Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-467

Anonymous Referee #1

Referee comment on "Three-dimensional climatology, trends, and meteorological drivers of global and regional tropospheric type-dependent aerosols: insights from 13 years (2007–2019) of CALIOP observations" by Ke Gui et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-467-RC1, 2021

This study displayed the spatiotemporal and vertical distribution characteristics of AOD with the CALIOP data as well as AOD retrievals from other satellite sensors and reanalysis AOD data at a global scale. It also analyzed the associations between AOD and meteorological factors. The detailed analyses by region and by aerosol type contributed to our understating of the variation trends of atmospheric aerosols.

Major comments:

In the introduction section, the author provided a detailed introduction on the importance of studying the atmospheric aerosols; however, the summary of previous studies and findings is lacking, making it hard to evaluate the contribution of this study to this field.

In the data and methods section, the method used for data assimilation may not be appropriate. The VSM data (1-degree spatial resolution) and WS data (0.5 degree * 0.625 degree) were at higher spatial resolutions than the CALIOP data (2 degree * 5 degree). Thus, the VSM and WS data should be averaged to match the CALIOP grid, but the author used bilinearly interpolation to assimilate the data. The PBLH data from MERRA-2 were also assimilated by bilinearly interpolation, which may lead to systemic bias.

The result section lists too many numbers without a summary of findings, making it hard to follow. Please only highlight important numbers to support your findings and other numbers can be moved to SI.

Minor comments:

Line 58, the phrase “on the other hand” should follow “on the one hand”. The conjunctions in this paragraph should be carefully considered. For example, the usage of “Furthermore” (line 70) and “More importantly” (line 71) could be adjusted.

Line 141, why these three subtypes of AOD have been paid special attention in this study? The description in line 255-259 can be moved to here.

Line 149-150, the logic is not clear. I would say that the better aerosol extinction detection sensitivity during nighttime is resulted from the lack of solar background illumination rather than is resulted from the decreased aerosol extinction detection sensitivity during daytime.

Line 389, I do not see the contrast with the phrase “In contrast”. What exactly did the author want to compare?