A Hybrid, NWP-Analog Ensemble

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An analog ensemble is constructed by first matching up the current forecast from an NWP model with similar past forecasts from the same model. Then the past verifying observation from each match is used as an ensemble member. The advantages include application to a higher resolution real-time forecast model, avoidance of model perturbation challenges, and production of calibrated forecasts. However, the analog ensemble may have a limited ability to capture flow-dependent error growth due to reliance on a single model solution, whereas a traditional NWP ensemble may do better.

A hybrid ensemble may be an optimal approach, combining strengths of an NWP and analog ensemble. The hybrid ensemble is constructed by finding m analogs for each member of a small n-member NWP ensemble, to produce a total of m*n members. Real-time compute cost is kept low with only a few model runs, but those runs reveal the major aspects of flow-dependent error growth. The analogs then increase the sampling and map from model space to reality to produce a calibrated forecast PDF.

Comparing the performance of the analog ensemble and hybrid ensemble shows mixed preliminary results. The hybrid ensemble performs worse for probabilistic 10-m wind speed forecasts and somewhat superior for 2-m temperature forecasts. A possible explanation is the hybrid ensemble's use of the Environment Canada's Regional Ensemble Prediction System (REPS) in which all members share the same model configuration. The hybrid ensemble approach may work best when applied to a multi-model NWP ensemble where the members' diversity is considerably higher.