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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Satellite observations of aerosols and clouds over South China from 2006 to 2015: analysis of changes and possible interactions" *by* Nikos Benas et al.

Anonymous Referee #2

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The authors investigated seasonal and decadal variations of aerosols and clouds over South China using several satellite observation data and GFED biomass burning emissions to understand aerosol cloud interactions and aerosol semi-direct effect. The methodology of combined use of passive and active satellite sensors is useful, but some discussions are not enough clear to understand aerosols cloud interactions.

General Comments:

1. The authors used the CALIPSO aerosol classification product to examine atmospheric aerosol composition over South China; however, misclassification of aerosol type in CALIPSO product often occurs. Burton et al. (2013) indicated that 78% of

the smoke layers of the CALIPSO product are inferred by the airborne high spectral resolution lidar (HSRL) to be urban (polluted continental) aerosol.

2. The accuracy of data products and the uncertainties caused by the different data sampling derived from the different sensors are not discussed in the manuscript. More detailed description about data quality is needed.

Specific comments:

P2 line 25: The paper about the CALIPSO level 3 product written by Tackett et al. (2018) was recently published. I would suggest that the authors cite this paper.

P2 line 28: Why only three types (dust, smoke, and polluted dust) were used? The CALIPSO aerosol models are consist of six aerosol types (Omar et al. 2009).

P2 line 33: Why monthly GFED data used? I think the daily product is more appropriate for applying the thresholds in section 2.3.

P3 line 26: It is not clear to me how several products with different pixel sizes are treated. In addition, how about data sampling? The data sampling of each sensor is different. The swath width of the MODIS sensor is 2330 km, while the CALIPSO lidar only measure the nadir direction from the satellite orbit.

P4 line 9: It is not clear to me why MODIS AOD and CALIPSO AOD are different in Mach and April. The difference of MODIS AOD and CALIPSO total AOD in March and April is 0.3, which is comparable to the seasonal variation of CALIPSO total AOD.

P7 line 23: The CALIPSO lidar is unable to detect aerosols and clouds underneath optically dense cloud layers; therefore, the extinction coefficient of low-level cloud in Figure 8a is underestimated.

P8 line 5: "less absorbing aerosols above stratocumulus clouds would lead . . .". The "polluted continental" type of CALIPSO aerosol models (Omar et al., 2009) is also regarded as one of absorbing aerosols. Why the "polluted continental" type is not

included in the analysis?

References:

Burton, S. P., Ferrare, R. A., Vaughan, M. A., Omar, A. H., Rogers, R. R., Hostetler, C. A., and Hair, J. W.: Aerosol classification from airborne HSRL and comparisons with the CALIPSO vertical feature mask, Atmos. Meas. Tech., 6, 1397-1412, https://doi.org/10.5194/amt-6-1397-2013, 2013.

Tackett, J. L., Winker, D. M., Getzewich, B. J., Vaughan, M. A., Young, S. A., and Kar, J.: CALIPSO lidar level 3 aerosol profile product: version 3 algorithm design, Atmos. Meas. Tech., 11, 4129-4152, https://doi.org/10.5194/amt-11-4129-2018, 2018.

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