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Development of an OPerational Tide Model for the ELbe Estuary-OPTEL

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The German river Elbe and especially the part of the Elbe which is influenced by the tide, is an important fairway for container ships. Due to the tidal influence ships coming from the North Sea to the port of Hamburg need a permanent and precise prediction of the water level within the next hours.
Moreover, the population of Greater Hamburg is increasing permanently and storm surge protection is an important task.
During extreme events such as storm surges, very high or very low fresh water discharges to the Elbe, the detailed prediction in space and time of water levels and currents is most important and a challenge for operational predictions. Storm surge predictions for 2006/2007 showed, that there is still need for improvements.
In order to develop an operational model of the Elbe Estuary the 3D hydrodynamic numerical model UnTRIM is used [1]. UnTRIM solves the shallow water equations on an unstructured orthogonal grid [2, 3] that allows an efficient handling of complex bank and coast lines.
The boundary values forcing the model are the wind over the estuary, the fresh water discharge to the Elbe river, and water level and salinity at the boundary to the North Sea.
The model is embedded in an operational prediction system. The wind forcing is derived from forecasts of the COSMO-EU weather model [4] of the German Meteorological Service (DWD). Salinity and water levels at the boundary to the North Sea are taken from forecasts of the Operational Circulation Model of the Federal Maritime and Hydrographic Agency (BSH) [5].
The presentation will discuss modelled water levels for a very high fresh water discharge and a storm surge in comparison with observations along the Elbe Estuary.

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Literature:

[1] BAW (2004): Mathematical Model UnTRIM – Validation Document http://www.baw.de/vip/abteilungen/wbk/Methoden/hnm/untrim/PDF/vd-untrim-2004.pdf

[2] Casulli,V. and Walters, R.A. (2000): An Unstructured Grid, Three-Dimensional Model based on Shallow Water Equations, Int. J. Num. Methods in Fluids, Vol. 32, pp. 331-348

[3] Casulli,V. and Zanolli,P. (2005): High Resolution Methods for Multidimensional Advection-Diffusion Problems in Free-Surface Hydrodynamics, Ocean Modelling, Vol.10, No 1-2, pp.137-151

[4] http://www.cosmo-model.org/content/tasks/operational/dwd/default_eu.htm

[5] http://www.bsh.de/en/index.jsp