



Sea state projections for the North Sea: Impact of climate change on very high waves?

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Abstract

The research program KLIWAS of the German Federal Ministry of Transport, Building and urban Development investigates the impacts of climate change on waterways and navigation and provides options for adaptations. One aspect of the research task is to analyse climate scenarios for the sea state, eg. Sea wave height (SWH), wave direction and wave periods for the North Sea. Of particular importance for the safety on waterways is the potential change of frequency and magnitude from severe waves. The scenarios together with the wave climate of the recent years will give an approximation of projected changes of the sea state in coastal and open sea areas.

Here we show the results for projected changes of medium, high and very high waves in the North Sea for the period 2000-2100 in comparison to 1961-2000, based on the wave model WAM4.5.3 The wave model is driven with wind data from two different regional atmosphere-ocean-models (DMI-HIRHAM and MPI-REMO) in the scenario A1B. The wind data are delivered in a horizontal resolution of about 20 km and a time resolution of one hour, while the wave model provides data of the calculated sea state with a horizontal grid of 5 km and the time resolution of one hour.

It is seen, that in the eastern North Sea and especially in the German Bight there is a trend to a increasing of the 99th percentile of SWH, while in the western part the 99th percentile of SWH decreases in the future. These changes are mainly caused by changing wind directions in the future, while the wind speed will be mostly unaltered. Supplementary, it was carried out an extrem value analysis with the same data. Although the very high waves (eg. waves with a return period of 1-, 5-, 10-, up to 100 years) displays a similar behavior as the median or 99th percentile, there are regions in the North Sea (eg. the German Bight) with stronger changes of the higher waves. For all wave heights a strong decadal variability is detected which superimposes the calculated trends.