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Ocean Science Discussions



# *Interactive comment on* "Estimates of radiance reflected towards the zenith at the surface of the sea" *by* E. Aas

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The author presents an overview, supported by theoretical determinations and experimental measurements, of the radiance contributions reflected towards the zenith by the sea surface. Even though the study is limited to a very specific observation radiometry, it certainly proposes an original analysis of radiance reflected by the sea surface in to the field of view of above-water radiometers which can be of interest for the ocean color scientific community.

The manuscript is well written and well supported by past and recent bibliography, however a few revisions are strongly recommended.

Comment 1 (Section 1) a. The author claims that simple and accurate methods do not



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exist for the correction of reflected radiance in above-water radiometric measurements. This statement requires some major qualification. In fact there is a significant community which applies a combination of theoretical and experimental solutions to determine reflected radiance contributions into the field of view of above-water radiance sesnors (e.g., Ruddick et al. 2006, Zibordi et al. 2004, Deschamps et al, 2004). b. Limiting the analysis to zenith reflected contributions is certainly acceptable. But this is a critical case not generally considered for operational above-water radiometric measurements because of the larger uncertainties affecting the theoretical determination of the sea surface reflectance with respect to other privileged geometries. The work of Mobley (1999) comprehensively addressed the sea surface reflectance as a function of wind speed and geometry. I believe that much more space should be given to that basic work in the introduction of the manuscript.

Comment 2 (Sub-section 2.1). The work of Cox and Munk (1954) and successive developments certainly provide elegant and appropriate solutions for the statistical quantification of sun-glint as a function of wind speed. Nevertheless, i. uncertainties in wind speed values, ii. effects of bottom topography in coastal regions and iii. the limited number of radiometric observations generally available, reduce the effectiveness of such a statistical modeling. This should be clearly stated.

Comment 3 (Sub-section 3.2) The methods proposed in the so called NASA Protocols refer to measurement geometries centered on viewing angles and azimuths much different from that considered in the present manuscript (i.e., nadir view). It is then quite inappropriate to compare differences in surface reflectance determined through comprehensive modeling (as applied in this work) and surface reflectance approximated by the Fresnel reflectance for viewing geometries not significantly affected by sun glint. The text should be revised and the former elements clearly reported. For instance it should not be stated that the NASA methods are only applicable for low wind speeds. This is valid for the measurement geometry considered in this work but not for the measurement geometries proposed in the NASA Protocols.



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Comment 3 (Sub-section 3.3) The independence of sun-glint from wavelength was already applied to quantify residual sun-glint contributions in above water radiometry (e.g., Zibordi et al., 2002).

Comment 4 (Sub-section 4) The author makes a commendable effort to quantify uncertainties throughout the manuscript. It should be of general interest to have a table where the various uncertainties are summarized and statistically composed.

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Interactive comment on Ocean Sci. Discuss., 7, 1059, 2010.