Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1139-RC1, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Large-eddy simulation of radiation fog with comprehensive two-moment bulk microphysics: Impact of different aerosol activation and condensation parameterizations" *by* Johannes Schwenkel and Björn Maronga

Anonymous Referee #1

Received and published: 20 November 2018

Review of the paper entitled
"Large-eddy simulation of radiation fog with comprehensive two-moment bulk microphysics: impact of different aerosol activation and condensation parameterizations"

by Johannes Schwenkel and Bjorn Maronga

manuscript number ACP-2018-1139

This paper addresses the difficult topic to evaluate the influence of cloud microphysical parameterizations on large-eddy simulation of radiation fog. The results are based on one case of deep fog observed at Cabauw (Netherlands). The subject of the manuscript is interesting as radiation fogs are not well known, and particularly the influence of microphysical processes on the fog life cycle. However, I think that some revisions will be helpful to make this paper clearest.

1. **clarify the effect of microphysical parameterizations on the fog life cycle** : Following Fig. 8, the microphysical parameterizations used do not modify the fog onset, the time when fog becomes optically thick, the lifting time of fog and the time when fog is completely dissipated. However, it is very difficult to evaluate precisely these parameters from Fig. 8. I think that a table summarizing these 4 times, crucial in the fog life cycle (onset, transition into optically thick fog, lifting time and complete dissipation), would be helpful to evaluate the impact of the parameterizations used. Could you please add this table and discuss the impact of microphysical parameterizations on these parameters? Please elaborate.

2. **effect of microphysical parameterizations on visibility at ground level** : Your simulations demonstrate that the microphysical parameterizations mainly impact the microphysical properties of the fog layer (liquid water mixing ratio and LWP). These parameters (q_l and n_c) have a significant impact on the diagnosed visibility. Could you please discuss the impact of the microphysical parameterizations used on the diagnosed visibility at ground level? Is this impact significant?

Or is this impact of the same magnitude than uncertainties due to visibility diagnostic? Please elaborate.

3. **effect of aerosol** :
   Your tests are done for a background aerosol concentration of 842cm^{-3} and for a given aerosol chemical composition. What is the impact of this hypothesis on your results? Are your results also valid in a highly polluted atmosphere (e.g. observation made during WIFEX), or in an atmosphere with low aerosol concentration? Please elaborate.

4. **shallow fog** / **deep fog** Are your findings also true for shallow fog (with thermal inversion at ground level)? The dynamical processes between shallow and deep (mature) fog are strongly different. And consequently, the impact of microphysical parameterizations could be very different during the fog life cycle (due to difference in supersaturation magnitude). Could you please clarify the sensitivity of microphysical parameterizations depending on the fog type (ie shallow vs deep fog)?

5. Stolaki et al. (2015) use 1D model. She does not use 2D LES. Please modify (p2 l2).

6. Figure 6b, 6c, 6d, 9c and 10c are very hard to read (too many curves on the same plot). Could you please try to improve these figures?