

Development of a Model based Monitoring of the Elbe Estuary

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Introduction: Observed rising dredging amounts at the Elbe estuary in the last years, have put back the scientific focus on the basic transport processes of sediments, suspended material and the morphological behavior of the bottom zone of the tidal river Elbe and their natural and anthropogenic influences.

For instance the dredging amounts of the Hamburg Port Authority have been doubled from ~4 Mio. m³ in 2002/2003 to ~8 Mio. m³ in 2004/2005 and the focus dredging areas of the Federal Administration for Waterways and Navigation have been moved more upstream in direction Hamburg during the same time period. Therefore more dredging capacities are necessary, the average haul distance between the dredging and open water disposal site have been increased and more ecological tests have to be carried out.

Concept: To overwhelm the gaps in the knowledge of the real sediment transport mechanism in the Elbe estuary, a model based monitoring should be developed to ensure a sustainable sediment and dredging management of the involved authorities, which have to maintain the navigation channels of the Elbe and the harbor basins of Hamburg.

Therefore different organizations like the Federal Waterways Engineering and Research Institute (BAW Hamburg), the Federal Institute for Hydrology (BfG Koblenz), the Institute for Coastal Research of the GKSS Research Centre (GKSS Geesthacht) as well as the Federal Administration for Waterways and Navigation (WSA Hamburg and Cuxhaven) and the Hamburg Port Authority (HPA Hamburg) will coordinate their nature measurements at the Elbe. Prospectively they will develop the same analyzing and interpretation mechanisms on basis of different hydro numerical models. The main objectives of this coordinate scientific analyzing and measuring concept are to identify gaps in today monitoring concepts, to get a more model based orientation of the nature measurements and to realize a more economic and near process operation of all measuring devices. Moreover a new operational hydro- and morphodynamic 3d model should be developed by using data assimilation techniques from meteorological models to build up a more precise decision support tool, which should support the maintenance dredging decision processes and works.

Figure 1 shows the different working groups, which were founded to work out and layout the above described model based monitoring concept.

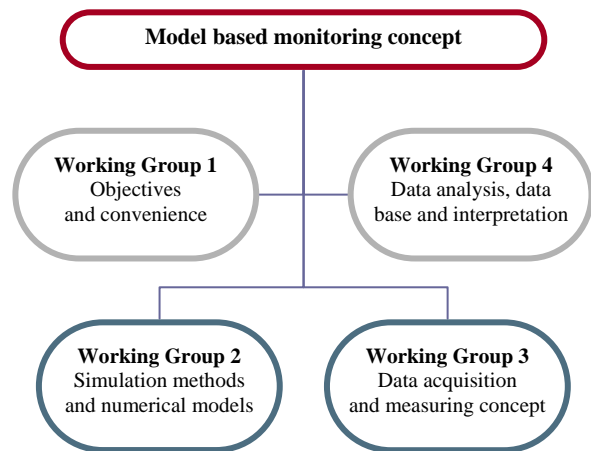


Fig. 1: Working groups and layout of the model based monitoring concept.

Methods: The first concrete step to introduce the model based monitoring concept will be a coordinated measuring campaign of all partners. Therefore the water turbidity should be measured on a long term run at several measuring points within the German bight and the Elbe estuary up to Hamburg. In this case the type of the measuring devices, the installation type (buoy or pole), the calibration techniques, the data management and the analysis and interpretation methods were discussed together and will be tested.

To ensure a consistent approach of a model based monitoring and to be certain that all developed methods match the state-of-the-art of science and technology, the German Branch of DHI Water - Environment - Health was involved for coordinating and structuring all topics, working groups and decision processes.

References: [1] Stoschek, O., Larsen, O., Ohle, N. and Entelmann, I. (2008) Monitoring von Sediment- und Schwebstofftransport in der Tideelbe 5. Rostocker Baggergutseminar, 24. – 25. Sep. 2008, University of Rostock;