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Interactive comment on “A method to retrieve super-thin cloud optical depth over ocean background with polarized sunlight” by W. Sun et al.

Anonymous Referee #1

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General comments:

Super-thin clouds are very difficult to be detected by passive sensors, thus can complicate the retrieval of atmospheric constituents and sea surface temperature that require clear-sky conditions. The authors did lots of nice works about this topic by using observations and models. Based on their previous results and polarized sunlight, this paper presented a novel method to retrieve super-thin cloud optical depth over ocean. Overall, the method is innovative and the results also are reasonable. These results can be used to develop the new sensors and algorithm. I think that the paper can be published by ACP. Thus, I just have a little bit suggestions.

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Specific Comments::

1. In the modeling, only single-layer cloud or aerosol is included in the atmosphere. The question is: The multilayered clouds are very frequent. When a cloud overlap system is present (such as, thin cloud over water cloud), is there any impact of underlying water cloud on your results?

2. The optical depth of aerosol also is constant values (0.06) in all simulations. What's the uncertainty of fixed AOD? In addition, in the paper(page 6, Line 21): “ One manifestation of this can be seen in the glory, which occurs at near backscattered angles and is p-polarized. If the particle strongly absorbs light, like some aerosols, the refracted light cannot emerge from the particle, and the p-polarization feature is not observed”. Thus, my question is: the properties of aerosol (absorbing or shapes, et al.,) whether can affect the cloud retrieval by using p-polarized sunlight when they co-exist? The method whether possible misclassifies some aerosols as clouds?

3. Page 5, Line 12: What's the C1 size distribution of water cloud droplets? Detailed parameter information (such as, distribution function, modal radius, shape of the distribution) are needed to be added in the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21959, 2015.

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