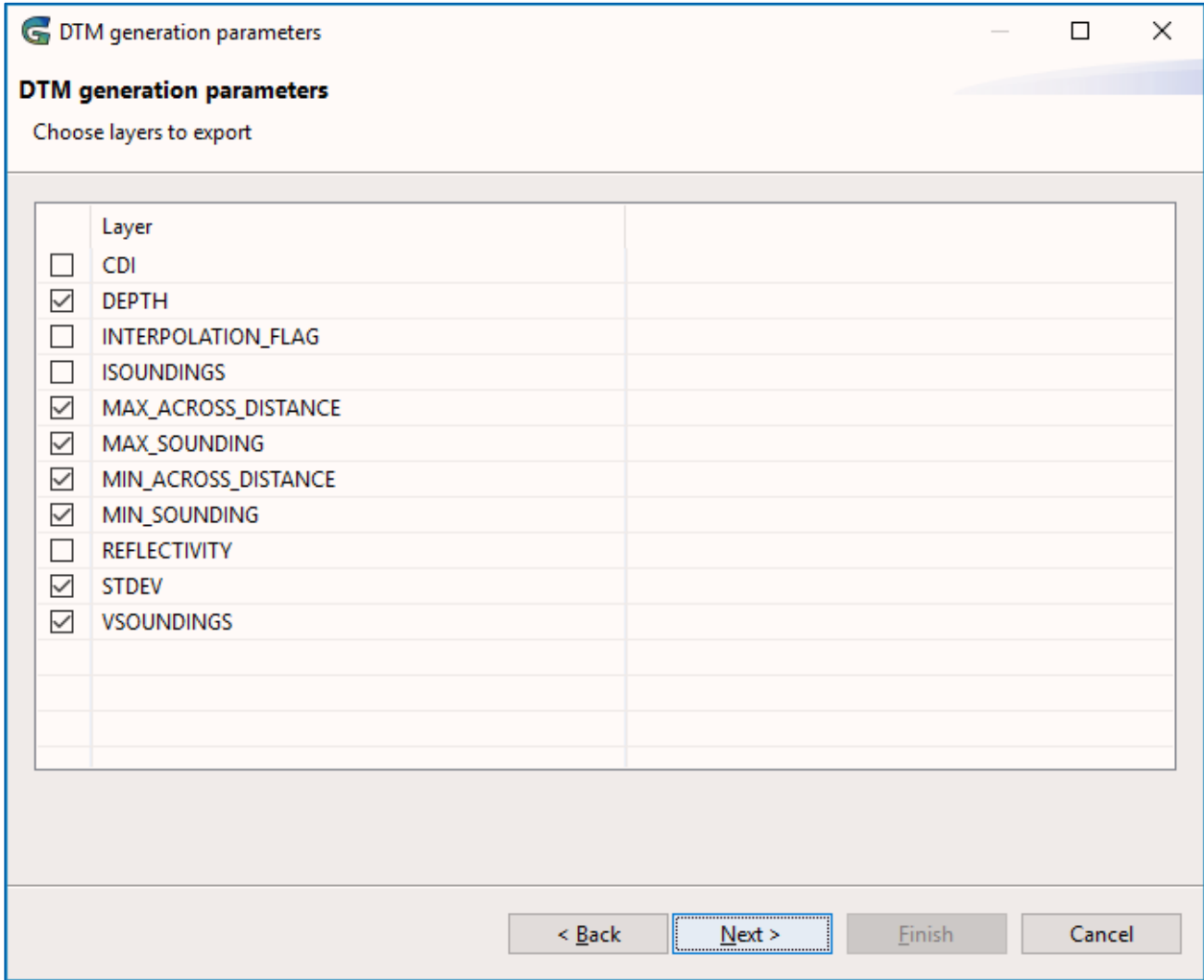
- The fourth page allows the user to:
 - include CDI information contained in a text file,
 - delete isolated values,
 - take in account valid and/or invalid soundings.



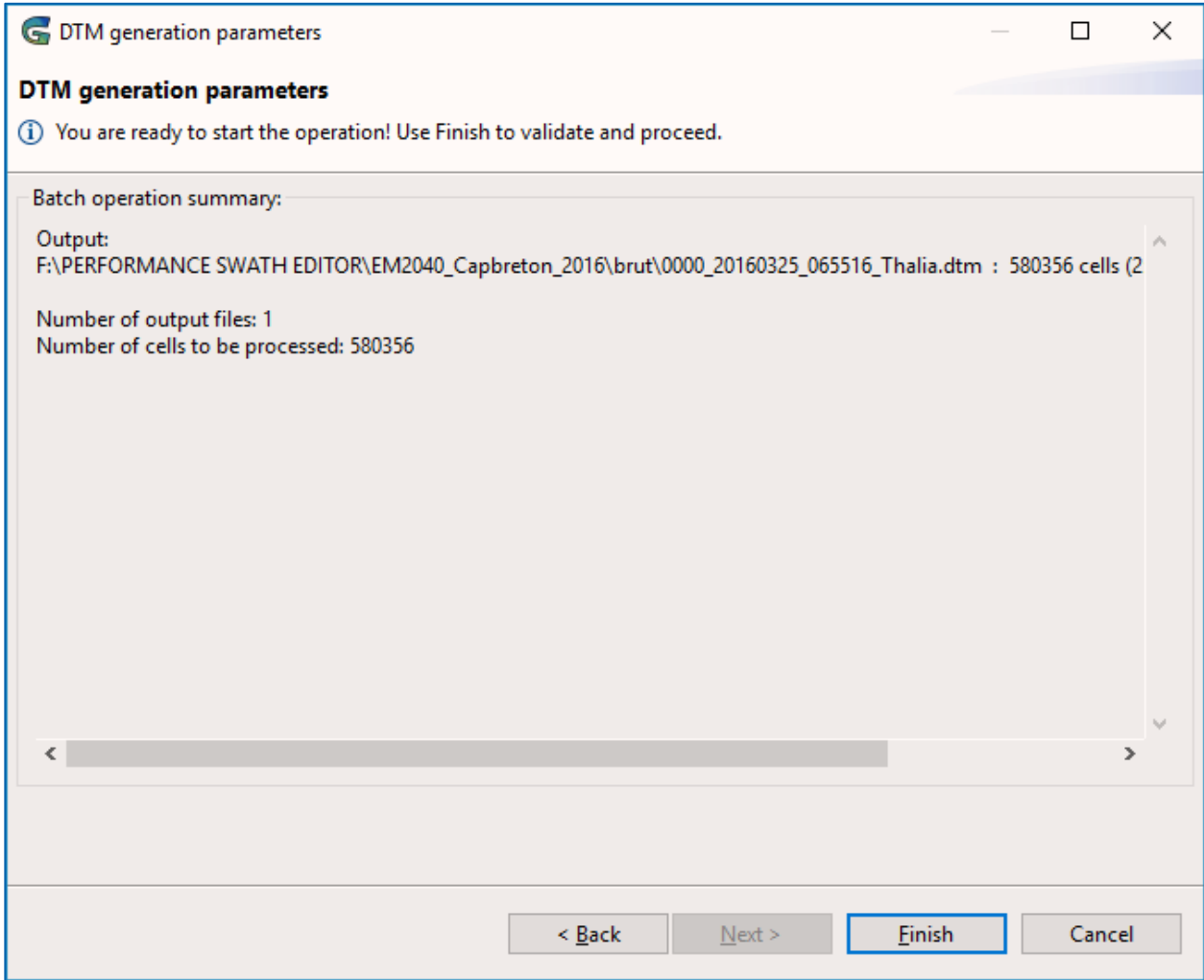
- The fifth page allows the user to:
 - choose which soundings are taken into account in the algorithm
 - give a priority between the input files,
 - give a weight proportional to the quality factor,
 - select the soundings with the best incidence angle,
 - just merge all the soundings (simple average is computed)
 - in case the user has chosen Priority option, define the priority list between all input files.



- The sixth page allows the user to select which layers to export.



- The seventh and last page show a summary of the operation.



Finally, just click on Finish

Chapter 5. EDMOnet TOOLS in GLOBE

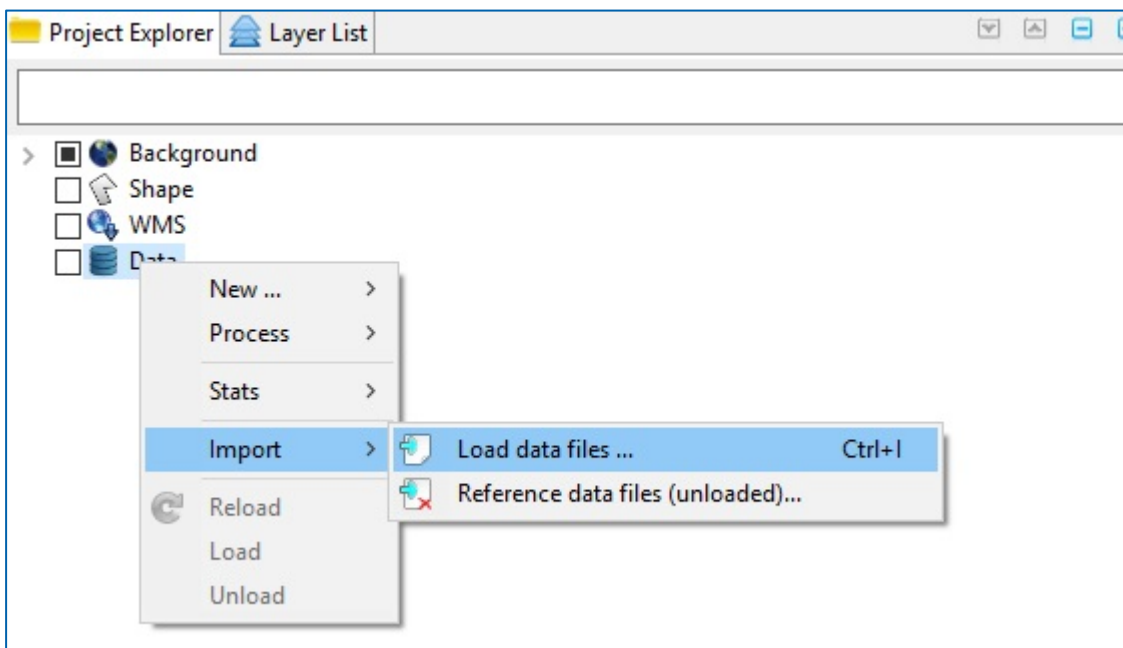
This chapter presents the tool set used specifically for EMODnet in GLOBE

Classical EDMOnet process

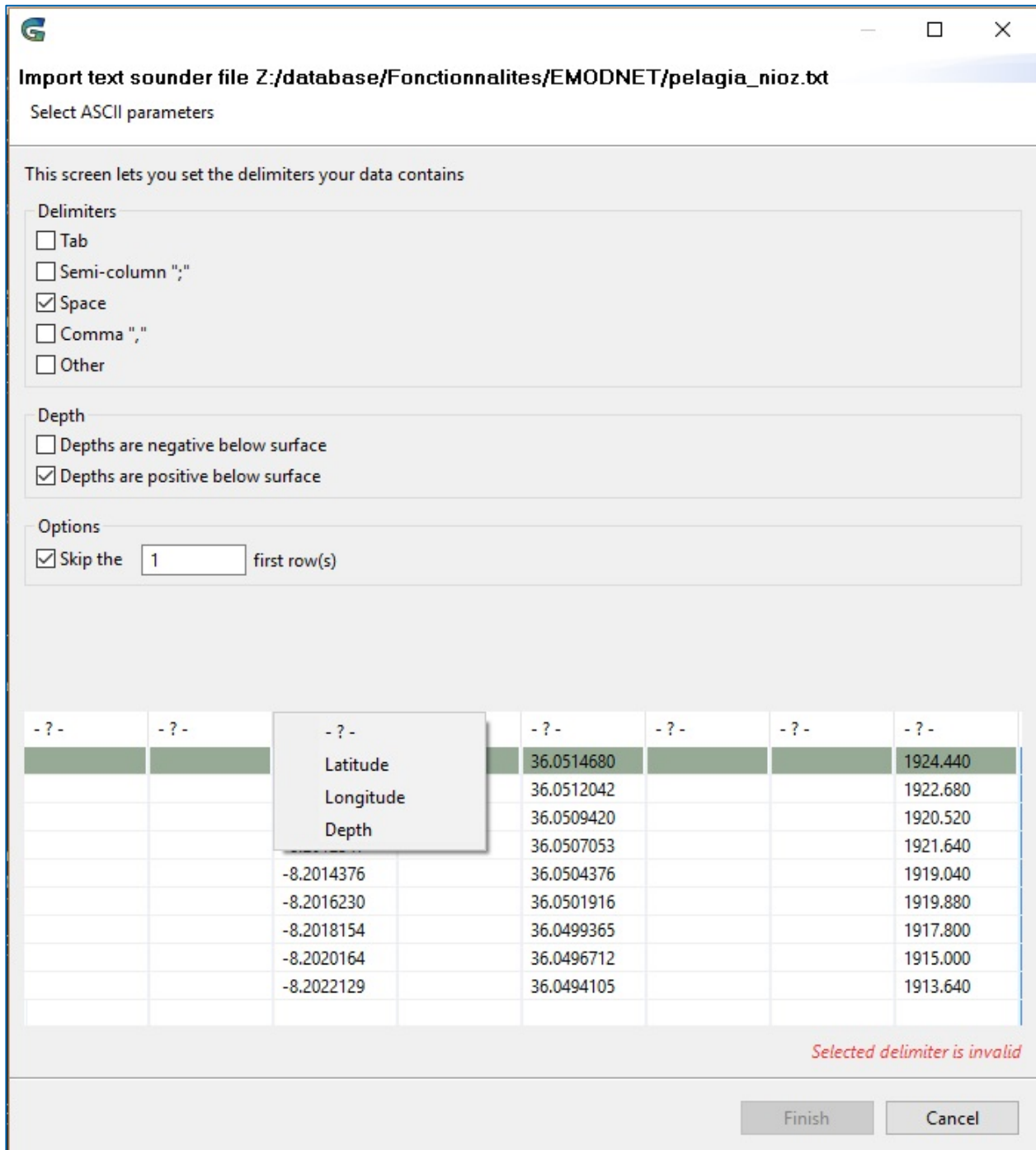
- Steps 1 to 3 describe how to process a single DTM from sounding data sets and reduce them to a 1/16' grid. (all data providers)
- Steps 4 to 8 describe the merging of all contributions into a regional DTM. (regional coordinators)
- EMODNET / Convert and reproject describes the tool available to input a composite DTM and to convert it into an "EMODnet" file, compliant for merging with all other contributions. (providers of composite product)

