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Systematic Assessment of Uncertainty of Downscaled Information on Severe Wind Storms due to Different Influencing Factors

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One of the most promising techniques to estimate information about potential future changes of extra-tropical wind storms and related impacts will make use of dynamical global scale model simulations with state-of-the-art coupled climate models. The global model, although limited in their detailed amount of information on local to regional scales, are expected and partly proofed to simulate the general characteristics of severe extra-tropical storms in a sufficient way to get a first impression on potential synoptic to large scale causing processes. Based on this, different techniques to achieve more regional scale information are applied. This will especially consider the recognition of the importance of extreme events and their representation in downscaled information. One way of achieving high resolute data on extreme wind storms and related damages (and thus related to monetary losses) is the development and application of a specific downscaling approach with tailored high resolution regional model simulations for specific events of interest. This physically-deterministic approach is presented here and will be used to demonstrate the effect of incorporation of different levels of uncertainty arising from different steps of the algorithm to deduce impact relevant information.

Modelling future storm losses requires a highly complex model chain, including the physical modelling of extreme meteorological conditions under future climate conditions as well as the socio-economical modelling of wind induced losses. All steps in the conceptual framework introduce uncertainties which propagate into resulting estimates of losses under potential climate change conditions.

In this study we present a full conceptual model for the estimation of future storm losses, based exemplarily on global simulations with ECHAM5-MPIOM1. Dynamical downscaling of severe storm events is carried out using the regional climate model CCLM and near surface wind speeds are translated into storm-losses using a state-of-the-art storm-loss model developed and maintained at Free-University of Berlin.

Besides the assessment of return characteristics (such as return periods and return levels) of severe winter storms, the main focus of this study lies in the assessment of the uncertainties of these return values introduced by each of the modelling steps of the chain. The sources of uncertainties covered by this study are the well known scenario uncertainty, the initial value uncertainty, the dynamical downscaling uncertainty, the statistical modelling uncertainty, as well as the loss modelling uncertainty. The effects of incorporating these different influencing factors will be quantified and discussed. Estimates of the future risk for losses due to winter storm damages in Germany will be given.