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Factors influencing skill improvements in the ECMWF forecasting system

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During the past 30 years the skill in ECMWF numerical forecasts has steadily improved. Three major factors contributing are (1) improvements in the forecast model both regarding resolution and physical aspects, (2) improvements in the data assimilation and (3) the increased number of available observations. In this study we are investigating the relative contribution from these three components by using the simple error growth model introduced in Lorenz (1982) and extended in Dalcher and Kalnay (1987), together with the results from ERA Interim forecasts where the improvement is only due to an increased number of observations.

We are also applying the growth model on ”lagged”-forecast differences in order to investigate the usefulness of the forecast jumpiness as a diagnostic tool for improvements in the forecasts.

Our main findings are that the main contribution to the reduced error comes from model improvements together with a large contribution from the initial conditions around year 2000. The changes in the available observations contributed to a lesser degree, but we have to remember that the all the ERA Interim forecasts are from the satellite era and that we here focus on the mid-troposphere in the extra-tropics. Regarding the jumpiness in the forecasts, this is mainly a function of the error in the initial conditions and is therefore an insufficient tool to investigate improvements in the full forecasting system.