

Interactive comment on “Variations of net primary productivity and phytoplankton community composition in the Southern Ocean as estimated from ocean-color remote sensing data” by S. Takao et al.

Anonymous Referee #2

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Within this study over the past decade the spatio-temporal relationships between satellite-derived estimates of SST, net primary production (NPP) and phytoplankton community composition within the Indian Sector of the Southern Ocean are investigated. This has been done for the first time specifically for the Indian Ocean, with particularly focusing on changes in phytoplankton groups' composition over a longer time scale. The satellite derived products of dominant phytoplankton groups (the PHYSAT product) were validated with own in-situ information on the dominance of phytoplankton groups derived from pigment data (partly verified with microscopic data). For SST

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a publicly open access data set was used, phytoplankton groups' dominance and NPP data were calculated by the authors using various SeaWiFs level-3 data based on published methods. Overall the paper is well written and shows that the summer NPP values are at most regions within the Indian Sector of the Southern Ocean affected by the phytoplankton composition. The paper contributes to the understanding of phytoplankton dynamics regarding its composition and productivity in this part of the ocean and therefore fits well in the scope of the paper it has been submitted to. However, still a major revision of the paper is necessary to improve it, especially regarding the validation of the presented PHYSAT and NPP data sets and the description of the methods and presentation of some results. In some parts there are quite a few grammar mistakes and typos which should be removed. Mayor changes: - Since only an analysis of the Indian Sector of the Southern Ocean is shown, the title and the abstract should state that properly. - Page 4364, line 25 ff.: Because in the Southern Ocean ocean color data are scarce, it is dangerous to base the analysis on monthly means of satellite data. These can be represented by very few observations especially in winter time. I therefore recommend to first use the daily level-3 data and calculate from that monthly mean values in case a threshold for a reasonable amount of observation exists. - Validation of PHYSAT: In chapter 2.2 it is stated that pigment data from 5 austral summer cruises within the Indian Sector of the Southern Ocean were used for validation. Later on in Fig. 4 and Table 6 only the collocation and validation results of 10 matches of Jan-Feb 2006 are shown. Why is that? In addition, this figure and this table deviate from the text in the results section where on page 4372 line 18 it states “the PHYSAT outputs matched at 32 out of 39 data in CHEMTAX”. It is necessary to at least present the whole results of the PHYSAT validation also regarding the three other dominating phytoplankton groups and other seasons besides the summer. It is difficult to compare the results of Fig. 4a and 4b, probably with including more data in the validation a new presentation will be necessary. - The new NPP derived satellite product uses the method of Hirawake et al. (2011) – it would be good to have some information on the accuracy and precision of this product (page 4365, 2nd paragraph)

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- The authors should check for this part of the Southern Ocean also other pigment and primary production data sets in order to include these with their own measurements in the validation of NPP and PHYSAT satellite derived data products (e.g. data presented in: Uitz, J., H. Claustre, N. Garcia, F.B. Griffiths, J. Ras and V. Sandroni (2009). A phytoplankton class-specific primary production model applied to the Kerguelen Islands region (Southern Ocean). *Deep-Sea Res I*, doi:10.1016/j.dsr.2008.11.006.) - Chapters 2.3, 3.12. and 3.2: the inter-annual variations and trends in the different regions have been calculated for NPP, SST and the dominant ratio of PFTs. They are only described in detail for NPP. It would be good if the results of PHYSAT and SST are presented in a table in the appendix, because the discussion on the relation of the parameters actually misses concrete values for those two. E.g. in chapter 4.2 and specifically at Page 4375 last sentence: how much is the NPP actually increasing with decreasing SST and what temperature differences actually will considerably reduce microzooplankton grazing? - Appendix A: what kind of cluster analysis was used. Can you provide more details on that.

Minor changes: - Fig. 3 – no intermediate ticks are necessary (they are rather confusing), since only 1 value per summer is shown. - Page 4364, line 3: change “filed” to “field” - Page 4364, line 12: change to “...estimated on global scale...” - Page 4365, line 4 :change to “Satellite data were analyzed for five frontal zones ...” - Page 4366, line 13: unclear! -change to “..., P_i is the number of pixels where PFT_i dominates, P_{PFTs} is the number of all pixels.”? - Page 4367, line 1: give number of HPLC samples used for validation and clustering - Page 4370, line 9: add more information here as well, e.g. “and the difference between highest and lowest value are below xxxTgC in the entire STZ” - Page 4371, line 1: change to “...NPP correlated not only with the DR for diatoms positively (. . .) but also with the DR for haptophytes . . .” - Page 4372, line 4: change to “...carried out except for coastal . . .” - Page 4373, line 13: can you give an explanation here why it was not possible to separate hetero- and autotrophic dinoflagellates. - Page 4374, line 18 end: change sentence to “South of 60°S, Smith and Comiso ...was strongly influenced by sea ice melting.” - Page 4376, line 15: change to “in several

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frontal zones...” - Page 4376, line 20: change to “...northwest of South Georgia” - Page 4377, line 5-6: change to “...we found over the decade within the PFZ a statistically significant reduction of NPP.” - Page 4377, line 8: change to “...NPP correlated not only with the DR for diatoms positively, but also with the DR for ...”

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