# Comment on gmd-2021-188

Anonymous Referee #2

Referee comment on "Evaluation of the COSMO model (v5.1) in polarimetric radar space – impact of uncertainties in model microphysics, retrievals and forward operators" by Prabhakar Shrestha et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-188-RC2, 2021

General: I think this is a nice study demonstrating the uncertainties not only with model microphysics parameterizations, but also the challenges with polarimetric radar forward operators. I have a few minor comments.

Abstract: A reader approaching this for the first time does not know what Dice or Tgr are. Secondly, it is unclear what a 'low bias' is in the sense of polarimetric moments.

Ln28 – remove extra ')'.

Ln 34: "..total mass peak" what is meant here? The model was not able to capture the correct height of the ice mass or the ice mass was too large?

Ln 75 – I am confused about what 99.9 m MSL is indicating here. Is that the actual height of the BoXPol radar?

Ln 125: "it μ depends on" -> "it's μ depends on"

Ln 130: What is 'n'?

Ln 149: I'm curious about the selection of Dice for the sensitivity studies. The range of values from 5.0 to 400.0 seem like rather large perturbations, and 400.0 seems excessive

compared to the original 50.0 . I suppose such a large value essentially limits the production of snow from ice? How were these values selected for the sensitivity tests?

Ln 178: Put () around 2 to be consistent.

Ln 224: What temperatures (are they derived from a sounding, model, etc.) are used for the HCA-Dolan and HCA-Zrnic?

Ln 227: "Problem description" seems a little ominous. Perhaps "Case description?"

Ln 230: Spell out 'approx.' to approximation.

Ln 308: I am confused here about the inter-changed language of mixing ratio and percentages. Are you able to derive an actual mixing ratio (g/kg) for the different hydrometeor types with HCA-Pejcic? Or is this more related to the probability of a given hydrometeor type within a volume?

Ln 357-360: Unless I'm missing something in the figures, the mean sizes are not shown? That is fine, but perhaps add (not shown) so the reader is not feeling like they are missing something from the figures.

Ln 424: This reads a little strange with "Since". Perhaps it would make more sense to start with "Even though…"

Ln 430: It is hard to cross-reference these temperature on Fig. 11. Perhaps add a temperature scale on the right side as in Fig. 9?

Ln 465: If I'm not mistaken, $D_{ice}$ was increased in EXP1,3 not EXP2,3?

Ln 489: EMA has not been defined.

Figure 3: Perhaps state in the figure caption that the top row is the CTRL and the bottom is EXP3 for clarity.

Figure 6: I understand the logic of keeping the color scales consistent for each HCA, but it is a bit confusing that the different colors do not align with different species across the three HCAs. For example, it is great that RN and 'snow/Aggregates' are the same colors across all three, but melting snow is purple in a) and cyan in b) and c); light blue is ice crystals in a) and light rain/drizzle in b) and c), and perhaps most confusingly, graupel is orange in a) but ice crystals and vertical ice in c). I also find the purple for WS difficult to distinguish from the blue RN and black HA in a). Finally, in the caption for panel c) vertical ice is listed as VI but in the colorbar it is VC.

Table 1: are $[m\ s^{-3}]$ the correct units for $v_T$?

Table 2: The values for EMA are meaningless to me unless I dig up Blahak (2016). Is there a simple way to describe what these mean?