Step 1: Import files

In the *Project explorer* window, right click on Data, then go to Import > Load data files...
(You can also drag & drop the file on the Data node)



- Case of the text file format (.txt or .xyz) :
 - The top part of the window describes the data format
 - Field delimitation symbol
 - Depth sign convention
 - Possibility to skip the first lines in case of header in your txt files
 - The bottom part of the window shows an overview of the file: select the variable for each row (latitude, longitude or depth) by clicking on the column header.



Click Finish.

- MBG file (Ifremer file format)

There is not any setup window to import these files. The software automatically zooms to the MBG file extent (*Geographic View*).

- Import from other formats

NOTE

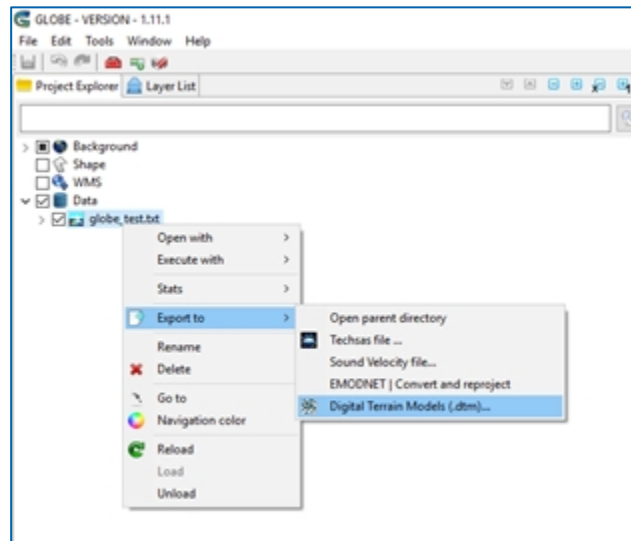
If the input file is a DTM from another software, you need to export it in a text format (Lat/Lon/Depth), keep in mind the cell size AND the geographic parameters (ellipsoid and projection). Then, you import it as a text file (see previously) and then convert and reproject into a DTM with the EMODnet specs by using the

EMODNET / Convert and reproject tool (see description of this tool).

Step 2: Single DTM (1/64, 1/32 or 1/16 arc of minute)

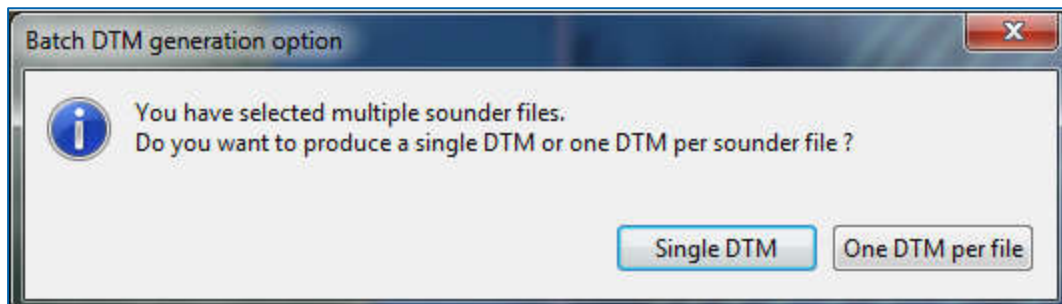
A single DTM will be created for each data file (*CDI* or *CPRD*).

In the *Project explorer* window, right click on the data file (*TXT* or *MBG*) and select Export > Export DTM (Batch).



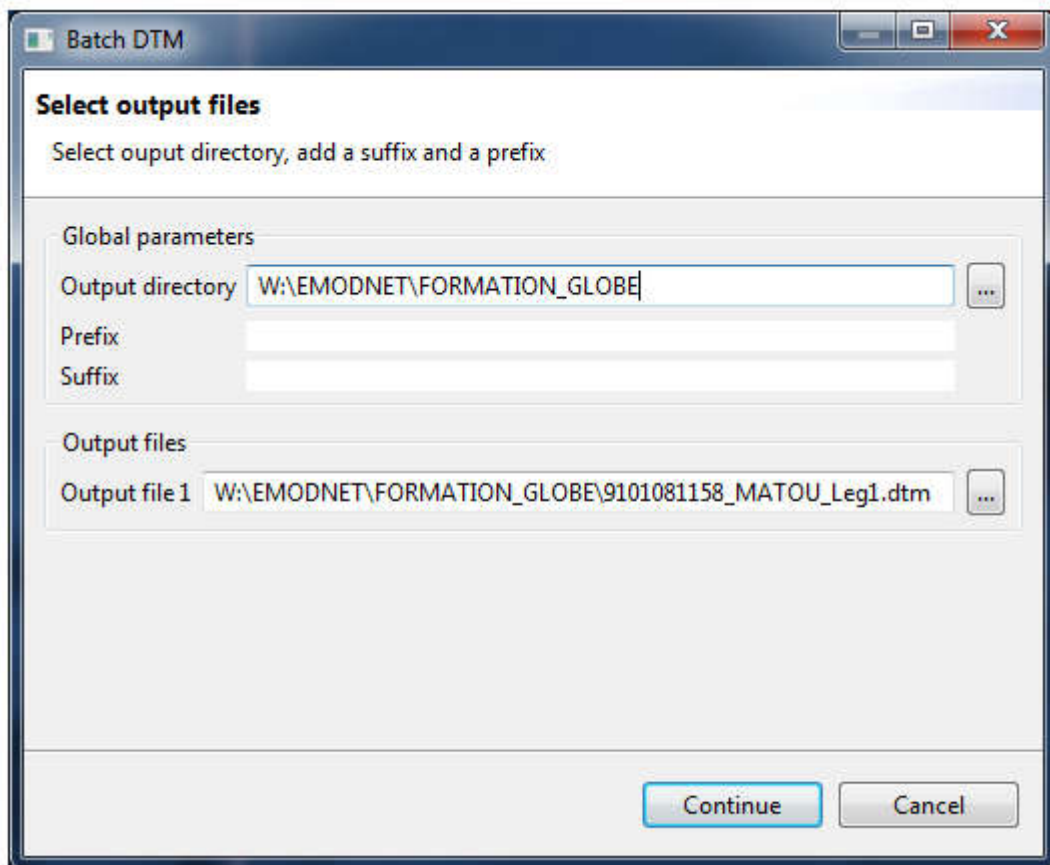
NOTE It is possible to select more than one file as an input.

Choose the option create one DTM per file, in the first window.



Batch DTM parameters are then defined in different windows, in both cases (one or several input files):

Window 1: *Directory* and *name* of the output files (prefix and suffix can be used).



Click Continue ->

Window 2: Definition of the *projection* and the *spatial resolution* of the resulting DTM.

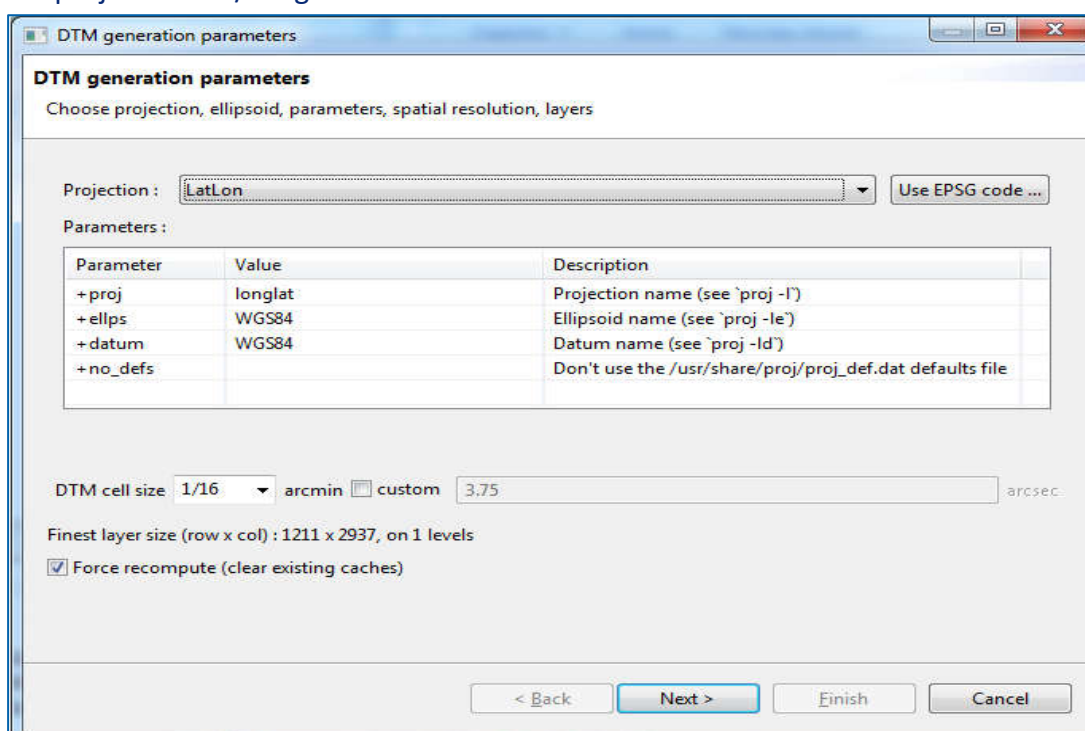
WARNING: Be careful about the depth of the DTM you want to create. The cell size must be adapted to the depth and the spatial resolution of the dataset.

As an indication about the cell size to choose the following table gives ideas of the relationship between depth and cell size:

Depth	Cell size (arc second)
Less than 200m	1/128 to 1/64
200m to 1500m	1/64 to 1/32
Deeper than 1500m	1/32 to 1/16

NOTE The cell size must also be consistent with the quality of the data set.

Choose projection Lat/Long and resolution in arc seconds.



Keep the Force recompute (clear existing caches) option selected (*Default*). The process will then be more efficient especially if the DTM created has the same name as a previous one.

