

# ***Interactive comment on “Daytime aerosol optical depth above low-level clouds is similar to that in adjacent clear skies at the same heights: airborne observation above the southeast Atlantic” by Yohei Shinozuka et al.***

## **Anonymous Referee #2**

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This paper uses recent airborne high-spectral-resolution lidar (HSRL) and sunphotometer observations to examine an assumption that aerosol properties over low clouds are similar to that in the neighboring clear sky. This assumption is widely used in the studies that investigate aerosol radiative effects in cloudy and clear-sky conditions using passive satellite remote sensing data. The paper referenced a previous study by Chung et al that used the satellite-borne CALIOP observation to examine the aerosol optical depth (AOD) difference in cloudy and clear-sky conditions. The Chung et al paper revealed a large day and night difference that is most likely related to the CALIOP

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measurement. CALIOP is an active lidar instrument and can provide globally range-resolved cloud and aerosol vertical profiles. Its return signal is generally weak due to the high altitude (>700 km) of the satellite orbit, and the data SNR for daytime is not as good as that during nighttime in the presence of large sunlight background noise. Therefore, some tenuous aerosol layers can be missed in the feature detection. This can cause underestimate of daytime AOD. The airborne HSRL measurement used in this study has much larger SNR than that of the CALIOP measurement and can provide the aerosol extinction as well as lidar ratio which is modeled in the CALIOP data processing. This paper uses this HSRL dataset to revisit the cloudy and clear-sky AOD difference. The study is very useful and valuable. I suggest the paper published after some revision.

In the paper, the authors concluded that daytime 532 nm AOD over low-level clouds is similar to that in the surrounding clear skies at the same heights. This supports the assumption mentioned above in the geographical region and season investigated. However, some information and analysis results presented in the paper are confusing and need more explanation and clarification. My biggest confusion is with the statistical analysis using t-test in the paper. In figure 6, the mean 532 nm AOD<sub>ct</sub> difference approaches zero as the separation distance between the aerosol layer over cloud and in the surrounding clear sky decreases. This is as I expect. However, the p-values from the t-test are smaller than the threshold of 0.05 for smaller separation distances, suggesting that the null hypothesis of zero AOD<sub>ct</sub> difference is rejected (refer to lines 227-228) at a confidence level of 95

Some minor comments:

It may be useful to provide the expression of t-test that can help the discussion and interpretation about the results.

The mean difference is compared to RMSD (line 241, line 249 and line 255) in the discussion about the results in this paper. It may make more sense to compare the

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mean difference and standard deviation (or RMSD) to the corresponding mean value of each parameter.

In Table 2, statistics of log10532 nm AODct difference are listed, in addition to 532 nm AODct difference. Is there a reason for this? Any additional information can be drawn from it? A little bit more explanation is needed.

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