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Interactive comment on "divand-1.0: n-dimensional variational data analysis for ocean observations" *by* A. Barth et al.

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This software introduced in this paper aims to extend current interpolation methods used in oceanography using methods based on data assimilation. However the work ignores a large body of work that has already been done in the field of data assimilation, including in oceanography, and the methods as explained are already well known in the data assimilation literature. The main novelty seems to be in this particular application. However the method of application in the results section also lacks robustness.

Specific comments are as follows:

1. A good part of the paper is dedicated to the method of covariance modelling, with the only reference being a PhD thesis from 1996. There is no indication as to how this relates to other covariance modelling commonly used in data assimilation e.g. see references below.

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2. The algorithms presented in section 3 are very common and there is nothing particularly new in their implementation for this system. There is little reference to the large body of work that already uses these methods.

3. The algorithms as presented assume a linear observation operator and no there is discussion of nonlinearity (maybe not needed if only interpolating?).

4. Eq. (16) - I believe that yˆo should be (yˆo-Hxˆb) in the minimum of the cost function.

5. The methods presented for solving the problem in section 3 are likely to be highly ill-conditioned. There is no discussion of this or as to whether any preconditioning is necessary.

6. The method as applied in the results section requires a climatological field in order to estimate the parameters in the analysis. This means that the procedure is linked to a particular model climatology. In practical data assimilation such parameters are normally based on a physical understanding of the system and it is not clear why a simulataneous optimization of the parameters as described here should lead to anything that is physically realistic. (Note this also explains my score on scientific reproducibility, though I think that is less important than the main point here).

7. Eq. (27) - The second term is already included in P_{inv} and so appears twice.

8. In section 6.2 it is mentioned that the parameter a_s is calibrated according to the significance of the advection, but there is no explanation as to how this is done in practice.

9. In Fig 5 (top, left) it is not clear why the cross and circle do not overlap. It is discussed in the text, but if the panel is showing correlation with respect to the point of the cross, then by definition the correlation is equal to one there.

References on covariances:

Gaspari, Gregory, and Stephen E. Cohn. "Construction of correlation functions in two

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and three dimensions." Quarterly Journal of the Royal Meteorological Society 125.554 (1999): 723-757.

Weaver, Anthony, and Philippe Courtier. "Correlation modelling on the sphere using a generalized diffusion equation." Quarterly Journal of the Royal Meteorological Society 127.575 (2001): 1815-1846.

Bannister, Ross N. "A review of forecast error covariance statistics in atmospheric variational data assimilation. II: Modelling the forecast error covariance statistics." Quarterly Journal of the Royal Meteorological Society 134.637 (2008): 1971-1996.

Haben, S. A., A. S. Lawless, and N. K. Nichols. "Conditioning of incremental variational data assimilation, with application to the Met Office system." Tellus A 63.4 (2011): 782-792.

Interactive comment on Geosci. Model Dev. Discuss., 6, 4009, 2013.