



EMODnet Bathymetry

Work performed for the GLOBE software

Technical Report

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1 Introduction

The GLOBE software tool is used by data providers in the consortium and external for processing and pre-gridding of their survey data sets or possible composite DTMs. The GLOBE software can deal with different data types such as multibeam or single beam surveys, seismic surveys, etc. and provides support for seafloor mapping (elevation, backscatter, gridded, 4D data, water column echoes, rasters and grids). The GLOBE software can handle data in NetCDF (CF), standard grids and sensor acquisition formats and after processing can make products compliant for WMS, GoogleEarth, and GIS.

In the EMODnet process, the GLOBE software is also used by each of the regional coordinators to review all available data sources and to produce the regional DTM for their region in EMODnet specifications, also performing QA-QC activities.

GLOBE also includes a 3D viewer on the basis of NASA WorldWind which allows displaying data generated for EMODnet and thanks to its 3D capacities spotting possible anomalies. IFREMER provides full support for the software and during the ongoing projects based upon feedback of data providers and regional coordinators.

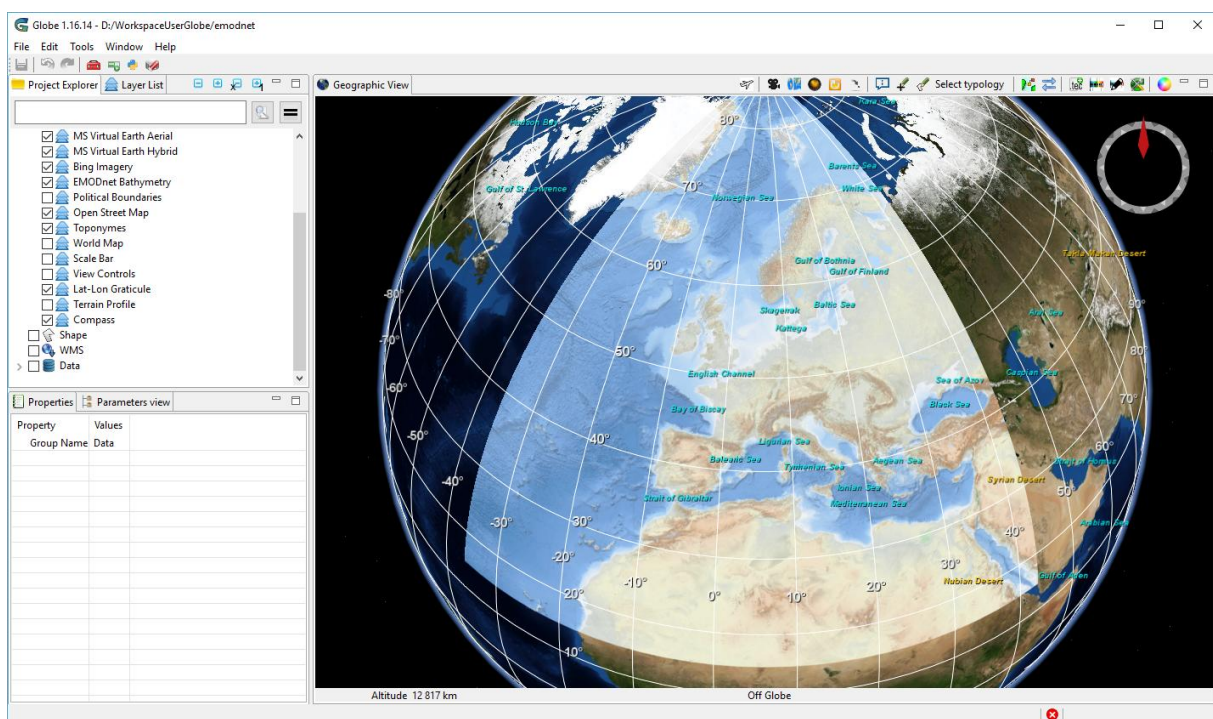


Figure 1 Globe software with EMODnet background

2 Period 2019-2020

For EMODnet bathymetry the GLOBE software has developed in the past years a set of tools allowing to manipulate bathymetry digital terrain models. Those tools allow data producers and regional coordinators to correct, to set metadata like CDI, to compute QA/QC information and to merge datasets. All the tooling proposed by GLOBE was based on a historical NetCDF 3 digital terrain model file format (.dtm). And this .dtm file format suffered from several limitations:

- It uses a scale factor to compress data and resolution in bathymetry depending on minimum and maximum values of terrain model. Due to cumulative effects of the scale factor this became an issue in EMODnet case because of the large expand of the area considered. Resolutions became too degraded especially for near shore areas and the scale factor generates discontinuities between contiguous datasets.
- Technically the NetCDF3 format is limited to a 2Gb size per file. This became an issue too due to the increasing resolution of datasets. For large datasets, data providers had to split their datasets in smaller pieces to respect this limit.
- CF compliance was made several years ago and the .dtm file format was no longer up compliant with the latest CF and SeaDataNet standards.

