Climate change and North Sea storm surge extremes - an ensemble study (PRUDENCE)

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Possible changes in North Sea storm surge climate are studied in a systematic manner. Following up on previous studies, we use a tide-surge model to derive storm surge climate and extremes from atmospheric conditions under present-day and enhanced greenhouse gas conditions. Results for modeled storm surges obtained by using regional model output from four RCMs, namely CLM (GKSS), RCAO (SMHI), REMO5 (MPI) and HIRHAM (DMI) are presented.

The atmospheric regional simulations were prepared within the EU project PRUDENCE. The research strategy of PRUDENCE is to compare simulations of different regional models (RCMs) driven by the same global control and climate change simulations. These global conditions, representative for 1961-1990 and 2071-2100 were prepared by the Hadley Center based on the IPCC A2 SRES scenario. The effect on windiness of the enhanced greenhouse gas conditions, projected by these four regional climate models was in all cases similar, namely a moderate increase of high wind speeds in most parts of the North Sea during winter.

These simulated surface wind and pressure data have been used to run a storm surge model. We show the expected storm-related changes in different storm surge parameters. For instance, the largest increase of high water levels, defined as the 99.5%ile during winter sampled every half hour would have to be expected along the southern and eastern North Sea coast, with maximum values of around 30 cm, which is beyond the range of normal year-to-year variations. Similar results can be found for all four experiments. Together with the expected rise of mean water levels of 40 cm by IPCC (2001), the total increase is 70 cm at the end of the 21st century under the assumptions of the rather severe A2 scenario. If an ECHAM-scenario A2 is used, quantitatively similar results are obtained, but in that case there are also significant increases along parts of the UK coast.