Responses to comments of "Susceptibility of Marine Warm Clouds to Aerosols in Different Monsoon Periods over the South China Sea" (Manuscript ID: egusphere-2025-5935) to *Atmospheric Chemistry and Physics*.

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We are grateful to the reviewers for their thoughtful and constructive comments, which are very helpful for improving the quality of this manuscript. We have thoroughly revised the manuscript to address all comments with the point-by-point responses. We hope that the revised version can obtain favorable approval and meet the journal requirements. The referee's comments are reproduced (*black*, *italic*) along with our replies (blue) and changes made to the text (red) in the revised manuscript. All the authors have read the revised manuscript and agreed with the submission in its revised form.

Responses to Editor

Thank you for submitting the revised manuscript. Both reviewers have indicated that the manuscript has improved substantially. However, minor revisions are still required before the manuscript can be accepted.

In addition, please carefully review the ACP author guidelines and ensure that the manuscript fully complies with them. In particular, the Discussion and Conclusions section should be revised accordingly. ACP requires that the concluding section not only summarize the main findings, but also provide synthesis and interpretation, place the results in the context of previous studies, discuss limitations and caveats, and clearly articulate the implications of the findings for our understanding of the atmosphere and climate.

Please refer to the ACP guidelines for details: https://www.atmospheric-chemistry-and-physics.net/policies/guidelines_for_authors.html

Response: We thank the Editor for the helpful comments. We have revised the Discussion and Conclusions sections in accordance with the ACP Author Guidelines, with improved synthesis and interpretation of the results, and clearer discussion of their limitations, uncertainties, future work and implications.

Changes in Manuscript:

[Page 32-34 Line 688-791 (in the "Track Changes" version)]

To investigate how ACI vary under the alternating influence of two opposing monsoon systems over the South China Sea (SCS) and how different environmental conditions modulate these interactions, the study period was divided into three representative phases based on variations in wind direction, precipitation, and specific humidity: the southwest monsoon wet period (SWMW), the northeast monsoon wet period (NEMW), and the northeast monsoon dry period (NEMD). Satellite observations and reanalysis data were used to quantify ACI variability and its environmental controls across different thermodynamic and moisture conditions.

Distinct environmental regimes characterize the three monsoon phases. SWMW is dominated by strong ascent, high SST, and abundant moisture. NEMW features enhanced continental aerosol transport, reduced SST, and increased LTS. NEMD is the driest and most stable regime, with widespread subsidence and favourable conditions for boundary-layer aerosol accumulation.

A pronounced Twomey effect was consistently identified across all three periods, as indicated by smaller CER and higher Nd with increasing aerosol loading under nearly constant LWP. Quantitative estimates of ACI_r show that the Twomey effect dominates when LWP ranges from 50 to 200 g m^{-2}, whereas an apparent "anti-Twomey" behaviour appears in optically thin clouds (LWP < 50 g m^{-2}), likely associated with strong competition for limited water vapor and entrainment-induced drying. Precipitation tends to amplify the ACI by simultaneously suppressing cloud droplet number concentrations and removing aerosols from the atmosphere. After removing raining samples, the ACI derived from non-raining warm clouds provides a more reliable representation of the first aerosol indirect effect, reducing biases caused by precipitation processes, although some uncertainty may remain due to undetected light precipitation under high-LWP conditions. Across the three periods, shallow stratocumulus clouds (CTP: 800–950 hPa) show limited variability in ACI, while deeper cumulus clouds (CTP: 650–800 hPa) exhibit the strongest ACI during NEMD. In contrast, no clear separation is observed between the SWMW and NEMW periods.

The inter-monsoon differences in deeper cumulus cloud ACI are primarily governed by coupled variations in moisture, atmospheric stability, and aerosol conditions rather than monsoon phase itself. Stronger ACI in NEMD is consistent with drier and more stable conditions that favour aerosol accumulation and suggests a possible role of aerosol accumulation in increasing aerosol availability for cloud activation, which may in turn contribute to stronger ACI. In contrast, moist and convectively active environments during SWMW and NEMW likely weaken ACI through enhanced condensational and coalescence growth processes. These results highlight the key role of environmental modulation in shaping the expression of the Twomey effect in marine warm clouds over the SCS.

