Notes to Editor and Reviewers:

We sincerely thank the Reviewers for their insightful and constructive comments and suggestions.

1. In the following response, the reviewers' comments are presented in *black*, our responses are in black, and the corresponding revisions in the manuscript are highlighted in *italic blue*.
2. A detailed, point-by-point response to each comment is provided below.

Reviewer #2:

Ou et al. (2026) investigated the impacts of tropical cyclones on aerosol–cloud interactions over the South China Sea based on shipborne observations. The study found that Tropical Cyclone Chaba enhanced the influence of anthropogenic emissions from the Indochina Peninsula on the physicochemical properties of aerosols over the South China Sea, which subsequently affected cloud microphysical properties. Overall, this study presents interesting and potentially important findings that are relevant to the scope of Atmospheric Chemistry and Physics. However, some aspects of the data analysis and figure presentation need further improvement to better support the main conclusions. I therefore recommend publication after the authors have adequately addressed the following comments:

Response: We thank the reviewer for taking the time to read our manuscript and for providing valuable suggestions. In response to the reviewer's comments, we have reassessed the OA PMF factors and expanded the discussion of uncertainties in aerosol hygroscopicity associated with particle size differences and in cloud model simulations. We have also clarified that our study focuses on tropical cyclone-related effects in the western region of the tropical cyclone (TC) and added satellite observations from two additional TC cases to further examine potential aerosol effect in cloud microphysics. Our point-by-point responses to the reviewer's comments are provided below.

Major comments:

1. The authors applied the PMF method to identify the sources of organic aerosol,

and one factor was identified as biomass-burning organic aerosol (BBOA) based mainly on the obvious signal at m/z 60. Although m/z 60 is widely recognized as a tracer for levoglucosan and biomass burning, the mass spectrum of this factor also shows a clear signal at m/z 58. The signals at m/z 58 and m/z 60 may also be associated with chloride and its isotopic signals, respectively. Considering the relatively small contribution of this factor, I suggest that it may instead be related to sea salt and could represent a mixture of sea-salt-related and organic aerosol components. Therefore, the identification of this factor as BBOA requires further justification.

Response: We thank the reviewer for this valuable comment. Based on the study by Van Den Born et al. (2026) on NaCl detection using CV-ToF-ACSM and the reviewer's suggestion, we have renamed the BBOA factor as Sea-salt-related OA in the revised manuscript and added further explanation to clarify this assignment (Lines 144-156):

"*Three OA factors were resolved, including two primary OA factors—hydrocarbon-like OA (HOA) and seasalt-related OA—and one secondary OA factor, oxygenated OA (OOA) (Fig. S6). OOA constituted the largest fraction of OA, accounting for 82.6% (Fig. S7a). Its oxidation indicator, the fraction of m/z 44 (CO_2^+, f44), was 0.31—similar to the f44 value of LVOOA (0.31) observed over the SCS in 2018 (Liang et al., 2021), and slightly lower than that of OOA (0.33) measured in 2019 (Fig. S7b) (Sun et al., 2023). HOA was the second largest contributor (15.6%). Its mass spectrum is characterized by prominent C_nH_{2n-1} and C_nH_{2n+1} ion series (e.g., m/z 41, 43, 55, 57, 69, and 71) (Fig. S6a1), consistent with the mean HOA profile reported by Ng et al. (2011). The mass spectrum of sea-salt-related OA showed peaks at m/z 58 and 60, which may be associated with chloride-containing ions. Van Den Born et al. (2026) experimentally demonstrated that CV-ToF-ACSM can detect a fraction of NaCl. Although NaCl is generally difficult to vaporize in SV-ToF-ACSM, a small fraction may still be detected (1.7%). Given its small and relatively stable contribution, this*

factor was interpreted as a mixture of sea salt and OA and was therefore named Sea-salt-related OA in this study."

Reference:

van den Born, M., Ou, H. J., Mulder, J., et al.: Measurements of NaCl in ambient air with a Capture Vaporizer-ToF-ACSM, Aerosol Research Discuss., 2026, 1-14, 2026.

2. *The pre- and post-TC observations may correspond to different locations along the cruise track, including TC-avoidance maneuvers. Spatial variability may therefore be confounded with the temporal changes attributed to TC Chaba. The selection of 28 June as the boundary between the pre-TC and post-TC periods lacks a clearly stated objective meteorological criterion, particularly because Chaba was officially named on 29 June.*

Response: We thank the reviewer for this valuable comment. Although Chaba was officially named on 29 June, the system had developed into a tropical depression by 28 June, as identified by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and the Japan Meteorological Agency (JMA). We have added sea-level pressure and wind field maps for 27–29 June to the supplement (Fig. S2). These maps show a distinct low-pressure system west of the Philippines around 28 June, accompanied by substantial changes in the regional wind field. Based on this evidence, we defined the period before 28 June as the pre-TC Chaba period and the period from 28 June onward as the post-TC Chaba period. We have clarified this rationale in the revised manuscript (Lines 100-106):

"*Although Chaba was officially named on 29 June, a tropical disturbance had formed on 26 June and developed into a tropical depression by 28 June (Fig. S2), as classified by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and the Japan Meteorological Agency (JMA). Based on the above information, the period from June 22 to 27 is defined as the*

pre–TC period, and the period from June 28 to July 4 is defined as the post–TC Chaba period in this study."

