



## Investigations on artificial Sandbanks in the Mouth of the Elbe Estuary for Mitigation of Tidal Energy

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The Tidal Elbe River is the artery of the whole region and functions as an important federal waterway. About four million people live in the metropolitan region of Hamburg in an area of approximately 19.000 km<sup>2</sup>. However, the influence of the Tidal Elbe River extends far beyond this area. The Port of Hamburg is an international hub. It is the largest port in Germany and the second largest in Europe. Together with the other Elbe seaports of Lower Saxony and Schleswig-Holstein the Port of Hamburg is the biggest employer of Northern Germany and as such is indispensably linked to the economic development of Hamburg, Schleswig-Holstein, Lower Saxony and beyond.

Scientific results and the observations of the people in this region unfortunately indicate an unfavourable hydromorphological evolution of this essential artery. In a natural estuary the meandering channels and varying bed forms tend to damp down tidal energy but man-made changes together with evolutionary processes have removed this ability so that the flood tide comes in with more tidal energy. Within a seventh EU research framework programme project, called THESEUS, investigations on artificial sandbanks in the mouth of the Elbe estuary for mitigation of tidal energy should be worked out.

The (re)generation of offshore sandbanks represents one option to reduce the above described increase of incoming tidal energy. In the THESEUS project the efficiency and stability of such sandbanks is analyzed by means of a high resolution 3 dimensional hydrodynamical model TRIM (Cheng, R.T., Casulli, V., and Gartner, J. W.; Tidal, residual, intertidal mudflat TRIM model with applications to San Francisco Bay; Estuarine, Coastal Shelf Science, Vol. 36, pp. 235-280).

In its present version the TRIM model is a parallel finite difference model which calculates the water levels and current velocities as well as the transport of dissolved constituents on a rectangular grid. For the Elbe Estuary a spatial resolution of 50 meters will be used, which allows the investigation of the effects of the coastal structures in the mouth of the Elbe on the currents and water levels in the inner estuary, e.g. the port of Hamburg.

Moreover results of wave simulations are used to get a sustainable design of the artificial sandbanks. All numerical simulations are carried out under various scenarios and boundary conditions, including storm surge conditions and climate change options.

The final paper will give a short report on the work of the THESEUS project, it will show first design studies for the artificial sandbanks and will hopefully give first results of the numerical models.