Click Next ->

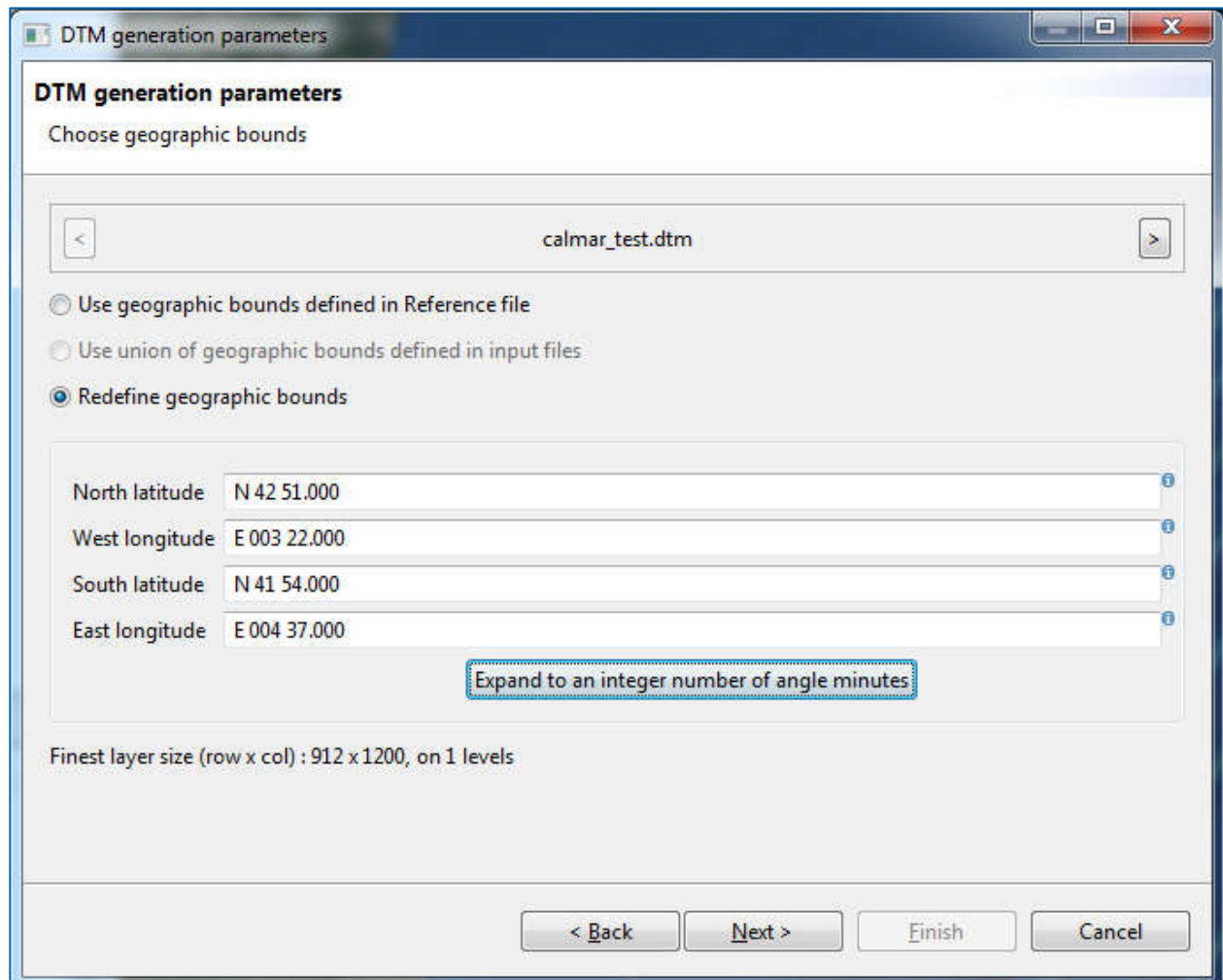
The cell size values, depending on the chosen units, are presented in the following table.

Arc-minute (')	Deg (°)	Sec (") - rounded	Meters (m) - rounded
1/128	0.00013021875	0.469	14.469
1/64	0.0002604375	0.938	28.935
1/32	0.000520875	1.875	57.875
1/16	0.00104175	3.750	115.750
1/8	0.002083	7.500	231.500

Window 3: Definition of the *geographic box* extent.

The geographical extent needs to be adjusted to *round minutes*:

Select the Redefine geographic bounds option. Then, you can either redefine the extent values automatically clicking on the Expand to an integer number of angle minutes button or do it manually.

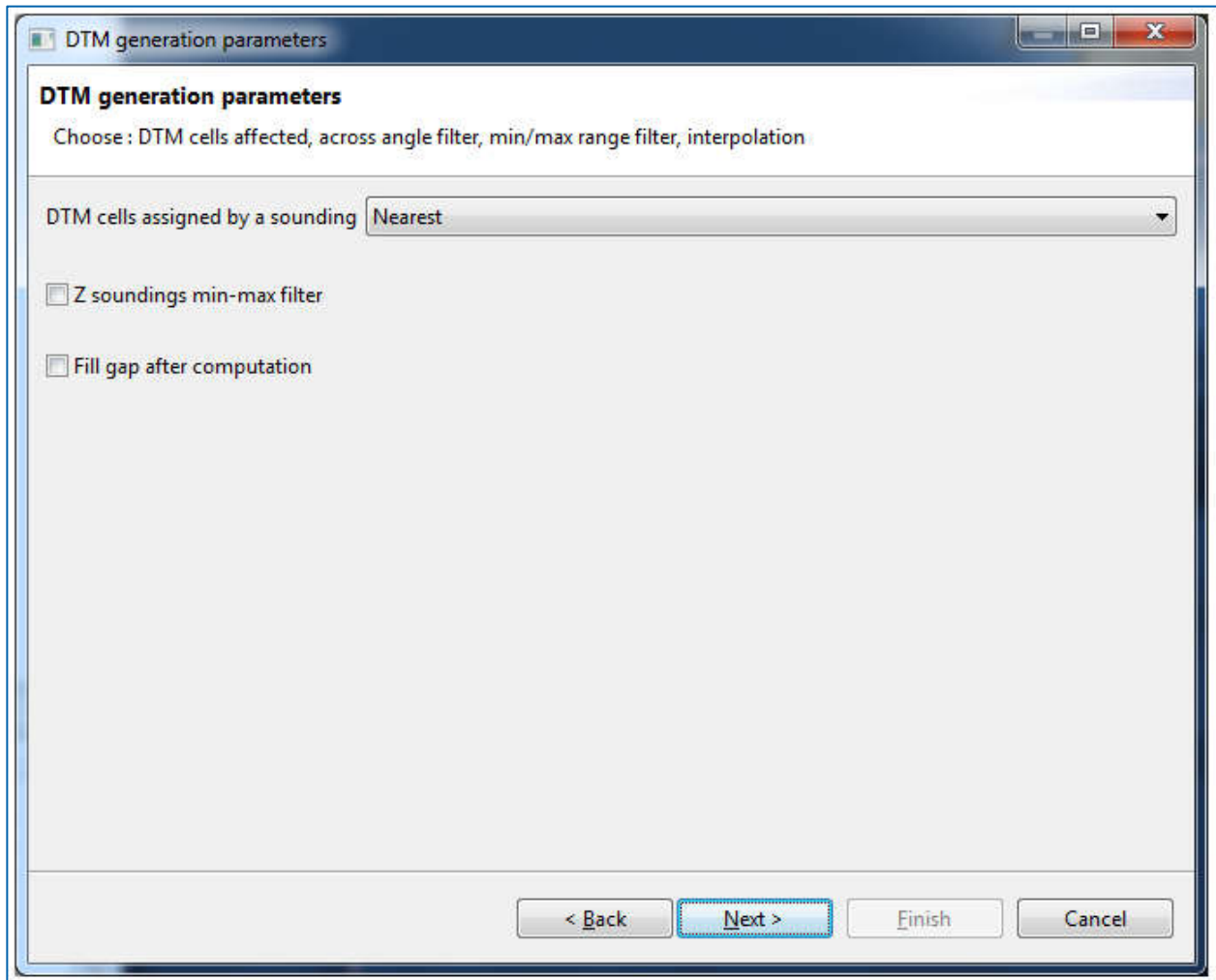


In case, you have selected many data files as input of the *Batch DTM* tool, then choose the *automatic* solution to individually adapt the geographical boundaries to *round minutes* for each DTM.

Then, click Next ->

Window 4: Option for the *gridding algorithm*.

For the Emodnet purpose, select nearest, do NOT apply any filter (*min-max filter* or *interpolation*).



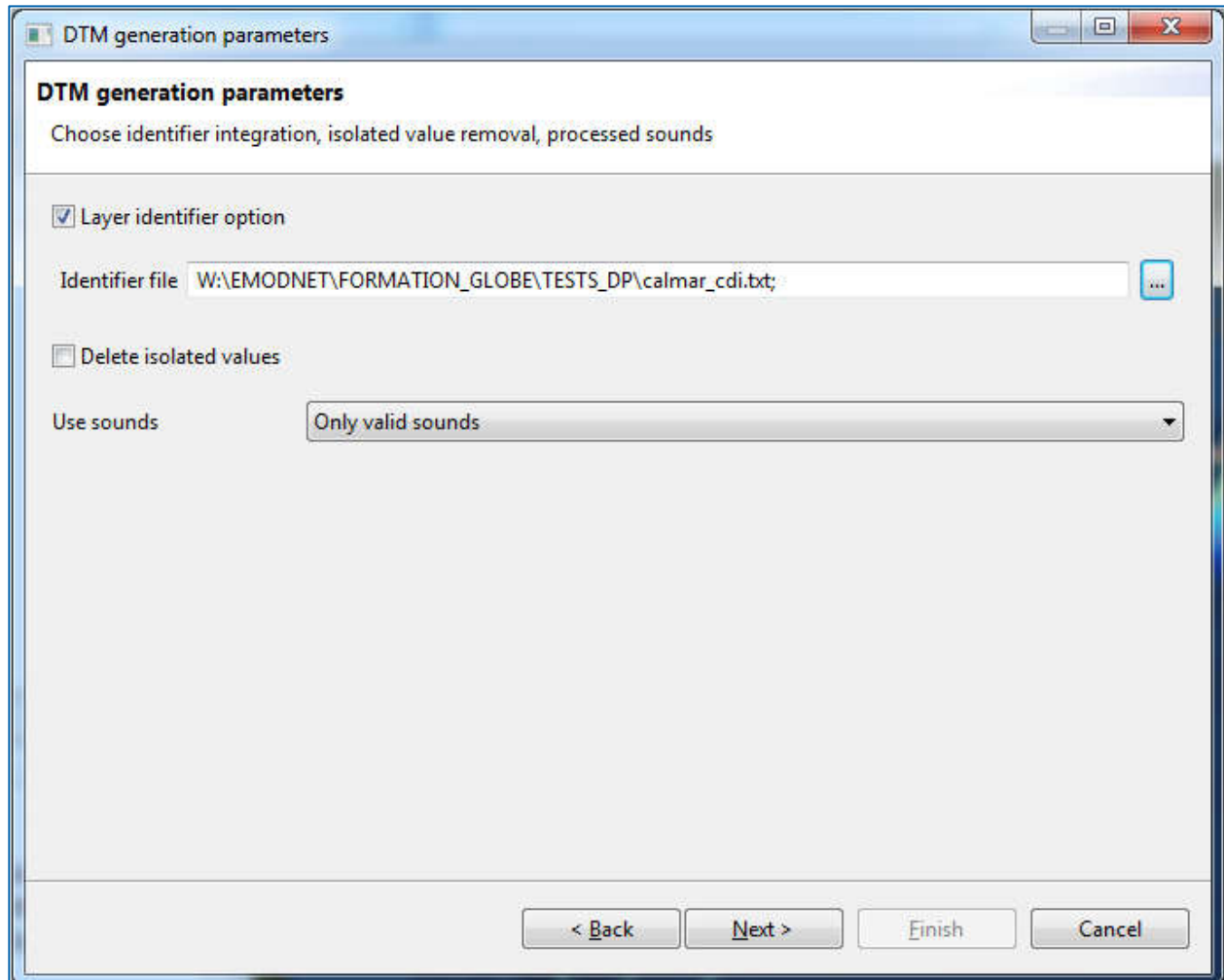
Click Next ->

Window 5: Selection of the *CDI_Id* file to fill in the *CDI_Id* layer.

The *CDI file* is made of 2 columns: one for the *name* of the input data file and another one for its *identifier*.

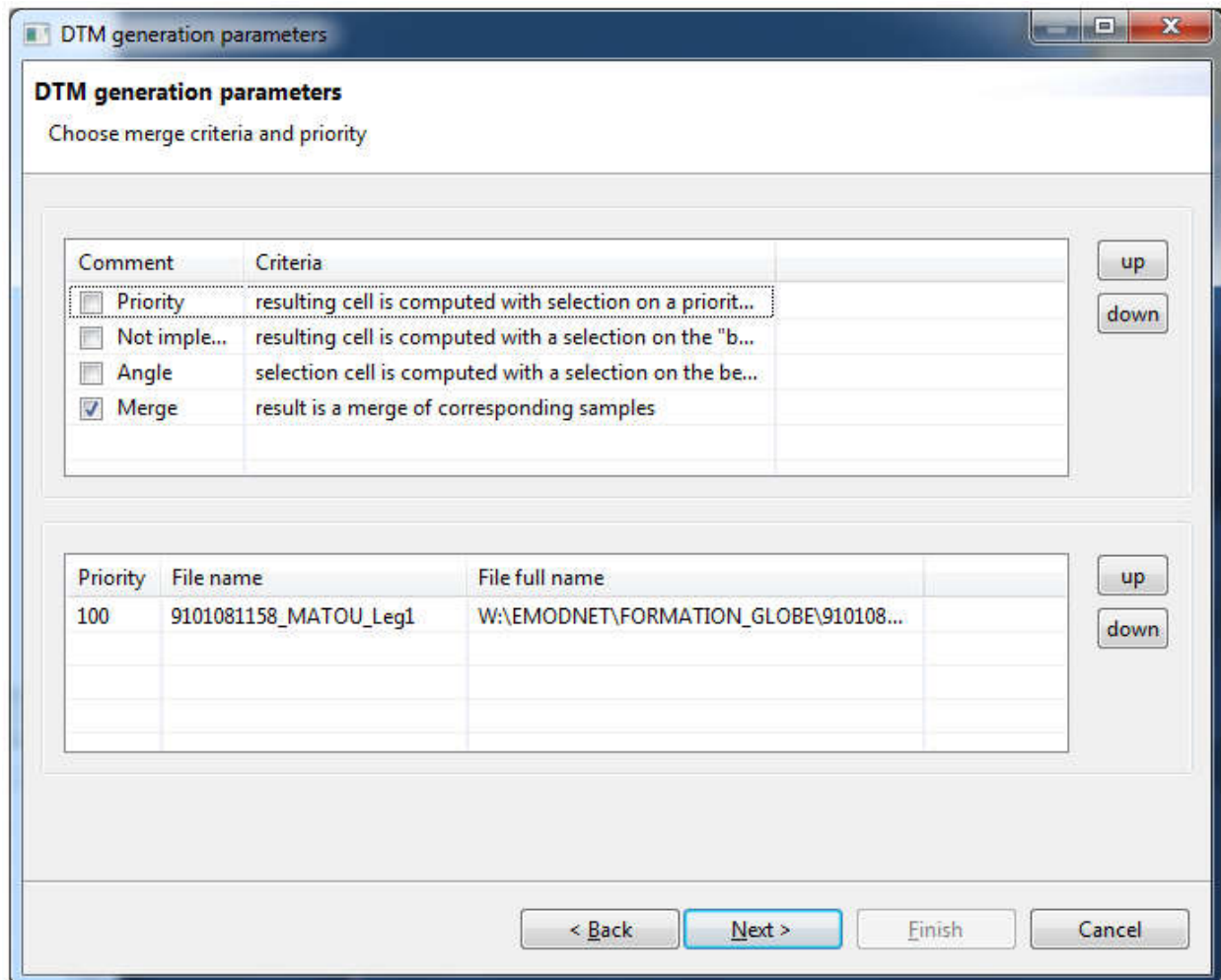
The layer identifier option activates the loading of *CDI file* which is needed to link the grid cells with the corresponding data source.