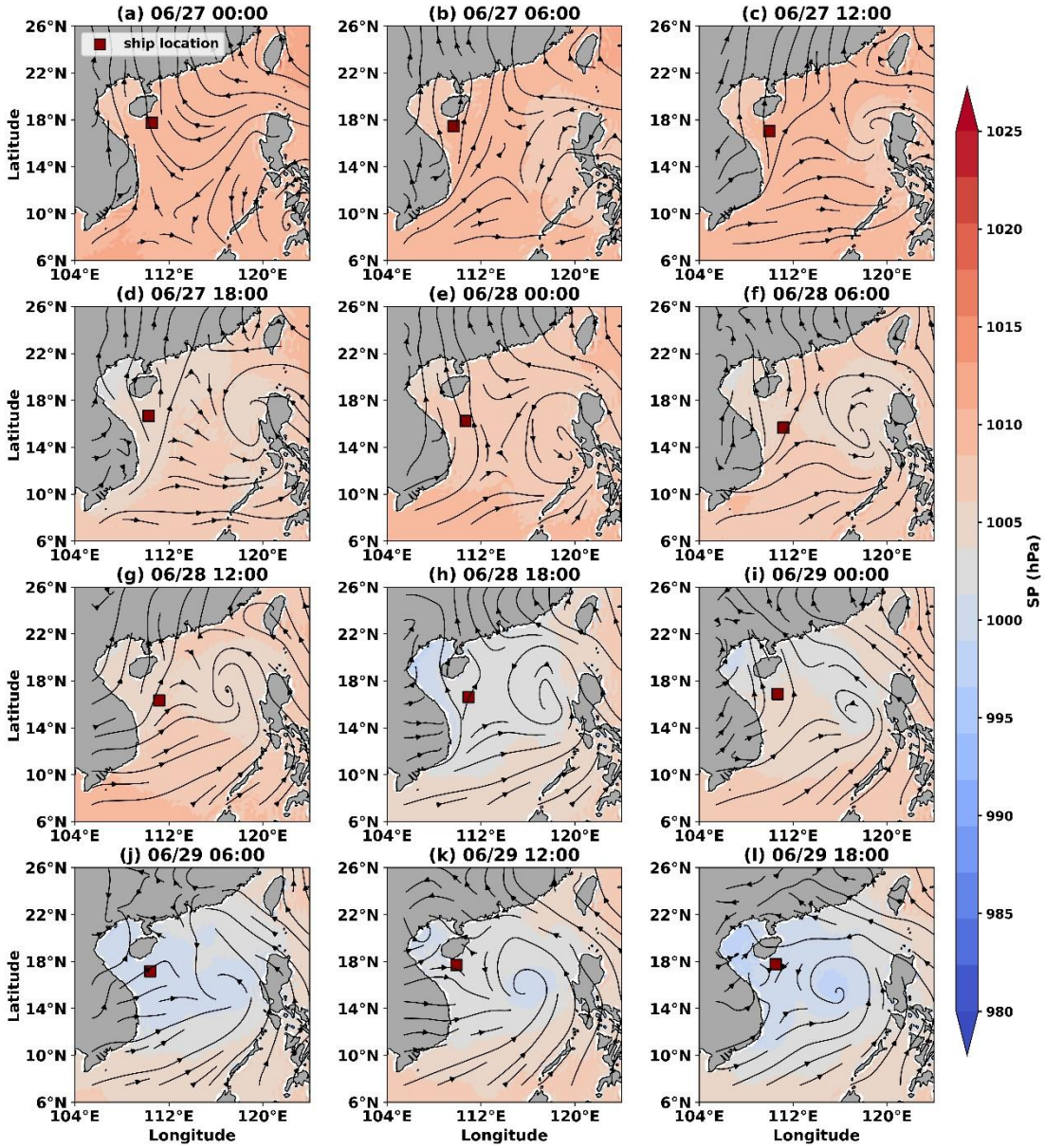


Figure S2. The surface sea pressure (SP) and wind field map from 27 June to 29 June in South China Sea.

3. *Precipitation is shown in Fig. 1, but it is not mentioned or discussed in the manuscript. The authors should briefly describe the precipitation conditions during the observation period, as precipitation can substantially reduce aerosol concentrations through wet removal and may consequently affect the observed aerosol properties and their temporal variations.*

Response: We thank the reviewer for this valuable comment. We have added a description of the precipitation conditions during the observation period to the revised manuscript. No significant precipitation occurred during most of the observation period, except on 1 July, when precipitation caused substantial aerosol wet scavenging and pronounced decreases in both aerosol number and mass concentrations (Lines 279-282):

"*It should be noted that no significant precipitation occurred during the observation period under the influence of TC Chaba, except on 1 July. The precipitation during this period resulted in substantial wet scavenging of aerosols, leading to pronounced decreases in both aerosol number concentration and mass concentration.*"

We have also expanded the Discussion to address the potential effects of TC-related precipitation on aerosol properties. Although the vessel approached approximately 446 km of Chaba's center, no prolonged period of substantial precipitation was observed. As the extent and structure of TC rainbands vary considerably, the potential range of precipitation-induced wet scavenging cannot be determined from the distance to the cyclone center alone. We have therefore clarified that our observations primarily represent the effects of Chaba on its western region, where the area was not substantially affected by the outer rainbands. These additions acknowledge the role of precipitation in aerosol removal and clarify the conditions under which our results should be interpreted (Lines 513-522):

"*However, TC-related precipitation can counteract circulation-driven increases in aerosol concentrations through wet scavenging. The inner and outer rainbands typically extend to approximately 200 and 500 km from the TC center, respectively, although their size and structure vary considerably among TCs (Addington et al., 2025). During our observations, the vessel approached within approximately 446 km of Chaba's center, but no prolonged period of substantial precipitation occurred. Although previous studies have reported extensive outer-rainband precipitation 200–500 km from TC centers, particularly under favorable moisture conditions*

(Hence and Houze, 2012; Addington et al., 2025), the limited precipitation during our campaign suggests that the observed aerosol changes primarily reflect TC-related transport and associated atmospheric processes rather than sustained wet removal. Nevertheless, precipitation may have affected aerosol properties during individual periods, as observed on 1 July."

