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Model optimization with a genetic algorithm

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In an Ensemble Kalman Filter (EnKF), many short-range forecasts are used to propagate error statistics. In the Canadian global EnKF system, different ensemble members use different configurations of the forecast model. The integrations with different versions of the model physics can be used to optimize the probability distributions for the model parameters.

Continuous parameters accept a continuous range of values. Categorical parameters can serve as switches between different parametrizations. In the genetic algorithm, the best member are duplicated, while adding a small perturbation, and the worst performing configurations are removed. The algorithm is being used in the migration of the global ensemble prediction system to an upgraded version of the model.

Quality is measured with both a deterministic and an ensemble score, using the observations assimilated in the EnKF system. With the ensemble score, the algorithm can converge to non-Gaussian distributions. Unfortunately, for several model parameters, there is not enough information to improve the distributions. The optimized system has slight reductions in biases for humidity sensitive radiance measurements. Modest improvements are also
seen in medium-range ensemble forecasts.

Thematic area

1. Machine Learning for Data Assimilation - Including Model Error Estimation and Correction, Parameter estimation, Fast linearised models for DA, Hybrid DA

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