

The ECMWF Hybrid 4D-Var and Ensemble of Data Assimilations

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The operational 4-Dimensional Variational (4D-Var) data assimilation system at the European Centre for Medium-Range Weather Forecasts (ECMWF) was in June 2011 extended to a hybrid system, where flow-dependent background error variances for balanced variables were provided by an Ensemble of 4D-Var Data Assimilations (EDA) [1, 2, 3]. In addition the EDA was used to compute new climatological background error covariances in June 2012. With the June 2013 upgrade the EDA will provide flow-dependent variance estimates for unbalanced background error variables. At the end of 2013 we furthermore plan to extend the number of members from 10 to 25 to provide an on-line estimation of flow-dependent covariance matrices. All these background error related upgrades of the assimilation system have resulted in significant analysis and forecast skill improvements. The hybrid system upgrades were a major reason for ECMWF forecast improvements during the last three years. The paper will present the EDA-based hybrid assimilation system method, associated results, and plans for further development of the hybrid assimilation system. We will also discuss the viability of 4D-Var for the future in face of challenges like scalability and the need for an accurate tangent-linear approximation.

References

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