



A comparison of observed extreme water levels at the German Bight elaborated through an extreme value analysis (EVA) with extremes derived from a regionally coupled ocean-atmospheric climate model (MPI-OM)

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As a consequence of climate change atmospheric and oceanographic extremes and their potential impacts on coastal regions are of growing concern for governmental authorities responsible for the transportation infrastructure. Highest risks for shipping as well as for rail and road traffic originate from combined effects of extremes of storm surges and heavy rainfall which sometimes lead to insufficient dewatering of inland waterways. The German Ministry of Transport and digital Infrastructure therefore has tasked its Network of Experts to investigate the possible evolutions of extreme threats for low lands and especially for Kiel Canal, which is an important shortcut for shipping between the North and Baltic Seas. In this study we present results of a comparison of an Extreme Value Analysis (EVA) carried out on gauge observations and values derived from a coupled Regional Ocean-Atmosphere Climate Model (MPI-OM).

High water levels at the coasts of the North and Baltic Seas are one of the most important hazards which increase the risk of flooding of the low-lying land and prevents such areas from an adequate dewatering. In this study changes in the intensity (magnitude of the extremes) and duration of extreme water levels (above a selected threshold) are investigated for several gauge stations with data partly reaching back to 1843. Different methods are used for the extreme value statistics, (1) a stationary general Pareto distribution (GPD) model as well as (2) an instationary statistical model for better reproduction of the impact of climate change. Most gauge stations show an increase of the mean water level of about 1-2 mm/year, with a stronger increase of the highest water levels and a decrease (or lower increase) of the lowest water levels. Also, the duration of possible dewatering time intervals for the Kiel-Canal was analysed.

The results for the historical gauge station observations are compared to the statistics of modelled water levels from the coupled atmosphere-ocean climate model MPI-OM for the time interval from 1951 to 2000. We demonstrate that for high water levels the observations and MPI-OM results are in good agreement, and we provide an estimate on the decreasing dewatering potential for Kiel Canal until the end of the 21st century.