Status of the Canadian Ensemble Prediction System

4th North American Ensemble Forecast System Workshop
NCEP (NOAA Science Center)
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Science and Technology Branch (Montreal)
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The medium-range EPS

Twice a day, at 0 and 12 UT, we generate 20 16-day medium-range forecasts. We use the Global Environmental Multiscale (GEM) model with a uniform 400 x 200 global grid, 28 η-levels and with the model top at 10 hPa.

The initial conditions are provided by an Ensemble Kalman Filter (EnKF). The initial perturbations are thus coherent with properties of the observational network and with the dynamics of the forecast model.

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The Ensemble Kalman Filter

The since January 2005 an Ensemble Kalman Filter (EnKF) is used to provide 20 initial conditions to the medium-range component of the EPS.

The EnKF internally uses 96 members.

- Each member has its own set of randomly perturbed observations.
- Different combinations of physical parameterizations are used for different members.
- Additive isotropic perturbations account for unexplained "model error".

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The medium-range forecasts

To sample model error, we use a combination of methods.

Like in the EnKF:

- Isotropic random errors are added to the initial conditions that have been obtained from the EnKF.

- We use different parameterizations for in particular: deep convection, surface interactions and the computation of mixing length.

In addition:

- We use stochastic Physical Tendency Perturbations (PTP, Buizza et al. 1999).

- We use a Stochastic Kinetic Energy Backscatter (SKEB, Shutts 2005) algortihm .

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Configuration forecast:

Supported by improving computational facilities, we expect to be able to upgrade the medium-range EPS:

year,	ensemble sizes,	grid,	time step,	observations
2008,	96 and 20,	400 x 200 x 28,	45 min,	200 000
2009,	96 and 20,	400 x 200 x 29,	30 min,	200 000
2010,	96 and 20,	500 x 375 x 45,	24 min,	400 000
2012,	96 and 20,	600 x 450 x 45,	20 min,	500 000
2014,	96 and 20,	600 x 450 x 60,	20 min,	500 000

Note: as usual, actual changes will be where we think the impact is biggest.

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4D-Var and EnKF

Currently our centre has two different 4-dimensional data-assimilation systems.

The 4D-Var system delivers an initial condition for a high-resolution deterministic forecast.

The EnKF system delivers 20 initial conditions for the medium-range EPS.

Early results from an intercomparison of the two systems will be presented by Mark Buehner at Buenos Aires (Nov 2008). In the future, we intend to just use the best possible system for 4-dimensional data-assimilation.

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Current research/problems:

EnKF Research:

- We are not happy with the relatively important isotropic sampling of model error in the EnKF.

- Sometimes the EnKF and 4D-Var systems respond differently to additional observations. It is unclear why.

EPS Problems:

- With increasing interactions (4D-Var, GEM model, surface forecasts, warnings for various extreme events, NAEFS, regional ensemble, monthly forecasts, hydrological applications, MJO forecasts, ...) the complexity increases. How to keep it clean and simple?

- The verification system is dispersed.

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