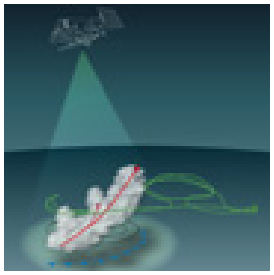

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Examining model error in potential temperature and potential vorticity via weather forecasts at different lead times

Tuesday, 10 March 2020 14:20 (20 minutes)

The examination of model error is fundamental to improve weather forecasts at any time scale. In this contribution, model error in potential temperature and potential vorticity (PV) is analysed through the examination of 12-h and 24-h forecasts at the grid-point level using an Eulerian approach and another based on the use of diabatic tracers of potential temperature and PV. Diabatic tracers enables a more detailed investigation of the Eulerian results by decomposing the total Eulerian changes into materially-conserved and diabatically-generated components. This analysis is particularly relevant for warm conveyor belt systems, characterised by a strong diabatic influence on their environment. The approach taken throughout this work consists of considering the behaviour of a theoretical unbiased model, for which the only assumption is that forecast error is zero when averaged over a large number of cases, as a reference. Deviations from this theoretical behaviour are used to highlight conditions leading to large errors. The analyses are performed on forecasts produced with the Met Office Unified Model during the NAWDEX field campaign in autumn 2016. The Eulerian approach indicates that changes in potential temperature and PV are underestimated with respect to the theoretical behaviour of an unbiased model. The grid points with the largest changes in 12-h forecasts have the largest underestimation in the 24-h forecast, highlighting the importance of the underestimation for grid points corresponding to the location of warm conveyor belt outflows. The Lagrangian-tracer investigation reveals very large deviations from the theoretical behaviour of an unbiased model regardless of the level of Eulerian change, in particular for PV, and an unrealistic similarity in magnitude between parametrised diabatic changes of PV in the forecasts. Addressing the deviations from the behaviour of a theoretical unbiased model found in this work could be a step forward towards an operational unbiased model.

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