4. *Line 305: The attribution of enhanced OOA to heterogeneous oxidation is not adequately supported. RH, Ox, OOA and air-mass origin all covary during TC development, and their correlations do not independently distinguish local chemical formation from transport of aged OOA.*

   Response: We thank the reviewer for this important comment. We agree that RH, Ox, OOA, and air-mass origin varied concurrently during the development of TC Chaba, and that their correlations alone cannot distinguish local chemical formation from the transport of aged OOA. We have therefore revised the relevant discussion to avoid attributing the OOA enhancement specifically to heterogeneous oxidation.

   In the revised manuscript, we clarify that the concurrent increases in RH, Ox, and OOA, together with the change in air-mass origin, indicate an association between OOA enhancement, air-mass transport, and a more oxidizing atmospheric environment, but do not independently establish their causal contributions. We have analyzed the diurnal variation in OOA/ΔCO as additional evidence. The nighttime enhancement in this ratio suggests that the observed OOA increase cannot be explained solely by changes in boundary-layer mixing and dilution and is consistent with a contribution from secondary OA formation. Nevertheless, we acknowledge that this pattern does not independently prove local chemical production or exclude the influence of air-mass transport and other meteorological processes.

   Accordingly, we have revised our conclusion to state that both long-range transport and secondary OA formation likely contributed to the observed OOA enhancement

at Lines 341-351:

"*These changes coincided with a shift in air-mass origin toward the Indochina Peninsula, indicating that the observed OOA enhancement may have been influenced by both regional transport and secondary formation. To further examine the potential contribution of secondary formation, we normalized OOA by ΔCO to partly account for changes in boundary-layer mixing and dilution. The OOA/ΔCO ratio showed a clear nighttime enhancement (Fig. S15), suggesting that the OOA increase cannot be explained solely by boundary-layer evolution. This pattern is consistent with a contribution from secondary OA formation, although the influence of OA aged process during air-mass transport cannot be excluded. Overall, our results suggest that both long-range transport and secondary formation likely contributed to the observed OOA enhancement.*"

5. *Line 415: The simulated maximum supersaturation of approximately 0.03% – 0.28% lies partly below the 0.2% – 0.7% range of the CCN measurements. The applicability of measured k values to these simulated cloud conditions is therefore uncertain. The Pyrcel assumptions concerning adiabatic ascent, aerosol mixing state, modal size distributions and the use of fixed k values at 0.4% and 0.7% supersaturation introduce uncertainties that are not quantified.*

Response: We thank the reviewer for this valuable comment. In Pyrcel, the simulated maximum supersaturation depends on the prescribed aerosol hygroscopicity, as κ affects water uptake and the critical supersaturation of aerosol particles. Thus, the simulated critical supersaturation may differ from the measured supersaturation. We acknowledge that the prescribed κ values may not fully represent the hygroscopicity of particles in different modes, introducing uncertainty into the simulations. We have therefore conducted a sensitivity analysis of the κ values and added the results to the revised manuscript. (Lines 199-207):

"*During pre-TC Chaba and post-TC Chaba periods, the geometric mean diameters of the Aitken and accumulation modes were 57 and 156 nm and 60 and 123 nm, respectively. The D_{50} values at of 0.4 % SS and 0.2 % SS were 54 and 87 nm during*

pre-TC Chaba period and 74 and 127 nm during post-TC Chaba period, respectively. Following Pöhlker et al. (2016), we selected the SS level with a D_{50} closest to the geometric mean diameter of each mode to represent its hygroscopicity. Although the D_{50} at 0.2 % SS was smaller than the accumulation-mode geometric mean diameter during pre-TC Chaba period, the size-dependent hygroscopicity varied relatively little as particle size increased after 54 nm (Fig. 3c). Thus, the hygroscopicity measured at 0.2 % SS was considered representative of the accumulation mode."

Based on reported size-dependent variations in κ at other observation sites, we varied the prescribed κ values by ±50 %. During the pre-TC Chaba period, this variation changed simulated concentrations by −8.78 % to +3.11 % across the tested updraft velocities. During the post-TC Chaba period, the changes generally ranged from −10.74 % to +3.01 %, except at an updraft velocity of 0.3 m s^{-1}. At this velocity, a 50 % reduction in κ led to a 38 % difference in the simulated concentration, mainly because the resulting increase in critical supersaturation, together with the model's limited resolution, amplified the deviation (Fig. S15). Overall, the sensitivity analysis indicates that uncertainty in aerosol hygroscopicity had a limited effect on simulated concentrations under most conditions (Lines 470-479):

"*The κ values assigned to the Aitken and accumulation modes may differ from their actual values. To assess the resulting uncertainty, we varied κ by ±50 %, based on reported size-dependent variations in κ at other observation sites (Pöhlker et al., 2016). During the pre-TC Chaba period, these variations changed the simulated concentrations by −8.78 % to +3.11 % across the tested updraft velocities. During the post-TC Chaba period, the changes were generally smaller, ranging from −10.74 % to +3.01 %, except at an updraft velocity of 0.3 m s^{-1}. At this velocity, a 50 % reduction in κ resulted in a 38 % difference in the simulated concentration. This larger difference was mainly due to the increase in Smax caused by the lower κ, which, combined with the model's limited resolution, led to a larger deviation in the simulated concentration. Overall, uncertainties in κ had only a small effect on*

the simulated NC concentrations."

