

## Response to Editor Comments

Dear Editors:

We are sincerely grateful to the editor for their valuable time for reviewing our manuscript. The comments are very helpful and valuable, and we have addressed the issues raised by the reviewer in the revised manuscript. Please find our point-by-point response (in blue text) to the comments (in black text) raised by the reviewer. We have revised the paper according to your comments (highlighted in blue text of the revised manuscript).

Sincerely yours,

Dr. Yuanjian Yang, representing all co-authors

### # Editor

I thank the authors for properly addressing the comments and suggestions raised by the different referees. However, I encourage the authors to take into account the following comments before the manuscript is accepted for its publication.

Minor comments:

1. The authors used “aerosols” and “aerosol” along the manuscript to refer to "aerosol particles". Given that the gas phase of the aerosols are not taken into account in this study, I suggest changing “aerosols” and “aerosol” by “aerosol particle or particles” along the manuscript.

Response: Done. Thank you. Since multiple changes have been made regarding the “aerosol particle”, line numbers will not be annotated in detail here. Please refer to the blue texts in the manuscript.

2. Droplets and raindrops are not particles. Please fix this.

**Response:** Done. Thank you. Please refer to the blue texts in the manuscript. (Lines 507, 511, and 614)

3. The usage of hydrometeor and hydrometeors along the text is not always correct. I suggest referring to raindrops, cloud drops or the correct hydrometeor and avoid using hydrometeor(s).

**Response:** Done. Thank you. Most of the term “hydrometeors” has been changed to “raindrops” in the revised manuscript. Please refer to the blue texts in the manuscript.

4. Figure 6. It is necessary to indicate the meaning of each color

**Response:** Done. Thank you. “**The blue, orange and pink colors indicate the clean, fine-aerosol polluted and coarse-aerosol polluted environments, respectively.**” has been added in lines 432-434 in the manuscript.

5. Figure 7. It is necessary to indicate the meaning of each color

**Response:** Done. Thank you. (Lines 478-480)

6. Figure 10. The figure caption is incorrect. Please fix it.

**Response:** Done. Thank you. (Lines 596-598)

Technical comments:

Lines 20: Please define GPM, DPR, MERRA-2, and ERA

**Response:** To make it concise, this has been modified to “**Using eight years of data from dual-frequency precipitation radar measurements, aerosol reanalysis, and atmospheric reanalysis, ...**” (Lines 20-21)

Line 49: What do the authors mean with the “marine continent”

**Response:** To make it clear, “marine continent” has been changed to “coastal continent” (Line 50).

Lines 88-89: I suggest replacing “most regions of eastern China (except Northeast China) (Sun et al., 2022); Xiao et al. (2022)” by “most regions of eastern China (Sun et al., 2022), except Northeast China as Xiao et al. (2022) found”

**Response:** Done. (Line 90)

Line 124: Replace “observations from Aerosol” by “observations from the Aerosol”

**Response:** Done. (Line 126)

Line 125: Replace “products from Advanced” by “products from the Advanced”

**Response:** Done. (Line 127)

Line 128: Define “AOD”

**Response:** Done. (Line 130)

Line 141: Replace “In this present” by “In the present”

**Response:** Done. (Line 143)

Line 151: Define “2ADPR”

**Response:** Done. “2ADPR” has been changed to “DPR”. (Line 153)

Line 151: Replace “and the generalized intercept  $N_w$  (in  $\text{mm}^{-1} \text{m}^{-3}$ )” by “and the generalized intercept  $N_w$  (i.e., number concentration of droplets in  $\text{mm}^{-1} \text{m}^{-3}$ )”

**Response:** Done. (Line 157)

Line 159: Replace “in vertically” by “in vertical”

**Response:** Done. (Line 161)

Lines 162-163: Replace “and STH below 5 km in altitude. The storm top height (STH) is” by “and the storm top height (STH) below 5 km in altitude. The STH is”

**Response:** Done. (Lines 164-165)

L192: Replace “occurrence of the shallow” by “occurrence of a shallow”

**Response:** “occurrence of the shallow precipitation event” has been changed to “occurrence of shallow precipitation events” (Line 194).

Line 243: Replace “aerosols before the shallow” by “aerosols before a shallow”

**Response:** “aerosols before the shallow precipitation event” has been changed to “aerosol particles before shallow precipitation events” (Line 246).

Line 270: Replace “number concentration of droplets ( $N_w$ ) at” by “ $N_w$  at” as this was defined above.

**Response:** Done. (Line 273)

Line 271: Replace “and mass-weighted mean diameter ( $D_m$ ) at” by “and  $D_m$  at” as this was defined above.