Uncertainties arise from the use of aerosol index (AI) as a proxy for CCN, which does not fully capture coarse-mode sea-salt aerosols, potential biases associated with aerosol hygroscopic growth, and assumptions in Nd retrieval (e.g., constant sub-adiabatic factor). Cloud selection criteria may preferentially retain more homogeneous scenes, potentially underrepresenting broken cumulus clouds, and may be less reliable for deeper trade cumulus and congestus clouds that dominate the 650–800 hPa CTP regime highlighted in this study. Undetected light precipitation may also affect ACI estimates, especially at high LWP. In addition, the present analysis cannot fully disentangle the respective influences of water vapor, thermodynamic stability, cloud regime, and aerosol type and loading, as these factors co-vary systematically with the monsoon phase, which limits attribution of the observed inter-period ACI differences to any single controlling mechanism.

Despite these uncertainties, the results show that deeper cumulus cloud ACI over the SCS are strongly regulated by coupled variations in moisture, stability, and aerosol conditions associated with monsoon transitions. Monsoon phases act not as direct physical drivers but as an organizing framework for environmental variability that shapes cloud microphysical responses. Future work will focus on reducing observational and retrieval uncertainties to improve the quantification of ACI across different monsoon regimes. These findings provide important observational evidence for understanding ACI and offer valuable guidance for improving the representation of ACI in climate and numerical weather prediction models.

Responses to Reviewer #1

I thank the authors for the substantial effort invested in this revision. The majority of my concerns have been considered by the authors, and the new analysis built upon a more confident dataset brings useful food for thought. The manuscript now reads with clearer logic and improved self-consistency. A small number of remaining items, which I classify as minor, warrant attention before potential publication. None requires new analysis, most concern internal consistency and the calibration of interpretive language.

Response: We sincerely thank the reviewer for the positive and constructive comments. We appreciate your positive assessment of the revised manuscript and thank you for the additional valuable suggestions. Detailed point-by-point responses are provided below.

Comments:

Comment #1:

Lines 103–104. The study period stated in the Introduction, "July 2002 to February 2023," is inconsistent with Table 1 and the captions of Figs. 3, 4, 5, and 6, which all read "Jul 2002–Feb 2020." Please correct the Introduction to match the operative end date (Feb 2020) used throughout the figures and Table 1.

Response: We thank the reviewer for pointing this out. We have corrected the study period in the Introduction to July 2002 to February 2020. We have also checked the manuscript accordingly.

Changes in Manuscript:

[Page 4 Line 98-101 (in the "Track Changes" version)]

Long-term multi-satellite and reanalysis datasets from July 2002 to February 2020 are integrated to characterize variations in aerosol, cloud, and environmental properties across the southwest monsoon wet (SWMW), northeast monsoon wet (NEMW), and northeast monsoon dry (NEMD) phases, and to quantitatively evaluate the corresponding ACI responses.

Comment #2:

Lines 174–184, 858–861. The adopted Nd product (Nd_G18_37) is an adiabatic retrieval subject to quality control (single-layer, sub-pixel homogeneity, optically thin screening) that is most reliable for stratocumulus-like overcast columns and less reliable for the deeper trade cumulus and congestus that the revised analysis now headlines (CTP 650–800 hPa). The adiabatic assumption is most strongly violated in this regime, and the pixel-level screening will preferentially discard broken cumulus scenes, potentially biasing the retained 650–800 hPa sample toward the most overcast, near-adiabatic cases. The current acknowledgment is limited to the fixed sub-adiabatic factor. Please add an explicit caveat in the text that the Nd retrieval validity, and the representativeness of the retained sample, is weakest in precisely the deeper-cumulus regime that carries the central result.

Response: We thank the reviewer for pointing out this important issue. We have added an explicit statement in the Discussion section clarifying that the validity of the Nd retrieval, as well as the representativeness of the retained sample, is indeed weakest in the deeper-cumulus regime that carries the central results.

Changes in Manuscript:

[Page 33 Line 751-754 (in the "Track Changes" version)]

Cloud selection criteria may preferentially retain more homogeneous scenes, potentially underrepresenting broken cumulus clouds, and may be less reliable for deeper trade cumulus and congestus clouds that dominate the 650–800 hPa CTP regime highlighted in this study.

