# Abstract

In this project, current climate model simulations were evaluated with regard to the anthropogenically induced change in storm risk for Hesse. This risk was determined by the number of days with extreme wind speeds exceeding a threshold relevant for damage production. The latest global models (CMIP6, SSP5-8.5 scenario, 12 models) show, for an approximately 330 km × 330 km model grid cell that includes Hesse, considerable long-term variability which is greater than the mean change due to the imposed rising greenhouse gas concentrations. Compared with the reference period of the recent past (1970–2000), the ensemble mean signal towards the end of the current century (2070-2100) is an increase of storm day probability of just under 10% . In addition, the damage-effective intensity (measured by the Storm Severity Index, SSI) for storm days increases by a similar magnitude. This result is consistent with findings based on other storm-relevant variables (frequency of intense cyclones, storm track), which likewise indicate a mean tendency towards increasing storm activity for Central Europe. It should be noted, however, that the ensemble-mean signal for the grid cell encompassing Hesse is significantly influenced by the selection of model simulations entering the ensemble. Essentially, two of the twelve CMIP6 models included in the evaluation are responsible for the ensemble-mean result of an increased risk. It is also striking that the climate signal becomes clearly apparent only for the late period of the current century (2070–2100), under conditions of strong increases in greenhouse gas forcing. For the near future (2020–2050) only one of the model experiments shows a notable climate signal—namely, a decrease in storm day probability.

A dependence of the chosen type of wind data for determining the climate signal has been identified. As surface (10 m height) wind is strongly influenced by changes in surface roughness as an external factor, changing surface characteristics can also affect simulated changes in storm risk. Some of the used simulations incorporate an increased coverage of Central Europe's land surface with forest, leading to higher roughness and thus reduced winds. Since it is unclear whether such a change would actually reduce the damage potential, the wind speed at 850 hPa had been chosen as the basis for the climate signals listed above, as it is largely unaffected by surface roughness changes. The analyses also showed a strong increase in near-surface storm activity over the high polar latitudes, which could be attributed to increasing destabilization of the lower atmospheric layers. With regard to the role of spatial resolution, we found no systematically different storminess signal in the Euro-Cordex regional models which are driven by CMIP5 global models.