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MOTIVATION FOR AND DEVELOPMENT OF A 4DENVAR SYSTEM FOR THE MET OFFICE

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en salle E259 de l'ENM

Abstract :

The Met Office pioneered the development of hybrid-ensemble-variational data assimilation; it was successfully implemented in a global hybrid-4dvar system, using the "alpha control variable" method to directly use a localised ensemble to augment the standard "climatological" background error covariance model (Clayton et al. 2013).

Starting from this, it was technically straightforward to modify the software to build and test a 4DEnVar system which did not have the technical and computational cost of using the linear and adjoint forecast model needed for 4DVar. While technically a success, the trial demonstrated that hybrid-4DEnVar did not match the performance of hybrid-4DVar, with both using the Met Office's operational ensemble system (Lorenc et al. 2015). We suggested that further progress needed a bigger and better ensemble as well as better localisation. So development focus switched to a twin project: to replace the operational (localised ETKF) ensemble by a larger ensemble of hybrid-4DEnVar assimilations, and to test this ensemble in a repeat comparison of hybrid-4DVar with hybrid-4DEnVar.

The first part was relatively successful; we demonstrated that the new ensemble's covariances were a better model for background errors. Significant work was needed to address stability of the ensemble forecasts, well calibrated inflation, and efficiency of the system for a large ensemble; some issues remain but results were sufficiently encouraging to continue the development (Bowler et al. 2016a submitted).

The second part was less successful, because the better ensemble helped both methods, so that even when using it hybrid-4DVar still outperformed hybrid-4DEnVar (Bowler et al. 2016b submitted). Since we can see our way to running our global hybrid-4DVar system on our current computer until at least 2020, emphasis has switched to improvements to the localisation which might be applied to both systems. Longer term, the strategy for a radical refresh of the software infrastructure for exascale computers remains uncertain.

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