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Atmospheric Measurement Techniques Discussions

Interactive comment on "Inversion of multi-angular polarimetric measurements over open and coastal ocean waters: a joint retrieval algorithm for aerosol and water leaving radiance properties" *by* Meng Gao et al.

Anonymous Referee #2

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The manuscript by Gao et al., "Inversion of multi-angular polarimetric measurements over open and coastal ocean waters: a joint retrieval algorithm for aerosol and water leaving radiance properties" presents a study to apply the joint retrieval algorithm (to obtain the aerosol and water leaving signal simultaneously) to RSP airborne measurements. This retrieval algorithm has been validated with synthetic data earlier, while in this study the focus was to evaluate it against airborne polarimetric measurements from the Research Scanning Polarimeter (RSP) over both open and coastal ocean waters acquired in two field campaigns: the Ship-Aircraft Bio-Optical Research (SABOR)

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in 2014 and the North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) in 2015 and 2016. Thus the focus of the paper is clearly defined and targeted, and so are the results and conclusions that are presented. I think the manuscript suits the scope of AMT and deserves to be published. I have only few relatively minor comments that I wish are considered in the revised version.

The main comment has to do with aerosol "treatment" of the algorithm, for which I thought some further discussion might be suitable. For instance, regarding the "perturbations to the real and imaginary parts of the PCA refractive indices at 410nm and 470nm". I was thinking that it was likely the allowed perturbation particularly in imaginary index that resulted in the improvement of Figure 10b. However, this was not discussed, so the question remained which one more effectively influenced the results by these "perturbations"? If it was imaginary index, then this it is likely related to the spectral dependence of absorption by organic aerosols (Brown Carbon). It is well known that in this regard, what we nowadays know about spectral aerosol absorption, the Shettle and Fenn 1979 does not represent this understanding well. Perhaps these issues could be discussed in the revised manuscript.

About the Figures 4,8: is it so that you do not show unitless AOD? I thought it should be extinction in 1/km, but it seems it is something else in the unit,since from that Figure I would estimate much larger AOD than what is shown for HSRL in the Figure 9b. So good to clarify what exactly is shown by these type of figures.

Page 14, line #4. You mention that the retrieval produces larger aerosol absorption. What does this mean exactly and how it was concluded (comparing against AERONET AAOD)? This is not clear, since it seems that you retrieve only aerosol extinction and single scattering albedo is based on your assumed aerosol model. Please clarify this statement.

- In many plots Wavlength -> Wavelength

- Page 2, line #29: soley -> solely

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