**Geoscientific
Model Development
Discussions**

Interactive comment on "Addressing the impact of environmental uncertainty in plankton model calibration with a dedicated software system: the Marine Model Optimization Testbed (MarMOT)" *by* J. C. P. Hemmings and P. G. Challenor

Anonymous Referee #1

Received and published: 8 November 2011

The authors present a new, flexible 1-D model framework for simulating upper ocean marine biogeochemistry with a strong emphasis on evaluating model-data skill and optimizing model parameters. The work builds on a rich literature on skill assessment and optimization for marine ecological models. The manuscript is long, perhaps too long for many readers, but it is generally well written and clear. Some of the manuscript length reflects the fact that the authors review the choices made in past modeling studies on the numerous, often subjective, decisions that need to be made in developing such a system; so for example, how to balance uncertainty across different variables

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

or how to address errors beyond simply measurement error. Overall, the discussion is thoughtful, and though I don't agree with the authors on all of their choices, this will be quite useful to the community. In particular, the authors offer a more comprehensive treatment of the various flavors of uncertainty than are typically addresses, though some types of error remain difficult to address for real-world data (rather than the more controlled, model-twin experiments presented here. More specific comments are presented below.

page 1949: The authors choose not to include parameter penalty terms into the cost function whereas others in the field have found them quite useful (at least from a Bayesian perspective). The discussion could be expanded here and could be more balanced.

Page 1950: Equation 3, third term on RHS typically drops out for concentration if you assume seawater is incompressible; divergence or convergence of vertical mass flow needs to be balanced by corresponding horizontal flows. The effect on the local concentration depends on the assumption made on the concentration of inflowing/outflowing later flow.

Page 1952: The text equates the relaxation term r with horizontal flux divergence, and suggests a balance between perturbations and relaxation. I see nothing wrong with this crude form of data assimilation, but it seems that lateral processes can just as easily be the cause of an external perturbation (for the perspective of a fixed Eulerian site) as a relaxation term. The basic argument seems to depend on the idea that there is some large external pool of "unperturbed" water that is being advective into the site, diluting any locally generated perturbation. Although mechanically this may give well behaved simulations, I don't think it is fully reflective of the true ocean.

Page 1958: For clarity, it would help to partition the observational error into measurement error and representativity error. Measurement error is generally reasonably well known; the same is not always true for representativity error. Also the "environmental

error" that includes forcing, etc., is model dependent and is poorly known (and needs to be estimated for each physical-biological coupled model and for each site).

Page 1959: Equation 15; there is also a nice discussion on model-data error in Stow et al., J. Marine Systems, 2009.

Page 1959: Equation 16 is basically the form of a chi-squared statistic, and there is considerable discussion in the literature on measures of model goodness of fit based on chi-squared (See example, Press et al., 1992; Glover et al., 2011, both Cambridge University Press books;). The expected value of M_{ijk} is only 1 for a large number of samples.

Page 1959, last line: I generally agree with the authors arguments that different error measures may be required for different applications, but many of these error variances are either poorly known or not known at all. For example, the structural error is difficult to estimate and model dependent; some further guidance is needed.

Page 1960, line 11: More exactly, one would also need an estimate of the error variance in lateral forcing that could then be run through the model to propagate the error variance into model estimated properties.

Page 1963, paragraph beginning on line 16: It would be useful for the reader to relate the different experiments and simulation groups in Table 3 back to the discussion of error in section 3.1.1 and in particular link to the terminology for the different forms of variance and model-data error encapsulated in the equations in that section.

Page 1964: Please clarify: Line 1-2: "horizontal flux divergences ... treated as uncertain" versus Line 4-6: "uncertainty in . . . monthly mean horizontal flux divergence is not explored"

Page 1968, line 10 define "maximin criterion"

Page 1989: References. After the year, for each reference there are one or more numbers that also look like years. What are these numbers?

Interactive comment on Geosci. Model Dev. Discuss., 4, 1941, 2011.

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper