

Preliminary results on the 3D voxel model of the subsurface of the Belgian Continental Shelf

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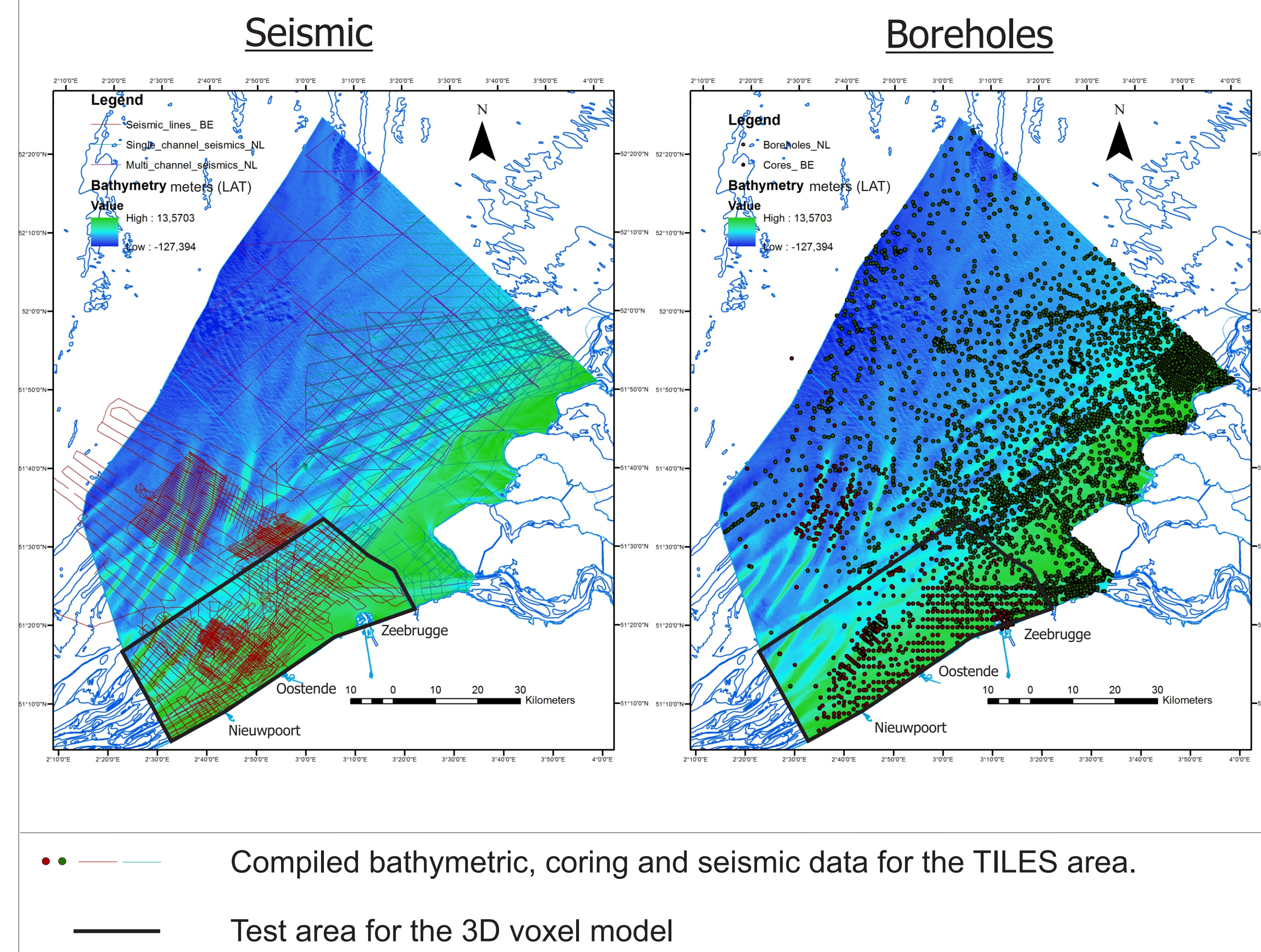
1. Introduction

The Belgian Continental Shelf (BCS) until recently regarded as one of the most well-studied geological areas of the North Sea has more to show than originally thought. Buried valleys, deltaic settings, tidal channels, and erosional surfaces provide a challenging environment for 3D modelling of the subsurface.

Within the frame of the Belspo Brain-be project TILES (Transnational and Integrated Long-term Marine Exploitation Strategies), a transnational, harmonized geological knowledge database will be developed as a platform for the exchange of resource-related data information and knowledge data base. The main feature of the project will be a 3D geological voxel model that will parameterise the above (Voxel = volume block). The borehole and 2D seismic database of Belgium and the Netherlands were combined to create the geological scheme.