Keep the Only valid sounds selection for the data to grid in the DTM.



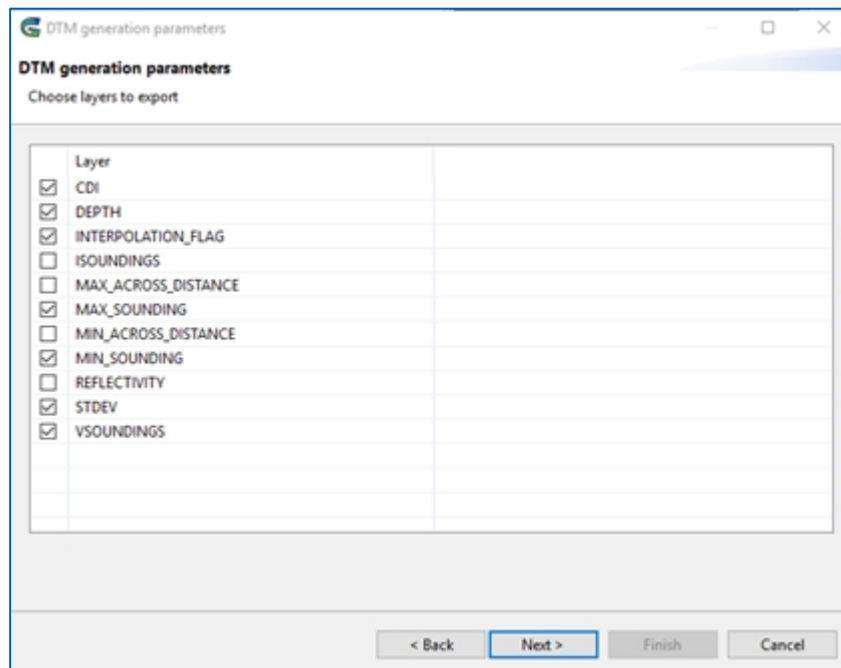
In that case, the Id *486_38465* is composed of: *486*, the Edmo code for *lfremer*, and *38465*, the local id of the survey defined by *lfremer*.

Window 6: Choice of the *DTM merge/priority criteria*
Keep the default parameters.



Click Next ->

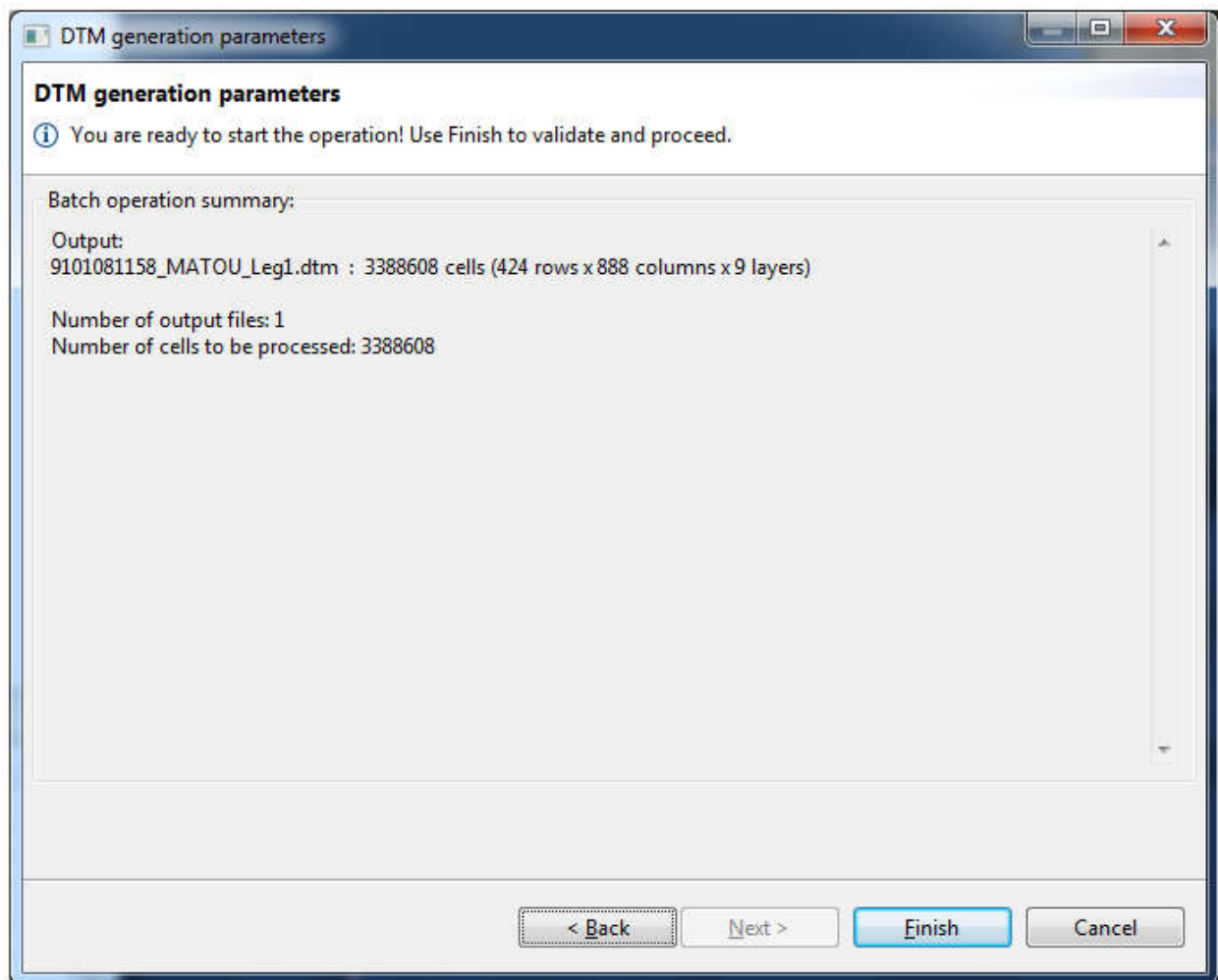
Window 7: Choice of the *DTM layers to process*
Keep the default parameters.



Click Next ->

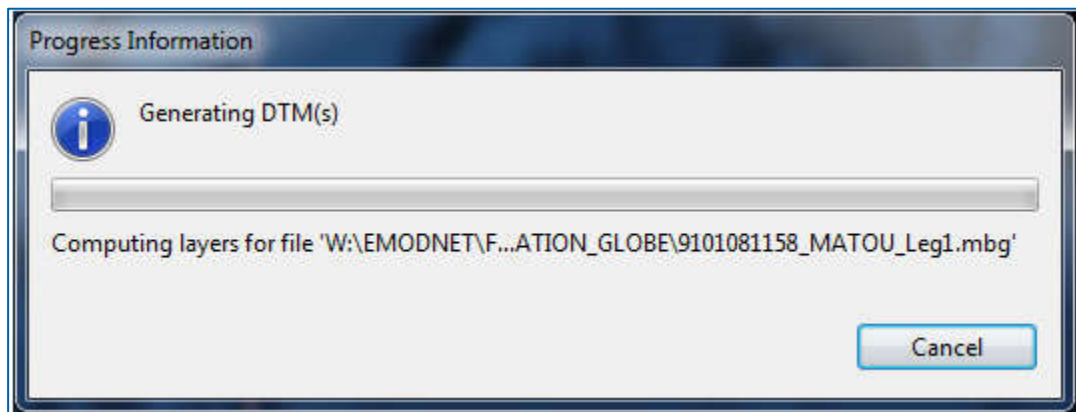
Window 8: Operation summary

The window summarizes the output parameters (*number of output files, rows, columns, layers*)



Then, if the information is correct, click Finish.

Window 9: DTM generation



The output file is created in the defined folder.

Validation– Check:

You can check the resulting DTMs by using the *Viewer*.

In DTM properties view

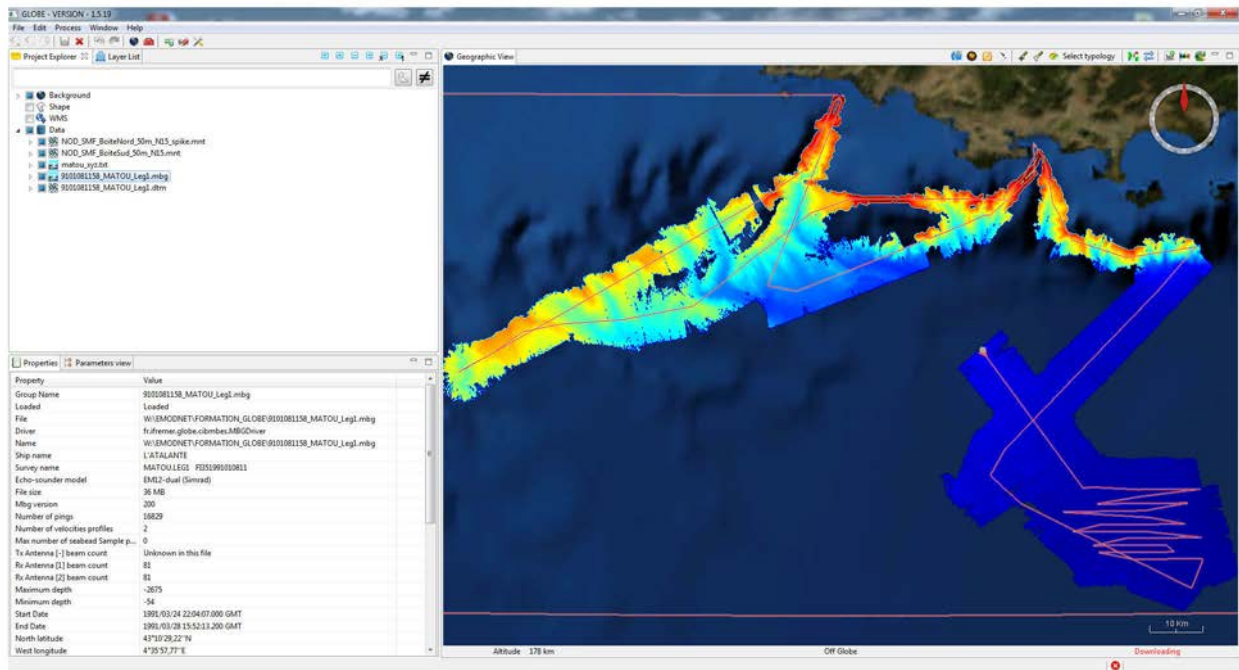
Click on the name of the DTM created and check in the *properties* window (below *layer explorer* tab):

- Boundaries (must be in round minute),
- CDI (must be present),
- Resolution (See equivalence table above)

In DTM parameters view:

The *parameters* view tab is available when you drag down the drop-down list of the DTM in the *layer explorer* window. Click on the first layer of it, then check in this parameter view the presence and value of all the layers in the DTM (*CDI / Depth / Min / Max / StdDev / Vsounding*).

