

Dear Reviewer,

Thank you very much for your effort and comments. We addressed them one by one below. Hope you find our revisions useful. Thank you again.

Yours faithfully,

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Satellite-based retrieval of PM_{2.5} shows great advantage over traditional ground-level observations, which largely relies on the well-established statistical relationship between AOD and PM_{2.5}. This manuscript by He et al. investigated the relationship between PM_{2.5} 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:

(1) L11: “to monitoring surface PM_{2.5} concentration” can be revised to “surface-based PM_{2.5} concentration observations”

Response: Thanks for your suggestion. We have revised the description in the revised manuscript.

(2) L13: “ground” -> “ground-level ”

Response: We have replaced “ground” with “ground-level” in the revised version.

(3) L29: the article is missing before “Findings”

Response: The article has been added at the beginning of the sentence.

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

Response: This long sentence has been replaced with two short sentences.

(5) L47: “heavily” -> “heavy”

Response: We has revised this word.

(6) L52: “tuning” needs to be corrected.

Response: “tuning” has been revised as “concordant”.

(7) L62-63: “further exploring the relationship between near-surface PM_{2.5} 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_{2.5} and MAIAC AOD over China based on much finer AOD products.”

Response: We have revised this sentence accordingly.

(8) L65: “suggested” -> “recognized”; also, “different definitions” can be revised to “the definition difference”

Response: We have revised them based on your suggestion.

(9) L70: “The vertical structure” of aerosols? Please clarify it.

Response: It is the vertical structure of aerosols. We have clarified it in the revised manuscript.

(10) 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.

Response: Thanks for your suggestion. We have revised the references.

(11) L303-309: Except for the different number of available observations for AOD and PM_{2.5}, the main causes for the mismatch between AOD and PM_{2.5} 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 PM_{2.5} represents the aerosol concentration measured at the ground level.

Response: Thanks for your suggestion. We have added the definition difference between PM_{2.5} and AOD as the main cause for the PM_{2.5}-AOD mismatch.

(12) 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)

Response: We have revised this sentence by following your suggestion.

(13) L395: “by PBLH correction” -> “corrected for PBLH”

Response: We have revised this sentence as per your suggestion.

(14) L399: “of ” is redundant.

Response: “Of” in this sentence has been removed.

(15) L421: “Corresponding to” -> “Generally consistent with”

Response: We have revised this sentence by following your suggestion.

(16) L455: “As far as the meteorology” -> “As far as the confounding impact of meteorology”

Response: We have revised this sentence as per your suggestion.

(17) L460: “despite of” -> “despite”

Response: “Despite of” has been replaced by “despite”.

(18) L465: “The vertical structure” of aerosols? Please clarify it.

Response: It is the vertical structure of aerosols. We have clarified it in the revised manuscript.

(19) 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.

Response: We have revised this sentence accordingly.

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

Response: We have explained the variables in Eqs.1-2 in the revised version.

(21) 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.

Response: We have replotted this figure to enhance its quality.