Aerosol-fog interaction and the transition to well-mixed radiation fog: Response to reviewer 2

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We thank the reviewer for their positive and constructive comments. We have described below how the manuscript has been altered to address them – any page or line numbers refer to the latexdiff file.

Abstract: -"Improvements to the representation of cloud droplet concentration" - it is more correct to say that you implemented a reduction of the concentration.

This was already addressed before the discussion phase. We have modified the sentence as "Modifications to the parametrization of cloud droplet numbers in fog, resulting in lower and more realistic concentrations". Simply stating that we have reduced the concentration makes it sound like arbitrary tuning, which it is not - a key focus of the paper is demonstrating that drop numbers in fog are low and the parametrization systematically over-estimates them. Hopefully by expanding the sentence we have made it both clearer and more correct.

Structure: In general the paper is well written, though I recommend the paper structure should be a bit more clearly presented in the beginning of the paper. The paper contains a discussion of observations, LES, and NWP model and a climate model. Some of these appearances appear a bit as a surprise or are only very briefly introduced, which give the reader a bit the uncertain feeling like "where do we go?". Hence the authors should better introduce why the chain of models presented in necessary to answer the research questions. Just some more details would be appreciated, which would also help to ensure reproducibility.

We have endeavoured to address this comment in the revised manuscript. The aims are now more clearly stated in the introduction (P2, L15-16 - to understand the observations and evaluate/improve an NWP model). The methodology to achieve this is then presented through the sections (P2, L16-19), including the introduction of the LES as a process model to supplement the observations. We have also expanded the motivation and description of the LES

(P3, L5-26), making it clear how it differs from the NWP model as a tool for understanding the physical processes at work.

Figures: I suggest to plot observations in dots and model results as lines so they are more easy to distinguish without reading the caption twice.

This was already addressed before the discussion phase. We're not sure exactly which figures the reviewer is referring to, as many plots contain multiple observations, which are plotted in a manner suiting their measurement - lines to represent continuous or high frequency data, dots to show discrete measurements. To enable the reader to get a quick overview of the plots without having to read the caption, we have added the primary observation on each panel to the legend (typically a black line).

Synthesis: I encourage the authors to strengthen the discussion section. Somehow I have the feeling the paper has a bit the nature of a technical report that present the impact of changes in model settings, that are in itself of course valuable, but the synthesis how the current results relate to other studies could be strengthened. At least I am aware of other studies that report on a much smaller sensitivity on the microphysical settings than presented here. As such a more complete synthesis would be valuable.

We have altered both the introduction and conclusions in response to this comment. We now motivate the work more strongly (P2, L5-11) as a follow on to the work of Bott (1991), a paper which first describes the strong effect of aerosol on the fog life-cycle. We have then included a discussion in the conclusions to the recent paper of Maronga and Bosveld (2017), describing how although their results may appear quite different, we actually feel they are quite complimentary (P16, L21-29). We have also clarified a further point on the treatment of longwave scattering in NWP models, which may make our results different to others (P16, L30 - P17, L2).

References

Bott, A. (1991). On the influence of the physico-chemical properties of aerosols on the life cycle of radiation fogs. *Boundary-Layer Meteorol.*, **56**, 1–31.

Maronga, B. and Bosveld, F. (2017). Key parameters for the life cycle of nocturnal radiation fog: a comprehensive large-eddy simulation study. *Q. J. R. Meteorol. Soc.*, **143**, 2463–2480.