Comment on gmd-2021-417

Anonymous Referee #1

Referee comment on "Simulated microphysical properties of winter storms from bulk-type microphysics schemes and their evaluation in the Weather Research and Forecasting (v4.1.3) model during the ICE-POP 2018 field campaign" by Jeong-Su Ko et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-417-RC1, 2022

This is a detailed study using WRF and 4 microphysics schemes for 8 snow events during ICE-POP for the 2018 Winter Olympics, focusing on one of each of 3 types of events, cold-low, warm-low and air-sea interaction. The inner domain is at a relatively high resolution of 1 km. Observations used in addition to the surface AWS stations include disdrometers and radar from which particle types were derived.

The paper distinguishes some large differences in particle types between the schemes and verifies them against observations. Some additional understanding is gained by evaluating the importance of every process as a source and sink for each particle type in each case. This is a large amount of data that is presented and a good attempt is made to derive the most important points and distinctions between the schemes from it.

I think the paper is acceptable after minor revisions. The level of detail may appeal mostly to microphysics parameterization developers, and is probably more than most would read through, but the conclusions are of more general interest. I have itemized my Minor Points below, the response to some of which may help to improve the paper.

Minor Points

1. line 33. What is meant by "inefficient melting"? Less efficient?

2. L52. convections -> convection here and several places. Common English error.

3. L76 Thompson.

4. L76 "snow efficiently affects precipitation efficiency for" rephrase to not include efficient twice.

5. L114 "of precipitationi systems" typo.

6. Table 2. Refers to Morcrette. I am sure this is not the correct reference.

7. Table 4. WDN typo.

8. L213 and Figure 5. Case color code should be mentioned in the text too.

9. L216. How is a rate used for an accumulated amount in the whole period? It says mm h-1.

10. L218 and Figure 5. Hard to interpret biases without absolute totals which vary from 6 mm in Case 3 to 57 mm in Case 4. Perhaps put totals from Table 1 on Figure 5.

11. L222. Hard to tell from Figure 6 that these schemes have more liquid rain. I would suggest finding a different way to show precip type. Either a separate plot of type, or shading by type and contouring amount.

12. Figure 8. It was hard to find qc because the dash length does not match the key. Make the key pattern exactly match the plot. Also hard to see that qs is a dot pattern in the key.

13. L262. Important to note that schemes with QCGEN have condensation mostly there while those without combine condensation and evaporation in QCCON. Is there much separate condensation in QCCON in the QCGEN schemes or is this all just evaporation?

14. Figure 9a-d. Maybe QRWET should be QCWET in labels. Check all these against Table 4 names.

15. Table 4. QRAUT in cloud section could be QCAUT? I am not sure about the rules for naming when the same processes may have different names. QCACR for example has the same name.

15. Figure 9, etc. Can a scaling number be put on these plots to show relative size? L270 points out an important scale difference that would not have been seen in the Figure. For example, add what 100 equals in absolute terms.

16. L301. As in note 11 above, this is hard to see.

17. L372. Should be Fig. 7l.

18. L373. Westerly wind is weak. The model clearly has an onshore wind that must be mainly northerly. This component should be mentioned.