

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-832

Anonymous Referee #2

Referee comment on "Demistify: a large-eddy simulation (LES) and single-column model (SCM) intercomparison of radiation fog" by Ian Boutle et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-832-RC2>, 2021

General Comments

This paper describes the initial phase of a model intercomparison project focused on the modelling of fog. Focussing primarily on the atmospheric development of fog, 5 large eddy simulation (LES) and 10 single-column models (SCM) are run with prescribed high and low aerosol/CDNC in the simulations while surface properties were constrained following a slightly idealised version of the LANFEX IOP1. They found that there were large differences between the models and highlighted the importance of the inclusion of processes such as cloud droplet sedimentation as well as the sensitivity of parameterisations within the microphysics.

It is great to see the international community come together to tackle the problem of fog modelling. This manuscript provides a good overview of the capabilities and limitations of the current state of the art models for fog. The comparison of the models for the same case and with similar constraints is useful. I think this paper provides a solid baseline for further studies and would recommend it to be accepted for publishing, with a few minor revisions.

Specific comments and technical suggestions

Figures: The observations in all figures except 1, 11 & 12 are very hard to see. Maybe plot it last so that it lies on top of the simulations, and/or use a darker shade in your colouring.

Line 6: "under high aerosol or cloud droplet number **concentration** (CDNC) conditions."

Line 30: Maybe say "The current intercomparison" instead of "This intercomparison"? As you were just talking about the previous one it was not immediately clear to which one "this" refers to.

Line 47: How exactly did you "idealise" IOP1? It is not clear.

Line 82-84: It might be useful to briefly describe the relationship between LWP and fog/cloud for readers less familiar with the phenomena. i.e. how do you distinguish between fog and cloud when looking just at LWP? Assuming the observed LWP towards the end of the period is cloud, do you expect the models to simulate that too?

Line 165: To which figure are you referring to here?

Table 4: It would be nice to have a reminder of which models are SCM and which are LES in this table. Either as an extra column or in brackets after the model for the ones that doesn't have it in the name.

Line 225-227: Yet the fog seems to persist for too long into the daytime for the LES models as well?

Line 254-255: To me it doesn't look like the microphysical parameterisation has a larger effect than the prescribed CDNC values. $c_{10,u=10}$ have a similar LWP to $c_{50,u=0}$, but all the other c_{50} simulations are well above the rest, whereas the c_{10} simulations only have a slight increase with increasing u between 2.5 and 10. So except for setting $u=0$, you'd need larger CDNC for u to have more effect. But your point stands that it does make a difference.