

**Review #2, Zheng et al., “Distinctive aerosol-cloud-precipitation interactions in marine boundary layer clouds from the ACE-ENA and SOCRATES aircraft field campaigns,” Egusphere/ACP**

**SUMMARY**

Thanks to the authors for their responses to my and my fellow reviewer’s comments. The reframing of the physical process discussion to de-emphasize turbulence as the primary contributor to increased collision-coalescence in the ACE-ENA winter regime was particularly appreciated. I still question the use of 1 Hz velocity data for quantifying turbulence but given the more qualitative discussion of the role of turbulence, this is sufficient. I have a few comments on additions to the manuscript and numerous typographical/language notes, but overall these should require only minor revisions.

On the latter topic of typographical comments, I understand the pressure to respond to reviews in a quick and timely fashion, but I encourage you to take a closer final editing pass before resubmitting future manuscripts. There are numerous errors in the added text that could easily have been avoided with one more close reading of the revised text. I can’t speak for all reviewers, but this particular reviewer is always more agreeable/less cranky when a resubmitted paper is free (or at least, very close to free) of these minor and entirely avoidable errors, which are distracting and add significant time/effort to my review process.

**MINOR COMMENTS**

L148-149: re: “the enhanced large-scale subsidence would lead to a deeper stratocumulus-topped MBL” -- This is paradoxical - enhanced subsidence ostensibly compresses the boundary layer, so how does it lead to a deeper cloud-topped MBL? Maybe you're getting at the fact that enhanced subsidence also tends to sharpen the inversion?

L184-185: re: “[the SOCRATES region] is under more consistent influence of mid-latitude cyclone systems than over the ACE-ENA region” – I’d say the dominant impact on winter weather at ACE-ENA is very much mid-latitude systems.

L302: “the ratio of the coupled sub-cloud MBL thickness to the sub-cloud MBL thickness” – I think you mean “cloud thickness” instead of the 2<sup>nd</sup> “sub-cloud MBL thickness”?

L302: Why such a complicated expression for  $D_{cp}$ ? Assuming  $H_c = z_t - z_b$  (which you haven’t stated in the text up to this point) and inserting your definition of  $H_{cp}$ , I come up with  $D_{cp} = 1 - ((z_t - z_{cp}) - (z_t - z_b))/z_b = 1 - (z_b - z_{cp})/z_b = 1 - 1 - z_{cp}/z_b = z_{cp}/z_b$ .

L743: There *are* high-rate measurements available from both SOCRATES (25 Hz; <https://data.eol.ucar.edu/dataset/552.005>) and ACE-ENA (20 Hz; [https://adc.arm.gov/discovery/#/results/id::6747\\_aimms\\_sfcmet\\_met-air\\_airborne\\_horizwind?measurementsView=true&showDetails=true](https://adc.arm.gov/discovery/#/results/id::6747_aimms_sfcmet_met-air_airborne_horizwind?measurementsView=true&showDetails=true)), so it’s misleading

that you frame this as a lack of access. You don't need higher rate data than that to estimate turbulence properties, although aliasing is still an issue.

Table S2: Add units for all variables. I also recommend replacing “nan” with “—” but this is not a requirement.

## **TYPOGRAPHICAL/LANGUAGE COMMENTS**

L145: “both summer and winter IOPs of ACE-ENA ~~are featured with~~ anomalously stronger high-pressure” – remove “are,” “with” and “er” from “stronger”; add “ly” to anomalous

L151: “while the winter IOP is ~~prevalently~~ featured ~~with prevalent~~ precipitation-generated...” – remove “is” and “with prevalent”; add “prevalently” before “featured”

L155: “~~In Over the~~ recent years; many observational studies; based on ~~the~~ ACE-ENA data have...” – remove “Over the” and commas from this phrase; add “In” to start of sentence

L181-182: “anomalously strong” instead of “anomaly-stronger”

L190: what do you mean by “the functioning physical processes?” Your usage of “functioning” doesn't make sense to me. Do you mean the “dominant” or “first order” processes? Or are you instead aiming to compile a comprehensive list of every process operating within these clouds?

L272-274: Sentence starting “In this regard...” is a sentence fragment. Please restructure.

L274: “the decoupling conditions” → “decoupled conditions”

L278: “in order to ensure the aerosols and CCN...” – I don't think “ensure” is the right word. I'd go for something like “to quantify the degree to which aerosols and CCN...”

L329: “which is described in the last section” – add “the”

L344: “subside ~~down~~” – the word “subside” implies downward motion; this is redundant

L345-346: “are in the reconciliation of getting the close-to-cloud...” – I'm not sure what you mean by “are in the reconciliation of”

L360: “and transport southeast” → “and be transported southeast”

L364: new sentence starting with “While...” should be combined with previous sentence.

L365: “a thousand” – add units after number

L382: superscript “-3” – I didn’t exhaustively catalog this issue, please double check unit superscripts throughout

L394: “double of the above-cloud...”

L477-479: remove duplicated phrase “which is also confirmed in...”

L586: “between the cloud top value and the upper-middle cloud...” – add “and”

L600: seems like “slowly” would be more appropriate than “not rapidly”

L604: what do you mean by “constant variation” – the nature of the variability is constant across cases? Please clarify.

L642: “which can be attributed...” – add “d” to end of “attribute”

L683: Correct reference “Atlas et al., 2020” => “Atlas et al., 2020”

L698: Correct reference “Wittle et al., 2019” => “Witte et al., 2019”

L880: “featured with enhanced...” – remove “with”; add “d” to “feature”

L881: “more larger” – remove “r” from “larger”

L896:  $R_{cb}$  equation – still not happy with this. I would prefer you explicitly write out “ $1.73 \times 10^{-6}$ ” as it is not clear whether you are saying “natural base e to -10 power” or if you are referring to engineering notation, in which case the -10 would not be superscript and the “e” would be capitalized.

L900: remove “where is”

L1064: remove comma between “evolution” and “during”