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Interactive

comment

Interactive comment on "Development of a probabilistic ocean modelling system based on NEMO 3.5: application at eddying resolution" *by* Laurent Bessières et al.

Laurent Bessières et al.

bessieres@cerfacs.fr

In the following, the reviewers' questions and comments are shown in bold-italic type, our answers appear in standard type and the modified text of the manuscript is given in italic type.

Response to REVIEWER #3:

1) Please refer to interactive discussion for referee#3 comment#1

We agree that the mathematical background given in section 2 does not provide the most general mathematical framework, and does not encompass all possible ways of simulating model uncertainties. However, on the one hand, it is general enough to

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[Discussion paper]

include everything that it is possible to do with our specific implementation. Our implementation indeed only introduces autoregressive processes (time-correlated and/or space-correlated), possibly followed by a nonlinear transformation to make them non-Gaussian, and all this is included in the given mathematical framework (by changing the definition of x and M as granted by the reviewer). And, on the other hand, using a more general mathematical framework would make this section more difficult to follow for non-mathematicians.

To answer the reviewer comment, we have thus decided to keep a simple mathematical framework, but we have added a word of caution explaining that this is only one possible approach, and an explanation that the ensemble method could also be used if another type of stochastic parameterization had been implemented.

(i) Before Eq. 3, the following sentence has been added: *"One possibility is for instance to modify Eq. 1 as follows:"*

(ii) After Eq. 3, the following sentence has been added: *"Eq. (3) does not include all possible ways of introducing a stochastic parameterization in a dynamical model, but it is sufficient to include the implementation that is described in this paper (in particular, to include the use of space-correlated or time-correlated autoregressive processes by expanding the definition of x in Eq. (3))."*

(iii) The last sentence of the 4th paragraph of section 2 (before the final summary paragraph) has been rewritten: *"This Monte Carlo approach is very general and be also applied to any kind of stochastic parameterization (not only the particular case described by Eq. 3). It was first applied (...)."*

2) Please refer to interactive discussion for referee#3 comment#2

Yes, we agree that the ensemble usually provides only a rough approximation of the probability distribution, and that the ensemble can give estimates of quantities (like time correlations) that are not contained in the marginal pdfs (for each time t) provided by

the Fokker-Planck equation.

To clarify this, the following changes have been made in the text of the paper:

(i) the last sentence of section 2 has been replaced by *"in this paper, this problem is solved using an ensemble simulation, which provides identically-distributed realizations from the probability distribution, and thus a way to compute any statistic of interest."*

(ii) in the 3rd paragraph, *"a solution to Eq. (2) or (4)"* has been replaced by *"an approximate description of the probability distribution"*.

(iii) in section 3.3, the first sentence has been replaced by: *"Ensemble simulation (...) parameterization (as introduced in Eq. 3)."*

3) Please refer to interactive discussion for referee#3 comment#3

Yes, we agree with the reviewer, the term *"equiprobable"* was not used correctly. It has been replaced by *"independent and identically distributed"* as suggested by the reviewer, or just suppressed where it was not useful.

NB: We thank the reviewer for his/her interesting comments about the mathematical formulation in our paper. They helped us improving the generality and accuracy of our statements. We did our best to take them into account.