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Forecast quality and predictability of severe European cyclones

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Severe extra-tropical cyclones are the most damaging weather phenomena affecting Europe, causing fatalities and economic losses. There is currently little agreement on how these cyclones will change under global warming conditions. This study is part of 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 climate models run in numerical weather prediction (NWP) mode.

As a benchmark for these simulations, this work investigates the NWP forecast quality of twenty historic storms that were associated with extreme surface winds with some storms inflicting substantial damage. Firstly, the large-scale situations in which the storms develop and the processes that contributed towards deepening are identified. Some storms deepen due to a strong contribution from diabatic processes, while others are predominantly baroclinic. Secondly, European Centre for Medium-Range Weather Forecasts (ECMWF) deterministic, ECMWF ensemble, ERA-Interim and UK Met Office operational forecast data are examined with regard to core pressure evolution and track for different forecast lead times. Results from this work agree with previous studies' conclusions that core pressures are generally less well predicted than cyclone positions and that forecasts deviate from the analysis most at the time of lowest pressure. Furthermore, there is a likely influence of the improvements in model resolution and physics during the investigation period, because earlier storms are generally forecast less well than later storms. The spread of the ensemble forecasts is also investigated and seen to be related to the deepening rate of the cyclone with greatest spread shortly after the minimum core pressure. Finally, possible links between the storm type and forecast quality are investigated.