Biogeosciences Discuss., 8, C2244–C2248, 2011
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Biogeosciences Discussions

Interactive comment on "Regional scale characteristics of the seasonal cycle of chlorophyll in the Southern Ocean" *by* S. J. Thomalla et al.

Anonymous Referee #2

Received and published: 29 July 2011

Review of Thomalla et al. 'Regional scale characteristics of the seasonal cycle in the Southern Ocean'

General comments:

This manuscript examines the seasonal variability in satellite derived chlorophyll in the Southern Ocean and describes the potential physical/chemical factors underlying the seasonality. Overall I found the manuscript a solid piece of work and not uninteresting.

My major comment is that the authors use the correlation of the mean seasonal cycle with the 'raw' data to define 'seasonality'. If there is a high correlation, then by the authors' definition the region has high seasonality. However, a high correlation only

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means that there is a relatively stationary seasonal cycle that doesn't change much interannually. This doesn't necessarily mean it doesn't have a strong seasonal cycle, just that interannual variability in the seasonality is low. Similarly a low correlation is described by the authors as low seasonality. In fact, it just means that a stationary seasonal cycle does not capture the seasonality in chl, even though there could be a very strong seasonal cycle. It just means that there's large interannual variability in that seasonal cycle. I would prefer it if the authors find some other terminology because their definition of low/high seasonality probably doesn't match most readers understanding of low/high seasonality.

Also, it's not clear how the authors define intra-seasonal variability (perhaps intra-annual would more appropriately describe what they mean?). I think improving the terminology used would make the paper much less confusing once the authors start to discuss intra-seasonal variability and seasonality in detail (earliest example I marked on the m/s was at P4779, L12-14).

Specific comments:

Missing data: Cloudiness and winter darkness must seriously affect the amount of chlorophyll data retrieved in this region. A 'cloud atlas' showing % of days with missing data would be very useful (perhaps in the supplemental info). I would like the authors to include a critical assessment of how missing data affects their ability to accurately determine the start of the spring bloom, to assess the interannual variability in bloom timing, and to assess whether the seasonal cycle is stationary or not. One example of where persistent cloudiness affects bloom estimation might be (P4778, L13-14) south of Australia? In relation to above, Figure 1b shows the chlorophyll in winter – but how much data is there in winter? Do some of the pixels in this plot represent just one winter retrieval in the entire SeaWiFS time series?

Abbreviations: are numerous and after putting down the m/s halfway through it, I was completely lost when I picked it back up a few days later! A list of abbreviations would

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be helpful for people with a bad memory and short attention span, like me.

Correlation coefficients: throughout m/s these should be r2 = 0.91 etc.(rather than r2 = 91). Also, please report 'p-values' or levels of statistical significance.

Non-seasonal regions: The authors suggest that some regions have low chlorophyll and weak seasonal cycles (e.g. P4778, L8-9 and P4786, L18-20). Is it appropriate to talk of 'blooms' in these regions? Or instead of a well-defined seasonal cycle, does chl just oscillate about some mean on much shorter time scales?

Transition zones: Might be worth mentioning similar work done in the North Atlantic on bloom timing, transition zones, links to physics etc. e.g. Dutkiewicz et al. (2001), Deep Sea Res; Henson et al. (2009), J Geophys Res.

Figures: All of the figures had miniscule axis labels, colour bars and contour labels. Please enlarge.

Supplementary material: I found this to be superfluous. Much of the text is repeated in the main manuscript. However, if the authors choose to retain it. . ..The caption didn't supply me with enough information to deduce what the many subplots in the figures were. Presumably different latitude bands??

Technical comments:

P4764, L1: The first line of the abstract made little sense to me.

P4764, L10: What do the authors mean by 'the more dynamically linked characteristics'?

P4768, L15-20: the authors state that they use bloom without reference to a particular threshold. But then they go on to use a threshold method (the 5% above median approach).

P4772, L14-16: Figure 1a doesn't show a rapidly-forming bloom.

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P4772, L26: Reference to ACC which is not plotted on the figures.

P4774, L18-P4775, L10: Is this paragraph necessary? As the authors aren't able to address grazing or growth rate with their dataset and furthermore use Sverdrup's arguments in their later discussions of physics-biology interactions, this whole section seems out of place.

P4779, L1-2: Have the authors already stated somewhere what their hypothesis is? Must have missed it. . .

P4781, L12-14: Could the increase in chl be partly due to relief of nutrient limitation by mixing up of new nutrients, combined with sufficient light for growth (as this is relatively low latitude region)?

P4781, L28-29: I didn't understand what the authors meant by 'a simple overturning threshold initiates the seasonal cycle'.

P4784, L12: Where did these % figures come from?

P4785, L17-18: What is the definition of 'high' and 'low' chlorophyll and 'high' and 'low' seasonality used in Figure 9?

P4787, L1-2: The authors do not demonstrate that the time series is entirely explained by light, etc. Please rephrase as a hypothesis, rather than fact.

P4787, L3-5: The meaning of this sentence eluded me entirely, I'm afraid.

P4787, L5-7: A low supply of new nutrients wouldn't prevent a bloom from starting. It just wouldn't last very long.

P4787, L29-30: Is the seasonal cycle the most important mode of variability in climate change??? Please add suitable references here if so.

Figure 6: The regions are referred to by colour in the figure caption but by region A-D in the text. Please cross-reference them (my preference would be to add to the text

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Region A (light blue) etc.)

Figure 7: Mark the contour of the 95% significance level for the correlation on this plot.

Figure 8: The contouring on this plot is just horrible (and the contour labels are unreadable). Could the contouring be made smoother somehow? Also please mark the latitude of the fronts on the figure. It would help to follow the related discussion.

Figure 9: Add to caption which are Regions A-D.

Figure 9: This plot had a lot of information on. I think I would have found it more useful if the authors had included some discussion of how this 'province' definition is of relevance to higher trophic levels or carbon export or defining future research priorities etc.

Interactive comment on Biogeosciences Discuss., 8, 4763, 2011.