Geoscientific
Model Development
Discussions

*Interactive comment on* "A flexible importance sampling method for integrating subgrid processes" *by* E. K. Raut and V. E. Larson

**Anonymous Referee #2**

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Summary:

This paper discusses methods for improving the calculation of microphysical process rates in the presence of sub-grid variability. It is a very technical paper, and as such quite tough to read, but the authors should be commended on their efforts to detail their methods so rigorously in the published literature. I see no technical errors in the paper, and only have a few minor comments for the authors to address before it is suitable for publication.

Specific points:

P9154, L26 - It might be useful to state here how the importance sampling level is chosen, since it is quite buried in section 6 and feels like something which should be

discussed with the method rather than with the results.

Section 4 - is quite long and technical, I wonder if some of it could be put in an appendix, to enable the reader to get to the results quicker. I am keen that none of the information is lost though, as I think it is useful to document the method in such detail.

P9169, L21 - An analytically upscaled version of KK is used as a reference, but as discussed in the introduction, this does not contain information about vertical overlap. Therefore the comparison of the results to this may differ for justifiable reasons, i.e. the results really should be different because the overlap is treated differently. Ideally it would be nice to see SILHS tests against something they would in theory converge to, but if it's not possible to get the vertical overlap assumptions to be the same, then the authors should at least mention this issue in the text.

P9175, last paragraph - whilst the authors statements about the 8Cat method being much cheaper than the 2Cat-Cld method are true, I feel they should also acknowledge that it will still be much more expensive (presumably 8 times?) than a 'standard' microphysics scheme that is not using Monte Carlo integration. I appreciate that this paper is detailing a method and some simple tests, but in the examples given there would really be no need to use Monte Carlo integration, as analytical upscaling gives perfectly good answers and is much cheaper. I feel this needs to be pointed out to the reader, as I don't yet feel that any paper has demonstrated the advantages of Monte-Carlo microphysics justify its costs.

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