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Interactive Comment

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

Anonymous Referee #2

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This paper introduces a variational method that can be applied to an arbitrary high dimensional space to interpolate sparse data, and describes its implementation into the numerical tool 'divand'. The code is designed to work with oceanographic measurements, and it is likely to become a useful tool for many oceanographers, being freely-distributed and documented online (http://modb.oce.ulg.ac.be/mediawiki/index.php/Divand). I think the paper is interesting and deserves publication on GMD, though I suggest some minor changes could be made, especially considering that the number of potential users of the tool is not restricted to the specialists in variational methods, so that a few clarifications might be necessary. There are some typos/grammar errors, requiring a more careful revision of the text (e.g. pag. 4010 Line 15: 'it increased' should be 'is increased'; pag.4011, line 4: 'a better [. . .] coverages': plural should not follow a singular indefinite article; pag.

4013 line 11: ‘derive’ should be ‘the derivation of’ followed by ‘are introduced’. . . etc.)

Introduction. This section presents a somehow generic (and sometimes a bit superficial) introduction to the data interpolation and assimilation problems. For example, the variational approach is much more effectively described in the abstract than in this section. Moreover, the differences between the proposed approach and the variational techniques used for data assimilation are only very superficially introduced (e.g. first paragraph of pag. 4012). Is this approach univariate or can it be extended to multivariate interpolation problems? References on the application of OI techniques to ocean data do not seem particularly up-to-date (e.g. Roberts-Jones et al. 2012). Covariance models based on generalized distances have also been proposed (e.g. Nardelli 2012). Lines 11-14. Direct linear interpolation is rarely an option also because the interpolant is not differentiable or smooth.

Section 2. Though this section provides a clear introduction to the variational inverse technique implemented in divand, and an exhaustive derivation of corresponding kernel, I suggest to add a reference describing kernel methods in general (or recall them in an appendix), so that it becomes immediate to see the way Eq. 5 defines the matrix B and how the kernel is effectively used in practice (pag. 4015 lines 4-15). Introducing the term Jc already in (1) seems logic and preferable. Section 2.1 Line 17-19, pag. 4017. Were there other possible choices for these coefficients? How can this assumption be interpreted in terms of physical properties? Section 2.2 seems quite generic and is it not well linked to the way the additional constraints are presented in section 5 and 6.

Section 5. Following previous comment on section 2.2, it would be nice to see (37) expressed in matrix form using the operators available within the tool.

Section 6. How is the “exhaustive search” cited in the first lines of section 6.1 carried out? What are the differences between this and the Nelder-Mead algorithm cited afterwards and, in case, why did the authors use different strategies in the two cases?

Nardelli, B.B., 2012: A Novel Approach for the High-Resolution Interpolation of In Situ Sea Surface Salinity. J. Atmos. Ocean. Technol., 29, 867–879, doi:10.1175/JTECH-D-11-00099.1. Roberts-Jones, J., E. K. Fiedler, and M. J. Martin, 2012: Daily, Global, High-Resolution SST and Sea Ice Reanalysis for 1985–2007 Using the OSTIA System. J. Clim., 25, 6215–6232, doi:10.1175/JCLI-D-11-00648.1.

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