

Environnement Canada



Environment Canada's Regional Ensemble Kalman Filter

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Current Operational System



Regional ensemble forecast (REPS)



Global system

Regional system

2014 implementation of the NWP suites



Global system

Regional system

2015-2016 implementation of the NWP suites



Global system

Regional system

Monte Carlo methods in the ensemble



Autonomous Regional EnKF Driven by the Global



- Regional EnKF starts from global ensemble analyses and then runs autonomously.
- Global Environmental Multi-scale (GEM) model is used for the forecast.

Sequential ensemble Kalman filter



Assimilation window



Localization

- Due to the small ensemble size, the impact of an observation needs to be localized using Schur product of an ensemble based covariances.
- Localization causes imbalance in the analysis.
- Performance of regional EnKF is more sensitive to the localization distance than performance of the global EnKF.

GEM Settings for the Regional EnKF

- 15 km resolution.
- 622 X 657 grid points. (~ 1000km X 1000km)
- 65 staggered hybrid vertical levels.
- Model top around 13hPa.

Comparison between Regional and Global EnKF

- Regional EnKF has to perform as good as the global EnKF or better.
- Make regional EnKF autonomous as long as possible.
- Test shows that regional EnKF is not as good as global EnKF with the same parameters as the global.
- Localization distance and the amount of the model error are the main parameters to improve the performance.

Correlation Distance for Localization



Ensemble Spread



Radiosonde Verification: REnKF .vs. GEnKF





Power Spectrum



Regional EnKF

Global EnKF

Low Pass Filtering (1000km)





Radiosonde Verification with Low Pass Filtering (1000km)



• Maintain the large scale quality as the global EnKF.

Low Pass Filtering (500km)

Radiosonde Verification with Low Pass Filtering (500km)

Summary and Future Work

- Regional EnKF is more sensitive to the localization structure than global.
- Fully autonomous regional EnKF is possible.
- Regional EnKF performs as good as the global EnKF in large scale.
- Regional EnKF is better to capture mesoscale circulation.
 - Beneficial to a high resolution (2.5km) EnKF.
- Assimilate more observations due to higher resolution.
- Obtain perturbations from the regional covariances.
 - Currently, they are from global covariances.
- Model parameter perturbation.
 - Multi-parameter model.
 - Stochastic parameterization.

