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Ocean Science Discussions

Interactive comment on "Towards an improved description of ocean uncertainties: effect of local anamorphic transformations on spatial correlations" *by* J.-M. Brankart et al.

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The paper by Brankart et al. provides a very important reflection on the use of variables transformations (anamorphosis) in the context of ensemble-based data assimilation. The paper is very well written and logically structured, and the coordination of 6 different applications on this theme is very impressive. The main result - the augmentation of the empirical correlation range - is a well known effect in the field of Geostatistics (See for example Chilès and Delfiner, 1999, Figure 6.6):In the case of asymmetric variables, the variogram function (and similarly the correlation function) being sensitive to outliers, is noisy and therefore the experimental variogram will systematically show structures shorter than they should. Applying a Gaussian anamorphosis helps improve the variogram and traditionally precedes its calculation in good Geostatistical practice. This effect is unfortunately still ignored in the field of data assimilation, although most of the methods are relying heavily on second order statistics. The paper by Brankart and co-authors is therefore confirming an issue predicted by the theory and a very healthy contribution to the field.

There are several novel and interesting aspects in the paper, especially the considerations of the accuracy of the approximation and the technicalities of the method (tails of the distribution and cases of discontinuous distributions) are discussed with sufficient details. The computational issues are also handy.

The fact that the anamorphosis function changes from one pixel to another should not be a major worry, as the authors explain based on Fig. 6, because the model errors applied to the dynamical data assimilation are generally smooth (as well as the variability from the historical ensemble in the case of a non-stochastic data assimilation). I thus see this as essentially the same issue encountered in computing an indicator variogram in Geostatistics, another well known method. The strength of the paper is then to demonstrate that these methods borrowed from the field of Geostatistics are not restricted to static variables under a strong stationarity assumption but also valid in the cases of dynamical, non-stationary ocean systems.

The only negative point is that I regret the scatterplots are only used once in the simplest example although they represent a very powerful tool to examine the cases less easy to interpret.

Minor points:

- The explanation of the Nitrate-Phytoplankton correlation after Fig. 14 is somewhat confusing in trying to explain the difference with Fig. 8. This is one of the cases where I would expect a scatterplot to help.

- The large correlation in Fig. 10 between the Loop Current and the Western Coast of the Gulf of Mexico are somewhat puzzling as one would logically expect very different dynamics in the nutrient-poor Loop Current and the river-influenced coatal waters. This point deserves a more thorough discussion.

- The only case when the anamorphosis is shown to reduce a spurious correlation is in Fig. 12, September case. In my view, this aspect is just as important as the increase of the horizontal correlation length and should be expanded, if possible with (again) a scatterplot between the reference location and an arbitrary point North of Iceland where the spurious correlation has disappeared.

- p. 31 (Section 6), the sentence starting with "it would of course be better" is unclear to me.

- Fig. 3 The captions say panels instead of panel.

- Typo p. 33, "anamoprhosis".

Interactive comment on Ocean Sci. Discuss., 8, 2147, 2011.