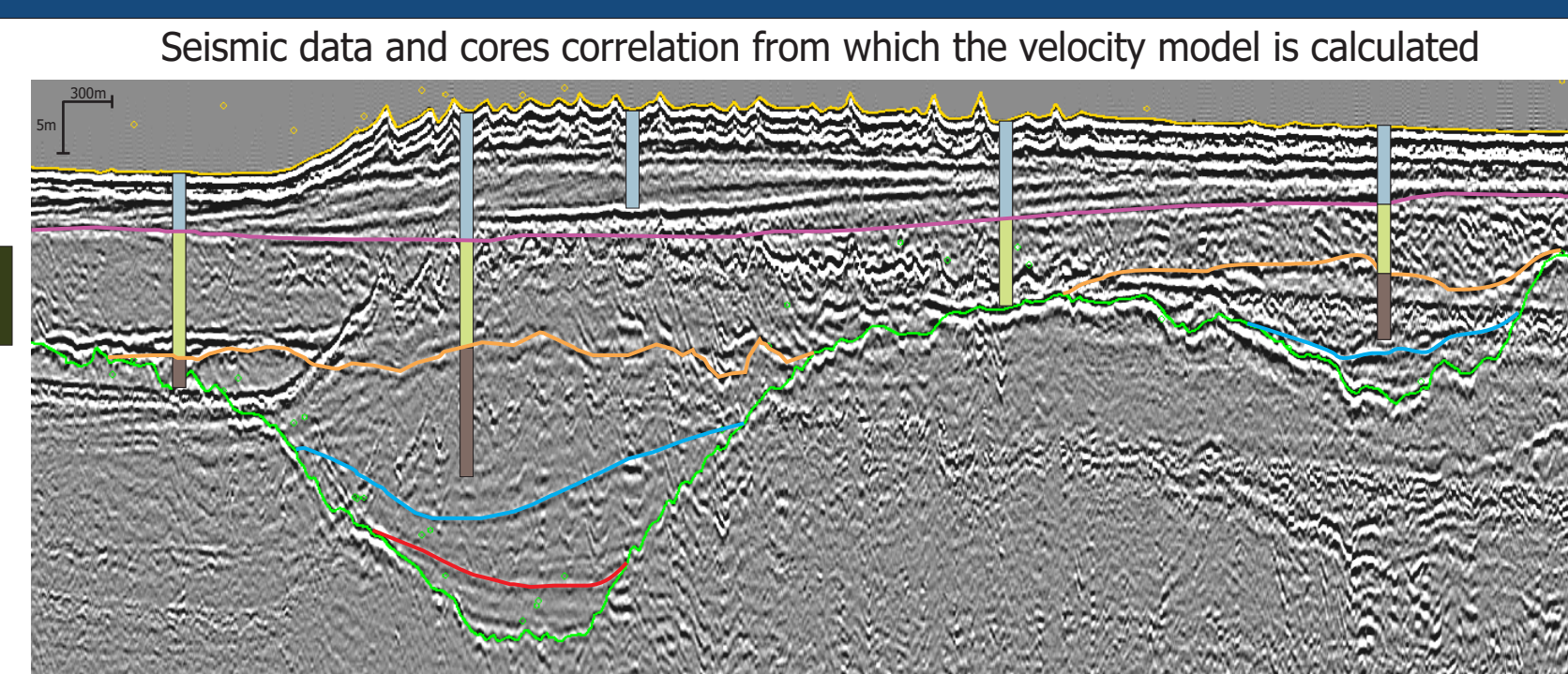
The test area to start the 3D modeling was chosen in view of a dense coverage (horizontal and vertical) of seismic and borehole data.

2. Data



3. Method

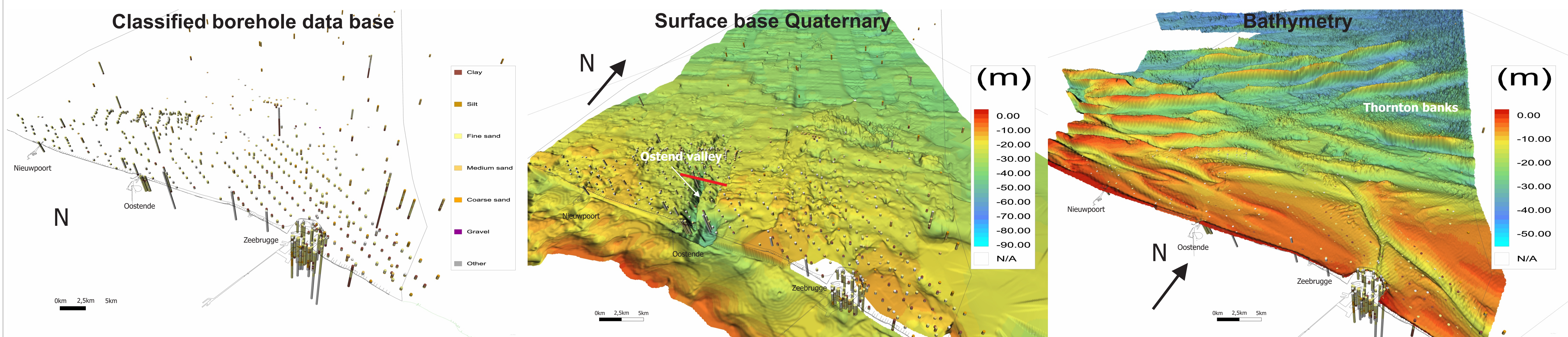
In order to create the 3D voxel model a unified borehole lithology and 2d bounding surfaces determining lithostratigraphical units had to be constructed. All Belgian coring and sediment data were standardized following European guidelines (defined in EU-FP7 project Geo-Seas). For the subsurface seismo- and lithostratigraphy of the BCS, the available geological layer model of Mathys (2009) was re-interpreted using Kingdom Software and integrating the borehole data. Using the dynamic depth conversion, an average velocity model was calculated using the depth from the boreholes in order to determine the depth of the interpreted horizons.



