The Relationship between Ensemble Member Selection and Accuracy in the Ensemble Kalman Filter

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In many operational center for weather forecast, ensemble forecasting has been employed as a main data assimilation technique for weather forecast. Ensemble forecasting is a numerical prediction method to generate and use a representative sample of future state. Therefore, when a large number of variables are needed for weather forecast, using the sample of ensemble is suitable.

The ensemble Kalman filter(EnKF) is one of the well-known ensemble forecasting methods. The EnKF originated from the Kalman filter. The EnKF is different from Kalman filter in the form of covariance matrix. The covariance matrix of EnKF is replaced by the sample covariance. Despite the improvement of computing cost, determining sample size is still important for accuracy and speed of forecast. The sample size can't increase enough due to astronomical number of variables in operational model forecast.

Generally, EnKF uses ensemble members to determine the error covariance. With more consideration of characteristics of ensemble member, more effective result can be obtained. These characteristics are related to red distribution of error. If the error has a direction of distribution, that information can improve the accuracy of error covariance evolution.

The result will be showed using Lorenz model and WRF model. The Dart Assimilation Research Testbed from UCAR helped this experiment. This result of experiment shows a change of accuracy according to choice of ensemble member.

References

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