The created DTM is loaded in the *Geographic View*:

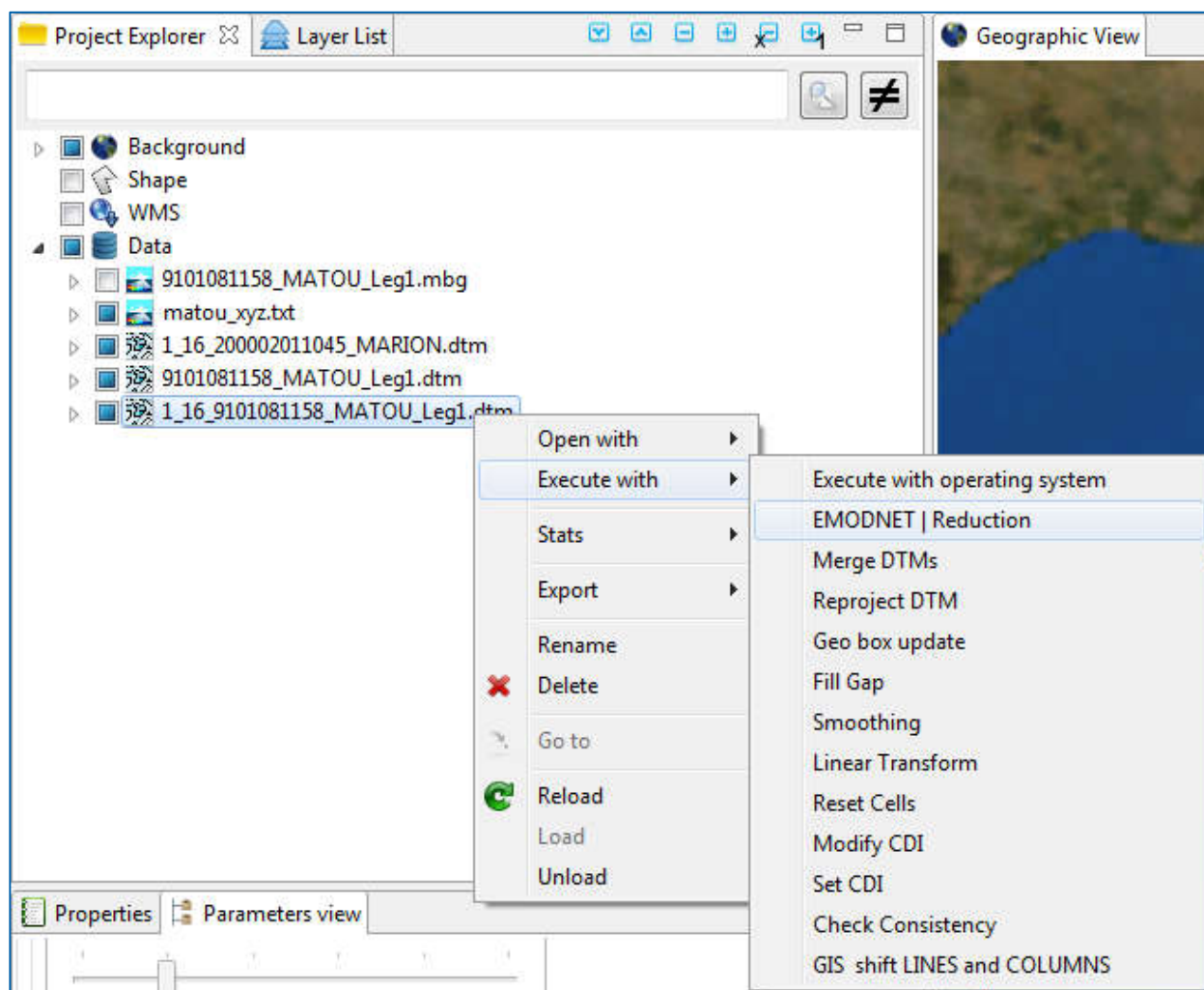


Step 3: 1/16 DTM - Reduction

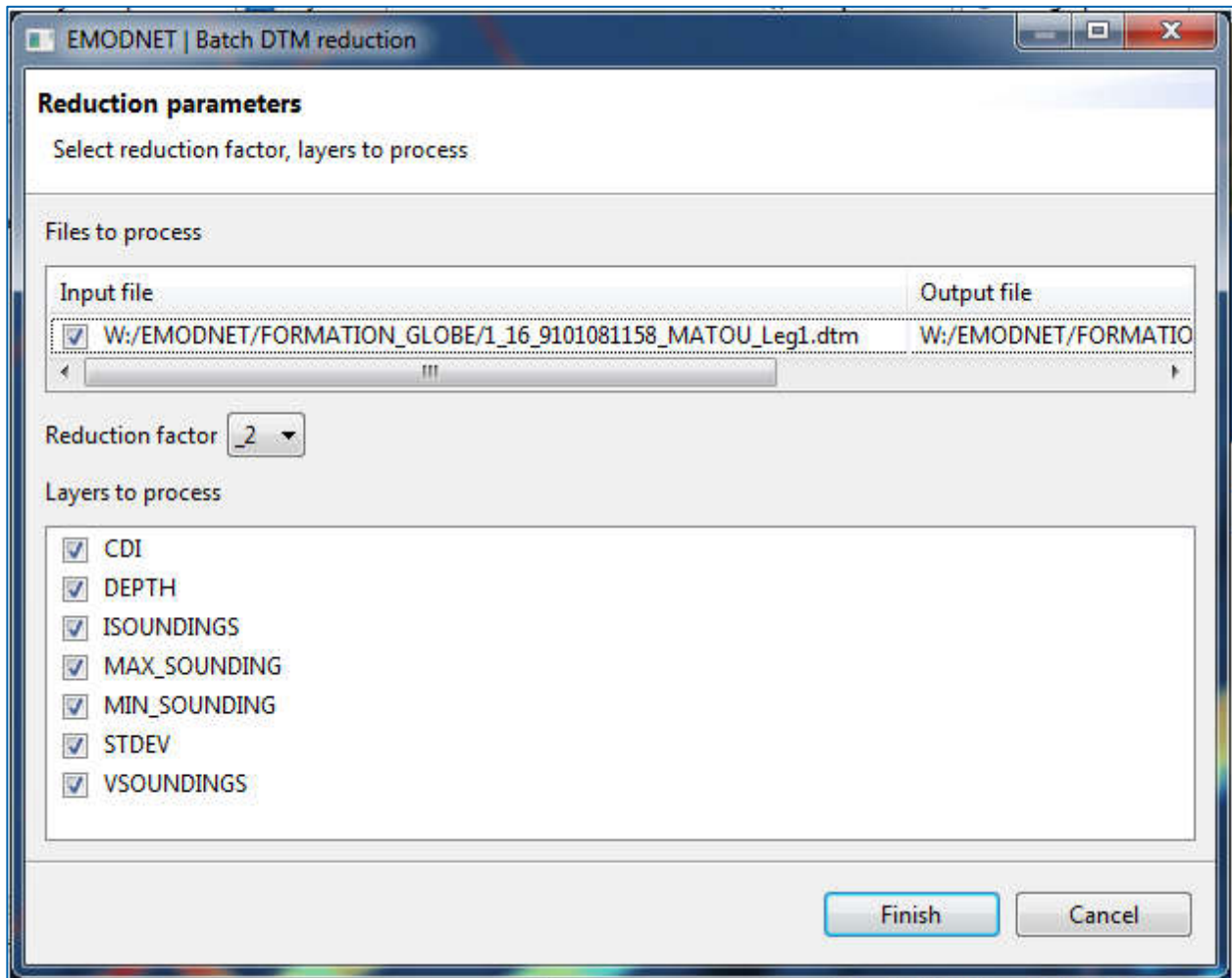
In the *Project explorer* window, right click on the previous *DTM file* of 1/32 resolution:

NOTE | It is possible to select more than one file as an input.

- Go on Execute with -> EMODNET | Reduction,



- Then choose the factor of reduction (2 to get a 1/16 DTM resolution from a 1/32 DTM).



- And finally click Execute.

The resulting name gets the extension *-Reduced_2* and is created in the same folder as the 1/32 DTM used for the reduction.

But this DTM is not automatically loaded into the software.

Step 4: Merge DTMs

All the DTMs have been generated and/or reduced to the common 1/16 arcminute resolution.

They will then be regionally merged into a single 1/16 DTM.

The merging operation is guided by two different options:

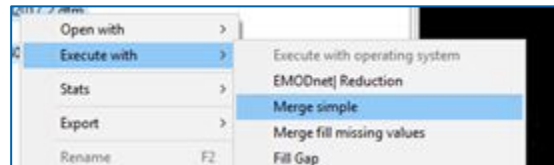
- 1: "simple average": Merge single DTMs by a simple averaging algorithm.
- 2: "Fill missing values": Fill in the regional DTM step by step with all available DTMs using priorities between the input files (like a deconflicting tool).

Option 1 is recommended when merging a batch of files of similar characteristics. They can be all DTMs registered with a CDI (sounding data), or all DTMs having similar Quality indicators, or similar ages...(see also sort DTM by Quality index).

Option 2 is recommended to fill in the gaps of the regional DTM by DTMs having a lower resolution or a lower evaluated quality. This option will apply rank of priority between the DTMs contributing to the regional grid. It is recommended to use this option to integrate the composite DTM (CPRD) and the regional grid (like GEBCO grid).

Both options are described below.

Select all the concerned DTM then right click on them and go on Execute with > Merge Simple.



Option 1: Simple average

Window 1: Merge parameters

Choose the merging option (here *Merge Simple*).

For this option, the resulting cell depth is the average of the input DTMs cell depths.

In case of overlap of DTMs in the cell:

The CDI Id is set to the CDI Id of the most dominant dataset in the cell.

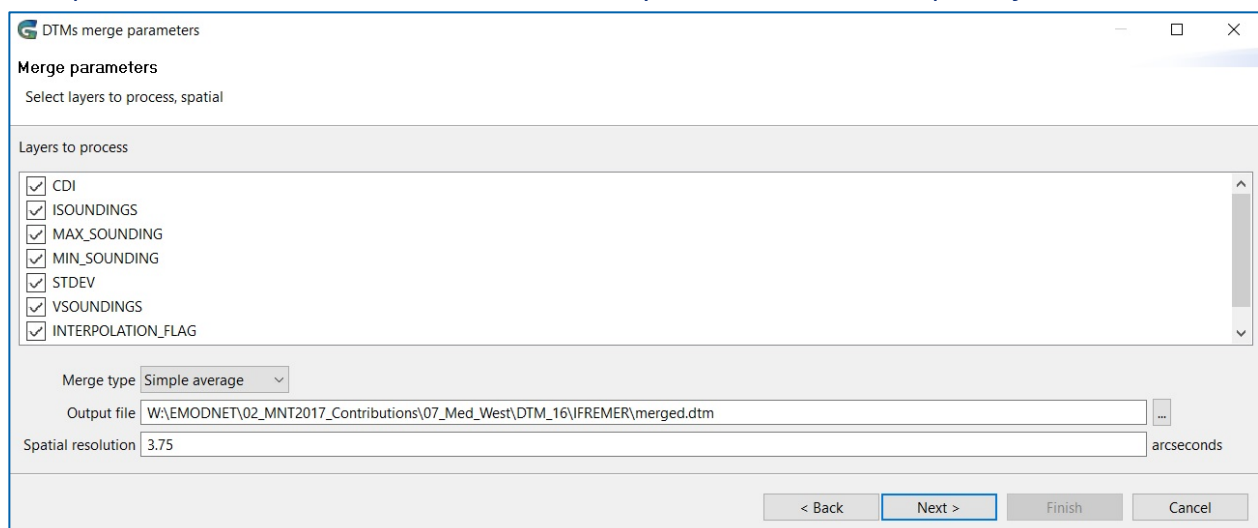
Vsoundings = Sum of all Vsoundings.

STDEV is reprocessed using STDEV and VSoundings layers of each DTM which are present in the cell.

Min and Max soundings are deducted from the Min and Max layers of the DTMs which are present in the cell.

Define the name of the *output merged DTM*.

The *spatial resolution*, or cell size, is automatically detected from the input *Reference DTM*.



