

## ***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 #2**

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Review of "Radiation feedbacks of aerosols via water vapor above non-precipitating maritime cumulus clouds" by Pfeffer et al.

This manuscript runs a mesoscale model to look at aerosols in shallow maritime cumulus clouds. The subject matter is suitable for ACP. The results try to classify factors that affect simulated outgoing longwave radiation. The results need to be far more quantitative and the methodology and simulations explained better. I am not sure of what the benefit is in using the mesoscale model set up, and how dependent the results are on heavily parameterized parts of the problem (such as vertical velocity). It is hard for example to tell if they are using a convective parameterization with their 3km

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resolution. The resolution seems awkward. Also the time period is limited, it would be nice to use more than one flight from the RICO experiment and try to run several cases. The conclusions are not quantitative enough, and little significance is shown. This work needs to be made more robust if it is to be publishable in ACP.

This paper may be suitable for publication in ACP subject to major revisions to address these general issues, and the specific points below.

P27638: Abstract: The abstract is a bit long and awkward.

P27638,L15: 1/10 as important as what? This section of the abstract is awkward. 1/10th as important as something 2/3 as important as something 2/3 as important of the 'predominant' effect. Please quantify all this in the abstract and paper.

P27639, L13: "more evaporation from the earth's surface": Only if they warm the surface. Aerosols don't change the energy balance except by reflecting radiation.

P27640,L23: "To summarize, we are looking for if in clean, non-precipitating maritime air, can different aerosols, through their influences on cloud droplet properties, change the concentration of atmospheric water vapor sufficiently to change the top of atmosphere radiation budget?" Awkward. Please rephrase.

P27641, L0: Maybe I misunderstood something, but essentially you are stepping back from LES modeling and using parametrized convection in a mesoscale model To try to represent the interactions. 'Complexity' comes in what aspects of the model? The Aerosols? How is the convection treated and the aerosols in convection?

Methods:

P27641,L14: What about other RICO flights? If I understand correctly you are extrapolating from 3.5 hours of data? That doesn't seem right.

P27641,L20: "high spatial resolution approaching cloud resolving models": 3km is not approaching cloud resolving models.

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P27641,L25: References for the Lin, CBM-Z and MOZIC8 schemes?

P27642,L11: "vertical velocities": this seems a bit like an Awkward solution. Is this linked to the convective parameterization? I assume you are using a convective parameterization at 3km? If not that would be really awkward. You should test the sensitivity to these assumptions about vertical velocities.

P27643, L1: On Figure 1, show the domain.

P27643, L20: Sea Salt emission: what does it depend on? Please provide a sentence of explanation

Results:

P27644,L15: I really do not like that you are quoting the gray literature for model evaluation. I think you need to download the data and plot it yourself in this case, or quote a published figure.

P27644, L20:"These concentrations were calculated by subtracting the concentration of the species in the experiment excluding the local aerosol source of interest from the Reference simulation." : I am not sure these would be linear to subtract. Also: need to show variability, not just an average. Also show for aircraft observations.

Also: what is the reference simulation?

P27645,L10: "here the Reference simulation was subtracted from the "1000 anthropogenic" simulation." Can you be sure this is linear? Not sure that removing one source yields the same answer: think about an autocoverion rate non linear in number, if you remove 20% of the number and fall below that you get a very different answer.

P27646,L19: "dry conditions: when the effect of H<sub>2</sub>O(v) is excluded (denoted as Dry);" What is a 'dry' atmosphere? Is this relevant (the atmosphere is never really 'dry').

P27647,L10: Need to show variance and thus significance for these statements about increases and decreases.

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P27648,L10:"In the longwave, the effect of H<sub>2</sub>O(v) is much greater than that of clouds..." As noted with the abstract, better discussion is needed here just give quantitative values and/or percentages instead of '»'

P27648, L18: "changes they make to the direct aerosol effect being about 2/3 of that due to changes to the clouds, and in turn the importance of the H<sub>2</sub>O(v) is about 2/3 of that of the direct effect" Are all these changes above the noise? Show variance and significance as well as quantify these statements.

P27650,L18: But the effect of H<sub>2</sub>O here is not significant? You are not talking about deep clouds here.

Conclusions ——— P27651,L1: Again: just quote percentages or magnitudes here.

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