

Interactive comment on “Indirect radiative forcing of aerosols via water vapor above non-precipitating maritime cumulus clouds” by M. A. Pfeffer et al.

Anonymous Referee #1

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This paper makes an interesting claim and is suitable for the journal. However, I am unconvinced by the manuscript for several reasons, and would argue that the study must be strengthened to merit publication.

First, studies of aerosol effects in shallow clouds are nowadays normally done at LES resolutions (e.g. ~ 100 m or better). I would not expect realistic results from a 3-km simulation with only 40 or so tropospheric levels, even for deep convection let alone for non-precipitating convection. A large domain does not seem particularly important for this study. The authors' view that “This model was chosen because it can simulate the direct, semi-direct, and indirect effects of aerosols in a realistic manner because

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aerosols, meteorology, radiation, and atmospheric chemistry are coupled in the model” is naïve given the complexity of the processes and reliance on parameterization. I become more skeptical still when the authors tell us that cloud base in the model is too high by over 50% compared to observations, a serious discrepancy. The authors don’t even mention whether they are running the boundary-layer scheme or not; it is basically required at this coarse of a grid.

The cloud-water and number distributions look good (almost too good!), but this may be a direct result of the retuning that they did for the unresolved w variations.

Second, the authors present their results in a confusing way with multiple subscripts on each term and I cannot make out what is being subtracted from what. Since the main point of the paper is to point out water vapor changes, shouldn’t those be shown? I’d expect to see some “before and after” profile plots showing exactly how cloud, water vapor, and temperature changed with and without aerosols, so I can make sense out of the radiation changes. A table of numbers is nearly impenetrable.

Finally, the authors don’t offer any physical explanation for why the water vapor changed in the way it did (whatever way that was, since we weren’t shown). Normally budget diagnostics or sensitivity tests would be used to understand why the water vapor changed, in order to present a more assured picture of what happened. As it is, I would count it as likely as not that the result is a model artifact.

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