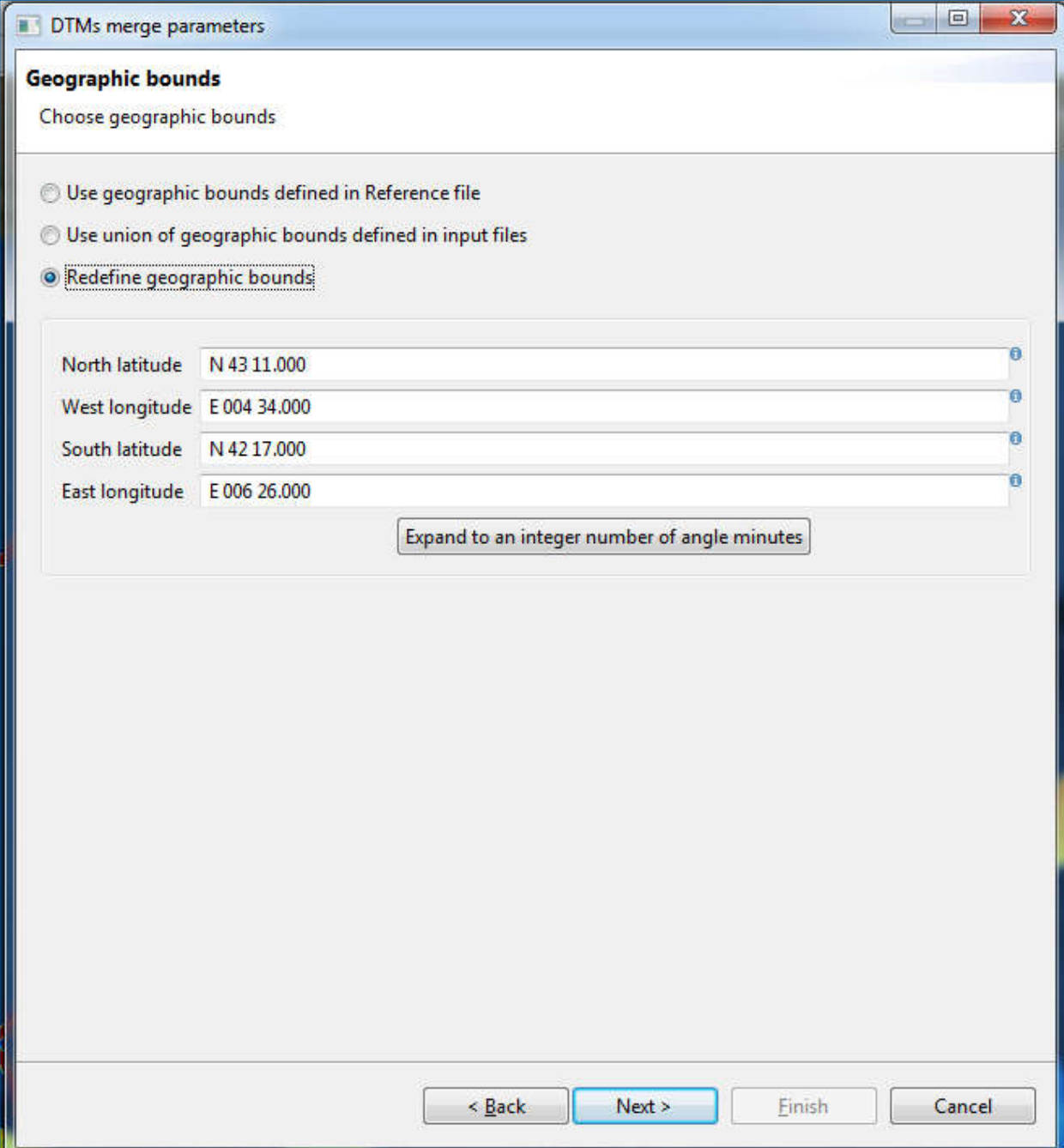
NOTE

All the layers must be selected (default).

And then, click Next ->

Window 2: Geographic boundaries

Define the geographic bounds of your region. These limits can be rounded.



The screenshot shows a software dialog box titled "DTMs merge parameters". The "Geographic bounds" section is active, with the instruction "Choose geographic bounds". Three radio buttons are present: "Use geographic bounds defined in Reference file", "Use union of geographic bounds defined in input files", and "Redefine geographic bounds", which is selected. Below these are four text input fields: "North latitude" (N 43 11.000), "West longitude" (E 004 34.000), "South latitude" (N 42 17.000), and "East longitude" (E 006 26.000). Each field has a small blue 'i' icon on its right. A button labeled "Expand to an integer number of angle minutes" is located below the input fields. At the bottom of the dialog are four buttons: "< Back", "Next >", "Finish", and "Cancel".

DTMs merge parameters

Geographic bounds

Choose geographic bounds

Use geographic bounds defined in Reference file

Use union of geographic bounds defined in input files

Redefine geographic bounds

North latitude: N 43 11.000

West longitude: E 004 34.000

South latitude: N 42 17.000

East longitude: E 006 26.000

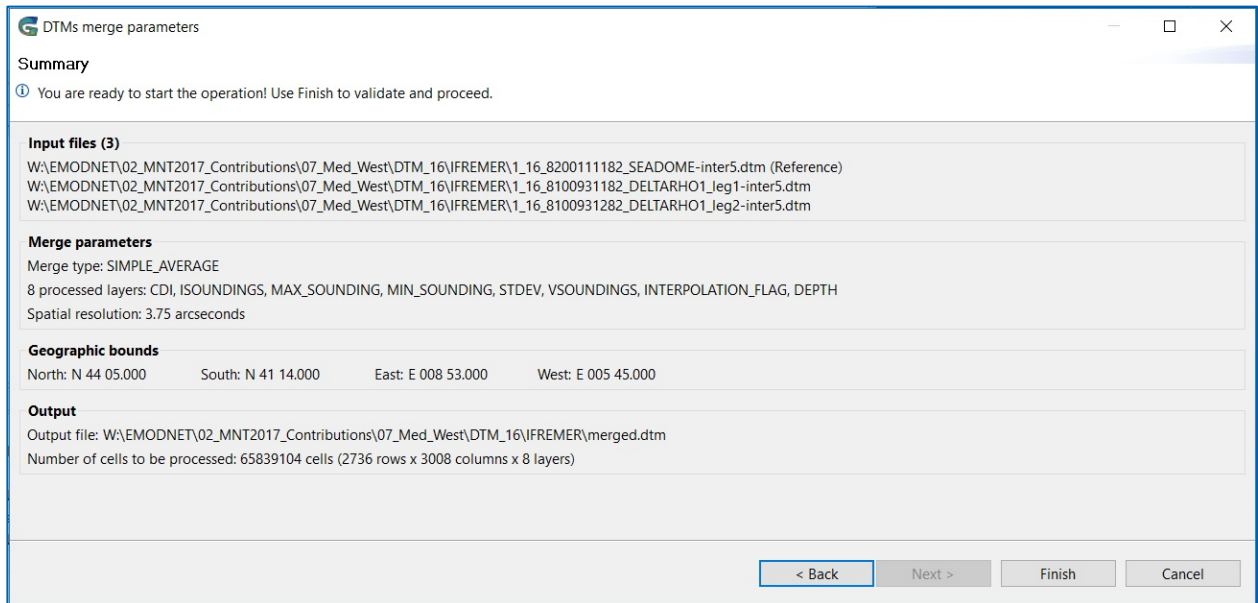
Expand to an integer number of angle minutes

< Back Next > Finish Cancel

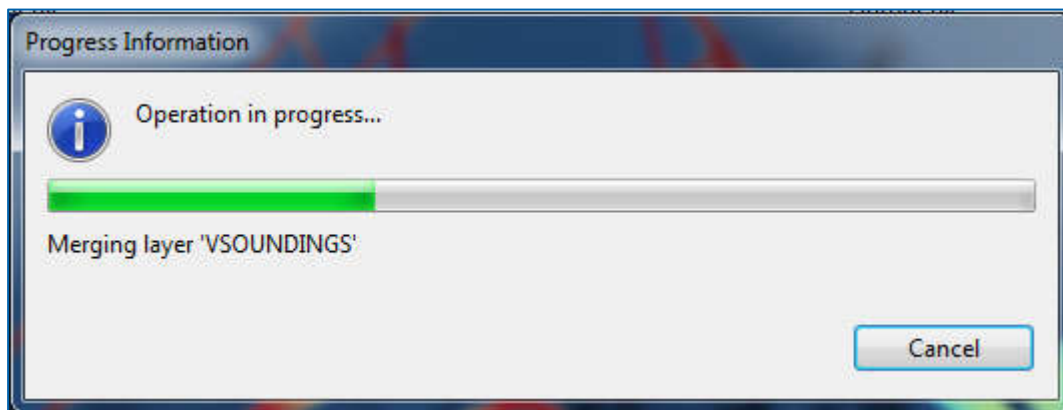
And click Next ->

Window 3: Operation summary

The window summarizes the output parameters (*number of input files, merge parameters, geographic bounds, output file with numbers of cells processed*)



Then, click Finish->

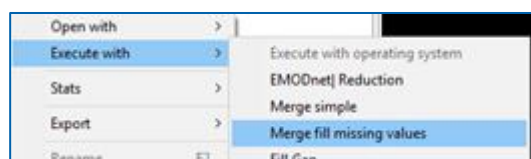


The output file is created in the chosen folder.

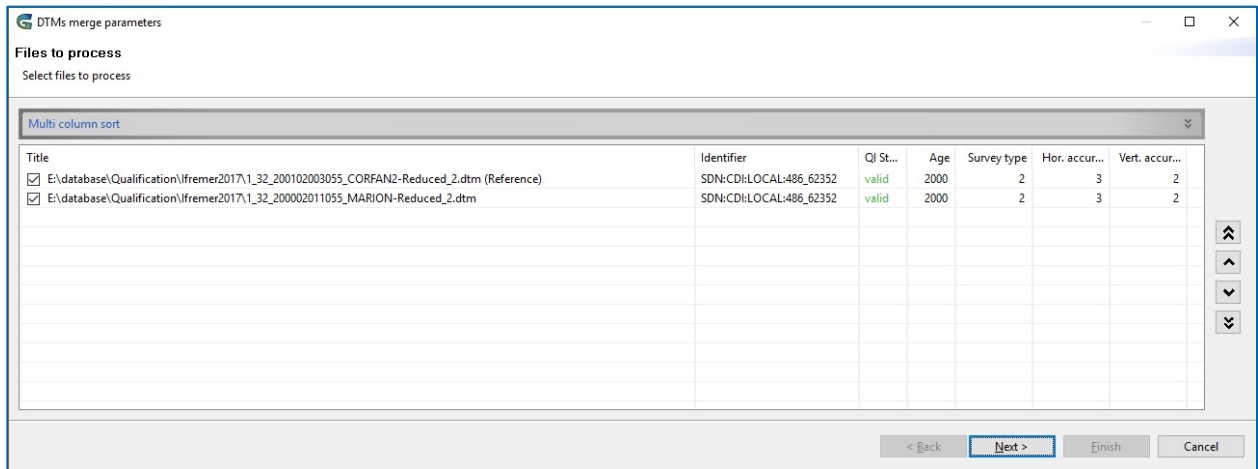
Option 2: Fill missing values

A Reference data set is defined. Each layer of the new grid is filled by the reference grid. Then, the empty cells will be filled in successively by the other grids. The priority order is defined by the list of the input DTMs.

Select the files to processed, then right click on them, and go on Execute with > Merge Fill missing values.



Window 1: File to Process

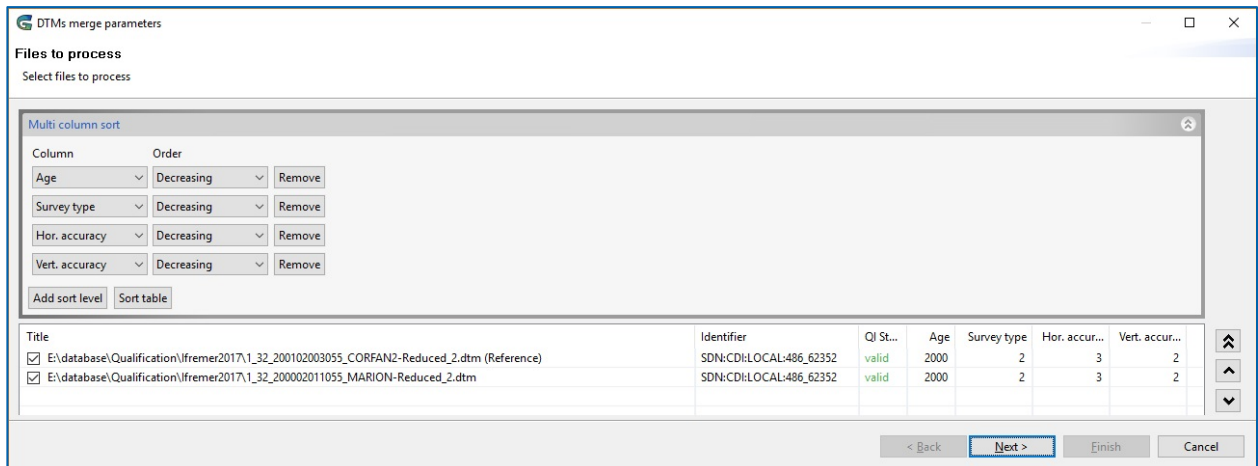


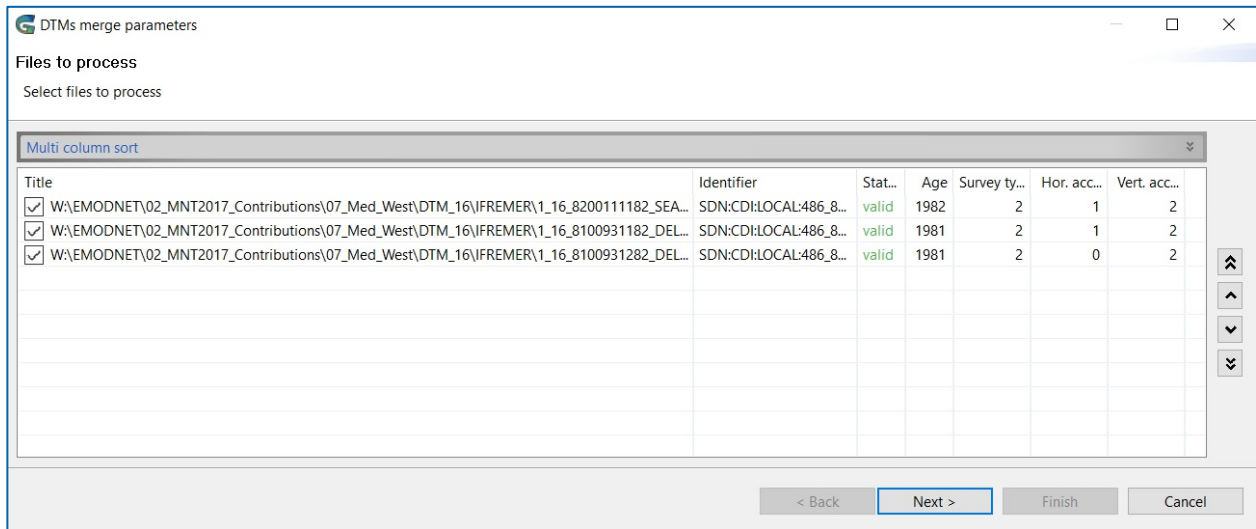
The associated Quality Indicators are extracted from the web databases. These indicators can be used to sort the files with respect to their values. The files retained for processing will be the checked ones. The arrows on the right allow the user to modify the rank of priority

NOTE

You can get several interactions with the files like *Go to* and *Highlight* by right clicking on them.