Because of these architectural limitations, a new NetCDF4 exchange file format was defined for the GLOBE software (.dtm.nc). This format now no longer has the limitations of the older format, brings more capabilities, and is compliant with the latest known CF standards more particularly with GDAL which is used by most of the geographic tools.

The change in the GLOBE's core datamodel format implied to rewrite deeply most of the tools and algorithms in the software. Instead of modifying the existing algorithms, IFREMER's GLOBE team rewrote all the processing tools in python. The choice of python in a set of independent modules aims to ease exchange and contribution inside and outside the EMODnet project and this development model allows their use outside of GLOBE in a web service or cloud like environment for example.

These modules are available as a separate project from GLOBE and are downloadable under an LGPLv3 licence here: <https://gitlab.ifremer.fr/fleet/pyat>

All of the processing algorithm needed by EMODnet have been coded in python and based on the new NetCDF4 file format (.dtm.nc). Integration in GLOBE now enables regional

coordinators to work seamlessly with the new processes as they used to do in the previous version of the software.

This new version was developed, tested and validated by IFREMER and by the end delivered to the group of regional coordinators in March 2020. The regional coordinators used this set of tools to compute and combine their datasets.

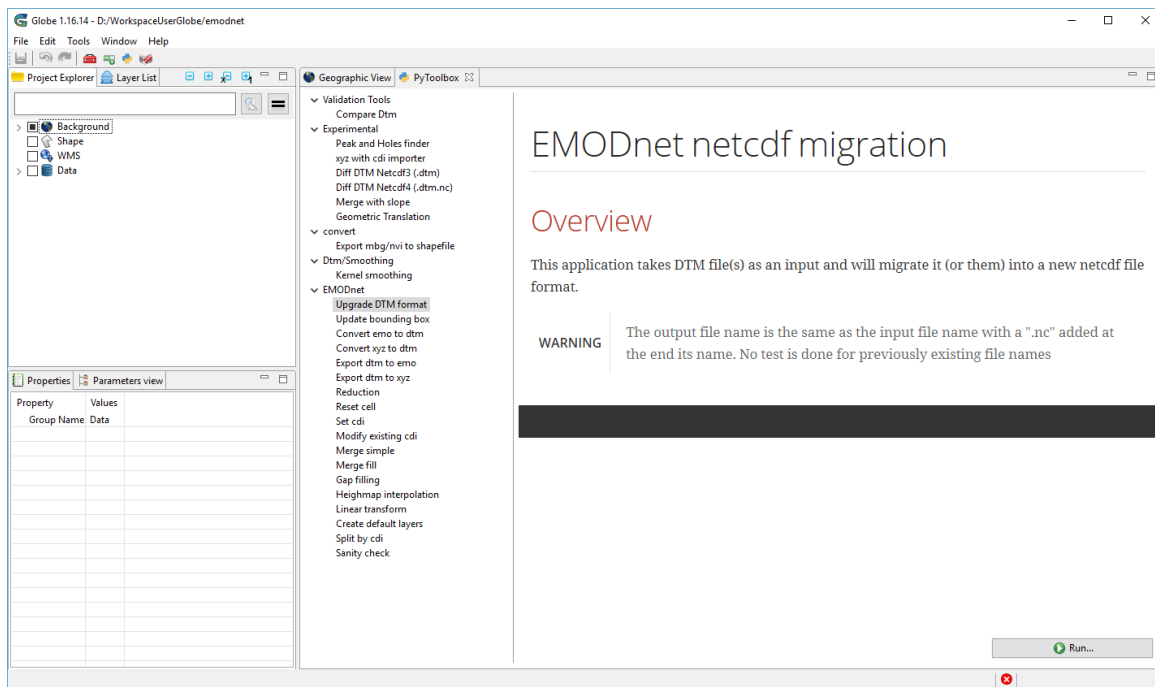


Figure 2 EMODnet new python toolset

In complement to porting of the classical algorithms, the following new functionalities were implemented and added to GLOBE to improve the EMODnet workflow:

- A migration tool that allows regional coordinator to migrate from NetCDF 3 to NetCDF 4 format in order to create the compilation products from DTM generated by data providers in the latest GLOBE file format.
- A history field indicating the process applied to the DTMs.
- As a new functionality, GLOBE also integrates Coronis interpolation algorithms (see below), some changes have been made to integrate smoothly in GLOBE and allow either re-process interpolated data or use the algorithm as a fill gap method.
- A peak and hole finder, which is a prototype of tools helping coordinators in finding outliers in their datasets.
- A tools computing differences in datasets for QA/QC inspection.
- A smoothing tool, based on kernel convolution.

3 Period 2021-2022

The deployment of the GLOBE version to handle the new NetCDF4 DTM format with all processes recoded in Python in 2020 has been followed by a support and maintenance period with few improvements and new developments.

In September 2021, IFREMER introduced a new version to the regional coordinators with several new features:

- Generation of DTM has been improved (import from GeoTIFF or gridded data)
- New tool 'Merge with slope': merge with smoothing between DTMs
- 'Peak and Hole finder' & 'Compare DTMs': finalization of tools and new parameter to specify an area of interest
- CDI tools improvement (sort CDI list in "Modify CDI", enables "Reset Cell" in all data except a selected CDI, set CDI in a specific area...)