The simulation of different κ values was shown in Table S3:

Table S3 The simulation result of cloud droplet concentration under updraft velocity range from 0.1 to 2 m s^{-1} when κ change 50%

Updraft velocity (m s-1)	*NC (cm-3, κ+50%, Pre-TC Chaba)*	*NC (cm-3, κ+50%, Post-TC Chaba)*	*NC (cm-3, κ-50%, Pre-TC Chaba)*	*NC (cm-3, κ-50%, Post-TC Chaba)*
0.1	*322*	*453*	*322*	*453*
0.3	*503*	*986*	*503*	*1361*
0.5	*633*	*1804*	*622*	*1804*
0.8	*832*	*2305*	*759*	*2305*
1	*903*	*2849*	*832*	*2849*
1.3	*968*	*3420*	*903*	*3420*
1.5	*968*	*3420*	*904*	*3420*
1.8	*1023*	*4000*	*968*	*4000*
2	*1066*	*4000*	*1023*	*4000*

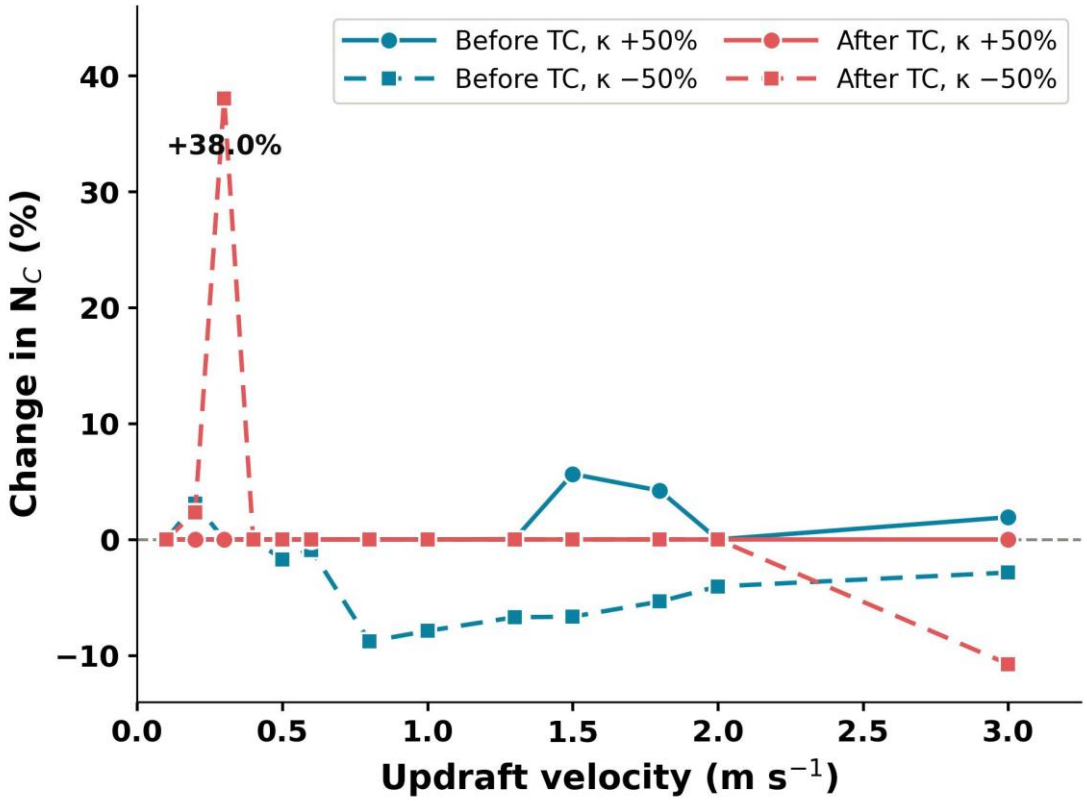


Figure S15. The change in cloud droplet number concentration (NC) due to change in aerosol hygroscopicity parameter (κ) during pre-TC Chaba and post-TC Chaba periods

6. *The k values represent particles near the supersaturation-dependent D50, whereas fOA is derived from bulk NR-PM1 This size mismatch introduces uncertainty into the estimated relationship between composition and hygroscopicity.*

   Response: We thank the reviewer for this valuable comment. We agree that the size mismatch between κ, which represents particles near the D_{50} at 0.2% SS, and f_{OA}, derived from bulk NR-PM_1 measurements, introduces uncertainty into the estimated relationship between composition and hygroscopicity. To assess this uncertainty, we have added a quantitative analysis to the revised manuscript. Based on studies conducted on the east coast of the Baltic Sea and Fukue Island (Ovadnevaite et al., 2007; Takami et al., 2005), f_{OA} increases by approximately 15 % from 100 to 600 nm. Considering that κ at 0.2 % supersaturation represents particles around 100 nm, whereas OA measured by the SV-ToF-ACSM was mainly associated with particles around 600 nm, we evaluated the effect of a 15 % change

in f_{OA} on the fitted slopes. The slopes changed by 10.5 % and 12.5 % during the pre-TC and post-TC Chaba periods, respectively. These results have been added to the revised manuscript to quantify the uncertainty associated with the size mismatch (Lines 380-385):

"*In addition, OA measured by the SV-ToF-ACSM was mainly associated with particles around 600 nm, whereas κ at 0.2 % SS represents the hygroscopicity of particles around 100 nm. Studies conducted on the east coast of the Baltic Sea and Fukue Island showed that the average f_{OA} increases by approximately 15 % from 100 to 600 nm (Takami et al., 2005; Ovadnevaite et al., 2007). This change in fOA would alter the fitted slopes by 10.5 % and 12.5 % during the pre-TC and post-TC Chaba periods, respectively, introducing uncertainty into the estimated result.*"

Reference:

Ovadnevaite, J., Čeburnis, D., Kvietkus, K., et al.: Chemical Composition and Size Distribution of Fine Aerosol Particles Measured with AMS on the East Coast of the Baltic Sea, Nucleation and Atmospheric Aerosols, Dordrecht, 2007, 792-796.

