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Interactive comment on "Construction of non-diagonal background error covariance matrices for global chemical data assimilation" *by* K. Singh et al.

Anonymous Referee #1

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The authors present a computationally efficient method aimed at constructing two and three dimensional background error covariance matrices by representing them implicitly as tensor products of one dimensional Gaussian correlation functions. Correlation lengths are chosen based on adjoint sensitivity approach as well as through numerical experiments. Impact of non-diagonal background error covariances derived as above was assessed for both 3-D VAR and 4-D VAR experiments for global chemical data assimilation. Overall a good contribution to the field of variational data assimilation with chemical transport models.

One would have liked to see other approaches at least mentioned such as those where

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the geostrophic and hydrostatic balance is maintained in the multivariate, multidimensional background error covariance matrices (Akella and Navon, 2009)

Other approaches that should be mentioned, at least in the introduction, have been put forward by Fisher (2003,2006) using ensemble and wavelet methods and those considering the statistical structure by Ingleby (2001).

Nature of possible approximations (any that applies to the present paper) being made such as:

- Isotropic correlations

- Homogeneous correlations

- Simple balance relationships (e.g. geostrophy)

- Static covariances

- Ignoring the vertical slope of atmospheric structures

- Assuming variables to be uncorrelated when they are not

- Treating terrain-following model levels as if they were horizontal

should be outlined.

Work of Derber and Bouttier (1999) on background error covariance matrices should also be mentioned.

It is not clear if the resulting background error covariance matrices are isotropic and homogeneous.(Purser et al 2003)

Some comparison with state of the art multivariate background error covariance matrix modeling would be beneficial.

References

Akella, S. and I. M. Navon, 2009: Different approaches to model error formulation in

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4D-Var: a study with high resolution advection schemes. Tellus A , Vol 61A, 112–128.

Derber, J. C. and F. Bouttier, 1999: A reformulation of the background error covariance in the ECMWF global data assimilation system. Tellus, 51 A, 195–221.

Fisher, M. 2003: Background Error Covariance Modelling. Proc. ECMWF Seminar on Recent developments in data assimilation for atmosphere and ocean, 8-12 September 2003. pp 45-64.

Fisher, M. 2006: ECMWF Data Assimilation Training Course: Background Error Covariance Modelling.

Ingleby, B., 2001. The statistical structure of forecast errors and its representation in the Met Office Global Model. Q. J. R. Meteorol. Soc., 124: 1783–1807.

Purser, R. J., W.-S. Wu, D. F. Parrish and N. M. Roberts, 2003b: Numerical aspects of the application of recursive filters to variational statistical analysis. Advanced methods of 4-D Var Data Assimilation in NWP models Part II: Spatially inhomogeneous and anisotropic general covariances. Mon. Wea. Rev., 131, 1536-1548.

Interactive comment on Geosci. Model Dev. Discuss., 3, 1783, 2010.