Review of ‘Assessing Cloud Representation in Two Microphysics 2 Schemes of MPAS-Atmosphere Model (version 8.2.2) over the Maritime Continent with Himawari-9 AHI Observations’

Summary

The paper compares simulated brightness temperatures from MPAS with satellite observations. I do not have much expertise on such observations, so my comments will not address the interpretation of these data. The results seem reasonable to me. It would be more useful if there were some digging into the differences of the scheme processes that could shed light on the different outcomes, if possible. It can be a tall order, however, to figure out why schemes have these differences, and it is often not what we speculate it to be. (Especially in a complex scenario like this one.) Otherwise, I have some (minor) comments for the authors to consider for revisions.

Best Regards, Ted Mansell

Minor Points:

1. It would be worth double-checking whether CRTM is fully consistent with the NSSL microphysics scheme. A colleague of mine did some work with CRTM, and I recall them saying that they had to make some modifications for NSSL-MP. I do not know what needed to be updated or how much difference it made, and I do not know if those updates were ever contributed to the code base.

2. Line 252: ‘Unlike the observed channel 13, which exhibits a distinctly narrower BT range and higher frequency distribution, the simulated BTs from both WSM6 and NSSL fail to reproduce this feature, implying limited skill in representing cloud-top radiative signatures.’

   What is this channel particularly sensitive to? Given the frequency is between 11 and 14, would it make sense that the microphysics schemes have more or less continuous values of particle size? Could it indicate something about ice habit that isn’t captured by the schemes? (I don’t know much about radiances!)

3. Line 258: ‘Lastly, verification against nighttime channel 7 (3.9 micron) observations indicates that NSSL aligns more closely with the observed BT

distribution, implying a more realistic simulation of low-level clouds or fog compared with WSM6.'

Any ideas why the schemes differ here? Is Fig. 2 showing that WSM6 has more warm clouds than NSSL?

4. Figure 3 is a single cross section snapshot from this entire forecast. Can you say how well it represents the forecasts generally? Also the S0 cross section goes right up to the domain boundary, so it might be showing too much influence from boundary conditions.

5. Line 285: 'In WSM6, the core of upward motion is generally confined to lower altitudes near the melting layer (Figure 3e)'

   Any ideas why this might be? Perhaps less freezing? Or maybe the mass loading is distributed differently, perhaps related to the coupled fall speeds of graupel and snow? I can only speculate.

6. Line 310: 'It is noted that both schemes tend to overpredict cloudy pixels and underpredict clear-sky pixels relative to the observations.'

   Could this also indicate excessive moisture in the environment? Or the boundary layer scheme is mixing too deeply? It could be that both microphysics schemes are somehow biased in similar ways in this regard, but it could also point to a separate cause (bias) that the schemes are responding to.

7. Line 324: '(WSM6) CSI score remains lower than that of NSSL.'

   This does not seem like a significant difference, however (0.02), and the scores are pretty high as it is (greater than 0.7).

8. Line 394: 'However, it also exhibits an expanded high-frequency occurrence of BTs near 220 K above 150 hPa (Figure 6c), suggesting an overprediction of optically thick high-level ice clouds.'

   Could you explain how this works, physically? A higher BT (warmer) at low pressure (low temperature)? Does a thicker cloud average its temperature depth?

9. 444: 'The enhanced efficiency of riming and accretion in WSM6 is likely associated with the lower altitude of the saturation-layer top (RH = 100%) near 400 hPa, which facilitates supersaturation and intensified liquid–ice interactions.'

A little more explanation here would be helpful. Enhanced efficiency relative to NSSL? I'm not sure that I follow the last phrase ('which facilitates....') With the default CCN concentration for NSSL, it may have a slower warm rain process than WSM6. That default setting is more appropriate for continental clouds (or over land generally), and may be too high for the maritime portions of the domain.

10. Line 449: 'The lower saturation height in WSM6 likely suppresses depositional ice growth, resulting in thinner ice layers in the upper troposphere.'

    It is possible, but this seems speculative. I think it could also be related to updraft magnitudes at these altitudes.

11. Line 582: 'both schemes tend to overpredict cloud-top heights for high-level clouds, while underpredicting mid- and low-level clouds.'

    Grid spacing might play a role here. 3km makes updrafts too wide for these conditions and may underestimate entrainment.

Technical/Editorial Notes:

1. Line 143: 'NSSL scheme is a bulk microphysics parameterization that predicts the same five hydrometeor species'

   This could be updated to say that NSSL-MP predicts 6 hydrometeor species but that the hail species was deactivated.