Takami, A., Miyoshi, T., Shimono, A., and Hatakeyama, S.: Chemical composition of fine aerosol measured by AMS at Fukue Island, Japan during APEX period, Atmos Environ., 39, 4913-4924, https://doi.org/10.1016/j.atmosenv.2005.04.038, 2005.

7. *The authors used the Pyrcel model to simulate the cloud droplet number concentration (CDNC) at cloud base; however, the simulation results are not presented in the manuscript. The authors should include the simulated CDNC results in Fig. 5, preferably together with the NCCN results, to allow readers to assess the model performance and better understand the effects of aerosol properties on cloud microphysics.*

Response: We thank the reviewer for this valuable comment. We have added the simulated N_C values at different updraft velocities to Fig. 5 in the revised manuscript:

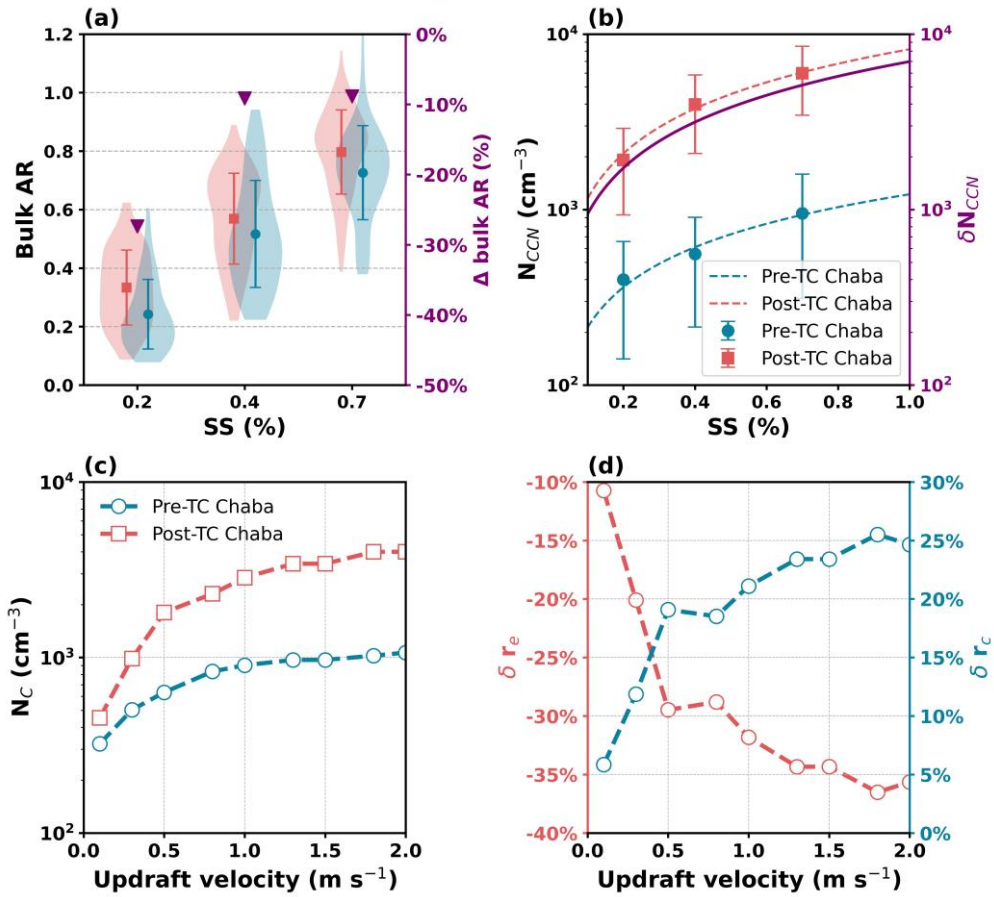


Figure 1. (a) The bulk activation ratio at different supersaturations (SS), the fitting result between the N_{CCN} and SS, and the change of NCCN at different SS during pre-TC Chaba and post-TC Chaba periods; (b) The change of cloud effective radius (re) and critical radius (r_c) at different SS; (c) The simulated cloud droplet (NC) at different updraft velocity in different periods; (d) The average liquid cloud particle size from Modis data during pre-TC Chaba and post-TC Chaba period; It is noted that r_e and r_c refer to the Twomey effect and Albrecht effect, respectively.

8. *The MODIS "Cloud particle size liquid" product is not necessarily equivalent to modeled cloud-droplet effective radius. The satellite averaging domain is also substantially larger than the ship-observation footprint. The pre/post-TC difference in MODIS cloud particle size may be associated with changes in cloud type, updraft velocity, liquid-water path, cloud-top height, precipitation or TC dynamics rather than aerosol effects.*

Response: We thank the reviewer for this important comment. We agree that the

MODIS "Cloud_Particle_Size_Liquid" product is not necessarily directly equivalent to the cloud droplet effective radius (r_e) simulated by the cloud parcel model. We also acknowledge that the satellite retrievals represent a much larger spatial domain than our shipborne observations and that changes in cloud droplet effective radius may be influenced by several meteorological factors, including cloud type, updraft velocity, liquid water path, cloud-top height, precipitation, and TC dynamics, rather than aerosol effects alone.

