

## ***Interactive comment on*** “Simulating the effects of phosphorus limitation in the Mississippi and Atchafalaya River plumes” *by* A. Laurent et al.

**A. Laurent et al.**

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Received and published: 7 August 2012

Below the reviewer’s comments were inserted. Responses are interspersed in italic font. Changes in the revised manuscript text in response to these comments are highlighted in green.

### **Comment:**

1. In the abstract, on line 4, please add "in marine waters" after "While phytoplankton growth is considered to be typically nitrogen-limited".

### **Response:**

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*The sentence has been changed accordingly.*

**Comment:**

2. line 107 - How were  $k_{\text{NO}_3}$  and  $k_{\text{NH}_4}$  chosen? This is explained for  $k_{\text{PO}_4}$  but not the N compounds.

**Response:**

*The values of  $k_{\text{NO}_3}$  and  $k_{\text{NH}_4}$  are the same as in previous modelling studies by Fennel et al. (2006) and Fennel et al. (2011). The references were added in the text and we added a table that describes model parameters and their values (Tab. 2).*

**Comment:**

3. this may be me missing something, but could you add a sentence explaining  $\min(\text{LN}, \text{LP})$ ?

**Response:**

*The description of nutrient limitation was clarified (see page 4, lines 100-106).*

**Comment:**

4. line 170 - can you name one or two of the unresolved processes controlling chlorophyll biomass? this is a bit vague.

**Response:**

*The following text was added to the manuscript (page 6, lines 170-171): "such as inputs of dissolved organic matter from wetlands adjacent to Atchafalaya Bay"*

**Comment:**

5. line 190 - are the LUMCON observations shelf-wide or just Line P? if just a few stations, this could be why agreement with that data is not as good...

**Response:**

**BGD**

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*We used the shelf wide observations from LUMCON, which were monthly and spatially averaged over each region. The number of data used for averaging is unlikely to be the main reason for the disagreement in the Mississippi Intermediate region.*

**Comment:**

6. line 292 - can you reword the first sentence of the discussion to include that variability in the delivery of nitrogen is the most important factor limiting phytoplankton growth in the NGOM? it is really the change in DIN load over the year that drives the patterns in nutrient limitation seen here.

**Response:**

*The sentence has been changed as follow (page 10, lines 305-308): “Variations in primary production in the surface waters of the northern Gulf of Mexico are primarily driven by N delivery from the Mississippi and Atchafalaya rivers (Rabalais et al., 2002). The annual cycle of N and P load controls the patterns of nutrient limitation over the shelf, while light limitation due to the presence of suspended terrigenous sediments and chromophoric dissolved organic matter is the most important factor limiting primary production in the delta regions”*

**Comment:**

7. light limitation is not part of your model - this is fine, but can you make any inferences about it's potential (or not) importance?

**Response:**

*Light limitation is an important factor in the model. Phytoplankton growth is limited by light (E), modulated by temperature (T), and limited by nutrients (see equations A10 and A11 in the Appendix). Light limitation was discussed in some detail in Fennel et al (2011) so we hadn't discussed it much in our original manuscript. In our revision we mention the potential for light limitation more explicitly throughout the manuscript and emphasize the importance of light limitation in the delta regions. We also updated the*

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*new Fig. 8 to explicitly show light-limitation.*

*Also, to clarify all the processes included in the model, we added an appendix presenting all the equations of the ecosystem model.*

**Comment:**

8. Figs. 8 9 - are the values in the columns summed? I'm not sure I understand the stacked columns. for example, in Month 2, Fig. 8, is Miss. intermediate 25? and far field 40? perhaps this data could be presented in a more intuitive way...

**Response:**

*Figs. 8 and 9 (now Figs. 9 and 10) were changed to have a more intuitive presentation of the results.*

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Interactive comment on Biogeosciences Discuss., 9, 5625, 2012.

**BGD**

9, C3001–C3004, 2012

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