



## Storm Surges in the Elbe Estuary - Analysis and Sensitivity Study

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Due to changing climatic conditions several parameters influencing water levels during storm surges are expected to change. In order to find a strategy for adaption to climate change it is important to understand today's situation and analyse the future situation under the influence of climate change. This concept will be presented by looking into storm surges in the Elbe estuary which hosts the waterway from the North Sea to the port of Hamburg. These investigations are embedded in the scientific joint venture programmes KLIWAS and KLIMZUG Nord.

Using a hydrodynamical numerical model (UNTRIM, V. Casulli and R. A. Walters (2000)) to calculate water levels and currents in the Elbe and a meteorological model (MKW, H. Schmidt und J. Pätsch (1992)) to provide the local wind field over the Elbe allows not only to understand historical storm surges but also to investigate probable future storm surge scenarios. Two historical storm surges with different characteristics are the basis of the sensitivity study:

- the storm surge of January 3rd 1976 which caused the highest observed water levels along the Elbe estuary and
- the storm surge of January 28th 1994 which had a high fresh water discharge.

The development and intensity of a storm surge in the Elbe estuary is determined by the water level at the boundary to the North Sea, the river runoff into the estuary and the wind field over the estuary. Based on a sensitivity study the influence of

- sea level changes in the North Sea,
- increase / decrease of river runoff into the estuary, and
- increase / decrease of the local wind over the estuary

on the highest water level along the Elbe estuary during storm surge are analysed. The parameters mentioned are varied according to the knowledge about expected changes in a future climate.

The aim of this investigation is to get a better understanding of the probable changes of water levels during storm surges along the Elbe estuary depending on parameters that might change in a future climate. The results will help to identify vulnerabilities of e.g. the shore protection along the Elbe estuary and give us a chance to work on adaption and risk mitigation necessitated under possible climate change.

Casulli, V. and Walters, R. A. (2000). An unstructured, three dimensional model based on the shallow water equations. *International Journal for Numerical Methods in Fluids*, 32, S.331 – 348.

Schmidt, H. und Pätsch, J. (1992). Meteorologische Messungen auf Norderney und Modellrechnungen. *Die Küste*, 54, S. 131 – 142.