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Interactive Comment

Interactive comment on "Coccolithophore surface distributions in the North Atlantic and their modulation of the air-sea flux of CO_2 from 10 years of satellite Earth observation data" *by* J. D. Shutler et al.

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General review

The authors of this manuscript examine the influence of coccolithophore blooms on pCO2 and biogeochemistry in the surface oceans in the North Atlantic. This work addresses a current need in understanding the impact on the flux of CO2 during bloom conditions, and relates year to year variability to the NAO climate index. Overall, the manuscript is well written, and the results could improve the understanding of the impacts of blooms on surface ocean biogeochemistry. I believe the analysis with the NAO index is interesting and adds to the value of the paper. The results are dependent on the differences between monthly climatology maps of pCO2 (which are assumed to represent baseline conditions without influence of coccolithophores) and derived pCO2 maps from a combination of bloom identification, carbonate conversion, and ultimately pCO2 values produced from an existing software package relating carbonate chemistry and pCO2. Anomolies between climatological pCO2 and derived pCO2 are attributed to the blooms.

There are several key assumptions that lack sufficient detail in either the methods and/or discussion, and this is the weakness of the paper which need to be addressed. For example, the pivotal calculations of pCO2 in bloom areas receives one paragraph in the Methods and no equations (section 2.3).

My specific concerns are listed below.

Specific and technical comments:

1) The Takahashi climatologies are assumed to not include the effects on pCO2 from calcifiers. While there is no mention of this in either the Takahashi article or the current manuscript, there is the possibility that certain grid cells may in fact include coccolithophore effects on pco2 since blooms are regular annual features in specific regions. If pCO2 samples were made inside blooms, then the climatology would be impacted by coccolithophores, and the perturbation calculation would be compromised. This should either be fact-checked or discussed.

2) The authors cite conservative numbers in their calculations - assuming a constant cell density of 2000 cells/ml and a CaCO3-C value of 0.065. Yet these are not the lower limits cited by the original authors of manuscripts they cite. In Balch et al (1991) - and more recently Holligan et al (2010), - bloom density was observed at cell concentrations ranging from 1000 -2000 cells/ml. Further, Tyrell and Merico (2004) adopt a minimum value of 1000 cells/ml for bloom criteria. The authors have also chosen the

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higher value of the CaCO3-C range (0.02 – 0.065 given in Brown and Yoder (1994b)). Shouldn't conservative estimates use the lower numbers, unless there is good reason (which would need some mentioning) of why the higher numbers were chosen.

3) The authors assume that the bloom features remain for 30 days. Berelson et al (2007) and references therein cite shorter residence times (5-18 days). Could the authors comment or acknowledge this, perhaps in the Discussion?

4) Could ocean color PIC maps be used as a better scalar for bloom PIC concentration, or for comparision? It seems a lot of effort has gone into identifying blooms in the methodology, but wouldn't using PIC directly alleviate the uncertainty with bloom detection by including all areas with PIC present, and also include areas that are at below-bloom concentrations, which are also likely to impact pCO2?

5) I believe the satellite radiance error term (listed at 11%) is not necessary in the total uncertainty calculations as it is already included inherently as part of the accuracy of the bloom pixels, since the bloom pixels are identified with satellite radiances. Since satellite radiances are being used in the bloom detection, there doesn't need to be a separate term.

6) The authors only report false negatives in their confusion matrix, but what about false positives?

Interactive comment on Biogeosciences Discuss., 9, 5823, 2012.