Comment #3:

Lines 19–20, 582–583, 820–821. The abstract and conclusions assert a "progressive increase from SWMW to NEMW and NEMD," whereas the body (lines 582–583) correctly concedes that for ACI_r "no consistent ordering is observed between the NEMW and SWMW periods." The reported ACI_{Nd} values reinforce this: SWMW (0.250 ±0.027) and NEMW (0.286 ±0.016) overlap within their confidence intervals, so the statistically defensible statement is that NEMD is distinctly highest while SWMW and NEMW are not cleanly separated. Please bring the abstract and conclusions into line with the body. I would also note that the 95% intervals derive from a Student's t test on daily 1°regressions with strong spatial and temporal autocorrelation, so the effective degrees of freedom, and hence the true intervals, are likely overstated for the adjacent pair.

Response: We thank the reviewer for pointing out this important inconsistency. Following the reviewer's suggestion, we have revised the statements in both the Abstract and Conclusions to ensure consistency with the results presented in the main text. Specifically, we now state that NEMD is distinctly highest, while SWMW and NEMW are not cleanly separated.

Changes in Manuscript:

[Page 2 Line 18-28 (in the "Track Changes" version)]

Shallow stratocumulus clouds show no significant differences in ACI across periods, whereas deeper cumulus clouds exhibit the strongest ACI during NEMD, with no clear separation between SWMW and NEMW. The enhanced ACI during NEMD is consistent with the relatively dry and stable lower-tropospheric environment (LTS), where stable conditions may enhance ACI through aerosol accumulation, while moist environments are likely to weaken it via enhanced condensational and coalescence growth. However, these differences likely reflect co-varying environmental conditions across monsoon periods rather than a single dominant controlling factor. Limitations of AI as a marine cloud condensation nuclei (CCN) proxy and satellite retrieval biases may affect these conclusions. These findings suggest that, within a monsoon-organized framework, the interplay among aerosols, humidity, and stability is associated with marine warm-cloud microphysics, providing observational constraints for climate model representation of ACI.

[Page 33 Line 737-740 (in the "Track Changes" version)]

Across the three periods, shallow stratocumulus clouds (CTP: 800–950 hPa) show limited variability in ACI, while deeper cumulus clouds (CTP: 650–800 hPa) exhibit the strongest ACI during NEMD. In contrast, no clear separation is observed between the SWMW and NEMW periods.

Comment #4:

Lines 587–593. The argument that the agreement between ACIr and ACINd demonstrates the signal is "governed by systematic changes in the underlying meteorological environment rather than by the choice of ACI metric" overstates an agreement that is largely mechanical. For the adiabatic Nd, Nd ∝ τ^(1/2)·re^(−5/2), so d ln Nd/d ln AI = (1/2)(d ln τ/d ln AI) + (5/2)·ACIr, and the two metrics share the same re response by construction, diverging only through the weak τ–AI term. The reported deeper-cumulus values (ACIr of roughly 0.10–0.14 against ACINd of roughly 0.37–0.43) are consistent with this built-in scaling. The two metrics are therefore not independent, and their agreement is a regression consistency check rather than corroboration of the physical signal. Please adjust the tone of this discussion accordingly.

Response: We thank the reviewer for pointing this out. We agree that the consistency between ACI_r and ACI_{Nd} should not be overinterpreted as independent corroboration of the underlying physical signal. We have revised the discussion accordingly.

Changes in Manuscript:

[Page 24 Line 491-497 (in the "Track Changes" version)]

The consistency between ACI_r and ACI_{Nd} suggests that the inferred ACI variations are robust to the choice of metric. However, because the two metrics are not independent, their agreement should be interpreted primarily as a consistency check rather than as independent evidence for the underlying physical mechanisms. Nevertheless, the similar inter-period variations exhibited by both metrics motivate a further examination of the environmental factors associated with these ACI differences. Therefore, Section 3.5 explores the potential influences of moisture and LTS on deeper cumulus cloud ACI across the three periods.

Comment #5:

Lines 620–624, 627–628. The claim that "all RH bins consistently exhibit the same enhancement pattern" holds only for the two moister bins. In the dry bin (RH < 45 %), SWMW (−0.126 ± 0.291) and NEMW (−0.055 ± 0.194) are both statistically indistinguishable from zero and from each other if considering the error, and only NEMD (0.127 ± 0.102) is marginally positive, restricting the inference to the RH 45–80 % and 80–100 % bins. Please also specify which relative humidity product is used for the binning, e.g., if it corresponds to the aerosol-layer ambient RH that governs the MERRA-2 swelling effect rather than surface or cloud-top RH. A clarification in the text is sufficient; no further experiment is required.

