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Interactive comment

# *Interactive comment on* "Analysis of simultaneous aerosol and ocean glint retrieval using multi-angle observations" *by* Kirk Knobelspiesse et al.

**Anonymous Referee #2**

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The manuscript describes in great details a theoretical analysis of the information content attached to the MISR satellite instrument in one given spectral band (i.e., centered on 865 nm) but performing acquisitions for nine distinct viewing directions. In this part of the spectrum, most of the ocean might be considered as virtually totally absorbing that is to say that the water leaving radiance is nil. Even if the assumption is a little restrictive (e.g., intense bloom), it can be advantageously used to get purely atmosphere and water surface information. Here, the authors discussed how accurate could be achieved retrieval of some key parameters concerning aerosols and air-water interface roughness given the nine pieces of information provided by the MISR directional measurements. This information content assessment is performed upon a sophisticated Bayesian approach and outcomes of a well-established radiative transfer code. The



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Discussion paper

results obtained for a limited set of “test cases” show not very surprising results: for low aerosol optical thickness (AOT), surface parameters are better retrieved and when AOT increases the aerosol model is better retrieved.

The manuscript is well-written with a sound mathematical background for such analysis. However, the parameters used in the analysis could be expanded to better delineate the optimal number of parameters to be estimated. More importantly, the primary goal of the analysis is not very clear and should be specified; is the study dedicated to: (i) estimation of aerosol microphysical parameters, (ii) atmospheric correction for ocean color purposes, (iii) sea surface roughness characterization (or (iv) all on the same time). For the first case, the study should include more aerosol parameters to be tested (single scattering albedo, mean radius and variance of the modal size distribution…). For (ii), the most important parameter is the spectral variation of the atmospheric radiance. As to (iii), the surface model should be furthered with inclusion of foam formation, for instance, and discussed in light of the uncertainties attached to wind-sea-roughness model with the isotropic and directional implementation (see (Breon  Henriot, 2006; Munk, 2009)) and compare with other technical approaches (see (Harmel  Chami, 2013)). In any case, the representativeness of the parameters retrieved from the near-infrared band should be analyzed over the visible-NIR spectral range. The study could conclude on the benefits of using the methods developed for the “aerosol” algorithms to the “atmospheric correction” ones, and respectively.

Minor comments:

The study is presented based on a few “test cases” corresponding to some AERONET-OC cases. First, those sites are mostly coastal with non-null NIR water-leaving radiance. Second, for such a theoretical study there is no need to restrict the analysis to very few and too specific conditions. For the sake of completeness, this test cases should be removed and replaced with a complete set of configurations, for instance sun angle from 0° to 90°, aerosol optical thickness from 0 to 1, wind speed from 0 to 12 m/s (of course, actual values are at the discretion of the authors).

Technical comments:

Through the manuscript: remove statement on future works, this gives the impression that everything is still to be done.

Title: specify the main purpose: atmospheric correction, aerosol retrieval. . . (see major comments)

L.16: “virtually black”

L.125: it would be very interesting to include more complex aerosol models than those obtained based on Mie assumptions (non-spherical, heterogeneous. . .)

Table 1: specify the distribution type (in number, surface or volume) for the modal parameters

L.138. Provide the values of the increments used

L.156: foam should be considered but if not you have to remove wind speed greater than a certain threshold (8, 10 or 12 m/s)

Section 2.3: to be removed

L.199: “a less common extremely low $\theta_s(20^\circ)$”, why is it less common, actually we can have sun zenith angle = 0° for subtropical acquisitions.

L.209: I would say: “the partial derivatives of the simulated signal in the vicinity of the retrieved parameters”

L.211: in equation with $\delta m_j, m_j$shouldn’t be bold.

L.220: PDF not defined

L. 221: “measurement space is locally linear”? “locally continuous”, instead?

L.253: it is not very clear to me, why eight dimensions?

Table 4: $\sigma_{pp}$is also a function of sun zenith angle

References

Breon, F. M., Henriot, N. (2006). Spaceborne observations of ocean glint reflectance and modeling of wave slope distributions. Journal Of Geophysical Research-Oceans, 111, C06005.

Harmel, T., Chami, M. (2013). Estimation of the sun glint radiance field from optical satellite imagery over open ocean: multidirectional approach and polarization aspects. Journal of Geophysical Research, 118(1), 1–15. https://doi.org/10.1029/2012JC008221

Munk, W. (2009). An Inconvenient Sea Truth: Spread, Steepness, and Skewness of Surface Slopes. Annual Review of Marine Science, 1(1), 377–415. https://doi.org/10.1146/annurev.marine.010908.163940

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