Contribution ID: **5**   Type: **not specified**

Representing uncertainty in initial conditions: experimentation from lagged average forecasting to singular vectors

Monday, 5 December 2022 11:00 (25 minutes)

Research on ensemble predictions started at ECMWF in the mid 1980's, using a time-lagged approach to generate 30-day ensemble forecasts initialised from consecutive operational analyses produced every 6 hours. While early experiments showed some positive results, it soon became apparent that the lagged ensembles were under-dispersive in the medium-range, and research on alternative methods was initiated under Tim Palmer's leadership. In synergy with developments occurring in data assimilation, linearised dynamical models and their adjoints were used to compute the fastest-growing singular vectors from different idealised initial conditions. The singular vectors computed from a 3-level quasi-geostrophic model proved to be sufficiently realistic to allow interpolation onto a medium-resolution version of the operational forecast model. Ensembles experiments performed with this approach gave promising results and paved the way for the operational ensemble design based on primitive-equation singular vectors.

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