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Modified risk of Storm surges at the German Bight derived from AOGCM scenario simulations

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As Storm surges are one of the major hydro-meteorological hazards in the Northeast-Atlantic and North Sea area, this study concentrates on the diagnosis of changes of the potential risk of occurrence for the German Bight under anthropogenic climate change. Therefore 3 simulations of the state-of-the-art AOGCM ECHAM5-OM1 are investigated, representing a changed climate due to increased greenhouse gas scenario, namely the IPCC SRES A1b.

Storm surges in the German Bight are identified from observations from the tide levels at the station Cuxhaven (1901-2008, in total 167 events). From this data source storm surge events are matched with atmospheric data (ERA40), which again are validated with wind data in hourly resolution from the station Scharhoern (Hamburg Port Authority, available from 1976 to 2009).

As storm surges are produced when a suitable wind direction is prevailing for a sufficient time a link between the local meteorological conditions and the larger scale synoptic conditions can be established via the analysis of the effective wind direction (295 degrees, WNW) and the diagnosis of responsible wind field structures in the reanalysis data set. From this, typical situations can be identified and their existence in coupled climate simulations analysed. As in the climate model simulation no tide calculations are made, only the pure atmospheric influence factors for the occurrence of storm surges can be diagnosed. Thus, for the climate change scenarios only potential meteorological situations will be analysed here. After successful assignment of historical storm surges to identified wind storm events, characteristics of these events were analysed. It turned out that the combination of identified large-scale wind storm events over the North Sea with strong effective wind speeds over the German Bight, is a suitable approach to select potential storm surge events. Comparing the results for nowadays climate with this under SRES A1B assumptions, shows an increase in the frequency of occurrence of potential wind storm events by roughly 20% to the end of this century.