To address these concerns, we have moved the MODIS analysis from the Results section to the Discussion section and expanded the analysis to include two additional TCs that formed over the SCS in 2021 and followed tracks similar to Chaba (Fig. S17-S18). The MODIS observations showed decreases of approximately 2–3 μm in r_e over the western area of all three TCs. For TC Chaba, the decrease was approximately 11 %, consistent with the reduction simulated at an updraft velocity of 0.1 m s^{-1}. We now present these satellite results as supporting evidence that is consistent with our model simulations, rather than as direct evidence of an aerosol-driven response. We have also explicitly acknowledged the differences in spatial scale and the potential influence of other meteorological factors in the revised Discussion (Lines 504-509):

"*MODIS observations showed decreases of approximately 2–3 μm in re over the western region of TC Chaba and two TCs that formed over the South China Sea (SCS) in 2021 and followed similar tracks (Fig 6, Figs S17-S18). The re were averaged over the same regions as those defined in Section 2.3.5. For TC Chaba, the decrease was approximately 11 %, consistent with our simulations at an updraft velocity of 0.1 m s-1. Although these satellite-derived changes may also reflect variations in cloud type, updraft velocity, liquid water path, cloud-top height, precipitation, and TC dynamics, aerosol effects may have contributed.*"

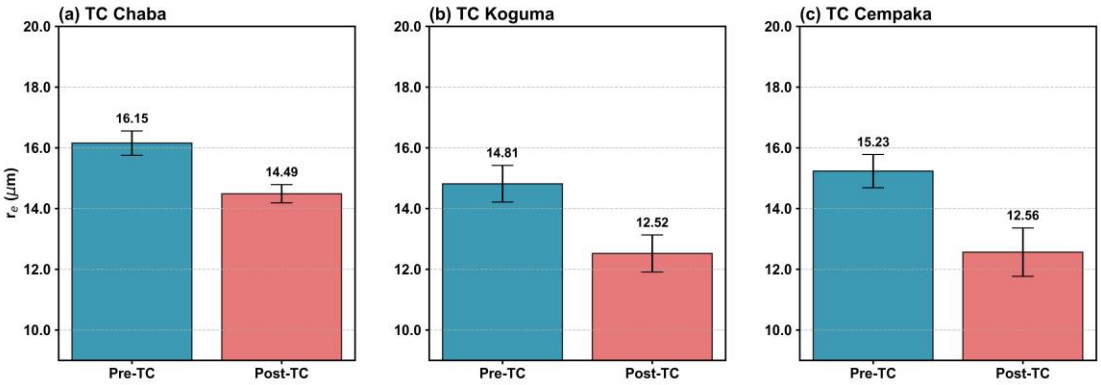


Figure 6. The cloud effective radius (re) from modis data during pre-TC Chaba Period and post-TC Chaba period (a); The re during pre-TC Koguma Period and post-TC Koguma period (b); The re during pre-TC Cempaka Period and post-TC Cempaka period (c)

