

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2022-835-RC1>, 2023
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Comment on acp-2022-835

Anonymous Referee #1

Referee comment on "Influence of cloud microphysics schemes on weather model predictions of heavy precipitation" by Gregor Köcher et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-835-RC1>, 2023

This is an interesting study giving a statistical evaluation of different microphysical schemes using real radar observations on 30 convective cases.

The first part of the results dedicated to the analysis of heavy rain is very convincing. The two ways of sorting the results as a function of reflectivity first and of rain content next is nice and helps showing the effect of the underestimation or overestimation (depending on the scheme) of the number of large drops in the PSD.

Regarding the part with hail and graupel statistics, I don't always agree with the interpretation of the results.

I 317: "large graupel and hail produce similar radar signals"

It is true only if graupel and hail are modeled with the same characteristics (PSD and density for Zh). Depending of the density options for graupel in the microphysics scheme you are evaluating, you could underestimate the maximum possible reflectivities that would be reached if explicit with hail (which is denser than graupel) was modeled in your schemes.

I 327: "Since none of the simulations, regardless of the cloud microphysics scheme, were able to reproduce these extreme events, we do not believe that this is related to the microphysics scheme, but rather a consequence of the model grid resolution."

The resolution very probably plays a role but again, you can't simulate the extreme

reflectivities due to hail (in your observation) while you don't explicitly have hail in your model (and the corresponding options in the forward operator).

L 363: "The SBM scheme, on the other hand, is again likely missing the larger particles, since a large mass of graupel particles is generated, but this does not translate into high reflectivities"

Again, could this be also due to a different graupel density in this scheme compared to others ?

More information about the differences in the density of graupel / rimed fraction between the different schemes (and compared to typical hail density) should be included in the paper, either to evaluate if this could have an effect or not.