

A Non-Gaussian approach for assimilating North-American reflectivity measurements

*Dominik Jacques¹, Mark Buehner¹

1. Environment Canada

This project describes a Non-Gaussian Deterministic data assimilation (NGD) procedure for assimilating continental-scale radar-derived precipitation. In contrast with other Non-Gaussian assimilation approaches that operate in an ensemble context, this method aims at generating a single deterministic analysis by combining the information from a forecast ensemble and 2D mosaics of reflectivity. The underlying assumption of the NGD approach is that the ensemble members whose precipitation are locally most similar to radar observations should also possess other atmospheric features that are more consistent with reality and therefore would provide more accurate forecasts when used to initialize the model.

A Bayesian approach is used to compute localized 2D weight fields for each ensemble member. The local value of the weight field is related to the "distance" between the precipitation simulated by each ensemble member and the precipitation inferred from weather radars. Complete atmospheric analyses are then generated by computing the weighted ensemble average, which essentially combines the states of the members whose precipitation are closest to the radar observations. However, in regions without any assimilated reflectivity measurements, the analysis reverts to the original background state.

Forecasts integrated from these analyses were run four times a day for a two-month period in the summer of 2016. The simulation domain covers the Eastern part of the North-America at a resolution of 10 km. Preliminary results indicate that the NGD approach can improve precipitation forecasts in a manner comparable to using Latent Heat Nudging (LHN), a popular diabatic initialization technique. However, in upper-air verifications the NGD approach leads to substantially better results than those obtained with LHN. The improvements are observed throughout the atmosphere and at lead-times that extend beyond 12h.

Experiments are currently underway to evaluate methods for combining the Non-Gaussian assimilation of reflectivity with the more traditional EnVar assimilation of the non-radar observations. One possibility is to use the NGD analysis as the background state for subsequent EnVar assimilation. Results from experiments exploring this possibility will be presented.

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