In 2022, developments have been focused on various topics:

- Refactoring of DTM/GeoTIFF display to get more realistic shading and avoid artefacts on border cells.
- An experimental process to perform automatic data processing (for Norway)
- New 'Set interpolated' process to mark DTM cells as interpolated
- 'SanityCheck': new cdi_interpolation option to get nearest CDI on interpolated cells
- New 'Geobox shrink' process: takes DTM file(s) and shrink the geographical box. The resulting geographic area can be scaled to a full minute of angle or full spatial resolution.

The effort to integrate Coronis interpolation tools was continued : GLOBE has been upgraded with the latest developments and the handling of interpolation layer has been added.

The GLOBE 2022 version (1.21.0), with all these features, has been shared with EMODnet users during the December 2022 meeting at Monaco.

At the end of 2022, new tools have been developed to analyse and compute statistics from DTMs.

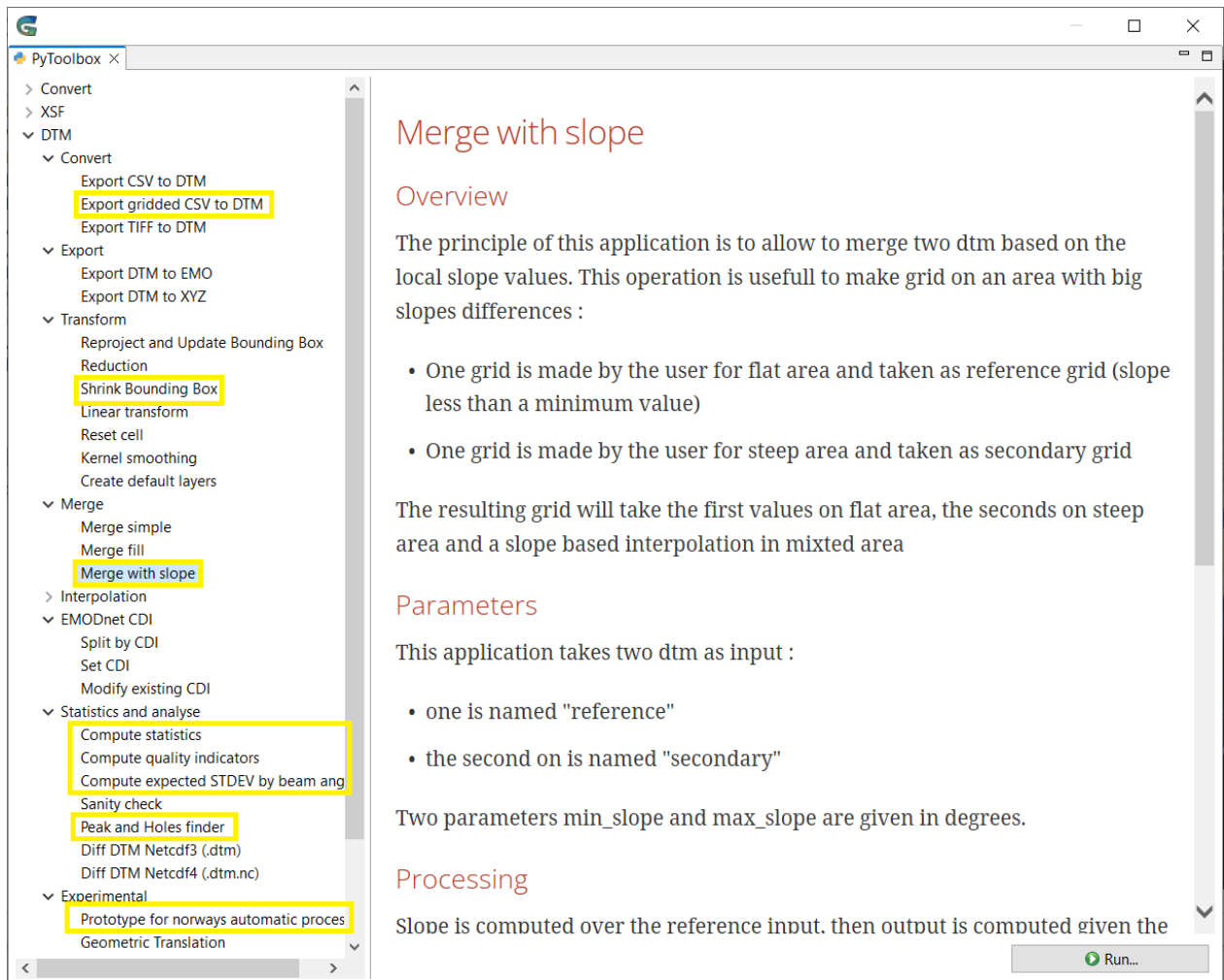


Figure 3 : PyToolbox 2022 with new processes