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Biogeosciences Discussions

Interactive comment on "Remote sensing of coccolithophore blooms in selected oceanic regions using the PhytoDOAS method applied to hyper-spectral satellite data" *by* A. Sadeghi et al.

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Review of: Remote sensing of coccolithophore blooms in selected oceanic regions using the PhytoDOAS method applied to hyper-spectral satellite data.

By: Sadeghi et al.

General points This paper uses hyperspectral data from the SCIAMACHY sensor on board ENVISAT to look at coccolithophore abundance in three regions of the global ocean: North Atlantic, South Atlantic and South Pacific. The retrievals are compared against satellite data from established ocean colour sensors and products: GlobColour for merged ocean colour and MODIS for the Particulate Inorganic Carbon product.

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Interactive Discussion

Discussion Paper

Although the use of hyperspectral remote sensing is an interesting advance, this paper suffers from two major flaws in my opinion. Firstly that the detection of coccolithophores is particularly easy from existing satellite platforms, indeed it could be argued that coccolithophores form the only group of phytoplankton that can currently be unambiguously determined from space. The use of a coarser spatial resolution satellite sensor is not improving our knowledge of the biogeography of an already well characterised species. Secondly, the validation of the hyperspectral data is only against satellite derived products, which are known to be in error in terms of deriving the higher level products of PIC (rather than just the biogeography described above).

Specific points

P3: I think the use of the abbreviation coccos is cumbersome and unnecessary.

P3: No need for italics in coccoliths

P4 line 4: this is really only one optical effect – high reflectance in the upper ocean causes a shading effect lower down in the water column.

P4 line 11: I disagree with this – diatoms are not always succeeded by coccolithophores. A great deal of this depends on which niche presents itself at particular times in the season, and to the nutrient availability (or lack thereof).

P4 line 20: replace with imagery

P5 line 6: True phytoplankton functionality depends on things like how they cycle nutrients within the water column. PFTs as defined by satellite algorithms are really only size specific and tell us little about the actual biogeochemical function of phytoplankton.

P6 line 2: replace phenomenal with an alternative word.

P6 line 24: direct comparison with in-situ data is not too difficult (see Smyth et al., 2002 and numerous papers by Gordon et al.) The problem you have here is direct comparison with coincidental data and a data sparsity issue.

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P6 line 26: reference for the CPR – Raitsos et al (2006). Although need some explanation as to how the CPR can be used. The CPR has a mesh size of 200um and coccolithophores are 5 – 20 um. There is evidence that they stick to the fibres of the CPR (works by Schroder) P7 line 5: Therefore this paper is a satellite algorithm versus satellite algorithm comparison.

P8 line 1: the Great Calcite Belt is still only a hypothesis. Balch et al. (2011) readily admit that the GCB is still only a hypothesis, with a few in situ observations to support it. Other factors in the Southern Ocean include elevated levels of bubble production, which in turn cause the PIC algorithm to overestimate PIC by a factor of up to three. You should not present a hypothesis as grounded fact.

P9 lines 4 – 12: There is possibly a good case for a more consistent dataset here. Options are: MODIS Aqua chlorophyll (from Ocean Color Web site) together with MODIS Aqua PIC or; GlobColour Chlorophyll and GlobColour radiances to derive the PIC product.

P11 line 29: low phytoplankton activity in wintertime. This is not just due to the deep winter mixed layer! This highlights often encountered problems with Remote Sensing papers: a lack of appreciation for the way the ocean works. The north Atlantic will have very low levels of light at this time of year which obviously affect photosynthesis. In April there is still a deep mixed layer depth (see your graphs), but productivity is increasing due to increasing light levels. It is also worth looking at the Behrenfeld (2010) paper and the ideas of Sverdrup.

P12 lines 1 – 5: Higher SSTs are associated with a stratified water column, which then leads to changes in the nutrient dynamics such as nutrient exhaustion.

P12 line 16: need evidence or a reference here for the temporal rhythm of phytoplankton dynamics.

P12 line 20: high wind speeds could also explain why the water appear white, therefore

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triggering the coccolith flag . . .

P15 lines 1 – 19: need to unpackage the chlorophyll algorithm issue in the presence of coccolithophores: the reason for an overestimate in chlorophyll is because coccolithophores make fundamental changes to the band ratio algorithms.

P17 – 19: I am always a little dubious about invoking trends and climatologies from such a short time series.

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