Review of 'How the representation of microphysical processes affects tropical condensate in a global storm-resolving model'

This manuscript investigates the impact of different representations of cloud microphysical processes on the distribution of tropical condensate in a global storm-resolving model using the ICON model. It focuses on the differences between a one-moment and a two-moment microphysical scheme and how modifying certain parameters within these schemes affects tropical-averaged species burdens, TOA and surface energy balance, and precipitation properties. Specifically, the change in the fall speed of hydrometeors significantly impacts both the distribution of condensate and precipitation efficiency, with faster fall speeds generally leading to less condensate and higher precipitation efficiency. Therefore, this manuscript may be worth publishing after addressing my concerns listed below:

Minor Comments:

The findings are specific to the ICON model and its configurations. The generalization of these results to other global SRMs should be made cautiously, as different models might exhibit different sensitivities to microphysical parameterizations. So, it is suggested to include "ICON" in the title for greater clarity.

While the manuscript is logically well-constructed in terms of scheme modifications, it solely focuses on model simulations and sensitivity studies but lacks direct comparisons with observational data. This omission limits the interpretation of the model's performance. It would be beneficial to include some case studies after the general assessment of the model changes, to demonstrate the efficacy of the different parameter perturbations.

The authors discuss the differences between the two schemes and the sensitivity tests, but a more elaborated discussion on the parameter-modified sensitivity runs is needed, given that these sensitivity simulations are one of the main focuses of the manuscript. For example, considering the discussions in Section 3, what are the corresponding implications of these parameter-induced changes in real-case simulation scenarios (which could be addressed in case studies)? Alternatively, how might these sensitivities impact the accuracy of climate predictions using the ICON model (considering a longer climatological simulation perspective)? I would like to leave the choice of such implementations to the authors.

Furthermore, the changes in species burdens appear to be determined by the changes in fall speeds, as suggested by comparing Fig. 4 and Fig. 1. However, it is difficult to quantify their sensitivities.

I suggest adding a quantitative assessment, such as evaluating the dependency of burden change rates on changes in fall speed. Additionally, it would be valuable to include the regional (latitudinal/longitudinal) distribution of these dependencies within the study domain in ICON.

Minor Comments:

Line 31: Please define NICAM.

Section 2.1: Does the ICON model's microphysical scheme used in this study include explicit aerosol-cloud interactions? If so, how are aerosols represented, what role do they play in the activation of cloud hydrometeors, and have these interactions been controlled across the different simulations?

Section 2.2: It would be helpful to include a table summarizing the sensitivity test configurations before discussing their potential effectiveness (e.g., in lines 115-116). This would provide a clear overview, and readers could be directed to the Appendix for more detailed information if necessary.

Figure 1b: Could you provide a potential explanation for the fluctuations in the 2mom standard rain falling speeds near the tails of the lines?

Figure 2i: The figure shows no hail mass across all simulations, yet hail fall speeds are presented for the 2mom standard simulation in Figure 1b. Could you clarify this discrepancy?