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Biogeosciences Discussions

Interactive comment on "Natural iron enrichment around the Antarctic Peninsula in the Southern Ocean" *by* M. V. Ardelan et al.

Anonymous Referee #1

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The Southern Ocean is key in the global carbon cycle, as a main driver in glacial/interglacial CO2 exchange. Large parts of the S Ocean are HNLC due to the unfavourable Fe:N ratio in upwelling waters and a very low atmospheric dust supply which delivers insufficient Fe to efficiently remove the residual N concentrations. Islands and continental shelf regions in the Southern Oceans are regions with enhanced biomass levels due to a benthic Fe supply. The submitted manuscript deals with dissolved and dissolvable iron concentrations in the regions of the Antarctic Peninsula. The strength of the paper is the presentation of iron data for a undersampled region. The calculation of the iron supply relative to the iron demand is nice, and confirms the observations of enhanced biomass in regions of high iron. The manuscript has quite a number of scientific English language errors and awkward sentences.

The paper is descriptive, and loses focus in places.

The manuscript makes a nice, but not large, contribution to Southern Ocean iron biogeochemistry.

Comments The paper is too descriptive, and can be shortened by focusing on the main points. The English will need to be improved. The use of the NASS 5 CRM is not appropriate for oceanic iron research. A range of more appropriate materials are available, including the SAFE, GEOTRACES and Ironages seawaters. The iron levels are lower in these samples and hence will potentially provide a realistic check on the low iron samples (e.g. Drake Passage). Line 2, 7483: iron may also diffuse out of sediments (in addition to re-suspension processes delivering iron to the overlying waters). Line 6, 7485: what are optical density measurements when applying to chlorophyll measurements. Line 10, 7485. In high chlorophyll waters, samples for nutrients should be filtered prior to freezing as the freezing process will result in cell breakage and hence intra-cellular nutrient release. Line 13, 7485. Make of autoanalyser Line 23, 7486. How was the buffer made, and make of chemicals Line 14, 7488. The recovery test involving microwaving did not prove that dFe was quantitatively recovered following the microwave test. The NASS crm was still not quite fully recovered following microwaving, and furthermore, the standard deviation (>10%) on the measurements was so large that a hard conclusion on this matter is not warranted. Line 13, 7490. I am not convinced that the higher beam attenuation at depth (100-350 m) for the three stations close to the shore could be attributed to suspended matter. There indeed appears to be an off-set in the readings for the deeper water. However this may well be due to a change in the electronic signal, as there appears to be a shift from 4.55 to 4.45 V. The conclusion is not properly supported.

Figure 8 is totally unclear to me. No TaLFe/DFe ratio is shown here. There must be something wrong with the graph.

Line 10, 7491. Where does the drifter track data come from?

Fig. 10 a is not very helpful, it just shows many wiggles and curves.

Line 11, 7492. Exceptionally high biomass. Provide values.

Line 21, 7492. Upper limit of iron solubility is also critically governed by the solubility of inorganic iron species in solution, and the stabilization of iron in solution by organic ligands and colloids. (Pollard 2007 reference is not appropriate here). In cold waters the solubility will be higher.

Section 4.3. This is a nice section, however its significance is somewhat limited because of the large errors involved in the estimations. The waters in the study region are very dynamic. Nutrient (incl. Fe) ratios in these waters will be subject to strong seasonal changes due to physical and biogeochemical processes and hence the use of ratios from observed depth profiles will have limited use. Furthermore, the authors use f-ratios for the study region from previous studies. Again, these numbers will have a large uncertainty as the conditions under which these ratio's were obtained will have been very different.

The final conclusion that the Fe supply is sufficient to meet the demand is not surprising, as that is what we observe in the enhanced biomass levels.

Line 13, 7498. The statement that the central scotia sea chl a levels are low and dFe must not reach this sea region is contradicted on lines 20-21.

Line 22-28, 7498. The final sentences of the manuscript are not convincing. What are the major findings of this work. Clearly upwelling of Southern ocean deep waters cannot result in important Fe enrichment as the Fe:N ratio in the upwelling deep waters is too low to result in enhanced biomass as the Fe is rapidly stripped out.

Overall, interesting manuscript. It has not been written very well, lacks a clear novel message, but will make a nice contribution to science following important revision.

Interactive comment on Biogeosciences Discuss., 6, 7481, 2009.