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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal and spatial variations in aerosol vertical distribution and optical properties over China from long-term satellite and groundbased remote sensing" *by* Pengfei Tian et al.

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The authors are grateful for the helpful comments from this referee. All the comments and concerns raised by the referee have been considered and incorporated into the revised manuscript. 1. What are the differences between CALIOP and NIES lidar? Response: The main difference between CALIOP and NIES lidar is the observation direction: the ground-based NIES lidar lies below the aerosol layers, with the emitted laser light penetrating the aerosol layers from the bottom to the top; while the satellite-based CALIOP lies above the aerosol layers, with the emitted laser light penetrating the

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aerosol layers from the top to the bottom. The satellite-based CALIOP provides a global observation, while the NIES lidar provides continues observation over SACOL. The retrieval methods are different. There are also some differences in technical details as shown in Table S2. 2. How about is the precision of CALIOP AOD in figure 3? There needs to compare CALIOP AOD with the ground AOD observation, e.g. AERONET AOD, in different regions. Response: The precision of CALIOP AOD over China has been evaluated by Liu et al. (2014) using both AERONET and MODIS observations. They found that CALIOP AOD is lower than AERONET AOD. Better agreement is apparent at XiangHe, Beijing, Xinglong, and SACOL sites, while low correlations between CALIOP and AERONET observations were observed at Taihu and Hong_Kong_PolyU sites. Comparisons over China and other regions show that the overall spatial-temporal distribution of CALIOP AOD and MODIS AOD are basically consistent (Kittaka et al., 2011; Koffi et al., 2012; Liu et al., 2014). 3. In figure 6, there need increase the results in autumn and winter, not only in spring and in summer. And to analyze their differences. Response: The AERONET volume size distribution and spectral SSA in all seasons have been included in Fig. 7 in the revised manuscript, and the seasonal variation has been also discussed. In Fig. 6 (Fig. 8 in the revised manuscript), we have selected a few sites to better compare the dust-dominant aerosols, anthropogenic aerosols and mixed type aerosols. Beijing, SACO,L and Taihu sites were selected because of large data amount at these sites (Table S1). SACOL is dominated by dust aerosols in spring, Beijing and Taihu are dominated by anthropogenic aerosols in summer, and Beijing represents mixed type aerosols by dust and anthropogenic pollution in spring. Therefore, we only selected SACOL in spring, Beijing and Taihu in summer, and Beijing in spring. 4. In figure 7, how about is the result in autumn and winter? Response: Seasonal aerosol properties from the ground-based AERONET observations have been studied using the volume size distribution and spectral SSA (Fig. 7 in the revised manuscript). In Fig. 7 (Fig. 9 in the revised manuscript), we selected a few sites to better compare the dust-dominant aerosols, anthropogenic aerosols and mixed type aerosols. As explained in Comment 3, we only selected SACOL in spring,

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Beijing and Taihu in summer, and Beijing in spring. 5. Finally, the title is too large. The manuscript mainly investigated three sites' results and compared with the CALIOP. So the manuscript need greatly enrich the content to match the title. Response: We have enriched the content by including as additional AERONET observations over China. All the AERONET sites with an observation of more than 3 months in the representative regions were selected (Fig. S1 and Table S1). As a result, 17 sites in the Loess Plateau, the North China Plain, the Pearl River Delta, the Tibetan Plateau, and the Yangtze River Delta regions were included in our study. In addition, 4 desert sites in Hexi Corridor of Gansu in northwest China were selected to represent dust aerosols. The climatological results were included in the revised manuscript (Figs. 6 and 7).

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