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Atmospheric Measurement Techniques
Discussions

Interactive comment on "Inversion of multi-angular polarimetric measurements from the ACEPOL campaign: an application of improving aerosol property and hyperspectral ocean color retrievals" *by* Meng Gao et al.

Anonymous Referee #3

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The study aims at demonstrating the benefit of using synergistically hyperspectral and multi-angular polarimetric (MAP) observations to improve ocean color remote sensing, especially in the coastal zone, where aerosols are complex, relatively abundant, and highly variable. The approach is to use aerosol properties (size distribution parameters, index of refraction, optical thickness) retrieved from MAP data in a forward radiative transfer model to estimate the aerosol signal, therefore perform atmospheric correction of the hyperspectral measurements. To achieve this objective RSP and SPEX aircraft measurements acquired off the West Coast of California were used, and the

retrievals of aerosol properties and, therefore, remote sensing reflectance were compared with AERONET-OC measurements. Uncertainties in aerosol retrievals are reduced substantially (factor of 2) when using polarization and reflectance instead of just reflectance data, and the retrieved quantities show some agreement with in-situ measurements. The authors conclude that the findings constitute a proof-of-concept for the PACE mission, i.e., MAP data would be used in a similar way to correct atmospheric influence on the OCI hyperspectral imagery.

The approach is technically sound, the inversion techniques appropriate and robust, and the data processing/analysis performed carefully, but several issues prevent publication of the manuscript. First, aerosol abundance during the flights analyzed is very small, i.e., about 0.02 at 865 nm. With such minimum loadings, the signal to correct is so small that even large errors in the aerosol model would still yield sufficient accuracy on the remote sensing reflectance. It is not surprising, therefore, that even though differences are relatively large between estimates of size distribution, real part of index of refraction, and single scattering albedo using 7rhos and 7rhos + 5Pols (e.g., Figure 5), the retrieved RSP remote sensing reflectance is similar. I suspect that simply using the aerosol information from the MERRA-2 data would have provided similar performance. In other words, the demonstration is not credible when using cases with almost no aerosols. Second, HARP2 on the PACE mission will not measure in the shortwave infrared, so the demonstration should have been made using 5rhos and 5rhos + 5Ps to better mimic/represent the PACE capabilities. Furthermore, no comparison was made with remote sensing reflectance retrievals performed by the standard algorithm applied to aircraft RSP and SPEX data (possible even though for SPEX the spectral range is limited in the near infrared), in order to evaluate potential improvements by the proposed method. Finally, examining Figure 6, one cannot convincingly conclude that SPEX-derived hyperspectral reflectance in the blue agree with the in-situ measurements, i.e., in Section 4 the statement "The resulting hyperspectral water leaving reflectances agree well with the ARONET OC and MODIS OC products" in incorrect.

The above criticisms notwithstanding, the study is interesting. The procedures for estimating the atmospheric interference are well defined. I would recommend showing retrievals over the entire 2 flights (along and perpendicular to the coast) to capture varied aerosol and water reflectance situations, even though in situ measurements may not be available, compare the remote sensing reflectance retrievals with those of the standard algorithm, and evaluate against the aircraft lidar measurements and satellite products, but this would require a new submission.

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