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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Expanding the validity of the ensemble Kalman filter without the intrinsic need for inflation" *by* M. Bocquet et al.

Anonymous Referee #1

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General comments: This manuscript addresses several aspects of data assimilation related to covariance inflation, localization, prior definition, and non-Gaussian errors, and suggests possible extensions to a hybrid system with error covariance localization. The experiments are conducted using low-dimensional modeling systems and synthetic observations. This manuscript clarifies several important results in connection with EnKF, square-root ensemble filters, and the EnKF-N scheme developed by the authors. It is definitely an important contribution to data assimilation theory, with potentially important implications for practice of data assimilation. I recommend the manuscript for submission subject to minor revisions.

Specific comments: (1) p.11, L. 17-18: Can the problem be stated in terms of new pdfs, followed by a straightforward derivation from Bayes formula without requiring additional

changes (e.g., gauge fixing, etc.) in any of the steps of the filter/smoother? (2) p. 18-19, Section 5: Could you diagnose results using the spread vs. skill tests, at least in some of the experiments? Such results may be more revealing than the individual RMSE and standard deviation results. (3) p.29, L.21: Eq.(57) requires the inverse of XXT and square root calculations. How practical is this formulation, given that a realistic state is of high dimensions effectively prevent such matrix operations, while a low-dimensional system in principle does not require localization?

Technical corrections (1) p.43: Fig.5 (also discussion on p.30, L.1-20): The axes labels (numbers) are not visible. Could you redraw this figure to make axes labels more visible?

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 1091, 2015.