The base bounding surface for the model is the buried landscape (base of the Quaternary) that was formed by a series of geological processes over a period of 2.58 million years. This base Quaternary surface contains important landscape elements such as valleys, plateaus, slopes and more.

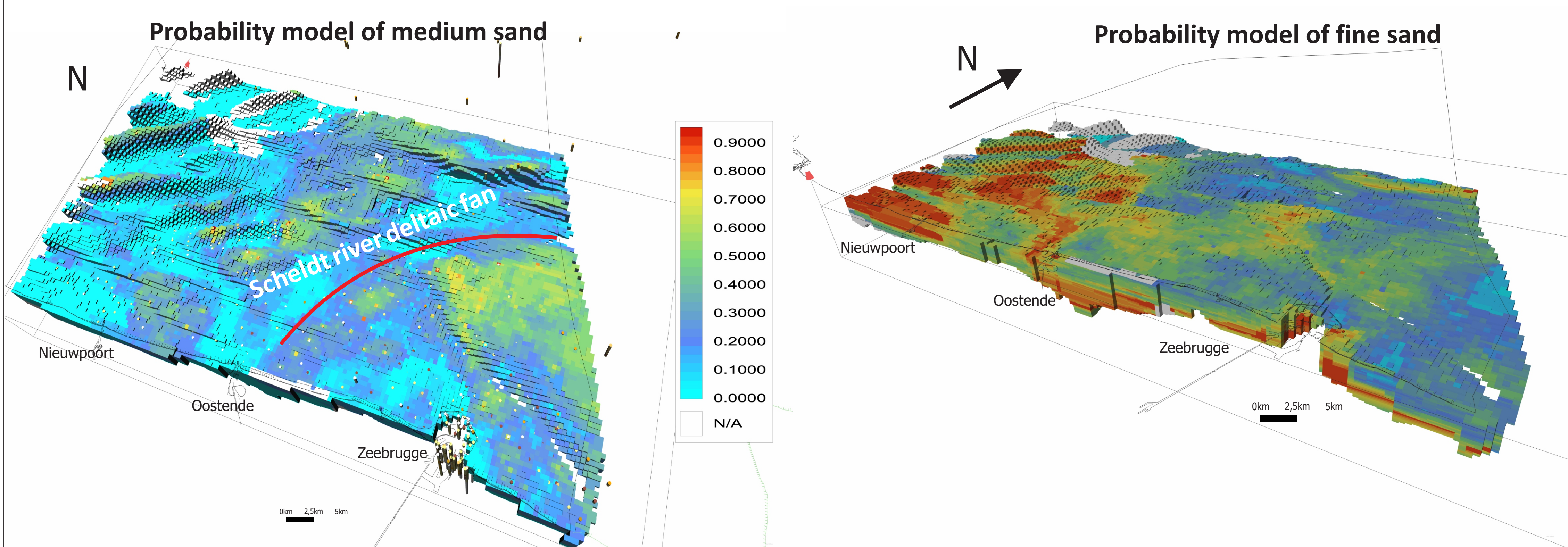
The top bounding surface for the model is the bathymetry map combining data from Belgium and the Netherlands. Both grids were merged and resampled at a 20x20 m grid resolution.

The surface and borehole data were interpolated using ISATIS (Co-kriging) in order to create the voxel model. For the test phase the resolution of the voxels is 400m X 400m X 1m.



4. Results

Each voxel describes either a lithological feature (fine sand, gravel, etc.) or, in this case, the occurrence probability of it (see figure below). Results clearly show the outline of the deltaic fan of the Scheldt river which is extending in front of the port of Zeebrugge almost till Ostende and consists mostly of medium sand (left figure). Although in general most of the fine sand sediments can be found in the sand banks, the probability model verified the presence of fine sand in deeper areas like in the Ostend Valley and Zeebrugge port area (right figure).



5. Discussion

- Different voxel resolutions may highlight or hide features of bigger or smaller dimensions.
- Different approach on the statistical analysis (voxel size, neighborhood, calculation method,) can affect areas without data in the model.
- Onshore boreholes will be used to create a more correct land-sea transition of the grid.
- In order to tackle the non-uniformity of the data and low/no coverage areas an uncertainty model will be calculated.
- The resulting preliminary model can be used to determine resources (i.e. sand/gravel) volumes, availability, usability and their sustainable exploitation.

Referenties:

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