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Occurrence of extratropical cyclones and windstorms in multi-model simulations for recent and future climate

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Considering studies on the occurrence of windstorms and strong extratropical cyclones under climate change, results in terms of an increasing or decreasing risk seem to depend on the individual climate models applied. Here, we attempt to address the uncertainties arising from the different signals by considering an ensemble of climate model simulations. Analyses of cyclone tracks, extreme wind speeds and storm loss potentials are performed for nine coupled global climate models. For each simulation, a 20th century control period and a future climate projection following the SRES A1B scenario are considered.

Validation of the simulations for recent climate against ERA40 reanalysis data confirms that most models reproduce the observed patterns of cyclone climatology reasonably well. The climate change signals in most simulations show a significant increase of extreme cyclones occurrence (strongest 5% of the systems) in the north-east Atlantic/Northwest European region. For the same region, a higher mean intensity of all cyclones is found. Two models, however, show disagreeing results, featuring a strong decrease of both number and intensity of cyclones. Over Southern Europe, all models reveal a decreased number of extreme cyclone events. The total number of cyclone systems is largely reduced under climate change conditions.

In terms of ensemble averages, and in spite of the increasing number of extreme cyclones in North-Western Europe in most models, the ensemble mean signal indicates a low statistical significance of changes. Weighting factors are considered favouring

models which are able to better reproduce the present day climatology. This results in an increased significance of the climate signals for the north-east Atlantic/Northwest European region.

The changes of extreme wind speeds and windstorm losses in the multi-model ensemble correspond well to the signals from cyclone track analyses: results show higher wind speeds and higher loss potential in northern West- and Central Europe, while there is less potential for windstorm induced loss in southern Europe under future anthropogenic climate conditions.