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## ***Interactive comment on “Evaluation of CALIOP 532 nm AOD over opaque water clouds” by Z. Liu et al.***

### **Anonymous Referee #2**

Received and published: 7 October 2014

Satellite remote sensing of above-cloud aerosol is an emerging capability, which is expected to contribute significantly to the understanding of aerosol long-range transport and climate effects. This paper evaluates CALIOP standard above-cloud aerosol retrieval in nighttime by applying multiple retrieval techniques (e.g., depolarization-based retrieval, full column retrieval), which has allowed for the characterization of data accuracy and identification of error sources. It is a suitable topic for ACP readers. Results from this study provide essential information for CALIOP data users. I recommend the paper be published after address following issues.

1. The paper would benefit from a better organization. There are some redundant texts in sections 2 and 3. Please reorganize and avoid the redundancy. Also the first two paragraphs of section 4 (just prior to 4.1) seemingly belong to section 3 (methodology).

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2. Please improve quality of figures. For example, a. Figure 1: you can add “dust” and “smoke” to the red boxes. Also it is necessary to add unit for wind speed in figure caption. b. Figure 3: better color scales can be designed to show the spatial distribution more clearly. c. Figure 5: modify the figure caption to clarify (c). It is not easy for readers to distinguish dark green from light green. d. Figure 6: for this dust region, you are including smoke aerosol near the equator and trying to explain this in the text. This is causing some confusion. I would suggest filtering out the smoke. e. Figures 8 & 9: please add color bars. In both figures, there are significant data points with  $AOD < 0$ . Can you explain why? It is also interesting to plot PDR vs AOD. f. Figures 10, 11, & 12: it would be informative if correlation coefficients are noted in the figure and discussed in the text. g. Figure 13: upper x-axis label “ $S_a/S_a=40$ ” is a bit confusing. Looks that “ $S_a/40$ ” is adequate.

3. Page 23585, line 23-26: recent capabilities as demonstrated for passive sensors such as OMI (Torres et al., JAS, 2012), MODIS (Jethva et al., IEEE TGRS, 2013), and POLDER (Waquet et al., AMT, 2013) should be mentioned/commented and cited. Yu and Zhang (2013, Atmos. Environ.) summarized these capabilities.

4. Page 23589, line 7: avoid using “semi-direct radiative effect”. Not all readers are familiar with this terminology. “Sakaeda et al. (2011)” is not listed in the references.

5. Page 23599, line 9-11: how did you determine final lidar ratio?

6. Page 23601, line 12: change “2x3 maps” to “2x3 resolution maps”.

7. Page 23604, last line: “Shuster” should be “Schuster”.

8. Page 23608: It was speculated that “marine” aerosol classification above clouds arose from a “coding error”. This doesn’t seem to be an issue in the dust region. Why?

9. Page 23610, line 12: add “/” between two “tau”.

10. Page 23611, last line: it is necessary to specify that this study looked into nighttime data only.

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11. Page 23613, 2nd paragraph: some conclusions about smoke are mixed with that for dust. It is better to move smoke-related conclusions to next paragraph.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 23583, 2014.

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