

## **Review of “Aerosol-cloud interactions in mixed-phase convective clouds. Part 1: Aerosol perturbations” – Miltenberger et al. (2018)**

In general, I am pleased with the responses provided by the authors and the corresponding changes made to the manuscript (exceptions provided below include the first Minor Concern and grammatical issues that remain causing the text to be hard to follow at times; there is also one instance where units are missing from a figure). Overall, I think the manuscript has been largely improved and should be accepted for publication pending the minor changes requested below.

### **Minor Concerns**

1. In my original review, I questioned the use of aerosol number density as a prognostic variable because it is not a conserved quantity. My understanding is that if the variable is prognostic, then it is treated like all other scalars in the model and undergoes advection. Thus, it should be conserved. However, mixing ratios are commonly used instead of densities because they are conserved. Perhaps this is just a wording issue but should be clarified.
2. Grammatical issues remain in the text, especially regarding punctuation (in particular commas) that cause the text to be difficult to read. I found myself again having to read many sentences several times to fully understand the meaning. The main issue is the lack of commas in introductory phrases, e.g., “for the highest aerosol scenarios no further increase in the condensate production occurs, as clouds grow into an upper level stable layer”. A comma needs to follow “scenarios.” There are approximately 50 instances of this in the text, which is far too many to list in a review. I strongly encourage the authors to read the text carefully and perhaps have it reviewed by a non-author for guidance. Along the same lines, commas should be removed before phrases that begin with “if” and “when”. Moreover, colons are used in many places in which they are not needed.

Furthermore, hyphens are needed in many cases, particularly with compound adjectives, e.g., “aerosol-induced changes”, “wing-mounted”, or “high-resolution simulations”.

Issues with subject-verb agreement also remain. For example, “data” is plural; however, singular verbs are used with the term throughout the paper.

### **Other Concerns**

1. The use of “knock-on effect” appears to be a British English phrase that may be largely unknown to the general scientific community. Consider using another phrase that would be understood by a general international audience.
2. When referring to prior works, please consider using the present or past tense consistently to avoid any confusion, e.g., “Smith (1990) found that...” or “Smith (1990) find that...”
3. Please define “COPE” the first time it is used in the abstract and main text.
4. In general, please be consistent with either “south-western” or “southwestern”.
5. Please use “period” or a similar term for the two different periods discussed in the paper instead of “phase” to avoid confusion between the two phases of condensed water.
6. Page 3, Line 30: Remove “often”.
7. Page 4, Line 10: It is not clear why “how large?” is in parentheses. Consider expanding on this or omitting.

8. Page 8, Line 21: Add “the” before “standard”.
9. Page 9, Line 25: Add “the” before “domain”.
10. Page 9, Line 35: Add “the” before “observed”.
11. Page 10, Line 16: Change “which” to “that”.
12. Page 11, Line 11: Add “the” before “simulations”.
13. Page 11, Line 22: What about changes in chemistry and size?
14. Page 11, Line 30: Change “that” to “which”.
15. Page 12, Lines 27-28: Please expand upon this statement because it seems as though the assumption is that aerosol particles are recycled back into clouds.
16. Page 13, Line 27: Reduction of what? The occurrence of cloud tops between 3 and 4 km?
17. Page 13, Line 31: Add “the” before “thermodynamic”.
18. Page 14, Line 7: Change “in” to “into”.
19. Page 14, Lines 17-19: This sentence needs to be reworded. Perhaps the confusion is because of the word “sensitivity” when in fact you mean a “response”?
20. Page 15, Line 6: Change “is evident also” to “is also evident”.
21. Page 15, Line 16: Change “to” to “in”.
22. Page 16, Line 17: Put “PE” in parenthesis and consider using it for the remainder of the text for conciseness.
23. Page 16, Line 31: Change “in” to “into”.
24. Page 18, Line 8: Use “concentrations” for consistency.
25. Page 18, Line 18: Do you mean “decreasing aerosol number concentration”?
26. Page 19, Line 25: Change “to” to “with”?
27. Page 19, Line 28: Add “the” before “precipitation”.
28. Page 20, Lines 12-13: Reword – perhaps just removing “profiles” and “structure” from the first two items in the list and then making the last word plural would suffice.
29. Page 20, Line 26: Please change “heigh” to “high”.
30. Page 20, Line 31: Add “the” before “aerosol”.
31. Page 21, Lines 6-7: Define the acronyms.
32. Page 21, Lines 31-32: This is an important point that I believe should be emphasized as well as placed in the context of prior studies that have suggested a similar finding (see Lebo (2017) and references therein).
33. Page 22, Line 21: The reference is not correct; please use Lebo et al. (2012).
34. Figure 4: Please add °W or similar to the x-axes of the figures.
35. Figure 6: Why did you choose to use  $10^6$  kg for precipitation? Why not use domain average values in mm?

## References

- Lebo, Z. J. (2017), A numerical investigation on the effects of enhanced latent heat release in deep convective clouds relative to other factors, *J. Atmos. Sci.*, doi:10.1175/JAS-D-16-0368.1 (in press).
- Lebo, Z. J., H. Morrison, and J. H. Seinfeld (2012), Are simulated aerosol-induced effects on deep convective clouds strongly dependent on saturation adjustment?, *Atmos. Chem. Phys.*, **12**, 9941-9964, doi:10.5194/acp-12-9941-2012.