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Forecast quality and predictability of severe extra-tropical cyclones in operational forecasts

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Severe extra-tropical cyclones are the most damaging weather phenomena affecting Europe, causing fatalities and severe economic losses. There is currently little agreement on how these cyclones will change under global warming conditions. Some recent studies suggest a northward shift of the North Atlantic storm track and a higher frequency of intense storms. This study falls within the SEAMSEW project funded by the AXA Research Fund, which takes a seamless approach to evaluating the sources of uncertainty in climate projections of European windstorms through simulations using IPCC climate models run in numerical weather prediction (NWP) mode.

As a benchmark for these simulations, this work investigates how accurately seventeen historic damaging and/or intense European storms were forecast by operational NWP models. First, the evolution of the storms and the synoptic conditions in which they developed is examined based on ERA-Interim and ERA-40 reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF). The next step is to evaluate forecast performance by looking at core pressure evolution and track for different forecast lead times, in ECMWF deterministitic, ERA-Interim, ERA-40 and UK MetOffice operational forecast data. Finally, ECMWF ensemble predictions are used to investigate the predictability of the investigated storms through examining the forecast spread.

First results indicate that forecast quality varies widely across the storms; however, they confirm previous studies in that the cyclones' core pressures are generally less well predicted than their position and that forecasts deviate from the analysis most at the time of lowest pressure. Model resolution in the operational ensemble predictions system appears to play an important role, as earlier storms are generally forecast less well than later storms. The extent to which these differences can be related to the type of storm and to the ensemble spread is currently under investigation.