Review on "Impact of combined microphysical uncertainties on convective clouds and precipitation in ICON-D2-EPS forecasts using different synoptic controls" by T. Matsunobu *et al.*

This paper examines the contributions of microphysics uncertainties arising from two sources, the cloud condensensation nuclei (CCN) concentration and the shape of the parameter of the cloud drop size distribution (CDSD). These impacts are investigated in 5 cases of precipitation over Germany in August 2020, including 2 strong forcing and 3 weak forcing situations. The work is performed using the convective-scale ICON-D2-EPS with 180 members. The contributions of microphysical uncertainties and initial and boundary condition uncertainties (IBC) are primarily examined on precipitation forecasts, with a focus on intensity and spatial variability, and secondly on cloud and rain water contents. While the impact of IBC overall dominates for precipitation forecasts, cloud and rain water contents appear to be more sensitive to the microphysical uncertainties.
The paper is well-written and provides a number of new and interesting results. It will surely contribute to a better understanding of model uncertainties, with potential applications for the design of EPS. In addition, the methodology is sound and the in-depth analysis with several diagnostics is valuable.
My main comments, detailed below, would recommend a simplification or clarification of some results, and a potential re-organization of the manuscript plan. For that purpose, I consider major revisions are required before publication in Weather and Climate Dynamics.

Major comments

• 1. My main concern is about the huge volume of information on some figures, in particular I found the readibility/understanding of Figure 3 particularly challenging (especially the top panel). Would it be possible to think about a new design that would make the interpretation easier ?

• 2. Different ensembles are examined in the paper (IBC, MP, CCN, CDSD). It would be very helpful to clearly define these sub-ensembles in a table (rather than in the text), with information on the number and size of the associated sub-ensembles.

• 3. As microphysics perturbations more directly impact cloud and rain water contents than precipitation, I think it would be more natural to start section 4 with the results of 4.3. Such a re-organization would imply a non-negligeable work but the resulting manuscript should be more consistent.

• 4. The study is based on the in-depth analysis of 2 cases, and more statistically robust results are computed with 5 situations. This is a small sample to draw conclusions, however I understand that running additional cases is beyond the scope of the paper for computational reasons. At least I seems important to underline this limitation in the conclusions.

Specific comments

• 1. L37-39 "The impact of parameter perturbations ... using a variety of NWP models and schemes" : add references to studies.
• 2. Figure 6 : add Time [utc] as x-axis legend.
• 3. Section 4.2 : add the definition of FSS somewhere.
• 4. L267-268 : do you think the differences of sampling size for the different ensembles can impact the results ?
• 5. L342-344 : is it only a spin-up and/or the nature of precipitation that explain the differences between nighttime and daytime rainfall ?
• 6. Figure 9 legend : (c) domain-averaged total column rain water content.

• 7. Figure 10 : It would be interesting, for each variable, to discuss the statistical significance of differences observed between the 3 sub-ensembles, and between weak and strong forcing situations.