

Atmos. Chem. Phys. Discuss., referee comment RC2  
<https://doi.org/10.5194/acp-2021-143-RC2>, 2021  
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## Comment on acp-2021-143

Anonymous Referee #2

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Referee comment on "The spatiotemporal relationship between PM<sub>2.5</sub> and AOD in China: Influencing factors and Implications for satellite PM<sub>2.5</sub> estimations by MAIAC AOD" by Qingqing He et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-143-RC2>, 2021

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Satellite-based retrieval of PM<sub>2.5</sub> shows great advantage over traditional ground-level observations, which largely relies on the well-established statistical relationship between AOD and PM<sub>2.5</sub>. This manuscript by He et al. investigated the relationship between PM<sub>2.5</sub> and AOD in China using the high-resolution AOD products from MAIAC, and the major influencing factors, including relative humidity, PBLH, and terrain, have been discussed. Overall, this work is well organized, and the analysis methods are scientifically sound. I am almost in a position to accept it for publication at ACP after the authors adequately address the following concerns, even though most of them are minor.

Specific comments:

L11: "to monitoring surface PM<sub>2.5</sub> concentration" can be revised to "surface-based PM<sub>2.5</sub> concentration observations"

L13: "ground" -> "ground-level "

L29: the article is missing before "Findings"

L38-43: This is a pretty long sentence and can be shortened or rephrased.

L47: "heavily" -> "heavy"

L52: "tuning" needs to be corrected.

L62-63: "further exploring the relationship between near-surface PM<sub>2.5</sub> and MAIAC AOD for China during a long-term period is necessary." can be rephrased as "further exploring the relationship seems critically imperative between near-surface PM<sub>2.5</sub> and MAIAC AOD over China based on much finer AOD products."

L65: "suggested" -> "recognized"; also, "different definitions" can be revised to "the definition difference"

L70: "The vertical structure" of aerosols? Please clarify it.

L80: The reference of Guo et al. 2017 is wrongly cited here, since the effect of aerosol diurnal variability on precipitation did not involve at all. Instead, the author may refer to Kim et al. 2010 (doi: 10.1007/s00382-010-0750-1); Guo et al., 2016 (doi:10.1002/2015JD023257) and Lee et al. 2016 (doi: 10.1002/2015JD024362), and Zheng et al. 2020 (doi: 10.1088/1748-9326/ab99fc), among others.

L303-309: Except for the different number of available observations for AOD and PM2.5, the main causes for the mismatch between AOD and PM2.5 lie at the fundamental discrepancy in physical concept. AOD is a unitless variable that denotes the total extinction induced by aerosol in the whole atmospheric column, whereas PM2.5 represents the aerosol concentration measured at the ground level.

L378-379: The diurnal variability of PBLH needs to be specified from a climatological perspective, and the authors are suggested to refer to Liu and Liang 2010 (doi:10.1175/2010JCLI3552.1); Zhang et al. 2018 (doi: 10.1175/JCLI-D-17-0231.1)

L395: "by PBLH correction" -> "corrected for PBLH"

L399: "of " is redundant.

L421: "Corresponding to" -> "Generally consistent with"

L455: "As far as the meteorology" -> "As far as the confounding impact of meteorology"

L460: "despite of" -> "despite"

L465: "The vertical structure" of aerosols? Please clarify it.

L465-466: "Even though the individual effect...., the synthetic impact of these factors has been recognized to be core..." seems problematic in terms of logic. The joint effect of these factors could be revealed using the multi-regression analysis in the future. This point is suggested to be taken into account when revising this sentence.

The variables appeared in Eqs. 1-2 should be clarified, including the units.

The quality of Figure 6 is a little low for its blurred x-axis and y-axis titles, and I strongly recommend the authors redraw it.