Response: We thank the reviewer for pointing out this issue. We have revised the manuscript accordingly by correcting the interpretation of the RH-bin results. We also clarified the definition of relative humidity used in this analysis. Specifically, RH is taken from ERA5 at 950 hPa at 06:00 UTC, representing the ambient humidity relevant to aerosol hygroscopic growth. Previous studies have shown that aerosols over the South China Sea are mainly confined below ~3 km, with a peak extinction occurring around ~480 m (Li et al., 2020; Su et al., 2022). Based on this vertical distribution, the 950 hPa level is considered representative of the aerosol-rich lower marine atmosphere.

Changes in Manuscript:

[Page 6 Line 123 (in the "Track Changes" version)]

Parameter	Data Source	Spatial Resolution	Temporal Resolution	Data Range
Cloud Effective Radius Cloud Optical Thickness Cloud-top Temperature Cloud-top Pressure Liquid Cloud Area Fraction	CERES–MODIS V04 SSF1deg (Aqua, daytime)	1° × 1°	daily	Jul 2002 – Feb 2020

Liquid Water Path				
Cloud Droplet Number Concentration	Gryspeerdt et al. (2022)	1° × 1°	daily	Jul 2002 – Feb 2020
Total Aerosol Extinction AOT (550 nm)	MERRA-2	0.5° × 0.625°	daily	Jul 2002 – Feb 2020
Total Aerosol Ångström Parameter (470–870 nm)				
Specific Humidity	ERA5	0.25° × 0.25°	daily	Jul 2002 – Feb 2020
Temperature				
Relative Humidity				
Horizontal Wind Components				
Mean Sea Level Pressure				
Precipitation	IMERG V07 Final	0.1° × 0.1°	30 min	Jul 2002 – Feb 2020
Sea Surface Temperature	NOAA OI SST V2	1° × 1°	monthly	Jul 2002 – Feb 2020

[Page 25 Line 523-531 (in the "Track Changes" version)]

The RH used in this study is from ERA5 at 950 hPa at 06:00 UTC, representing the ambient environmental humidity within the marine atmospheric boundary layer. Previous studies show that aerosols are predominantly confined below ~3 km in the marine atmosphere over the SCS (Li et al., 2020; Su et al., 2022), with a peak in extinction occurring at approximately ~480 m (Su et al., 2022). Therefore, the 950 hPa RH is adopted as a representative proxy for the ambient humidity governing aerosol hygroscopic growth.

As shown in Table 2, the enhancement from SWMW to NEMW and further to NEMD is evident in the moderate and high RH bins (45–80 % and 80–100 %), whereas the low RH bin (0–45 %) does not exhibit statistically robust differences among the three periods.

Add the References:

Li, Y., Wang, B., Lee, S.-Y., Zhang, Z., Wang, Y., and Dong, W.: Micro-Pulse Lidar Cruising Measurements in Northern South China Sea, Remote Sensing, 12, https://doi.org/10.3390/rs12101695, 2020.

Su, Y., Han, Y., Luo, H., Zhang, Y., Shao, S., Xie, X., Su, Y., Han, Y., Luo, H., Zhang, Y., Shao, S., and Xie, X.: Physical-Optical Properties of Marine Aerosols over the South China Sea: Shipboard Measurements and MERRA-2 Reanalysis, Remote Sensing, 14, https://doi.org/10.3390/rs14102453, 2022.

Comment #6:

Lines 757–763. The proposed LTS mechanism, that higher stability promotes "aerosol accumulation and coagulation, leading to an increase in aerosol particle size" and *thereby more efficient CCN and stronger ACI_{Nd}, is weakly supported and arguably works against itself, since coagulation reduces number while increasing size, and elevated aerosol loading does not by itself raise the susceptibility slope, which can instead shift toward the updraft-limited regime. The moisture-based mechanism in Section 3.5.1 is more coherent. I suggest softening this passage.*

Response: We thank the reviewer for pointing this out. We have softened the description of the LTS-related mechanism as suggested.