You can modify the sort order and criteria by expanding the "Multi column sort" area





Then, the following windows and parameters are the same as seen previously for Option1.

Merging with a composite grid like the GEBCO grid.

In this case, we select Depth and CDI as the 2 layers to be processed as the others are not significant for the GEBCO grid.

The merged DTM is created in the chosen folder but it is NOT loaded automatically.

Operations on DTM

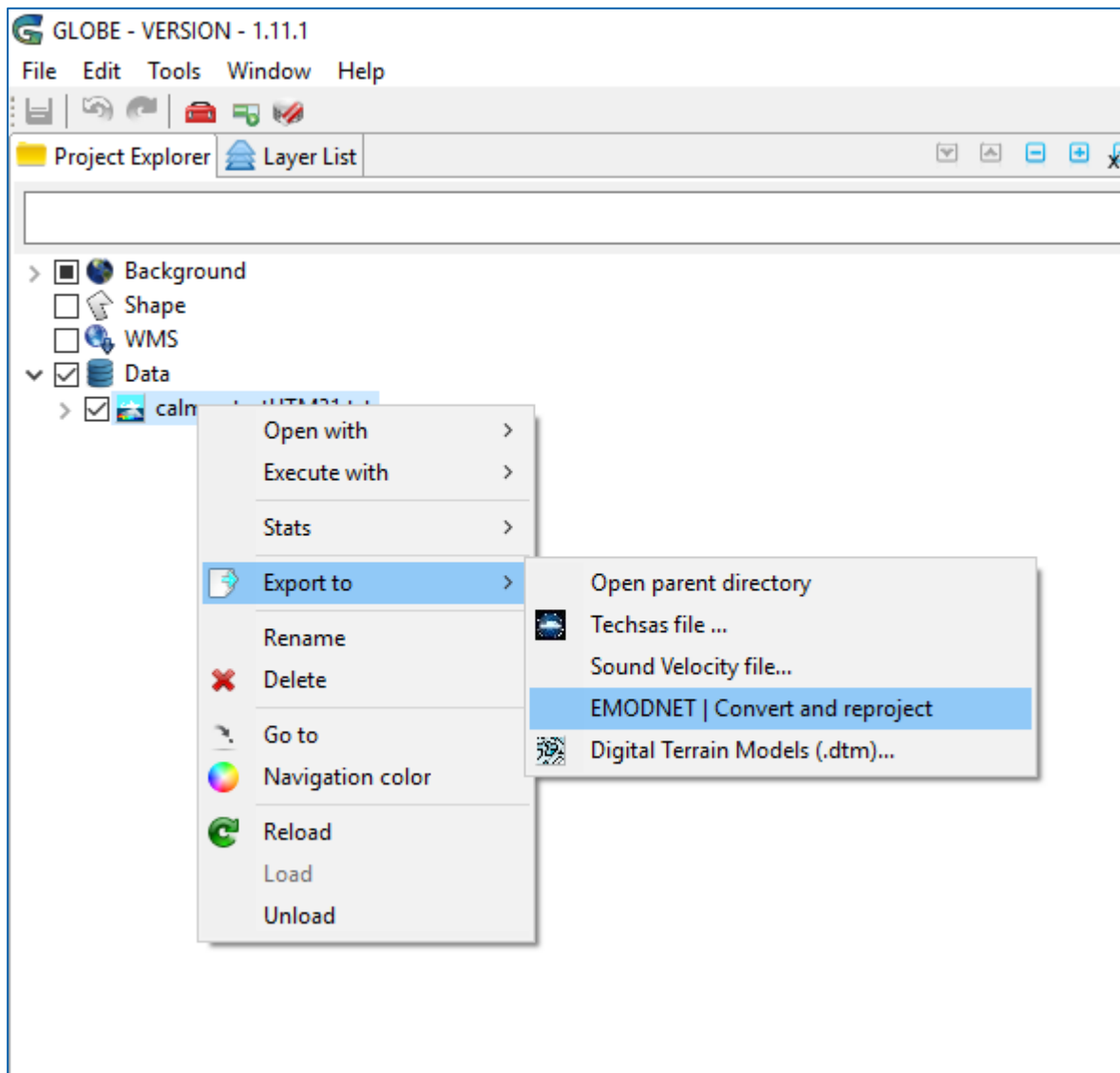
Some operations are possible on DTM (interpolation, smoothing etc.). These tools are accessible by right clicking on DTM files from the *Project Explorer*.

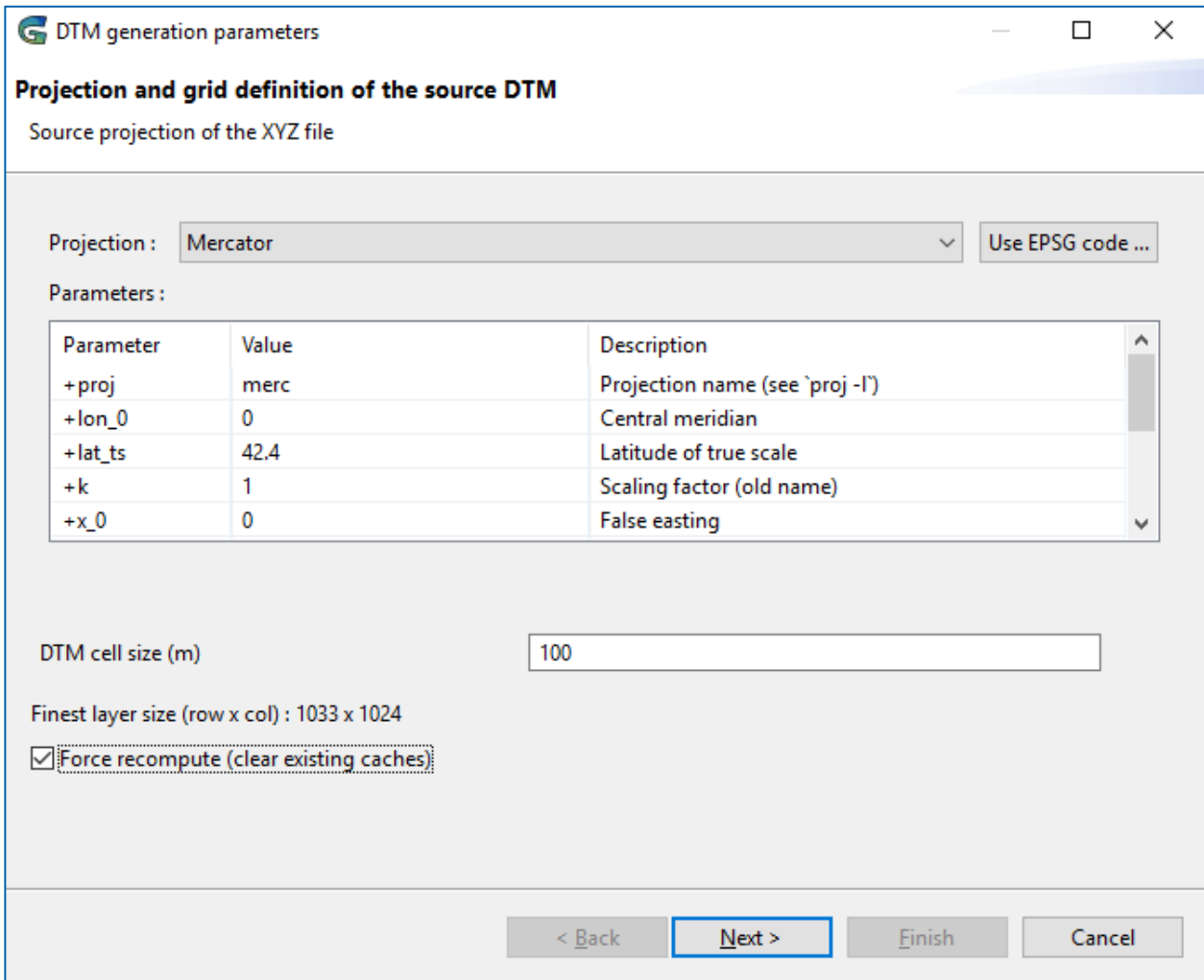
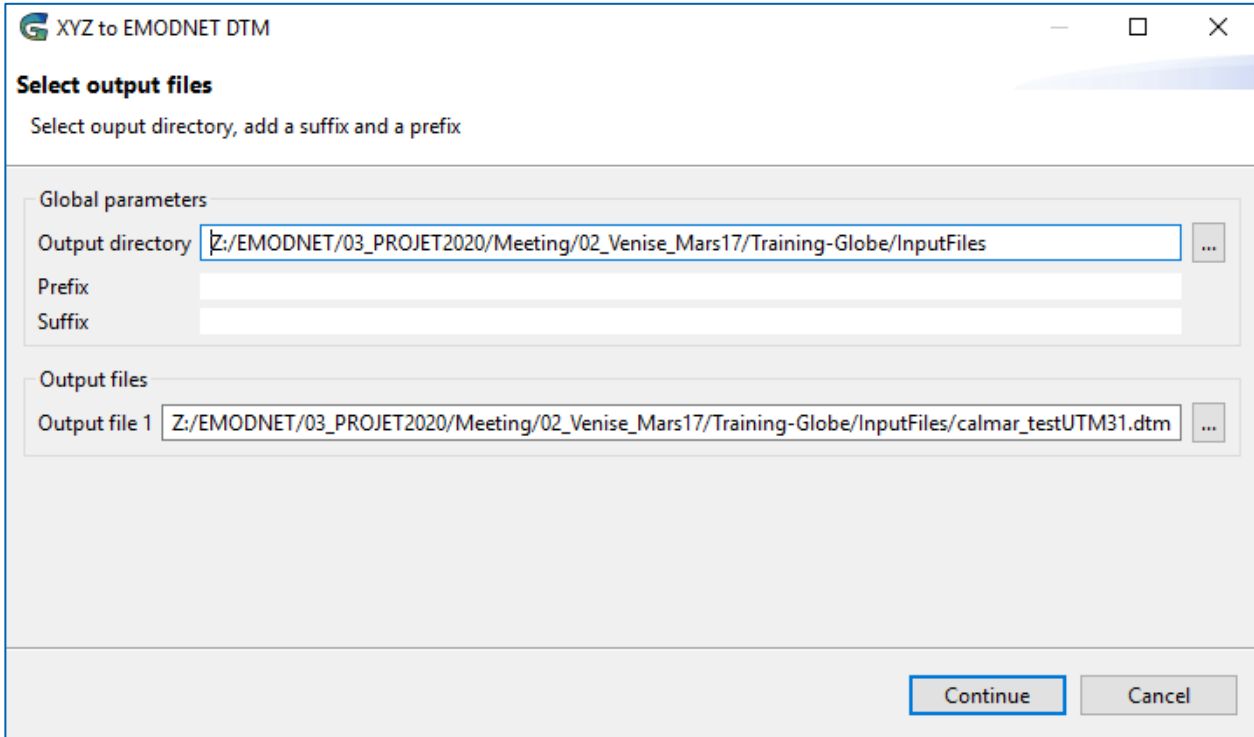
EMODNET / Convert and reproject

This tool is made to import and convert a grid file or a CPRD product, which has been processed using another software or different parameters than thus defined by the EMODnet Bathymetry methodology.

As Input file, you must have an “ascii” file with the 3 rows, Longitude/Latitude/Depth, as the export file of your grid. This file is input in GLOBE using the “import/load data” tool.

Then, you can use the “Export to / EMODnet / Convert and reproject” tool: it will reprocess your grid ascii files into the required standard grid format for the merging process.





