

Interactive comment on “Environmental sensitivities of shallow-cumulus dilution. Part I: Selected thermodynamic conditions” by Sonja Drueke et al.

Anonymous Referee #2

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This is interesting, carefully done investigation into the impact of environmental relative humidity, cloud and subcloud layer depth, and surface sensible and latent heat fluxes on mixing and dilution in shallow clouds. The use of TKE scaling arguments allow the authors to bring some clarity into the broad range of effects that the environment has on cumulus mixing. Minor comments:

1) Resolution: I wasn't clear what the meaning of the parenthetical 100(50) notation was regarding Δx and Δy in Table 1. Does the 50 indicate that the same run was done at that finer resolution, and the results didn't change? It would be helpful to clarify this, and if possible to confirm that parameters like the cloud base mass flux didn't change

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with changing resolution.

2) Cloud size distribution: Satellite observations (e.g. Zhou and Di Girolamo, 2007 doi:10.1029/2006JD007371) indicate that cloud sizes follow a powerlaw distribution, so that the simple arithmetic mean isn't particularly representative of the actual size pdf. Feingold et al. (2017) doi: 10.1002/2017JD026467 showed that in an equilibrium simulation the size distribution actually changed significantly even given equilibrium mean field statistics and smaller clouds coalesced and then split. How stable is Re_{eff} in your simulations over the time periods that the entrainment rate is diagnosed?

3) TKE and entrainment time: The conclusion section's take on cloud size vs. dilution is clear, and the results in the paper give a good indication about why correlations between cloud size and entrainment break down. I think a second paragraph, discussing in a similar way the impact of these results on assumptions underlying mixing-time parameterization schemes based on Neggers et al. 2002, like Tan et al. 2018 (doi: 10.1002/2017MS001162) would strengthen the conclusions.

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