Biogeosciences Discuss., 9, C4933–C4935, 2012
www.biogeosciences-discuss.net/9/C4933/2012/

Biogeosciences
Discussions

Interactive comment on "Distribution and recurrence of phytoplankton blooms around South Georgia, Southern Ocean" *by* I. Borrione and R. Schlitzer

Anonymous Referee #2

Received and published: 18 October 2012

Review bg-2012-328.

General comments:

This is a well-written and interesting paper about the occurrence and frequency of phytoplankton blooms in the South Georgia area of the Southern Ocean. Particularly to the north and northwest of the island, which is downstream of the ACC, large and persistent blooms occur. The authors determine the frequency of bloom occurrence (FBO) and with this tool identify a typical bloom area, where spring blooms and late summer blooms occur. The authors conclude that SG blooms have high regularity, which contrasts with work by Park et al. (2010). Park et al. (2010) only see low

seasonality in the SG area and are being criticized by the present authors for having applied an unrealistic delimitation of the study area in the SG region.

Park and co-workers based themselves on empirical orthogonal function analysis, to arrive at identifying eight different biological domains, which allegedly represented a good accordance with oceanographic and topographic features. Their focus was the larger southwestern Atlantic sector of the Southern Ocean, an area much larger than the SG area, but apparently they misjudged the situation around SG. They come however to similar conclusions regarding the transport of Fe. An important conclusion by Park et al. is the dependence of bloom occurrence on flow speed of the fronts bending their way around SG. Actually, what I think Park et al. try to say is that the higher the current speed, the more interaction with the topography, the more sediment resuspension from the island shelves, and the more Fe gets into the water column. Personally I don't think that Fe diffusion from the sediment is sufficient to sustain a lateral Fe flux from the island shelves, resuspension is the key. See also a recent paper by De Jong et al. 2012 (JGR Biogeosciences 117, G01029, doi:10.1029/2011JG001679), who not only describe long distance transport of Fe in the ACC, but also show the role of sediment resuspension in bringing loads of Fe in the water column of the western Weddell Sea and the SOI region. In the case of the SOI region (January 2005) a bloom with 9 μg/L Chl a had developed.

This paper boils a bit down to a Park-is-wrong, we-are-right message, which is too simplistic. This probably is a matter of a discussion that stays a bit at the surface of things and doesn't go beyond what Park has already stated. As the other reviewer observed, it would indeed be interesting to look with more detail into the role of wind forcing and radiation aspects on mixed layer depths development and the timing of bloom onset.

An aspect that I find quite intriguing of this paper is the second bloom peak, or should we say the interruption of the blooming conditions due to the bloom running out of nutrients mid-summer, particularly silicate. I believe this is not the whole story. Judg-

ing from the very low Fe concentrations north of SG from Nielsdottir et al. (2011), I would say that the bloom runs into Si/Fe co-limitation. The authors claim that the bloom gets going again after renewed supply of Si. This should come from below or from advection of Si replete waters upstream ACC. The same is likely so for Fe, see Nishioka et al. (2011, JGR 116, C02021, doi:10.1029/2010JC006321) and De Jong et al. (2012) for mechanisms and fluxes. I could think up even a role for icebergs (see Raiswell et al. 2008, Geochemical Transactions, 9:7 doi:10.1186/1467-4866-9-7) in supplying bioavailable Fe, although that depends on the number of them present in the SG area. I really wonder if increased erosion of the upper mixed layer towards the end of summer (i.e. the onset of deep winter mixing) creates the right circumstances for increased upwelling of enriched waters from the UCDW. The authors believe this is not the case, as allegedly the UML remains relatively shallow until April, but is this true all the time? Couldn't it be that the first end-of-season storms increase the mixing after which the UML restores to its previous shallow state? This does happen in the PF, even in summer. I don't know if the data exist for the SG area to substantiate this hunch, the authors know probably better than me.

Technical remarks

Page 10091 line 16: distributed with capital D. Everywhere: chl-a, pleas write Chl a (a italic) Page 10102 line 19: the very small yet positive slope: this is only going so far as the regression is significant. The authors should show its significance, otherwise this claim is mere hand waving and should better be deleted.

End of review

Interactive comment on Biogeosciences Discuss., 9, 10087, 2012.