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Comment on gmd-2021-230

Anonymous Referee #1

Referee comment on "Representation of the Autoconversion from Cloud to Rain Using a Weighted Ensemble Approach" by Jinfang Yin et al., Geosci. Model Dev. Discuss.,
<https://doi.org/10.5194/gmd-2021-230-RC1>, 2021

Comments on "Representation of the Autoconversion from Cloud to Rain Using a Weighted Ensemble Approach" by Yin et al.

General Comments:

In the study, the authors explore the idea of improving numerical simulation by improving the representation of the autoconversion from cloud to rain (ACT) with a "weighted ensemble (EN)" ATC parameterization. To construct the EN scheme, four widely used ATC parameterizations are employed, and then the EN scheme is coupled into the Thompson microphysics scheme in WRF. With the EN scheme, the authors run nested (to ~1 km) simulations of an extreme precipitation event over southern China and then examine the results by comparison of accumulated precipitation and radar reflectivity to observations. Besides, a detailed analysis is given in vertical motion and hydrometeor mass mixing ratios. The results show that the WRF model with EN run matches the observations better, compared to the BR scheme which is used originally in the Thompson microphysics scheme.

The premise of trying to improve cloud microphysical parameterization through such a kind of ensemble approach is interesting and potentially useful. One unique feature of the ensemble approach is that the weighted mean is calculated within a microphysics scheme with a negligible increase in computation cost. In my opinion, the ensemble approach could easily be extended to other cloud microphysical processes. Besides, the ensemble scheme appears to be a useful tool that can be used to effectively switch between a single scheme alone as desired or to take the average result of chosen ensemble members. This paper is generally in a good shape, well organized, and conclusions well supported. However, there are a few items of concern that the authors should address before being accepted for publication

(1) Several grammar errors and typos throughout the text, please check carefully.

Line 43 "articales" → "articles"

Line 51 "riandrops" → "raindrops"

Line 291 "were" → "was"

Line 512 suggest changing "more heavy" to "heavier"

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(2) In Section 2, four widely used autoconversion schemes are employed in the present

study. Please elaborate on the advantages and disadvantages of these schemes, which might tell readers more information.

(3) Line 377 "the EN scheme generated larger rainfall area and stronger rainfall rate than those of the BR scheme". The result is interesting. I would suggest adding more explanation to make it easily understood.

(4) Line 397-398 Evaporation does produce decreasing reflectivity field near the surface. However, large particle (raindrop) breakup is another microphysical process that can lead reflectivity values to decrease toward the surface.

(5) Line 402, The authors need to reword this sentence. It is hard to determine the raindrop number concentration.

(6) Although the ensemble approach is coupled in the WRF model, it might be beneficial for a global modeling system with distinctly cloud microphysical processes over the world. Some discussions in the last part may expand the application scope of the ensemble approach.