

The Hybrid Local Ensemble Transform Kalman Filter

Stephen G. Penny^a

^a*Department of Atmospheric and Oceanic Science, University of Maryland, USA, Steve.Penny@noaa.gov*

Hybrid data assimilation methods combine elements of ensemble Kalman filters (EnKF) and variational methods. While most approaches have focused on augmenting an operational variational system with dynamic error covariance information from an EnKF [1][2][4][5][8], we take the opposite perspective of augmenting an operational EnKF with information from a simple 3D-Variational (3D-Var) method [7]. We wish to determine which aspects of the variational methods are necessary for successful application of a hybrid method. To this end we have developed the Hybrid Local Ensemble Transform Kalman Filter (Hybrid-LETKF), which improves analysis errors when using small ensemble sizes and low observation coverage versus either LETKF [3] or 3D-Var used alone on a Lorenz-96 model [6]. The results imply that for small ensemble sizes, allowing a solution to be found outside of the space spanned by ensemble members provides robustness in the hybrid method compared to LETKF alone. Finally, the simplicity of the Hybrid-LETKF design implies that this method can be applied operationally while requiring almost no modification to an existing operational 3D-Var system. Further tests exploring this potential using a global scale ocean model are underway.

References

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