



## **Sensitivity of sediment contamination in the Elbe Estuary to climate change**

Carmen Kleisinger, Holger Haase, Uwe Hentschke, and Birgit Schubert  
Federal Institute of Hydrology, 56068 Koblenz, Germany (kleisinger@bafg.de)

As a result of the projected climate-induced changes of temperature and precipitation (IPCC, 2007), an increase of the frequency and intensity of extreme events such as floods, storm surges or of extended periods of low river discharge is to be expected. An increase of flood events would result in an additional input of contaminated sediments from the inland. Contaminated particles will be transported along the rivers to the estuaries and consequently, a deterioration of the quality of estuarine particulate matter may occur. In addition, a sea level rise is predicted to occur along with global warming. In case of sea level rise or more frequent low river discharge situations, the upstream transport of slightly contaminated sediments of marine origin may be intensified, and cause decreasing concentrations of contaminants in particulate matter. The contamination of particulate matter plays an important role for the ecological quality of water bodies and has accordingly to be taken into account in the sediment management of navigable waters.

This study focuses on the assessment of potential climate-induced and other man-made changes of particle-bound contaminant concentrations in the estuary of the river Elbe and the resulting challenges for sediment management in this navigable waterway. The estimation of climate-induced changes of contaminant concentrations in estuarine particulate matter was based on results of projections on the fluvial particulate matter input into the Elbe estuary in the near (2021-2050) and far future (2071-2100) and on assumed extreme changes of such inputs. A mixing model using the concentrations of selected contaminants as indicators for marine and fluvial particulate matter was applied. Distinct changes of contaminant concentrations were found only for the far future and with the assumed extreme particulate matter inputs in the inner Elbe estuary.

The worst-case scenario indicated that concentrations of some organochlorine contaminants in the far future exceed the national assessment criteria for the handling of dredged material within coastal waterways more distinct than today. Therefore, adaptations of practices for the management of dredged material to higher particulate matter contaminations should be considered there in the medium or long-term perspective. On the one hand, e.g. the practices of depositing dredged- material within the water system might be adapted (BfG 2014). On the other hand, the implementation of remediation measures like those planned under the Water Framework Directive could mitigate the climate-induced increase of contaminants. However, before the planning of adaption measures begins, the respectively prevailing contamination status should be verified, as climate-induced changes of contaminant concentrations might be superimposed by direct anthropogenic activities, e.g. remediation measures to reduce contamination or construction works in waterways.

### Literature:

BfG - Bundesanstalt für Gewässerkunde (2014) Sedimentmanagement Tideelbe - Strategien und Potenziale - Systemstudie II. Ökologische Auswirkungen der Unterbringung von Feinmaterial. Band 1, Endbericht. Im Auftrag des Wasser- und Schifffahrtsamtes Hamburg. Bundesanstalt für Gewässerkunde, Koblenz, BfG-Bericht 1763  
IPCC (2007) Climate Change 2007 The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.