A new temporally flow-dependent EDA to estimate B-matrix in Copernicus European Regional Reanalysis

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Abstract

A new Ensemble of Data Assimilations (EDA) framework to estimate the background error covariances (B-matrix) has been developed and tailored to the new Copernicus European Regional Re-Analysis (CERRA). CERRA is produced by the HARMONIE NWP system with ALADIN physics, 3DVAR to analyse upper-air fields and Optimal Interpolation (MESCAN) to analyse surface fields, cycling every 3 hours. CERRA spans 40 years and has 5.5km resolution.

Background errors are assumed isotropic, homogeneous and non-separable, meaning isometric horizontal breadth and vertical depth in 3D space. Linearised geostrophic and hydrostatic balances are incorporated as multivariate relationships, coupling vorticity and geopotential extended to wind, mass and specific humidity fields via f-plane approximation. We augment the estimation of background errors to be temporally dynamic, accounting for 'errors of the day', seasonal and weather regime variation (CERRA-EDA).

CERRA-EDA has 10 members cycled 6-hourly. CERRA-EDA comprises 2 components. The first component is 'seasonal' (5.5km), with respective summer and winter periods. A new augmentation governs the uptake of summer and winter differences at a given time of year. The second component is 'daily' (11km). B-matrix computation occurs every 2 days, with a fixed split of 80-20% seasonal-daily. Temporal flow dependence enables a degree of real-time tethering to meteorological situations as they arise.

We show how the EDA accounts for weather regime change by case study. We also show the impact of varying EDA-component weighting on the statistics, and analysis and forecast quality, with improvements worth considering.

Keywords: B matrix, 3DVAR, reanalysis, EDA, uncertainty quantification, background error covariances

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