Changes in Manuscript:

[Page 31 Line 647-655 (in the "Track Changes" version)]

This suggests that enhanced LTS may be associated with environmental conditions that influence ACI. Under more stable stratification, reduced vertical mixing may help maintain higher aerosol concentrations and moisture within the boundary layer, which may in turn influence cloud droplet activation and cloud microphysical properties. As a result, higher ACI_{Nd} is observed under stable conditions compared to unstable environments. Over the SCS, LTS is generally weaker during the southwest monsoon than during the northeast monsoon (Fig. 11), which may partly contribute to the observed inter-monsoon differences in ACI. However, given the complexity of concurrent variations in moisture, aerosol loading, and cloud regimes, the specific role of LTS in modulating ACI cannot be isolated.

[Page 33 Line 741-748 (in the "Track Changes" version)]

The inter-monsoon differences in deeper cumulus cloud ACI are primarily governed by coupled variations in moisture, atmospheric stability, and aerosol conditions rather than monsoon phase itself. Stronger ACI in NEMD is consistent with drier and more stable conditions that favour aerosol accumulation and suggests a possible role of aerosol accumulation in increasing aerosol availability for cloud activation, which may in turn contribute to stronger ACI. In contrast, moist and convectively active environments during SWMW and NEMW likely weaken ACI through enhanced condensational and coalescence growth processes. These results highlight the key role of environmental modulation in shaping the expression of the Twomey effect in marine warm clouds over the SCS.

Comment #7:

Lines 631. "LST" should be "LTS"?

Response: We thank the reviewer for pointing out this error. "LST" has been corrected to "LTS" throughout the manuscript.

Changes in Manuscript:

[Page 26 Line 542 (in the "Track Changes" version)]

Fig. 9 shows the ACI_{Nd} together with the corresponding q and LTS.

Comment #8:

Line 473. "CER is mostly smaller 15μm" should be "smaller than 15 μm."

Response: We thank the reviewer for pointing out this error. The text has been corrected to "smaller than 15 μm" in the revised manuscript.

Changes in Manuscript:

[Page 19 Line 395 (in the "Track Changes" version)]

As shown in Fig. 7, CER is mostly smaller than 15 μm, justifying the effectiveness of the filtering of non-raining cases.

Responses to Reviewer #2

I appreciate the authors' substantial efforts in revising the manuscript and addressing my previous concerns. The revised version is clearly improved. In particular, the use of a community-standard Nd product, the correction of the ACI Nd definition, the additional discussion of aerosol-proxy uncertainties, and the more cautious interpretation of the monsoon framework have strengthened the manuscript. I am generally satisfied with the revision and recommend minor revision before acceptance. However, I still have a few remaining comments that should be addressed to further clarify the interpretation and limitations of the study.

Response: We sincerely thank the reviewer for the positive and constructive comments. We are pleased that the revisions have been recognized as substantially improving the manuscript. We also appreciate the recommendation for minor revision before acceptance. Detailed point-by-point responses to the remaining comments are provided below.

Comments:

Comment #1:

The authors now clarify that the monsoon classification represents a coupled large-scale environmental background rather than an attempt to isolate individual causal factors. This clarification is useful. However, the manuscript should state more explicitly that the monsoon-period differences in ACI cannot be uniquely attributed to the monsoon regime itself, because LTS, humidity, cloud regime, aerosol loading, and aerosol type covary systematically. I suggest that the authors further soften causal *language throughout the manuscript and consistently frame the monsoon classification as an organizing framework rather than an independent physical driver.*

Response: We thank the reviewer for this helpful suggestion. We have revised the manuscript to further soften causal language and to consistently clarify that the monsoon classification is used as an organizing framework for coupled environmental variability rather than an independent physical driver.

Changes in Manuscript:

[Page 2 Line 23-25 (in the "Track Changes" version)]

However, these differences likely reflect co-varying environmental conditions across monsoon periods rather than a single dominant controlling factor.

[Page 33 Line 741-742 (in the "Track Changes" version)]

The inter-monsoon differences in deeper cumulus cloud ACI are primarily governed by coupled variations in moisture, atmospheric stability, and aerosol conditions rather than monsoon phase itself.

