

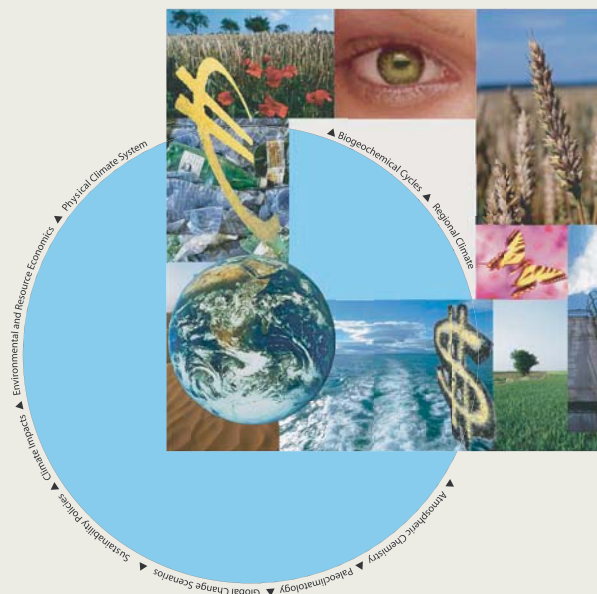


International Max Planck Research School on EARTH SYSTEM MODELLING

Regionalization of global climate change scenarios:
An ensemble study of possible changes in the North
Sea storm surge statistics

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PhD Thesis prepared within the
International Max Planck Research School on
Earth System Modelling



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Abstract

Possible changes in North Sea storm-related water heights due to increasing atmospheric greenhouse gas concentrations have been studied. The main tool is a barotropic tide surge model, which is used to derive storm surge climate from atmospheric conditions. The analysis has been carried out by using several 30-year atmospheric regional simulations under present-day conditions and for possible future atmospheric greenhouse gas concentrations. In addition, a statistical transfer function between a grid box of the tide surge model and the tide gauge in St. Pauli (Hamburg, Germany) has been calculated. This downscaling model has been derived by statistically linking observed high water levels in St. Pauli with hindcasted tide levels of a coastal model grid box. With the help of this transfer function local climate change conditions have been deduced for St. Pauli.

The ensemble of surge projections comprises two groups of experiments, distinguished only by the atmospheric forcing:

- four projections that are based on atmospheric input from four different regional climate models driven by the same General Circulation Model. These projections are all based on the same emission scenario;
- four projections that are based on input from the same Regional Climate Model driven by simulations with two different General Circulation Models under two different emission scenarios.

The different projections provide a range of possible evolutions of surge extremes under changing climate conditions. The differences among these future projections are statistically not significant. The results suggest that under future climate conditions storm surge extremes along the North Sea coast may increase towards the end of the 21st century locally up to 30% (around 30 – 40 cm). Based on the variability of the storm surge reconstruction for the recent decades it is found that this increase is significant (at the 5% level) for most of the continental North Sea coast. The East coast of the UK shows only small and statistically not significant increases in high storm surges.