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A global perspective of the limits of prediction skill based on the ECMWF ensemble

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In this talk presents a new model of the global forecast error growth applied to the forecast errors simulated by the ensemble prediction system (ENS) of the ECMWF.
The proxy for forecast errors is the total spread of the ECMWF operational ensemble forecasts obtained by the decomposition of the wind and geopotential fields in the normal-mode functions. In this way, the ensemble spread can be quantified separately for the balanced and inertio-gravity (IG) modes for every forecast range. Ensemble reliability is defined for the balanced and IG modes comparing the ensemble spread with the control analysis in each scale.

The results show that initial uncertainties in the ECMWF ENS are largest in the tropical large-scale modes and their spatial distribution is similar to the distribution of the short-range forecast errors. Initially the ensemble spread grows most in the smallest scales and in the synoptic range of the IG modes but the overall growth is dominated by the increase of spread in balanced modes in synoptic and planetary scales in the midlatitudes. During the forecasts, the distribution of spread in the balanced and IG modes grows towards the climatological spread distribution characteristic of the analyses. The ENS system is found to be somewhat under-dispersive which is associated with the lack of tropical variability, primarily the Kelvin waves.

The new model of the forecast error growth has three fitting parameters to parameterize the initial fast growth and a more slow exponential error growth later on. The asymptotic values of forecast errors are independent of the exponential growth rate. It is found that the asymptotic values of the errors due to unbalanced dynamics are around 10 days while the balanced and total errors saturate in 3 to 4 weeks.

Reference:
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