

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-492

Anonymous Referee #1

Referee comment on "The impacts of dust aerosol and convective available potential energy on precipitation vertical structure in southeastern China as seen from multisource observations" by Hongxia Zhu et al., Atmos. Chem. Phys. Discuss.,
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The authors present an investigation on the response of precipitation vertical structures to dust aerosols in southeastern China, which are mainly transported from northwestern China. The results are very interesting and understandable, and the analysis methods are quite scientifically solid. I would recommend accepting this paper after some improvement.

Major comments:

- Abstract: This work mainly investigated the dust aerosol impact on precipitation vertical structures using multi-source data, and gave statistical results. Nevertheless, I did not see the specific study area and time period.
- The title of Section 2 of "Study area and data" needs to be rephrased, since most of the paragraphs focus on the methodology. As such, this section can be restructured. For instance, I do not understand what is the logic and purpose of the references such as "Teller and Levin (2006)" and Yin and Chen (2007), both of which are simply listed as separated arguments and not tightly linked to the data or methodologies used in this study. In my opinion, these descriptions are more like related to the research status and can be moved to the introduction part.
- The English writing of this manuscript needs thorough improvement, and a complete polishing from the abstract to conclusion part is necessary with the help of native English speaker or a more experienced researchers.
- L204-206: In the presence of dust episode occurring in eastern China, a combination of high wind shear, low cape was observed, the author argued that "Such condition doesn't favor the vertical development of convection." Are there any literatures supporting this argument? In my view of point, the precipitation accompanied with dust episode is largely under the influence of large-scale circulation. This synoptic forcing favors the lifting of air mass and convection initiation. Besides, not every precipitation event was characterized by high CAPE, low wind shear.

Minor comments:

- "eastern China" in the title of this manuscript can be revised to "southeastern China"
- L14: "the study area" is suggested to be replaced with a specified area (e.g., southeast China?)
- L15: "contained"-> "containing"
- L34: ", they can" -> ", which can"
- L35: "to directly affect" -> "thereby directly affecting"
- L38: "warmer temperature" is not appropriate and can be revised to "higher temperature"
- L39: "server" -> "serve"
- L40: "moderate" can be revised to "mediate" or "modulate"
- L46: "Studies" -> "Previous studies"
- L78: "significantly was" -> "was significantly"
- L79: ". Such as" -> ", including"
- L83: I would suggest adding more recent references on the dependence of aerosol effect on precipitation on "the altitudes of the aerosol layer", and the authors can refer to Lee et al. ACPD 2022 (<https://doi.org/10.5194/acp-2022-385>) and the refernces therein.
- L104: "In some studies," in which studies? The authors can add references here to support this statement.
- L132: grammar errors in ", they are treated".
- L137: The acronym for "precipitation top temperature" has been given in introduction part and in this place and the following section, it is supposed to appear as "PTT".
- L173: the references to ERA-5 reanalysis are lacking.
- L178: "during recent two decades" -> "during recent decades"
- L179-180: it is a too long sentence in "by anthropogenic emission related fine mode aerosols with small fraction of coarse mode aerosol", and full of redudant words. I would suggest rewriting
- L181: "in which" or "when" can be added before "heavy dust aerosol"
- L182: "are" -> "were", and "that" is missing before "were defined"
- L183: "excessed" -> "exceeded"
- L188-190: I would suggest clarifying whether the selected date of 12 June 2006 was also a rainy day in the southeast China.
- L199: "CAPE" is not an atmospheric dynamic variable
- L200: please clarify what is "strong coupling" between dusty condition and meteorology condition? It seems to me this term is contradictory with the following weak correlation observed between dust AOD and meteorology.
- L225: "start"-> "starting"
- L288 and L321: the full name for precipitation top height was actually given in L66, and thus should be avoided here.
- L362: Except for the "atmospheric thermodynamical effects", the atmospheric dynamic impact can not be ignored.
- Figure 3: I would suggest adding the time period for which the meteorological fields are derived. Also the data sources are suggested to be added in this figure caption.
- Figure 11: it would be beneficial to give more descriptions in the figure caption on "70%" at the top of each panel in this figure. What does it mean, or how is it defined.