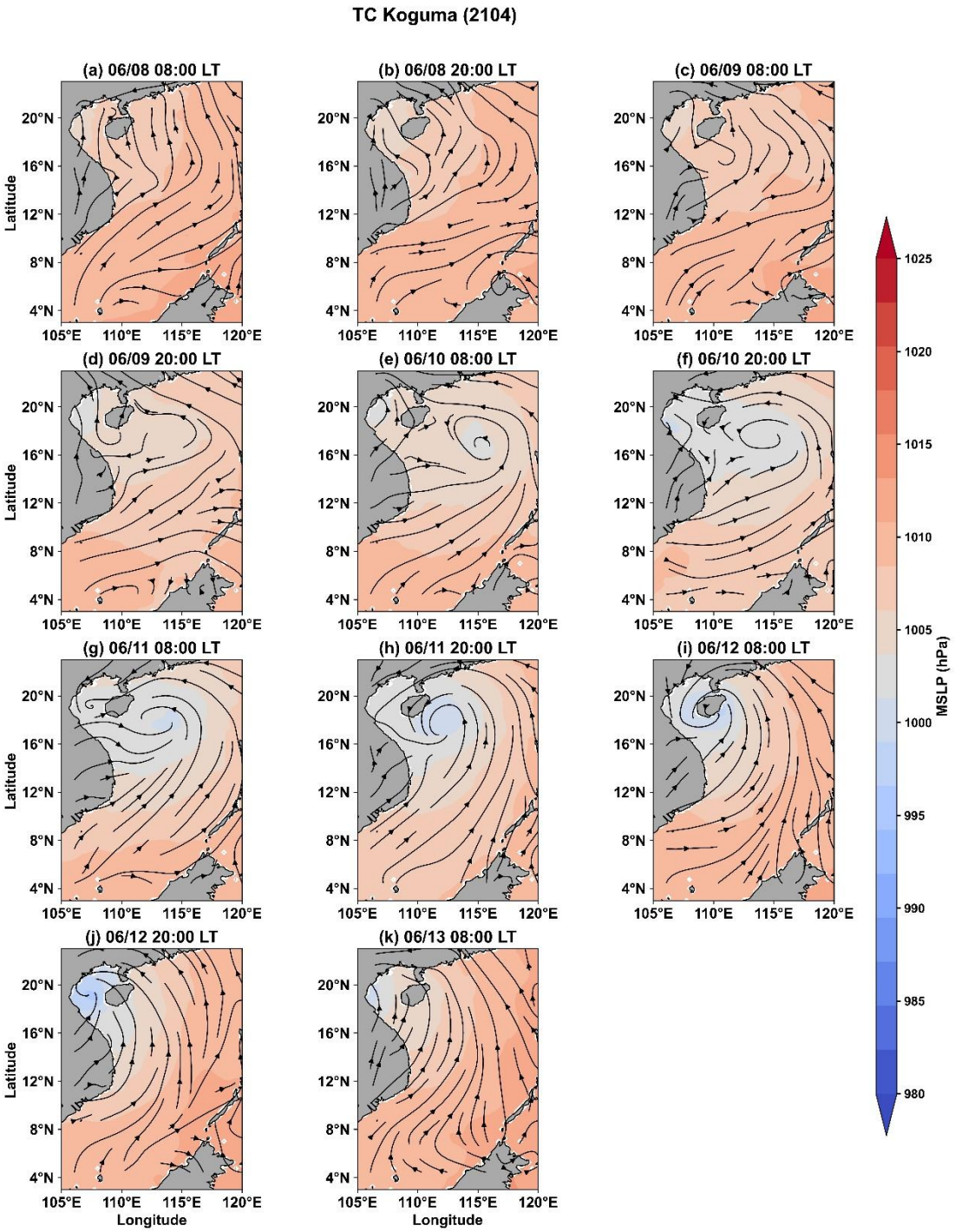


Figure S17. The surface sea pressure (SP) and wind field map from 8 June to 13 June in 2021 in South China Sea according to the lifetime of tropical cyclone (TC) Koguma from China Meteorological Administration (tcdata.typhoon.org.cn)

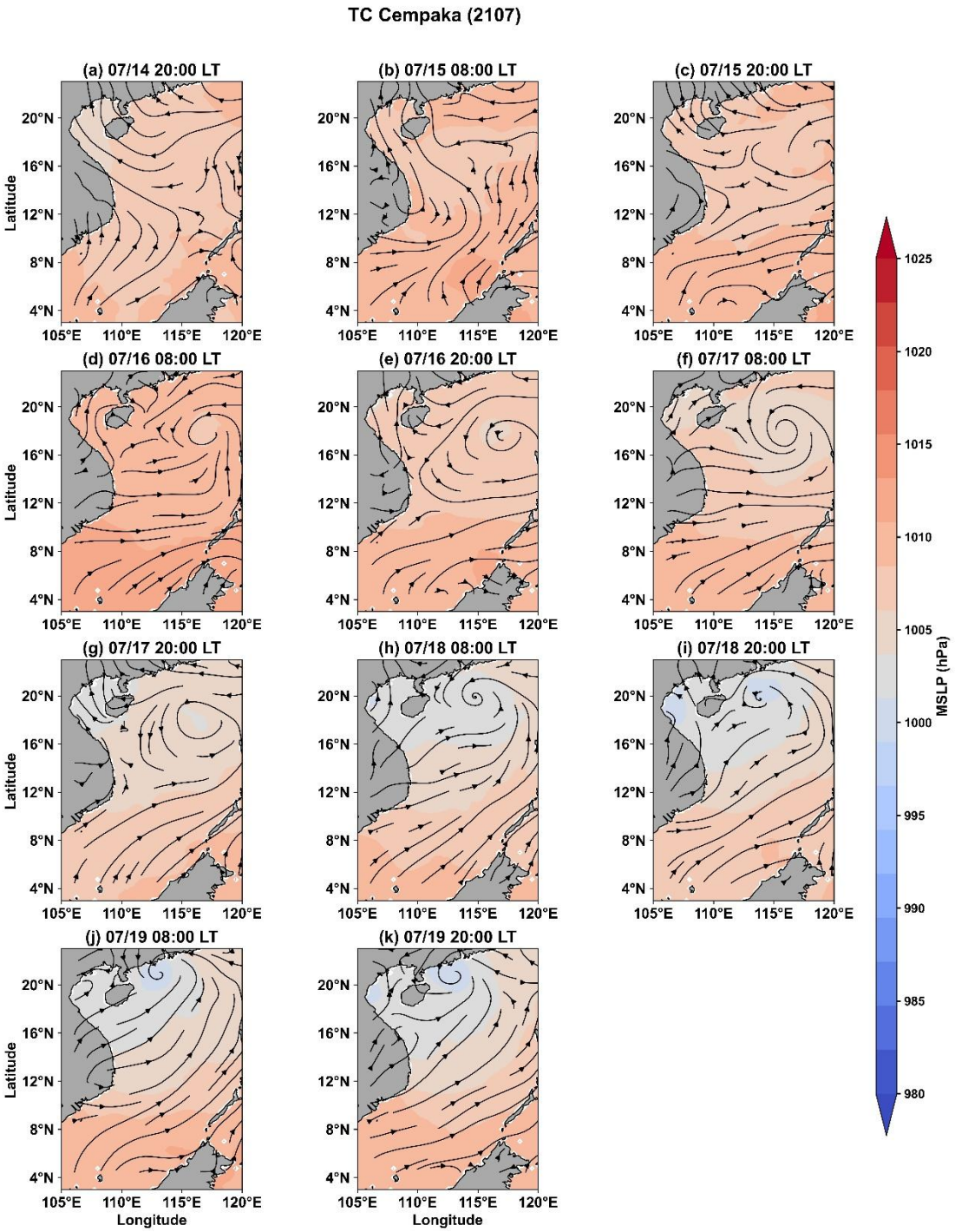


Figure S18. The surface sea pressure (SP) and wind field map from 14 July to 19 July in 2021 in South China Sea according to the lifetime of tropical cyclone (TC) Cempaka from China Meteorological Administration (tcdata.typhoon.org.cn)

9. *What is the specific definition of rc? The manuscript only presented the calculation method, but it does not clearly define this parameter.*

