Review of "WRF-SBM Numerical Simulation of Aerosol Effects on Stratiform Warm Clouds in Jiangxi, China"

Summary

This work studies the evolution of aerosol properties through a simulation of a stratiform cloud case study in China. They perform simulations in WRF using the SBM microphysics scheme, validating their results by comparing the simulation macro and microphysical properties to both satellite products and flight aerosol measurements, respectively. Then, they evaluate 5 variations of the aerosol number concentration and observe the resulting features. They describe that previous studies do not show a consistent trend between some aerosol properties, and they are able to conciliate those previous results by showing that, for this case study, the trend is nonlinear and the sign depends on the range of the volume-mean radius. While this main contribution is quite clear in the body of the manuscript and conclusions, there are certain aspects in the description of the first simulation results, setup, and figures that could be improved. Finally, there are some remaining questions, simulation setup variations, and other case studies that could be explored; and those could be mentioned for future work.

Minor comments

- The abstract does not describe which were all the variations performed: how many cases? It also does not specify what is the simulation / observation length of the case study.

- There are flight measurements that are not consistently mentioned in the text. Please include them early to not surprise the reader.

- How representative is the chosen case study? I understand that is great to compare a case for which there are observations available but it'd be great to know if this case is typical for that or other regions, or not.

- The first results of the simulations, where the cloud development is described, is not very thorough. First, some increasing/decreasing trends that are mentioned do not match the presented figures. Then, the magnitude of two of the properties are not so close when compared to the flight measurements, and there is no mention of that. Finally, the vertical resolution of the vertical-time plots is quite coarse, so the conclusions regarding cloud growth should be described carefully. In this sense, a more critical description, acknowledging the possible shortcomings of the chosen vertical resolution on cloud development could be included. Was there any way to validate cloud thickness for the reference case?

- For the main figures of the study (Figs. 11-13), we do not know what the data points represent. Are they combining all the data, at all times, for all the domain? Please specify. If this analysis were categorized, would it be helpful for exploring different processes?

- The two sections of results; first the time/height description, and then the aerosol statistics trends, seem a bit disconnected. For example, when aerosol statistics were analyzed by height in the first part, then that dimension was not mentioned again in the trend analysis. If the first part is not as important as the second, maybe the text could be simplified in order to be brief and to the point.

- The A1, B1, etc... notation in the figures is highly confusing since it makes the reader look at the caption very carefully every time instead of making good use of the plot labels/titles. I'd suggest replacing A1, B1 by the name of the case or the configuration shown in each subfigure.

Line by line comments

- L50 Are these modeling studies?

- L96 In this summary, it is not included that there are comparisons with observations, both satellite and flight derived.

- L109 What is the vertical resolution of the smaller domain?

- L110 Was any other PBL scheme tested?

- L116 How representative is the chosen case study in that geographical context?

- L123 Is this horizontal or vertical wind shear? (du/dx or du/dz) Is that expected to affect the cloud development?

- Fig. 2. This is the first time that the flight is mentioned, we have not read that in the main text.

- Fig. 3. The CM and ORG cases look the same. Is this a plotting issue? I was expecting the CM to be larger for greater D.

- L173 Here is the first mention of the flight, although Fig. 4. is not mentioned in the text. Is Fig.4 useful at all if it's not even discussed?

- L186 Here it mentions that "the simulation results are generally consistent" but the magnitudes of Clw and D are quite different according to Fig. 6. It'd be better to describe that and explain if that is significant or not.

- Fig. 6. What is the normalized height? Why is it only used in this Figure? Upper and bottom rows don't have the same x axis limits. What is the vertical resolution of the A plots?

- 3.2.1 Here it starts mentioning the growth of the cloud layer but in a very qualitative way. If the time resolution of the simulations is finer than 1 hour, I'd suggest to add time evolution plots for a better description.

- L202 I don't see the Clw and D decrease but an increase, and the opposite for Nc.

- L206 You say that the cases with greater concentration promote cloud growth but basically all the cases are showing that behavior. Same in L211, how noticeable is it when it seems like it is just 1 more grid point?

- L220 Is this analysis done for all simulation times or only 05 UTC? If separating the analysis by height is useful, why don't you continue using this approach later on?

- Fig. 8. What time is this data from? 05 UTC?

- L223 I'm not sure if it's an exponential decay.

- Fig. 11. This is probably one of the central results of the study. Not much is said about the data itself. Are all the points combining all the states in the whole domain and throughout the simulation? Were these results separated by height, time, etc.

- Section 3.3. Here many correlations are mentioned but no correlation factor is ever reported. Would that add value to the analysis?

- Section 4 There's no need to repeat what was already described in the Introduction. Simplify if possible.

- L347 Is it possible to consider the processes mentioned here in the analysis?

- Conclusions: What are the future directions for this work?

Writing comments / suggestions

- L13 Cloud base height?

- L16 You can specify that "generally" is in the context of your results.

- L90 "dependent"

- Fig. 1. It should not be described mentioning "the figure".

- Table 1-2: Maybe you could skip the decimals in the large numbers.

- L176 04:45

- Clw or C_{lw}? Also, you alternate between using the symbol and description throughout the text, which at times can be confusing.

- L259 Avoid starting a sentence with a symbol.

- Fig. 7, 10. Please add the x axis labels for each row.

- Fig. 10. Improve image resolution.

- Fig. 11, 13. In the y axis label: Should it be xi (ξ) or epsilon(ε)?