

A Comparison Between 4D-Var and 4D-EnVar in the Canadian Regional Deterministic Prediction System

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Over the recent years, Environment Canada (EC) has devoted important resources to investigate the feasibility of replacing its 4D-Var data assimilation scheme in the global deterministic prediction system (GDPS) by a computationally cheaper variational scheme (4D-EnVar) where background error covariances are represented by a blend of climatological covariances and 4D flow-dependent covariances derived from an EnKF-based global ensemble prediction system.

Following the positive results observed so far from 4D-EnVar in EC's GDPS, a similar effort was recently initiated in the regional deterministic prediction system (RDPS; limited-area domain with a 10-km grid spacing covering North America) which relies on a limited-area 4D-Var data assimilation scheme (operational since October 2012). Since there is currently no operational equivalent to the global EnKF at the regional scale at EC, we simply used the 4D ensemble covariances derived from the global EnKF as in the GDPS experiments. Results showed that a global-based 4D-EnVar scheme can provide RDPS forecasts slightly improved compared to the operational limited-area 4D-Var scheme, particularly during the first 24-h of the forecasts and in summertime convective regime where the lack of moist physical processes representation in our TL/Ad model impedes the performances of our 4D-Var scheme.