Response: We thank the reviewer for this valuable comment. In the original manuscript (Line 202), we briefly defined r_c as the critical autoconversion radius. In the revised manuscript, we have clarified that r_c represents the critical radius for the conversion of cloud droplets into raindrops through autoconversion, and that an increase in (r_c) indicates that this conversion becomes more difficult (Lines 224-227):

"*Based on the Pyrcel simulation, the following equations were used to quantify two key ACI effects—the Twomey effect and the Albrecht effect—using the cloud droplet effective radius (r_e) and the critical radius of autoconversion process (r_c). A larger re indicates a decrease in cloud albedo, whereas a larger r_c indicates a reduced likelihood of cloud droplets converting into raindrops (Wang et al., 2019).*"

10. *The study is based on a single TC event without an independent control period, but the manuscript repeatedly uses causal language implying that TC Chaba directly produced the observed aerosol and cloud changes.*

Response: We thank the reviewer for this important comment. We agree that our study is based primarily on a single TC event without an independent control period, which limits our ability to establish a direct causal relationship between TC Chaba and the observed aerosol and cloud changes. To address this concern, we have revised the manuscript to more clearly define the scope of our findings and avoid overstating causal attribution.

First, we have clarified in the Abstract and Results that our shipborne observations characterize aerosol physicochemical properties and cloud microphysical responses in the western region of TC Chaba, where the vessel was located during the observation period (Lines 25-27):

"*Using shipborne measurements over the South China Sea (SCS) from 22 June to 5 July 2022, we investigated how TC Chaba altered aerosol physicochemical properties and cloud microphysical responses in its western region by modifying atmospheric circulation.*"

Lines 306-309:

"*During the observation period, TC Chaba formed over the South China Sea and significantly influenced regional aerosol–cloud interactions. As the vessel location remained on the western side of the TC, the effects on aerosol physicochemical and cloud microphysical properties discussed below represent those observed on the western region of TC Chaba.*"

Second, to assess whether the observed cloud changes were also present during other similar TC events, we expanded the MODIS analysis to include two additional TCs that formed over the SCS in 2021 and followed tracks similar to Chaba. Decreases of approximately 2–3 μm in cloud droplet effective radius were observed over the western regions of all three TCs. The observed reduction in r_e can potentially be explained by the aerosol transport via the TC's western circulation. These elevated aerosol levels act as CCN within the cloud system, increasing cloud droplet number concentration and restricting the growth of individual droplets due to competition for available water vapor (Lines 504-513).

"*MODIS observations showed decreases of approximately 2–3 μm in re over the western region of TC Chaba and two TCs that formed over the South China Sea (SCS) in 2021 and followed similar tracks (Fig 6, Figs S17-S18). The re were averaged over the same regions as those defined in Section 2.3.5. For TC Chaba, the decrease was approximately 11 %, consistent with our simulations at an updraft velocity of 0.1 m s-1. This may be attributed to TC-induced circulation changes that facilitated the transport of terrestrial aerosols to the marine environment. The resulting elevation in N_{CCN} subsequently increased N_C, restricting individual droplet growth due to competition for available water vapor. Although these satellite-derived changes may also reflect variations in cloud type, updraft velocity, liquid water path, cloud-top height, precipitation, and TC dynamics, aerosol effects could have contributed.*"

These additional cases provide supporting evidence that similar cloud property changes occurred during multiple TC events, although they do not independently establish that aerosols caused the changes.

Minor comments:

1. Line 161: The format of the citation “Petters and Kreidenweis (2007)” here should be “(Petters and Kreidenweis, 2007)”.

   Response: Thanks for reviewer's comment. We have revised the reference formatting.

2. Some references are duplicated, while others contain incomplete or inconsistent bibliographic information. For example, the following reference appears twice:

   Response: We thank the reviewer for this comment. We have checked the reference list to ensure that no duplicate references remain.

3. Lines 145: The text contains the duplicated citation “Ng et al., 2011.Ng et al. (2011).”

   Response: Thanks for reviewer's comment. We have corrected this error.

4. Lines 167-168: The wording “it is noting” is grammatically incorrect.

   Response: We thank the reviewer for this comment. We have replaced “it is noting” with “it should be noted.”

5. The precise MODIS variable name, retrieval wavelength, quality-control criteria and valid-pixel coverage are not reported.

   Response: We thank the reviewer for this helpful comment. We have added details of the MODIS data in Section 2.3.5 of the revised manuscript (Lines 250-256):

   “*Specifically, we extracted the Cloud_Particle_Size_Liquid variable, which represents the liquid cloud droplet effective radius retrieved primarily from near-infrared observations at a wavelength of 2.1 μm (Platnick et al., 2017). Following the MODIS Collection 6.1 quality-control criteria implemented in the COSP framework, we retained valid retrievals according to the applied cloud-pixel*

selection criteria. The data were aggregated onto a 1° × 1° grid, and we used the resulting valid-pixel coverage without applying additional pixel-count thresholds."

6. Lines 430-440: "Cloud particle size," "cloud droplet size" and "effective radius" are used as though they were interchangeable quantities.

   Response: We thank the reviewer for this valuable comment. The MODIS output variable represents the cloud droplet effective radius. We have therefore used the term "cloud droplet effective radius" consistently throughout the manuscript when discussing aerosol effects on cloud microphysics. We have added the relevant information in Lines 260–262:

   "*Specifically, we extracted the Cloud_Particle_Size_Liquid variable, which represents the liquid cloud droplet effective radius retrieved primarily from near-infrared observations at a wavelength of 2.1 μm (Platnick et al., 2017).*"