Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Aerosol-fog interaction and the transition to well-mixed radiation fog" *by* Ian Boutle et al.

Anonymous Referee #1

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"Aerosol-fog interaction and the transition to well-mixed radiation fog"

by Ian Boutle, Jeremy Price, Innocent Kudzotsa, Harri Kokkola and Sami Romakkaniemi

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I would like to thank the authors for this very detailed response to my previous comments. You have did a very huge work and the impact of your research could be maximized. I hope that my comments would help you to improve your article.

1. **Demonstrate the usefulness of using 3 types of models (LES - NWP - climate model)** :
   I totally agree with you about complementarity between observations and LES. LES are a great tool to better understand the processes occuring during the fog life cycle. I also agree that the ultimate goal is to improve NWP simulations, and a statistical study could demonstrate that this goal is achieved. In my opinion, the statistical validation of NWP is very interesting and needs to be included in the revised version. However, for fog (rare event) I am not sure that probability of false detection ($b/(b + d)$) would be the best indicator of false alarm because $d >> b$. I prefer the false alarm rate : $b/((a + b)$

   I am not convinced by the usefulness of climate simulations. In my opinion, this part of the article makes the manuscript more confusing without added scientific values.

   For the LES, it would be useful to study in detail the variability found in LES simulations, and to validate it with observations (if available). Moreover, what is the impact of microphysics in this variability? I also have questions about activation processes in LES model. Given the time step used in LES study, I am not sure that a direct coupling between microphysics and LES updrafts (turbulent updrafts) is the best way to modelize the activation process. What is the representative time for activation processes? Is it compatible with the time step used in LES or with the lifetime of turbulent updrafts?

2. **Validate the microphysical parameterization** :

agree

3. **Validate the numerical model used and particularly the frost-dew deposition** :

I agree with your reply. Deposition (dew and fog settling) is clearly an important process in the formation phase of a fog layer, and I agree that it is an area in which NWP are deficient. Given the instrumentation deployed during LANFEX, you could perhaps discuss this point and discuss the impact of your modification on water deposition on ground. I think that the total water deposition on the ground could be more useful than the evolution of the specific humidity at screeen level.

For the soil-atmosphere exchanges, It would be nice to discuss the limitations of the appraoch used (imposed surface temperature and consequently no interaction between land and atmosphere). During the formation and dissipation phase, it seems that the surface - atmosphere interactions have a huge impact on fog life cycle. Therefore, your approach could be limiting.

4. **Contribution of this study with respect to bibliography** :

Agree fog Bott (1991). Your work should be discussed with respect to this reference.

The comparison of your results with the results of Maronga and Bosveld (2017) should be added in the revised version. I agree with your reply but this point should be clarified in the revised version.