

## Response to Anonymous Reviewer #1

We would like to thank Reviewer #1 for his/her comments. We have done our best to address each of the points as detailed below.

Note: All reviewer comments are in *italics*. All author responses are in normal format.

**#1. Title:** *The title is a bit misleading because it does not highlight what “a new study” means (new observations? new method?). In the abstract and in the conclusions it is specified that a new method is described. Therefore, I suggest to make the title clearer by using “a new method”, “a new algorithm”, etc.. or anything else equivalent.*

We agree with the referee, the title has been modified as: A new method deriving sea spray optical properties from multi-sensor spaceborne observations.

**#2. Abstract:** *Line 2: Replace the sentence “the assumption of an extinction-to-backscatter ratio” with “the assumption of the extinction-to-backscatter ratio”.*

The abstract line has been changed.

**#3. Introduction:** *General remark: It would be good to provide a list of state-of-art available methods, which allow the retrieval of the lidar ratio. This could be done just in 1-2 sentences.*

A table with references of the currently available state-of-the-art retrieval methods has been added to the revised manuscript. We also added the following to the last paragraph of the introduction: “Other techniques like the inversion of AERONET radiometer data (Holben et al., 1998) along with Mie theory can also provide the lidar ratio. The supplementary Table S1 summarizes available methods to retrieve the lidar ratio along with some measured  $S_p$  values for marine aerosol. A more comprehensive list can be found elsewhere (Catrall et al., 2005; Smirnov et al., 2001).”

**#4. Page 214, line 23:** *The acronym SSA sounds misleading in this context because usually it refers to “single scattering albedo”. The authors should find an alternative acronym for the sea spray aerosol. Maybe SS (sea spray) is sufficient.*

In the sea spray aerosol remote sensing/modeling community, it is common to use the abbreviation SSA. Therefore, we have retained the abbreviation throughout the manuscript.

**#5. Page 214, line 24:** *Replace the sentence “SSA contributes an aerosol optical depth (AOD) of approximately 0.15” with “the contribution of sea salt aerosol to AOD is approximately 0.15”.*

Corrected as suggested.

**#6. Page 216, line 21:** *Replace the sentence “Because of this” with “For this reason” or something equivalent.*

Corrected as suggested.

**#7.** Page 216, line 23: *The acronym  $S_p$  is introduced here for the first time with no clear meaning of the subscript  $p$ . Later in the manuscript, it's clear that  $p$  stands for particulate but it should be explicitly defined here.*

Corrected as suggested.

**#8.** Page 217, line 17: *Replace the sentence “we present a new method for deriving lidar ratios” with “we present a new method to derive lidar ratios”*

Corrected as suggested.

**#9.** *Methods: General remark: The title of this paragraph does not seem consistent with the ones of the sub-paragraphs. Please consider it to change it, or to change the ones of the sub-paragraphs or to re-organize this section.*

The header of the section was changed to “Instrumentation and Methods”

**#10.** Page 218, line 5: *Replace the sentence “The CALIPSO mission was launched on April 28, 2006. CALIPSO has been able to provide the scientific community with vertically resolved measurements of both aerosol and cloud optical properties like depolarization ratio (a measure of particle sphericity), AOD, and ice/water phase since June 2006” with “The CALIPSO mission (INSERT A REFERENCE HERE), launched on April 28, 2006, has been able to provide the scientific community with vertically resolved measurements of both aerosol and cloud optical properties like depolarization ratio (a measure of particle sphericity), AOD, and ice/water phase since June 2006”.*

This was changed as suggested and the reference Winker et al. (2009) was added.

**#11.** Page 219, lines 10, 12: *Repetition of “Therefore” at the beginning of the sentences. Please modify.*

Corrected as suggested. The revised manuscript reads:

“Since the radar signal attenuates mostly due to water vapor and the lidar signal weakens mostly due to aerosols, after the radar signal is corrected for attenuation by water vapor and oxygen, the change in the radar-to-lidar signal ratio is directly related to aerosol abundance (Josset et al., 2008; 2010a). Therefore, by using observations from two different sensors, SODA can eliminate uncertainties induced by the CALIOP aerosol extinction algorithm over oceans.”

**#12.** Page 220, line 14: *Replace the sentence “With these assumptions in mind, integration: : :” with “Based on these assumptions, the integration: : :”.*

Corrected as suggested.

**#13.** Page 220, line 20: *Replace the sentence “we get an equation for a columnar particulate*

*lidar ratio as” with “the equation for a columnar particulate lidar ratio is”.*

Corrected as suggested.

**#14.** *Page 221, line 1: Replace “The equation” with “Eq. 4”.*

Corrected as suggested.

**#15.** *Page 225, line 11: Provide a reference.*

The following references have been added to the revised manuscript:

Smirnov, A., Holben, B., Eck, T., Dubovik, O. and Slutsker, I.: Effect of wind speed on columnar aerosol optical properties at Midway Island, *J. Geophys. Res.*, 108(D24), 4802, doi:10.1029/2003JD003879, 2003.

Sayer, A., Smirnov, A., Hsu, N. and Holben, B.: A pure marine aerosol model, for use in remote sensing applications, *J. Geophys. Res.*, 117, doi:10.1029/2011JD016689, 2012.

**#16.** *Page 226, line 9: Replace “this figure” with “Fig. 3”.*

Corrected as suggested.

**#17.** *Page 231, line 10: Avoid repetition of “that” in the sentence, if possible.*

Corrected as suggested.