**Ocean Science
Discussions**

Interactive comment on "Modelling approach to the assessment of biogenic fluxes at a selected Ross Sea site, Antarctica" *by* M. Vichi et al.

M. Vichi et al.

vichi@bo.ingv.it

Received and published: 27 October 2009

We thank Referee #2 for positively judging our manuscript. We have taken into account all the comments and suggestions in the revised manuscript.

1. *As mentioned by the authors, the surface seasonal silicate drawdown is under-estimated in the model as compared to the observations, which lead to an under-estimation of biogenic silica flux along the water column. As the Antarctic Ocean is generally poor in iron, the Si:N uptake by the diatoms should be increased in the model to match the observations. N seasonal variations is about 4 mmol/m3 vs Si of about 12 mmol/m3. As the diatoms support mesozooplankton grazing which in turn is the main contributor to the fast sinking biogenic material, such a*

correction may ameliorate the biogenic silica flux found at 550 m. I don't under-stand why the authors suggest that an increase in the ratio does not substantially improve the results ?

The reviewer is right and we have now rewritten the text in the revised manuscript starting at line 420. The usage of a 3-5 times higher Si:C ratio actually increased the silicate drawdown, however it was not sufficient to reproduce the observations. Only an unrealistic value 10 times higher led to substantially different results. This is still an open question of the work.

2. *Any of the sensitivity analysis on vertical sinking velocity and mineralization rate has been able to reproduce the observed biogenic material peak in december. This means that the model should include a better planktonic succession during the spring / summer time period. It seems to me that Pondaven et al. (2000) in the Indian Ocean sector of the Antarctic have shown that diatom blooms occur in spring and is followed by other planktonic species. Again such a correction will improve the timing for the maximum organic carbon flux at 550 m. Is there any way to represent this process in the model without using an ice - biogeochemical model as suggested by the authors in the last section of the manuscript ?*

The spring bloom in the model is mainly composed of diatoms and then followed by nanoflagellates and grazers. This was moved as early as possible by halving the basal respiration rate (i.e. increasing the overwintering minimum concentration) and by increasing the initial slope of the production-irradiance (P-E) curve. This part is now better explained in the revised manuscript at lines 368-375. The fact that by reducing basal respiration we could improve much the results made us think that the initial biomass is the key to explain the early start. Therefore, the problem may also be solved by using first a sea-ice model (the used data have a weekly time frequency) and eventually a sea-ice buogeochemistry model as the one currently proposed by Tedesco et al. (2009, submitted to Ocean Modelling).

3. *I could not find any comment on the overestimation of organic N flux at 550 m ?*

C711

A suggestion would be to increase the N mineralization rate in the water column. As a matter of fact, organic N is mainly found in proteins which tend to be fastly mineralized as compared to, for example hydrocarbons.

This part is explained at lines 407-417 and was also in the original manuscript. The already model takes into account that N is remineralised faster than C, this is why we suggest that more specific studies are needed to define the range of this mineralisation, taking into account that the model is being used for global ocean studies as well. We have now added a further statement in the discussion where we argue that traps underestimate the amount of deposited organic matter (lines 436-453 and 473-487 of the revised manuscript), as it is found for instance by comparing the fluxes of sediment trap data with estimates from dissolved inorganic nitrogen drawdown (Catalano et al., 2009).

References

Catalano, G., Budillon, G., Ferla, R. L., Povero, P., Ravaioli, M., Saggiomo, V., Accornero, A., Azzaro, M., Carrada, G., Giglio, F., Langone, L., Mangoni, O., Misic, C., Modigh, M., 2009. The ross sea. In: Liu, K.-K., Atkinson, L., Quinones, R., Talaue-McManus, L. (Eds.), Carbon and Nutrient Fluxes in Continental Margins: A Global Synthesis. Springer-Verlag, New York, pp. 303–318.
Tedesco, L., Vichi, M., Haapala, J., Stipa, T., 2009. A dynamic biologically-active layer for numerical studies of the sea ice ecosystem. Ocean Modelling Submitted.

Interactive comment on Ocean Sci. Discuss., 6, 1477, 2009.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper