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European winter storm losses in a multi-model ensemble of GCM and RCM simulations

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Loss potentials due to severe winter storms are investigated in simulations with global (GCM) and regional climate models (RCM). RCM simulations were carried out driven by ERA40 reanalysis as well as by GCM scenarios. In total, 5 different GCMs and 11 RCMs from the EU-FP6 project ENSEMBLES are considered; the latter in spatial resolutions of 50km and 25km. There are 2 main objectives in this study: i) validation of calculated losses for the reanalysis period and investigation of the influence of model selection in the ensemble; and ii) estimating a range of potential future changes of storm losses due to anthropogenic climate change.
The calculated losses for the reanalysis period are validated against observed insurance loss data. Most reanalysis-driven RCMs reveal reasonable correlations with observed losses, although correlations for all models are smaller than the correlation of losses calculated from large-scale reanalysis data. If the individual RCMs are combined to a multi-model ensemble, the performance of the ensemble mean is as good as the performance of the best single model. A test of different ways to construct the ensemble has been performed; thus leaving out the weakest models from the ensemble leads to slightly increased correlation values, partly better than the best single model.
Future changes of extreme wind speeds and storm losses are analysed based on GCM and RCM simulations according to the SRES A1B scenario. Most simulations as well as the ensemble mean reveal enhanced extreme wind speeds over northern Central and Western Europe and decreased wind speeds over Southern Europe for the end of the 21st century. As a consequence, also loss potentials are increased over Western and Central Europe. There is increase of annual mean losses and also enhanced annual variability of losses, indicating the relevance of single extreme severe events, partly stronger than what is found in the simulations of recent climate. Over Southern Europe decreased extreme wind speeds and loss potentials are analysed. Patterns of change signals for the middle of the 21st century correspond in general to the signals for the end of this century, although magnitude and also significance is still lower.
There is a considerable spread between the change signals of the individual ensemble members, partly contrary signals are analysed in different models. The downscaling of the large-scale simulations with RCMs increases the range of possible changes. Even RCMs with identical large-scale driving feature partly fundamentally different change signals.