Nonlinear Processes
in Geophysics
Discussions

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Interactive comment on "Multivariate localization methods for ensemble Kalman filtering" *by* S. Roh et al.

Anonymous Referee #1

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General Comments This manuscript deals with one of the very important topics in EnKF data assimilation. The described localization functions for multiple state variables can be used both in EnKF and Variational Ensemble data assimilation systems. The schemes are extensively described and easy to follow. In addition, OSSE results with a low-dimensional system are presented to document benefit of the new schemes. I suggest accepting this paper after addressing the following comments.

Specific comments: 1. Is the localization function defined by Eqs. 8-9 a Gaussian-like function? As shown in Fig. 1, the plotted Askey function is not a Gaussian-like function, which might make it be problematic to filter a Gaussian-like error correlation pattern.

2. Need more details on experiment design, especially on experiment S3 and S4 (P847-848). For experiment S3, values of localization parameters should be described.

For experiment S3 and S4, please also explain the rationales used to specify localization parameters.

3. Sensitivity to number of ensemble members can be further studied. The presented results (Page 850) showed similar results when using 20- and 40-member ensembles. Is this because the use of localization schemes? The other question is that what is the critical number of ensemble member to produce a good multi-variable background error covariance (BEC) modeling for such a low-dimensional Lorenz-95 system? The BEC with very large number of ensemble member could be used to valid which loclation scheme is a better one. I suggest showing figures of the covariance in physical space to demonstrate the sensitivity with several number of ensemble members (e.g., 100, 200, 500,…).

Other minor comments: 1. Page 842, Eqs, 6-7, Please explain beta here. 2. Page 843, Eqs, 8-9, for real atmospheric data assimilation, do you have any ideas on rules to specify the related parameters in Eqs. 8-9? 3. Page 836, Line 13, what are values of variances for the two state variables? 4. Page 847, Line 14, beta(i,j)=beta ?, please explain beta. 5. Page 847, Line 21-22, Please speak more about the test results. 6. Page 850, Lines 14-16. Though I understand the statements are based on materials in Page 841, it seems to me the statement may confuse general readers. Actually, use of location functions is expected to alleviate the rank deficient issue in BEC modeling.

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 833, 2015.

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