DTM generation parameters

Geographic bounds

Choose geographic bounds

GLOBE_EMODNET_2243613266430187404.dtm

Use geographic bounds defined in Reference file

Use union of geographic bounds defined in input files

Redefine geographic bounds

North latitude: N 42 51.000

West longitude: E 003 22.000

South latitude: N 41 54.000

East longitude: E 004 37.000

Expand to an integer number of angle minutes

Finest layer size (row x col) : 1055 x 1030

< Back Next > Finish Cancel

DTM generation parameters

Geographic bounds

Choose geographic bounds

GLOBE_EMODNET_2243613266430187404.dtm

Use geographic bounds defined in Reference file

Use union of geographic bounds defined in input files

Redefine geographic bounds

North latitude: N 42 51.000

West longitude: E 003 22.000

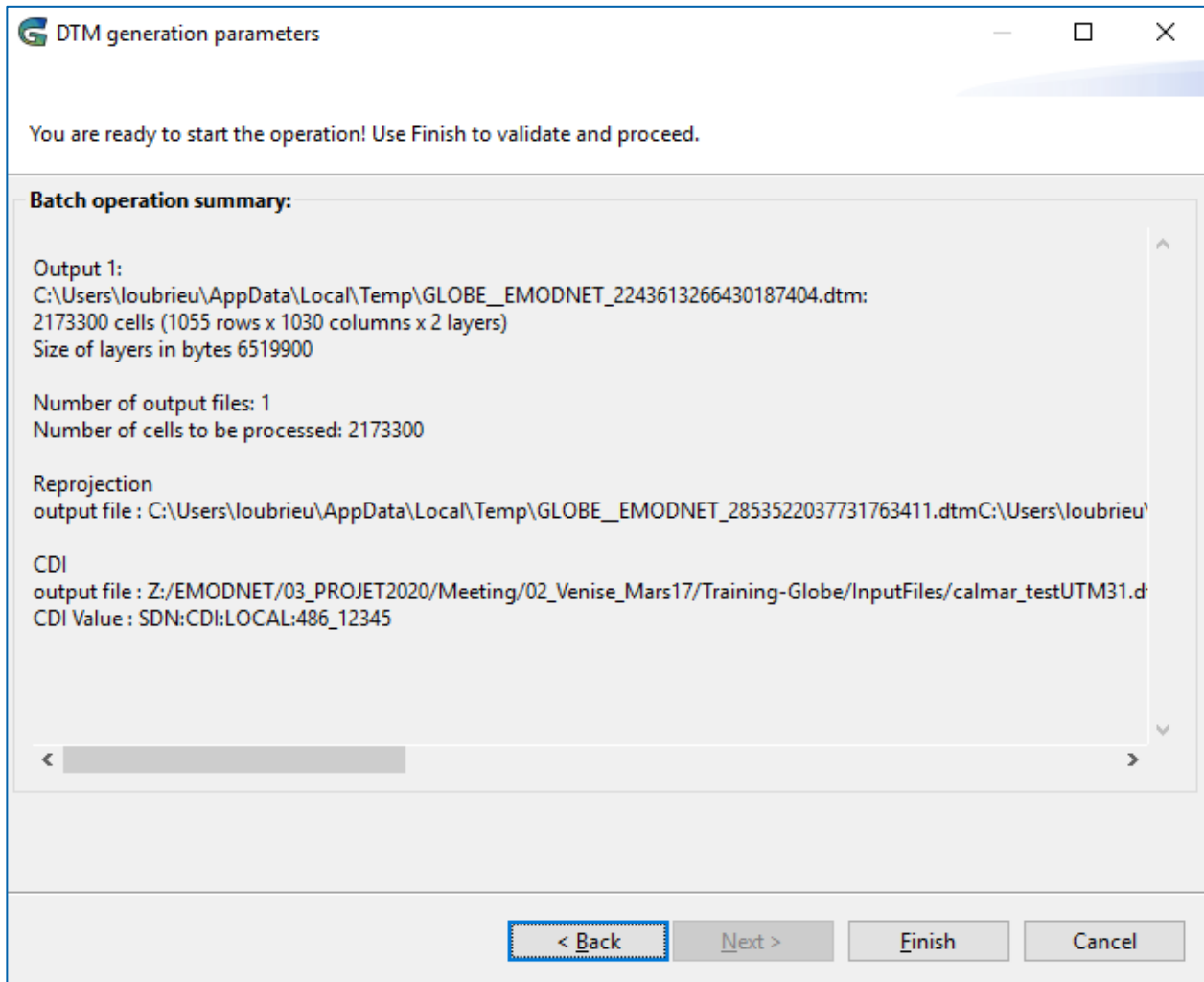
South latitude: N 41 54.000

East longitude: E 004 37.000

Expand to an integer number of angle minutes

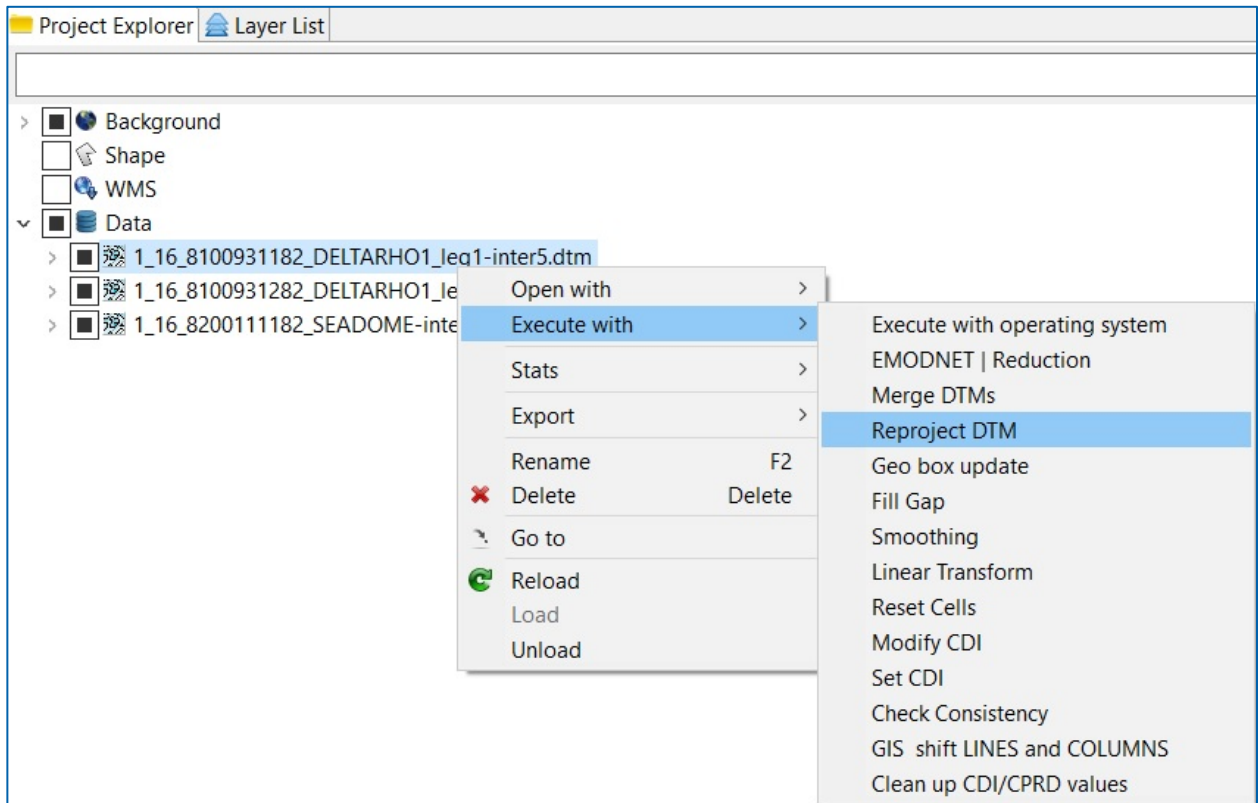
Finest layer size (row x col) : 1055 x 1030

< Back Next > Finish Cancel



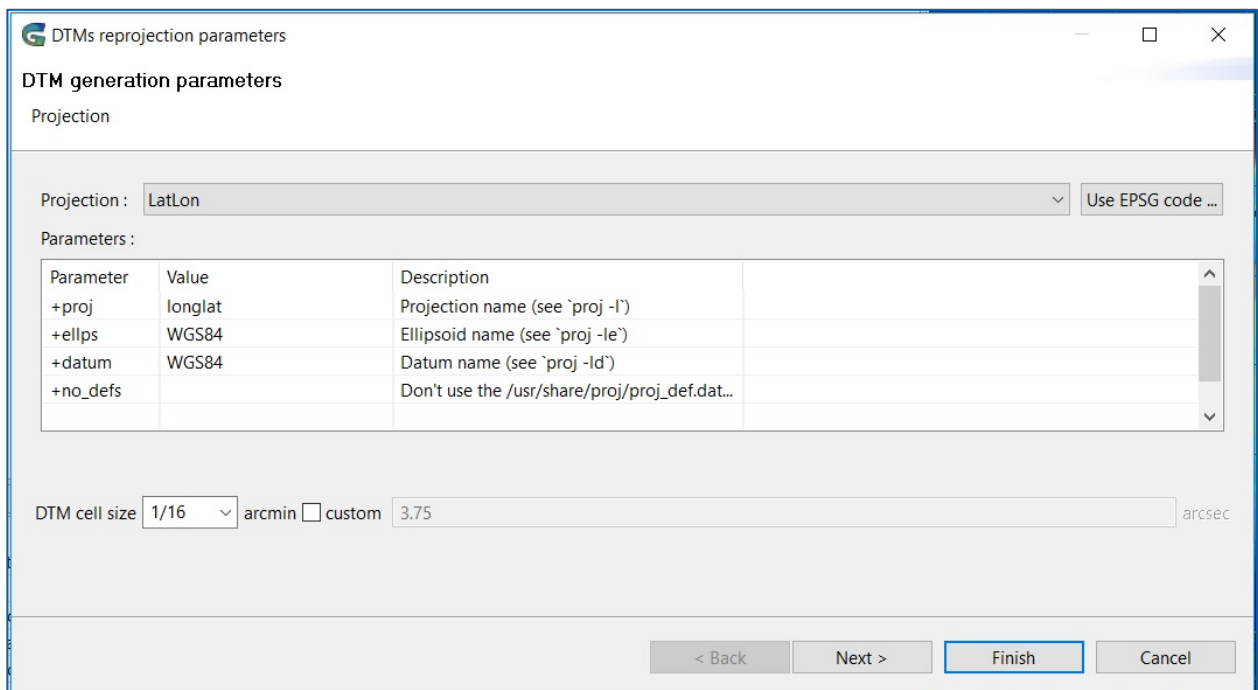
Reproject DTM

The following windows have to be filled in.

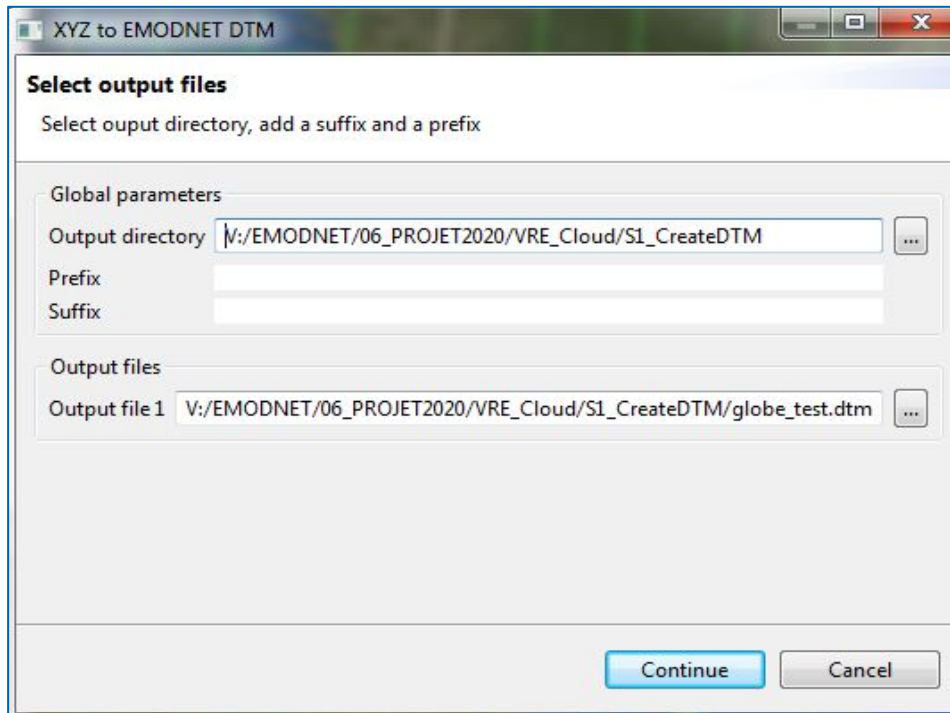


First parameters windows: DTM generation parameters

Here the projection and cell size of the output DTM are defined.



Second parameters windows: name of the output file



Next window is to define the geographical boundaries of the new DTM. Choose options "Redefine geographic bounds" and "Expand to an integer number of angle minutes". With both options, the grid will fit with the EMODnet grid characteristics.

