

Interactive comment on “Investigating potential biases in observed and modeled metrics of aerosol-cloud-precipitation interactions” by H. T. Duong et al.

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The authors go another important step forward in their series of papers that define and quantify the susceptibility of warm cloud microstructure and rain to aerosols. Here they combine nicely simulations and observations that foster their previously defined concepts, and show the sensitivity to measurement biases of the aerosols.

There are several important issues that need to be clarified before the paper can be published in ACP:

1. In Section 2.1, it is stated that the analysis is restricted to clouds that exhibit lifetimes between 15 – 45 min. What fraction of the clouds are incorporated in the analysis, say,
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as defined by domain integrated LWP?

2. In Section 2.1 it is also stated that "Merging and non-precipitating clouds ($R < 0.5$ mm day⁻¹) are excluded in the analysis". But this introduces a bias of incorporating the rare clouds with small effective radius that do precipitate, and excluding most of the low effective radius clouds that do not precipitate. This, in turn, causes an underestimate of the susceptibility. I understand the difficulty of including zero in the logarithmic conversion for the definition of the susceptibility. Work around could be another formulation of linear nature, or a shift in the logarithmic scale, where, say, 0.3 mm hr⁻¹ is added to R , so that zero rain intensity would be $R = 0.3$. See example in Eq. 2 of Nirel and Rosenfeld, 1995.

3. The merging clouds are excluded in the analysis. Is the relation between rain and cloud microstructure there fundamentally different, or is it just because of some other difficulties? Either way, the reason and physical ramifications have to be given.

4. What is the way by which the different resolutions are tested? Are the clouds being tracked and then analyzed independently based on the three resolutions?

5. Page 29903, line 13: The text reads: "LWP is quantified as the vertical integration of the liquid water content measured by a PVM-100 probe". How is the vertical integration of LWP of the aircraft-measured cloud being done with measuring cloud drop liquid water content and effective radius at a single height, or at most three levels that are not exactly above each other in the same cloud? Some assumptions must have been made here. Please provide the way that the vertically integrated liquid water content is being calculated.

6. Page 29904, line 4: Please define LTSS and its units, because LTSS is used quantitatively later in the manuscript.

7. Page 29904, line 25: From what height is the effective radius taken?

8. Section 3.2: Please explain why lowering the resolution lowers the LWP values for

the maximum susceptibility.

9. Page 29907, line 4: Again, how is the "column-integrated in-cloud value" calculated?

References:

Nirel R. and D. Rosenfeld, 1995: Estimation of the effect of operational seeding on rain amounts in Israel. *Journal of Applied Meteorology*, 34, 2220-2229.

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