



## **The influence of sea floor drag on tidal amplitude and phase in the eastern parts of the North Sea**

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The sensitivity of the North Sea tidal pattern to variations in bathymetry and bottom drag is studied for simulations using a barotropic setup of the circulation model GETM (General Estuarine Transport Model, Bolding and Burchard 2008, see <http://getm.eu/>). The model was forced on its lateral boundaries only in the form of the principal lunar component M2 estimated from altimetry (O. Andersen 1995, see <http://spacecenter.dk/data/>).

The model has been tuned to match observations by application of small successive modifications. In the eastern regions of the North Sea, a reduction of the bottom roughness parameter  $z_0$  from 0.01m to 0.001m yields a significant enhancement of the M2 tidal amplitude in the German Bight, while in Skagerrak and Kattegat the M2 phase is delayed by approximately one hour, and the amplitude here is slightly decreased. In the western regions of the North Sea, changes of bathymetry mean depth have been pre-computed based on simple linear shallow-water theory, and expected shifts of phase of the tidal wave have been obtained.

The results have been applied to a pre-operational setup of GETM thereby increasing the forecasting skill in the Danish waters. Subsequently, the customised model setup has been implemented for operational use at RDANH for computation of oceanographic forecasts in the North Sea - Baltic Sea coupled system (see <http://www.frv.dk/en/ifm/index.htm>) to increase safety at sea in Danish waters.