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A Seamless Approach to Assessing Model Uncertainties in Climate Projections of Severe European Windstorms

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Despite the enormous advances made in climate change research, robust projections of the latitude and strength of the North Atlantic stormtrack are not yet possible. In particular with respect to damaging windstorms, this incertitude bears enormous risks to European societies and the (re-)insurance industry. Previous studies have addressed the problem of climate model uncertainty through statistical comparisons of simulations of the current climate with (re-) analysis data and found that there is large disagreement between different climate models, different ensemble members of the same model and observed climatologies of intense cyclones. The use of different horizontal and vertical resolutions, as well as different approaches to measure storminess further exacerbate comparison between the results from different studies.

Generally such statistical evaluations have difficulties to separate influences of the climate model's basic state, which will be governed by slow processes such as ocean circulations or sea-ice transport, from the influence of fast processes such as energy fluxes from the ocean or latent heating on the development of the most intense storms. The former might generate a bias in storm counts through an incorrect occurrence frequency of storm-prone initial conditions, while the latter could generate a similar bias due to the lack of crucial dynamics of extreme cyclone intensification due to over-simplistic model physics or insufficient horizontal resolution. Compensating effects between the two might conceal errors and suggest higher reliability than there really is. Therefore, separating sources of uncertainty is an important step towards a more reliable interpretation of climate projections and towards targeted improvements of future model generations. Systematic biases in fast processes, if they were known, could be used to develop calibration techniques to post-process climate model output. One way to separate influences of fast and slow processes in climate projections is through a "seamless" approach of simulating historical severe storms with climate models in a numerical weather prediction mode with a common metric for storminess and predefined initial conditions on time-scales of several days. Such a cost-effective case-study approach is currently taken in a recently started project at the University of Leeds funded by the AXA Research Fund. The general concept of the numerical experiments conducted in this project and some first results will be presented at the conference.