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European storms and their property loss potential under enhanced greenhouse gas concentrations – a global and regional climate model analysis

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Winter storms are an important factor for property losses caused by natural hazards over Europe. The storm series in early 1990 and late 1999 led to enormous economic damages (US-$14.2 bn and $18.5 bn, respectively) and insured claims (US-$9.8 bn and $10.75 bn, respectively). Although significant trends in North Atlantic / European storm activity have not been identified for the last decades, recent studies provide evidence that under anthropogenic climate change the number of extreme storms could increase, whereas the total number of cyclones may be slightly reduced.

In this study, loss potentials derived from an ensemble of global and regional climate models using a simple storm damage regression model under climate change conditions are presented. For the two European regions (United Kingdom and Germany) ensemble-mean storm-related losses are investigated. Based on GCMs the ensemble mean is found to possibly increase by up to 37%. Furthermore, the interannual variability of extreme events will increase leading to a higher risk of extreme storm activity and related losses.

The results from global climate models are well recognised by regional climate models. The analysis of regional climate models from the ENSEMBLES initiative offer the unique opportunity to investigate the damage related wind speeds over a specific, flexible threshold in more horizontal detail. Due to the investigation method it is necessary to deduce the wind–damage-regression from historical (observed) data. Within the context of ENSEMBLES, RCMs has been forced with ECMWF-ERA40, thus providing a high resolution data set for this purpose.

With respect to climate change conditions, the RCM simulations follow the trend of the forcing global model for the occurrence of extreme losses on regional scales. By the application of the damage model to RCMs even extreme events (with respect to occurred damages) are partly better resolved than by the GCM. Thus, leading to even higher interannual variability as deduced from GCMs.