Response to reviewer comments regarding egusphere-2024-2268: 'How the representation of microphysical processes affects tropical condensate in the global storm-resolving model ICON'

We thank the editor and the reviewers for the additional time they devoted to the manuscript, and are glad we were better able to articulate the scope and motivation for the manuscript. We have addressed the comments raised in reports 2 and 3 through changes to the manuscript as noted below.

Report 2: raised the following points, our responses follow in color:

1. relation of the work to Mauritsen et al.: "This discussion seems to be closely linked to Mauritsen et al. (2022)"
2. clarification in the text: l. 67: unclear what "they" refers to and l. 68: investigate (no s), and l. 41-43: "this comparison is still not clear to me"

We have now slightly restructured the introduction to present the work in light of the work of Mauritsen et al., which we also now cite. The sentence with the unclear 'they' has been rewritten to avoid too many indirect references. The typo (investigate) has been corrected. The sentence with the confusing reference to the comparison to grid spacing has been removed. It was not necessary and was presented more clearly elsewhere.

Report 3: raised three issues, which we address in turn (in color):

Lines 61 – 68. It seems like the connection between changing habit properties and fall speeds could have been inferred using a much less computationally intensive model. Thus it's still very unclear what the value of doing this type of sensitivity study in a global SRM is. It seems like in future work the parameter spread could first be evaluated in a much less computationally expensive model and then this could be used to determine reasonable parameter values for the much more computationally expensive GSRM. Why was such an approach not taken here?

Yes in principle one could do as the reviewer suggested, but it leaves open the question as to whether the sensitivities that are identified in simple settings manifest themselves more generally, or even matter when looked at from the perspective of the global climate. The purpose of this study was to explore the latter. Now that we have an idea of what matters, and what doesn't, the questions are better defined for the types of studies the reviewer had in mind.

Since both myself and Reviewer 2 commented on how Figure 5 was extremely hard to read when such similar symbols were used for both the 2 moment and 1 moment cases, it's odd that the authors did not update this figure for readability. Despite many different comments from all reviewers regarding the readability of the figures and the presentation of the results throughout the manuscript, I note that the only update to any of the figures in this revised version was a slight resizing of some of the panels in a few of the figures.

The layout of the figure and the symbols have been changed to improve readability, and these changes have been applied consistently across figures.

Even if readers can look up the details of the one and two moment schemes in their original paper, it seems extremely relevant to the current study that this information be readily available to the readers. I suggest that a table or figure be added that includes which process rates were included in each scheme, as requested by myself and multiple reviewers in the previous round of reviews.

In association with this study the 1-moment microphysics was completely rewritten. This identified a little over 200 parameters. The two moment scheme is yet more complex. While we appreciate the idea that somehow microphysics enumerates a well defined set of processes set by a few constants this is not the case in practice. Neither the categories are well defined and generalizable across models, nor are the processes and the parameters that regulate them few. Rather than persisting with this illusion by selecting a few of the constants and presenting them as if they describe the scheme, and because we don't believe a particular process rate is important for our arguments, we now outline this reasoning (§2.2) and recommend that the interested reader take the code itself (which is open source) as the ultimate documentation