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Understanding medium-range forecast errors from a synoptic-dynamic perspective

Linus Magnusson
ECMWF, Reading, United Kingdom (linus.magnusson@ecmwf.int)

Medium-range weather forecasts have undergone significant improvement since the advent of global forecasts 40 years ago. The improvements originates from enhanced observation systems, improved data assimilation together with improved models. However, occasionally, forecasts experience very low scores and such episodes are often referred to as 'forecast busts' or 'dropouts'. Understanding the root causes of very poor forecasts and the processes involved in the error growth is essential but difficult.

Different techniques for tracking sources of errors include manual error tracking, ensemble sensitivity and nudging (relaxation) experiments toward the analysis. While the error tracking and ensemble sensitivity can be applied on standard model output, nudging experiments need access to run the model. Another technique is to use the same initial conditions but different models to understand the relative impact of errors in initial conditions and model formulation. Here we use 2 sets of forecasts with the same model but different initial conditions and 2x2 sets with same initial conditions. These pairs of forecasts give the opportunity to disentangle the impact of errors from initial conditions and from the model, and also to get a better understanding of some systematic errors.

In the presentation we will discuss results using different diagnostic tools both for busts in mid-latitude forecasts and tropical cyclones, and how the cases of large errors connect to different weather features. We will discuss the advantages and disadvantages with the different tools. The results will both give guidance for forecast system developments and highlight situations where forecasters needs to be more cautious.