HIGH RESOLUTION PROJECTIONS OF POSSIBLE FUTURE CHANGES IN NORTH SEA STORM SURGE EXTREMES

Katja Woth 1, Ralf Weisse1, Hans von Storch1
1Institut for Coastal Research, GKSS Research Center, Germany

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Objectives(s)
Possible future changes in North Sea storm-related water level heights due to increasing atmospheric greenhouse gas concentrations were studied by, first, a dynamical modelling approach and, secondly, by a statistical approach. Using different combinations of models and different greenhouse gas emission scenarions, a series of spatially detailed future North Sea water level projections are derived.

Material & Method(s)
The main tool is a barotropic tidesurge model, which is used to simulate storm surge time series from atmospheric weather streams. The analyses were carried out by using several 30-year atmospheric regional simulations under present-day conditions and for possible future atmospheric greenhouse gas concentrations (based on different IPCC emission scenarios). The models return projections with a grid resolution of 10 km, which is too coarse for some applications. To obtain more spatial detail, the projections were regionalized in a further step onto a finer mesh grid size up to about 250 m. This was done by applying a statistical downscaling approach for several coastal regions.

Result(s)
The first part of results, analyzed for the 10 m bathymetry line along the coast line, suggest that under future climate conditions wind-related storm surge extremes along the North Sea coast may increase towards the end of the 21th century locally up to 30 cm. Comparing this with the variability in the storm surge hindcasts for the recent decades this increase is found to be statistically significant (at the 5% level) for most of the continental North Sea coast. Interestingly, the differences between the chosen future projections are statistically not significant.
The statistical downscaling shows a significantly better description of near-shore-line water level variations. In some parts the water level is markedly increased, while in sheltered areas the effect is smaller.

Conclusion(s)
When a realistic modelling of water level heights closed to the shoreline is needed, a spatial resolution of a few hundred meters is advisable. Such high resolution datasets show a realistic projection of water heights in these shallow coastal regions under present climate conditions, which suggests that also our projections are realistic. Thus, our approach provides useful information for local decision maker and stakeholder for the coming 100 years of anthropogenic climate change