Responses to Referee's comments
The reviewer's comments were inserted. Responses are interspersed in *italic font*.

Referee 1

Comment:
I have read the manuscript with interest but felt that it should not be accepted by BGD without a major revision.

General comments

1. Sylvan et al. (2006) note that the phosphorus limits the growth of phytoplankton. How can the authors justify using a biological model without phosphorus to assess primary production variability and light-limited/nutrients-limited effects?

Response:
Nitrogen is considered the dominant limiting nutrient in the study region (illustrated, for example, by the fact that nutrient reduction strategies have focused exclusively on nitrogen). While Sylvan et al. (2006) have demonstrated sporadic P-limitation, this should be considered the exception rather than the rule (they reported occurrences of P-limitation only in spring and only in the zone of rapid nutrient depletion and highest chlorophyll). The previously published ecosystem model for the region by Green et al. (2008) also does not include phosphate. We included our rationale in the first paragraph of section 2.2.

Comment:
2. The model is driven by the climatologic surface heat and freshwater fluxes. Is it good enough to character the interannual change of the circulation?

Response:
The dominant drivers of interannual differences in circulation are wind and river forcing. The physical model captures variations in shelf-scale circulation patterns realistically as demonstrated by the detailed validation in Hetland and DiMarco (submitted; see response to next comment).

Comment:
3. The physical model results should be presented and also be compared with the observations. Without the physical part information, it is impossible to tell whether the model really reproduce the same dynamic in the model domain. It's very important because the trustable biological distribution is based on the reasonable physical dynamics.

Response:
We agree that realistic physics is necessary in order to reproduce biogeochemical processes on the shelf realistically. The physical model dynamics is discussed in two separate papers: Hetland and DiMarco (2008) and Hetland and DiMarco (submitted) – both are cited in the manuscript. The latter manuscript in particular presents a detailed validation of the model physics (manuscript is freely available at http://testbed.sura.org/publications). We added a summary of the main results from Hetland and DiMarco (submitted) in section 2.1.

Comment:
4. Current model-data comparison is not proper for the biological part validation. The model time (1990-1998) does not overlap with in situ data (2000-2004) and satellite data (climatology 1998-2004). Why not simulate from 2000 to 2004 or even longer to overlap the time period of the in situ data and satellite data? And also, several profiles comparisons need be done for the vertical validation.

Response:
We extended the simulation period to cover 15 years (1990 to 2004). The simulation period now overlaps with the NECOP program (1991-1993), with Sylvan's observations (2001-2004) and the SeaWiFS period (end of 1998 onward). Unfortunately no vertical profiles are available (Sylvan only mapped surface concentrations).

Specific comments:

Comment:
1. P.126 L.12: "for out model domain" to "for our model domain"?

Response: *Now corrected.*

Comment:
2. P.132 L.17: "Interestingly the simulated growth rates are very similar in all three regions with minima … in summer (Fig. 8d)". It should be Fig. 8a, right? But the maxima of the growth rate show in May, not in summer?

Response:
Yes, now corrected.

Comment:
3. P139 L.15-22: "We believe that advection is the primary process…" Could you show some figures to illustrate the difference of modeled circulation pattern in the years with higher/lower discharge respectively?

Response:
We removed the statement, as it was speculative. We feel that a more detailed analysis is needed which goes beyond the scope of the present manuscript (with 15 figures in total the revised manuscript is already rather long).

Comment:
4. In Fig. 7, could you give the seasonal change of mixed layer depth as well?

Response:
We included a figure that shows the seasonal changes in mixed layer depth (new Figure 11).

Comment:
5. In Fig. 7: Phytoplankton biomass reaches its peak in June, growth rate, however, reaches its maximum in May based on Fig. 8a. It is contra-intuitive that growth rate variation precedes that of phytoplankton biomass. Why?

Response:
We don't see an intuitive problem here. Even neglecting losses for the sake of argument (although losses are very important to understanding the dynamics in this region), biomass can continue to increase, even when growth rates don't increase or even decrease. We can draw an analogy to interest rates. If funds in an account are 100 in an arbitrary currency at the beginning of May and grow at a monthly rate of 10% in May, they will be 110 at the end of May. If in June the growth to drops to 8% funds will still continue to increase to 118.8 by the end of June and so forth.