Ocean Sci. Discuss., 8, C823–C825, 2011
www.ocean-sci-discuss.net/8/C823/2011/

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.

Anonymous Referee #1

Received and published: 14 December 2011

The manuscript examines the effect of a Gaussian anamorphosis transformations on the correlation length scale of different variables in ocean and coupled ocean-ecosystem models. In particular, the anamorphosis transformations are performed independently for each single grid point of a model and for each variable. The transformations are derived from a histogram of the ensemble used to represent the uncertainty of the fields. Using five application examples, the manuscript discusses that the local transformations increase the spatial correlation length scale of the uncertainties. The authors conclude that the increased correlation length scale reduces the number of degrees of freedom in a given ensemble and hence can improve the estimation accuracy provided by a given observational network, for example for the application of

ensemble-based estimation methods like ensemble Kalman filters.

It is difficult to comment on this manuscript. One the one hand the manuscript is generally well written and presents a detailed study of the effect of the local anamorphosis transformation. The discussion of the anamorphosis method is well written and also the five presented examples are interesting cases. On the other hand, the conclusions seem to be very speculative. It appears that the authors rely on the assumption that only a Gaussian description of uncertainties is reliable (This is already included in the first two sentences of the abstract). In addition, the manuscript relies on the assumption that the increased correlation length scale induced by the anamorphosis transformation is an improvement (e.g. page 2162, lines 15 and 17; p. 2165, line 29; p. 2171, line 18.; p2173, line 15) However, the authors never consider the question, if the increased correlation length scale is in fact reasonable. One has to keep in mind that the anamorphosis transformation is performed independently for each single grid point. The transformation function is derived from the ensemble of model states at this grid point. Obviously, the values of the fields of each ensemble member at neighboring grid points are linked through the model dynamics. However, it is not evident how this linkage influences the transformation itself and hence I don't see a chance to simply assume that the increase correlation length scales in the transformed fields are in deed an "improvement". Unfortunately, the authors don't explain, if there is a fundamental reason that allows this conclusion.

Actually, I would worry if in one of my applications the transformation of two nearly uncorrelated fields, like phytoplankton and nitrate in Fig. 9., by two different and unknown functions results in a much stronger correlation. A similar behavior is visible in Fig. 10, where the anamorphosis transformation results in strong correlations and anti-correlation between the base location of 86W, 23.8N and the far western coastal region of the Gulf of Mexico. While the fields at the different locations are uncorrelated in the original fields, the local transformations, which are only linked through the model dynamics when integrating the ensemble members, result in strong correlations and

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anti-correlations. The manuscript does not show any attempt to explain this effect of the transformations.

Thus, unless the authors can explain the increased correlation length and can show that it is really an improvement and not a spurious effect, I can only recommend to reject the manuscript. Just showing five examples where the local anamorphosis transformations result in increased correlation lengths, does - in my opinion - not justify a publication. In order to obtain a general result, one should study if there are mathematical reasons explaining that the increased correlation length scales are realistic. This theoretical basis would show under which conditions an increased correlation length scale can be expected. In this case, one would be able to provide a result that is generally valid. A selection of the five detailed examples could then serve as an illustration of the effect.I would like to motivate the authors to continue their work in this direction.

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