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Interactive comment on "A generic approach to explicit simulation of uncertainty in the NEMO ocean model" *by* J.-M. Brankart et al.

Anonymous Referee #2

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The paper describes a generic approach of how the currently deterministic ocean model NEMO can be transformed into a probabilistic model that explicitly represents fundamental and inevitable sources of model uncertainty as part of it. Atmospheric weather prediction models have been at the forefront of the emerging area of developing methodologies to account for uncertainties due to inherent limitations in the computation of the multi-scale flow. To my knowledge the here described developments within NEMO are the first attempts to expand the concept of representing model uncertainty explicitly within the model to an ocean general circulation model. It thus represents a substantial contribution to the modelling scientific community and is highly relevant for the Geoscientific Model Development journal.

The manuscript is clearly written and well structured. Some of the minor comments I

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would raise have already been pointed out by referee #1, in particular his/her points 1and 5.

In addition, I would like to point out to the authors some more recent literature on advances in stochastic parametrisations in atmospheric models. The most comprehensive description of the operational schemes at ECMWF is in Palmer et al. (2009). The special issue in Phil Trans A in 2014 on "Stochastic modelling and energy-efficient computing for weather and climate prediction", volume 372, issue 2018, contains lots of more recent research findings that could be useful for the discussion in the manuscript. Some interesting discussion on the motivation for stochastic perturbations is also given is the slightly less recent paper by Palmer (2001).

The two most commonly used schemes to represent model uncertainty in the atmosphere are stochastically perturbed physical tendencies and stochastically perturbed backscatter of kinetic energy. While the first scheme and variations of it has been discussed in the manuscript in some detail, the process of upscale energy cascade from the small (unresolved) to the large (resolved) scales has not. I wonder whether similar principles as in the atmosphere could be used for the ocean circulation as well?

Can you please give more background information on what unresolved biologic diversity is and what its relevance for the dynamic behaviour in the ocean is?

Typos:

Near the end of first para on page 622: AR(n)

Missing words in brackets near lines 23/24 on page 617 and 618

References:

Palmer, T. N. (2001), A nonlinear dynamical perspective on model error: A proposal for non-local stochastic-dynamic parametrization in weather and climate prediction models. Q.J.R. Meteorol. Soc., 127: 279–304. doi: 10.1002/qj.49712757202

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Palmer, T.N., R. Buizza, F. Doblas-Reyes, T. Jung, M. Leutbecher, G.J. Shutts, M. Steinheimer and A. Weisheimer (2009). Stochastic parametrization and model uncertainty. ECMWF Tech. Memo. 598, 42pp.

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