

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.

Anonymous Referee #1

Received and published: 11 November 2016

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Using long-term satellite and ground-based remote sensing observations, this study describes the climatology of aerosol vertical distribution and optical properties over China, particularly for several important regions. In principle, this paper is well written and the findings are interesting.

The followings are my minor comments:

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(1)Page 2, line 20, I would suggest to add references Garrett and Zhao 2006 and Zhao et al. 2015, which both show the strong warming climate effect of aerosols by serving as CCN and changing cloud properties. Garrett, T. J., C. Zhao, and P. C. Noel, 2010: Assessing the relative contributions of transport efficiency and scavenging to seasonal variability in Arctic aerosol. *Tellus B*, 62, 190-196. Zhao, C., and T. Garrett, 2015: Effects of Arctic haze on surface cloud radiative forcing, *Geophys. Res. Lett.*, 42, doi:10.1002/2014GL062015.

(2)Page 3, line 4, I would also suggest to add one reference which is about the effects of IN scheme representation using dust aerosols to radiation balance in climate model of CAM5. Xie, S., X. Liu, C. Zhao, and Y. Zhang, 2013: Sensitivity of CAM5 simulated Arctic clouds and radiation to ice nucleation parameterization, *J. Climate*, 26, 5981–5999. doi:<http://dx.doi.org/10.1175/JCLI-D-12-00517.1>.

(3)Page 3, line 16-18, is there any reference to support your claim that CALIOP AOD presents an underestimation because of the challenge of the thin layer detection. I am not sure if my understanding is right: if the thin layer clouds are missed, CALIOP AOD could be overestimated, not underestimated.

(4)Page 3, line 21, I would suggest “slight underestimation” instead of “small underestimation”.

(5)Page 4, line 2, do you mean “seasonal averaged vertical profiles”?

(6)Page 4, line 4-6, what do you mean ‘evaluate’ here: do Guo et al. 2016a use satellite observations to evaluate the ground-based findings? The logic seems not right to me.

(7)Page 4, line 7, what do you mean for the “representative regions” here? Where are they?

(8)Page 5, line 3-4, I would suggest to add a reference Yang et al. 2016, which estimated the air pollution enhancement due to the aerosol-PBL feedback in Beijing. Yang, X., C. Zhao, J. Guo, and Y. Wang (2016), Intensification of aerosol pollution associated

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with its feedback with surface solar radiation and winds in Beijing, *J. Geophys. Res. Atmos.*, 121, 4093–4099, doi:10.1002/2015JD024645.

(9)Page 5, line 11, use 'between ... and ...' or 'the ratio of 1064 nm to 532 nm backscatter'

(10)Page 5, line 15-18, what are the major points or findings you want to use from this cited study?

(11)Page 6, line 1, 'have investigated' ->'investigate'.

(12)Page 6, line 8, 'in sections 4 and 5, respectively'.

(13)Page 6, line 16-17, are you sure that Northeast China Plain is one of the cleanest regions in China? I do not know if it is right but it seems that this region is often heavily polluted.

(14)Page 8, line 1, 'daytime solar background illumination' -> 'daytime background solar illumination'.

(15)Page 8, line 19, National Institute for Environmental Studies (NIES).

(16)Page 10, line 6, 'is set as a threshold value to define weakly ...'

(17)Page 11, line 3, how is the inconsistency, larger or smaller?

(18)Page 12, lines 7-8, this sentences have been repeated two times, you may just keep one time description.

(19)Page 16, line 5-9, for these findings or descriptions, may you please give the likely reasons?

(20)Page 17, line 14, 'is also correspond to ..' ->'corresponds to'

(21)Page 18, line 9, as suggested earlier, please add one reference by Yang et al. 2016.

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(22)Page 18, line 12-13, is the claim generally right or just right for studied cases?

Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-749, 2016.

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