[Page 34 Line 785-786 (in the "Track Changes" version)]

Monsoon phases act not as direct physical drivers but as an organizing framework for environmental variability that shapes cloud microphysical responses

Comment #2:

The concern regarding AI as a CCN proxy has been partly addressed. Nevertheless, in a marine region such as the South China Sea, the possible role of coarse-mode sea salt and giant CCN remains important. If a full aerosol-type separation is beyond the scope of this paper, the authors should at least add a clearer limitation statement in the Results/Discussion and Conclusions, emphasizing that AI mainly represents fine-mode aerosol variability and may not fully capture sea-salt-related CCN effects. If possible, a simple sensitivity test using AE or MERRA-2 aerosol components would be helpful, but I do not consider it essential for acceptance.

Response: We thank the reviewer for this helpful suggestion. We have revised the manuscript to explicitly state the limitations of using AI as a CCN proxy, particularly its inability to fully capture sea-salt-related CCN effects, as suggested.

Changes in Manuscript:

[Page 34 Line 758-759 (in the "Track Changes" version)]

Uncertainties arise from the use of AI as a proxy for CCN, which does not fully capture coarse-mode sea-salt aerosols, potential biases associated with aerosol hygroscopic growth, and assumptions in Nd retrieval (e.g., constant sub-adiabatic factor).

Comment #3:

The treatment of precipitation has improved, but the possibility of undetected light *drizzle at high LWP should be more clearly acknowledged. The authors should clarify whether the main ACI conclusions are sensitive to the selected LWP range. A brief sensitivity check using a lower LWP upper bound, for example 50–150 or 50–180 g m⁻², would further support the robustness of the conclusions. If this analysis is not added, the limitation associated with hidden precipitation should be stated more explicitly.*

Response: We thank the reviewer for pointing this out. We have revised the manuscript to explicitly acknowledge the possible presence of undetected light drizzle at high LWP, clarify the associated uncertainty in the ACI estimates.

Changes in Manuscript:

[Page 23 Line 459-461 (in the "Track Changes" version)]

Nevertheless, the possibility of undetected light drizzle under high-LWP conditions may introduce additional uncertainty in the derived ACI estimates, despite precipitation screening using IMERG.

[Page 33 Line 729-730 (in the "Track Changes" version)]

Quantitative estimates of ACI_r show that the Twomey effect dominates when LWP ranges from 50 to 200 g m^{-2},

[Page 33 Line 734-737 (in the "Track Changes" version)]

After removing raining samples, the ACI derived from non-raining warm clouds provides a more reliable representation of the first aerosol indirect effect, reducing biases caused by precipitation processes, although some uncertainty may remain due to undetected light precipitation under high-LWP conditions.

[Page 33 Line 754-755 (in the "Track Changes" version)]

Undetected light precipitation may also affect ACI estimates, especially at high LWP.

Comment #4:

4. The revised manuscript still contains some strong interpretive statements, for example implying that stronger LTS enhances ACI through aerosol accumulation and enhanced CCN activation. This mechanism is plausible, but the present satellite/reanalysis analysis cannot fully prove it. I recommend revising such statements to more cautious language, such as "may contribute to," "is consistent with," or "suggests a possible role of."

Response: We thank the reviewer for this helpful suggestion. We have revised the manuscript to systematically soften the causal interpretation of the role of LTS, replacing strong mechanistic statements with more cautious language.

Changes in Manuscript:

[Page 31 Line 648-656 (in the "Track Changes" version)]

This suggests that enhanced LTS may be associated with environmental conditions that influence ACI. Under more stable stratification, reduced vertical mixing may help maintain higher aerosol concentrations and moisture within the boundary layer, which may in turn influence cloud droplet activation and cloud microphysical properties. As a result, higher ACI_{Nd} is observed under stable conditions compared to unstable environments. Over the SCS, LTS is generally weaker during the southwest monsoon than during the northeast monsoon (Fig. 11), which may partly contribute to the observed inter-monsoon differences in ACI. However, given the complexity of concurrent variations in moisture, aerosol loading, and cloud regimes, the specific role of LTS in modulating ACI cannot be isolated.

[Page 33-34 Line 726-745 (in the "Track Changes" version)]

Stronger ACI in NEMD is consistent with drier and more stable conditions that favour aerosol accumulation and suggests a possible role of aerosol accumulation in increasing aerosol availability for cloud activation, which may in turn contribute to stronger ACI.

Again, please to check this revised manuscript version and response files. We hope that the above responses can meet the concerns of the reviewers and the requirements of the journal. Thanks.

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