

Author's response 1

We would like to thank the reviewer for reviewing our manuscript and for the positive feedback. Please find below our replies highlighted in blue.

Reviewer 1:

"The spatial distribution of convective precipitation - an evaluation of cloud microphysics schemes with polarimetric radar observations" by Köcher and Zinner

This manuscript presents a statistical evaluation of five different cloud microphysics schemes within the Weather Research and Forecasting (WRF) model, focusing on their ability to simulate the spatial distribution of convective and stratiform precipitation. The study utilizes a 30-day dataset of precipitation events in the Munich region with 400m horizontal resolution, comparing WRF simulations with polarimetric radar observations. The authors employ a cell-tracking algorithm to differentiate between convective and stratiform regions and analyze reflectivity and differential reflectivity histograms, as well as simulated rain drop size distributions. The integration of polarimetric radar observations is crucial, as these data are highly sensitive to microphysical properties and allow for a more in-depth assessment of the simulated precipitation characteristics. It is concluded that the differences in convective and stratiform precipitation between the 5 different microphysics are mainly attributed to the differences in rain drop size distribution. This is a well-structured and important study that makes a valuable contribution to the field of numerical weather prediction and cloud microphysics. The statistical evaluation using polarimetric radar observations is a robust approach for assessing and improving microphysics schemes. The findings provide clear insights into the strengths and weaknesses of different microphysics schemes in simulating convective precipitation, particularly concerning rain drop size distributions and their impact on precipitation partitioning. The manuscript is clearly written and the figures are informative. It is suggested to accept this manuscript after some minor revisions.

Minor:

1). Line 143: is shown in 1 → is shown in Figure 1?

Fixed.

2). Line 327: Figure 6c → Figure 6a?

Fixed.

3). Line 348: Figure 6d → Figure 6b?

Fixed.

Author's response 2

We would like to thank the reviewer for reviewing our manuscript and for the positive feedback. Please find below our replies highlighted in blue.

Reviewer 2:

This manuscript highlights the value of polarimetric radar observations for evaluating cloud microphysical parameterizations within numerical weather prediction models. Cloud microphysical parameterizations are statistical representations of our understanding of sub grid scale processes, and as the authors highlight, the creation and validation of these parameterizations are limited by observations. In this study, polarimetric radar observations, together with inline reflectivity diagnostics (CRSIM), are used to understand the partitioning of the cloud fields into stratiform and convective parts across five cloud microphysical parameterizations. The authors show that these five cloud microphysical parameterizations are in somewhat close agreement with the distribution of total precipitation across the study area. However, the convection cloud fraction varies greatly across parameterizations, suggesting the partitioning into convective/stratiform is problematic. Additionally, they attribute that the rain drop size distributions within the microphysics parameterizations are a source of the differences in rain particle sizes within convective/stratiform regions.

This manuscript is well written and generally easy to follow. This framework for microphysics evaluation within NWP/GCMs provides a great tool for future cloud microphysics parameterization development and evaluation.

Minor Comments:

For both figures 5 and 6, panels a-b (upper-row) are labeled with 5500m, whereas panels c-d (lower-low) are labeled with 1500m. However, the figure caption has upper-low labeled with 1500m and lower-row labeled with 5500m. The Figure and references in the text appear to be correct, but the caption is not.

Fixed.