**Response:** Done. (Line 273)

Line 281: “other microphysical processes”. Please indicate the processes the authors are referring to.

**Response:** In the revised manuscript, this sentence has been changed to “**sea salt aerosol particles are more likely to form large cloud droplets through hygroscopic growth, facilitating the formation of raindrops through condensation within shallow precipitation clouds.**” (Lines 281-283)

Lines 284-285: “cloud microphysics, precipitation microphysics, and precipitation”. What is the difference between the three?

**Response:** Cloud physics, precipitation microphysics, and precipitation are closely interconnected. Clouds represent the smallest scale, followed by the microphysical processes of raindrop formation at larger scales, and finally, precipitation, which occurs at the Earth's surface. The present study focuses more specifically on the

precipitation microphysics. In the revised manuscript, “cloud microphysics, precipitation microphysics, and precipitation” has been changed to “cloud microphysics, precipitation microphysics, and rainfall.” (Line 286)

Line 297 and along the text: “small particles” and “large particles”. I think this should be “small droplets” and “large droplets”. Please revise the ms accordingly.

**Response:** Done. Thank you. The “particles” in the manuscript has been changed to “droplets” along the text. (Lines 298-299)

Lines 315-316: Replace “fine (b) aerosol-polluted and coarse (c) aerosol-” by “fine (b) and coarse (c) aerosol-”

**Response:** Done. (Lines 316-317)

Lines 348-350: This was already mentioned in Lines 338-340

**Response:** Thank you. These two sentences are different.

In Line 338-340, this sentence means at the same height, the median values of  $Z_e$ ,  $RR$ ,  $D_m$ , and  $N_w$  at any given altitude are the largest in a coarse aerosol-polluted environment and the smallest in a fine aerosol-polluted pollution. On the contrary, In Line 348-350, this sentence emphasizes the change rates (growth rate or decay rate) of the values within a particular height layer.

To avoid confusing, the sentence has been changed to “**Specifically, in coarse aerosol-polluted environments, the growth rates in  $Z_e$ ,  $RR$ ,  $D_m$ , and  $N_w$  from the 3 km to 1 km altitude layer are the largest, while these growth rates are the lowest in fine aerosol-polluted environments.**” (Lines 349-351)

Line 377 and along the text: Replace “of raindrop particles” by “of raindrops”

**Response:** Done (Line 378). Thank you.

Line 379 and along the text: Replace “coalescence of hydrometeors dominates” by “coalescence of raindrops dominates”

**Response:** Done (Line 380). Thank you.

Lines 385-386: The following is unclear “Similarly, the proportion of the hydrometeor particle breakup process is 33.1% (a decrease of 10%).”

**Response:** Done. This has been changed to “**Similarly, the proportion of the raindrop breakup process is 33.1%, with a decrease of 10% compared to 22.1% in coarse aerosol-polluted environments.**” (Lines 386-387)

Line 389: Replace “raindrop hydrometeors” by “raindrop”. Note that a raindrop is a hydrometeor, therefore, this sounds redundant.

**Response:** Done (Line 391). Thank you.

Lines 483-484: Replace “maximum in aerosol coarse mode environments polluted” by “maximum in environments polluted”

**Response:** Done (Lines 489-490). Thank you.

Line 604: “higher concentrations” of what?

**Response:** Done. Thank you. This has been changed to “**higher concentrations (average  $N_w = 36.98$ ) of raindrops at larger sizes (average  $D_m = 1.24$  mm).**” (Lines 610-611)

Lines 605-606: Replace “and larger raindrop sizes (average  $D_m = 1.24$  mm) of hydrometeor particles.” By “and larger raindrops (average  $D_m = 1.24$  mm)”

**Response:** Done. Thank you. This has been changed to “**higher concentrations (average  $N_w = 36.98$ ) of raindrops at larger sizes (average  $D_m = 1.24$  mm).**” (Lines 610-611)

Line 608: “raindrop particles through microphysical processes such as condensation”. Do the authors mean collision- coalescence? Condensation is an effective process up to

sizes ca. 20-30  $\mu\text{m}$ . Therefore, at the large drop sizes used in the present study condensation may not be of high importance.

**Response:** Thank you. This conclusion has been modified: “**This can be ascribed to the high presence of sea salt aerosol particles in South China, which tend to form larger cloud droplets through hygroscopic growth. This, in turn, enhances the condensation process, leading to the formation of additional rain droplets. As a result, it facilitates the coalescence and growth of raindrops, ultimately contributing to the formation of larger raindrops.**” (Lines 611-616)