Response to the comments of Reviewer 1

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.

Answer: The authors of this manuscript greatly thank this reviewer for the helpful and insightful comments.

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?

Answer: Following this comment, we add in the text of Conclusion: "However, as an algorithm based on a low-cost passive instrument measuring reflected solar light, it has difficulties in detecting super-thin clouds over thick clouds, since the thick clouds' glory pattern is much stronger than that of super-thin clouds. For those multilayer cases, this method can only tell there are thick clouds in the scene."

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?

Answer: Following this comment, we add in the text of Conclusion: "Moreover, since glory pattern is a special optical phenomenon of transparent cloud droplets or ice crystals, this algorithm is not sensitive to background aerosols that coexist with super-thin clouds. However, heavy aerosols (OD > 0.2) can cause electric field on the principal plane not parallel to the ocean surface at viewing zenith angles smaller than the backscattering angle, which will result in some ambiguities for retrieval, but they cannot produce the full glory pattern as shown in Figs. 1-3, i.e. electric fields in all radial directions around the backscattering direction."

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.

Answer: Following this comment, we add in the text "The modified gamma (MG) particle size distribution (PSD) is assumed for water cloud droplets

$$dN/dR = N_0 R^{\nu} \exp(-\nu \frac{R}{R_0}), \qquad (1)$$

where R denotes the droplet radius , R_0 is the modal radius, ν defines the shape of the distribution, and

$$N_0 = \frac{\nu^{\nu+1}}{\Gamma(\nu+1) R_0^{\nu+1}} N_{tot} \qquad (2)$$

is a constant with $\Gamma(\nu+1)$ as the gamma function and N_{tot} as the total number of particles per unit volume (Petty and Huang, 2011). The commonly used C1 size distribution (Deirmendjian, 1969), which is defined by Eq. (1) with R_0=4 μm and ν =6, is applied in this study."