

EGU21-9498, updated on 03 Dec 2022

<https://doi.org/10.5194/egusphere-egu21-9498>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Effects of mean sea level rise and tidal flat growth on tides and storm surge events in the Elbe estuary

Tara Mahavadi, Elisabeth Rudolph, Rita Seiffert, and Norbert Winkel

Federal Waterways Engineering and Research Institute, Hydraulic Engineering in Coastal Areas, Germany

Future mean sea level rise will influence tidal dynamics and storm surge events in estuaries. The bathymetry in estuaries and coastal areas will also be affected by mean sea level rise, since it is in a morphodynamic equilibrium with hydrodynamic forces. Tidal flats, which are an important component of coastal protection, will grow to a certain extent with mean sea level rise in case of sufficient sediment availability.

With the help of a highly resolved hydrodynamic-numerical model of the German Bight (North Sea), we analyse the potential influence of mean sea level rise and vertical growth of tidal flats on tidal dynamics and storm surge events in the Elbe estuary.

The results show an increase of tidal amplitude and storm surge water levels due to mean sea level rise. A bathymetric rise of tidal flats in the German Bight and the mouth of the Elbe estuary leads to a decrease in storm surge water level and tidal amplitude compared to the scenario with sole mean sea level rise without a change in bathymetry. Further analyses show, how geometric parameters of the Elbe estuary are changing due to mean sea level rise and tidal flat growth. These changes in geometry influence tidal dynamics and can therefore be an explanation for the observed changes in tidal amplitude and storm surge water levels.

These findings enable a better understanding of future changes in the Elbe estuary and support coastal managers in decision making processes concerning adaptation options to reduce the impacts of climate change.