

Interactive  
Comment

***Interactive comment on* “Reducing the model-data misfit in a marine ecosystem model using periodic parameters and Linear Quadratic Optimal Control” by M. El Jarbi et al.**

**Anonymous Referee #1**

Received and published: 7 September 2012

This paper describes application of optimal control methods to optimization of biogeochemical model parameters at the Bermuda Atlantic Timeseries Station. To implement optimal control procedures, authors first develop linearization of an NPZD biogeochemical model. A unique contribution of this study is the ability to impose periodicity in model parameters. Authors find that allowing for periodicity enables them to capture most of the variability in their signal, unlike past studies that assumed constant model parameters.

Before this paper is published, I would like authors to: 1) Better communicate how their study adds to the existing literature and specifically to (a) scientific understanding of

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biological processes at the BATS station and (b) to the existing practice of parameter estimation in 3D NPZD models. Some of this analysis is presented throughout the paper. However, I found it extremely hard to find and digest the relevant analysis. 2) Give proper credit to observational data and models used in their study. 3) You should define all mathematical symbols as soon as they are introduced. 4) Please number all equations that appear. 5) Please refer to figures in order they appear in the text of the paper. 6) Improve the quality of the presentation following specific comments below.

Specific comments:

Introduction: please split into multiple, well-organized paragraphs.

Page 10211, lines 1-10: this intro is not needed

Page 10211, line 22: please introduce specific mapping between 1,2,3,4 and N,P,Z,D. You will be better off refereeing to obs and variables by their names (N,P. . .) rather than numbers.

Page 10212, line 20: Give credit for data you are using here and in the acknowledgment section. Give information about frequency of sampling and time period of observation. Present a table with numbers of observations.

Page 10213, line 19: I assume you define euphotic depth as 1% of light on the surface. Was the euphotic depth rounded to the closest z level?

Eq. (3): please explain where these numbers come from?

Page 10216, line 4: Please give reference and credit to the OCAM model

Section 3.2: a plot of your linearization and time horizons will help.

Section 3.5: Give us an intuitive sense for R and Q. My understanding is that they are connected to your uncertainty in the magnitude of parameters and state vectors?

Section 4, lines 1-4: intro not needed

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Page 10222, line 12: did you mean “the” instead of “these”?

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Interactive comment on Biogeosciences Discuss., 9, 10207, 2012.

**BGD**

9, C3832–C3834, 2012

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