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

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Severe extratropical cyclones are the most damaging weather phenomena affecting Europe, frequently causing fatalities and severe economic losses. Reliable forecasts of such events on timescales of several days are crucial to warn the population and allow mitigating action to be taken. Funded by the AXA Research Fund, this study investigates how accurately eighteen historic damaging and/or intense storms over Europe were forecast by operational numerical weather prediction (NWP) models. An automatic tracking algorithm is used to identify the cyclones from gridded fields of mean-sea level pressure. As a first step, the evolution of the storms and the synoptic conditions in which they developed is examined based on re-analysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF). The next step is to evaluate forecast performance by the ECMWF and the UK Met Office deterministic models looking at core pressure evolution and track for different forecast lead times. Finally, ECMWF ensemble predictions are used to investigate the predictability of the investigated storms through examining the forecast spread, again for different lead times.

First results indicate that the quality of the forecasts varies widely across the storms; however, they confirm previous studies in that the cyclones' core pressures are generally less well predicted than their position. The extent to which these differences can be related to the type of storm and to the ensemble spread is currently under investigation. For example, are storms with a strong diabatic influence less well forecast than those where baroclinicity dominates? Are deterministic forecasts less reliable in situations with low predictability? Additionally, the magnitude of the forecast errors will be compared to those of less intense cyclones to see whether the most intense systems stand out in terms of their forecast quality and predictability. In the longer run, this work will feed into a broader project that evaluates the seamless prediction of the chosen cyclones. The NWP results presented here will serve as a benchmark for simulations with state-of-the-art climate models run in NWP mode at the University of Leeds and as part of the international Transpose AMIP initiative.