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Biogeosciences Discussions

Interactive comment on "Particle optical backscattering along a chlorophyll gradient in the upper layer of the eastern South Pacific Ocean" *by* Y. Huot et al.

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General comments

This work had two main objectives. First, to study the relationship between the chlorophyll-a concentration and the particulate backscattering coefficient, particulate scattering coefficient, and the particulate backscattering ratio in oligotrophic and hyperoligotrophic waters ($0.02 < [Chl] < 2$ mg m^{-3}). Their second objective was to investigate the [co-]variability in the spectral behavior of the particulate backscattering and scattering coefficients, and by extension, the backscattering ratio. This work is extremely important because measurements of these parameters in Case-I waters with

[Chl] of less than 0.15 mg m^{-3} have rarely been made, despite the fact that these waters constitute greater than 90% of the surface ocean. The paper is thoughtful and well written, and I recommend that it be published without much revision.

Specific comments and general thoughts

On Instrumentation and methods

There is likely to be active debate on the combined use of two different instruments to measure backward scattering in this work. It might seem incongruous to have used different processing methods and conversion factors (χ) for the ECO-BB3 and the Hydroscat instruments. In fact, different χ values are required because the ECO instruments measure the VSF at different backward angles than the Hydroscat instruments (117 degrees versus 140 degrees respectively). Itś arguable whether or not fitting a power function to the Hydroscat data was necessary and/or justified, and a figure or statistics on how robust the fits were would go a long way toward justifying taking this approach (perhaps outside the scope of this paper, but certainly should have been included in Stramski et al., 2007). Despite these differences, studies continue to show that these instruments provide estimates of the backscattering coefficient that are within 10% (or less) of each other in oceanic environments, and the results of this paper are no exception. I believe that the advantage of having a wider waveband selection by combining data from the two instruments supersedes what are probably minor differences between the resulting backscattering coefficients.

With regard to this manuscript, the authors were very careful to differentiate the ECO-BB3 and Hydroscat data in all figures, tables, and equations. This seems like the best compromise between the less desirable options of treating the two datasets as one or reprocessing and re-computing statistical relationships for a large dataset when it is probably not necessary (e.g., undoing the power fit to the Hydroscat).

On the Results

Figure 1 is remarkable, and seriously informs our understanding of the relationship be-

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tween backscattering and chlorophyll in oligotrophic, Case-I waters. One could still debate what the primary source of particulate backscattering is in these waters, whether it be the phytoplankton and heterotrophic flagellates themselves or their co-varying non-algal particles (detritus, colloids, etc.), but the tight relationship between chlorophyll and backscattering is an important finding. If the source of the backscattering is not the micro- and nanoplankton, then the detrital and colloidal particles are so tightly coupled with the chlorophyll-containing particles that they seem to be functionally equivalent in terms of their contribution to the backscattering signal, i.e. they appear to be one in the same as far as satellites are concerned. This is very interesting, and should stimulate some lively conversations about the so-called ´´backscattering enigma.´´ Would this tight relationship between backscattering and chlorophyll hold in areas where Aeolian inputs are more significant? How robust is this relationship in other central ocean gyres? There is more work to be done in this area, but this paper is a fantastic start.

Technical corrections

Page 4573, line 4: typo remove ´´?´´ after (λ).

Page 4574, line 5: ´´which may reflect the true natural variability in oceanic waters.´´ I would be inclined to say ´´which *likely reflects* the true natural variability in oceanic waters.´´

Page 4585, line 10: reverse the order of ´´are´´ and ´´also´´ at the end of the line.

Interactive comment on Biogeosciences Discuss., 4, 4571, 2007.