

## ***Interactive comment on “Performance assessment of a triple-frequency spaceborne cloud–precipitation radar concept using a global cloud-resolving model” by J. Leinonen et al.***

**J. Leinonen et al.**

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*We thank Reviewer #3 for the helpful comments. Please find below our responses, given below each comment in italics.*

This paper assesses the effectiveness of triple-frequency precipitation detection at two orbital heights using a CRM. The manuscript provides a unique perspective of radar simulations in a global context by utilizing a consistent model framework for the different precipitation regimes examined. The authors' cutting-edge global CRM application to the comparison of future satellites provides direct and informed conclusions. The

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paper is well written and the methods employed are sound. Some minor revisions are suggested:

There are a few parts of Section 1 that may need an additional citation or two. Pg. 4140 L25 as an example, “Prior studies...”. Pg 4140 L5 should explicitly state the 2007 NASA decadal survey.

*The 2007 decadal survey citation has been added.*

The authors should clarify the difference between the simulated retrievals and what the ACE satellite may actually see, beyond the explanation in Section 5.1. The authors make rigorous estimates for NUBF and multiple scattering, but neglect the effects of surface contamination for all regional cross sections. Right now the cross sections assume visibility to the surface, while the global analysis uses reflectivities only down to 400 m. It could be mentioned in subsections of Section 5 when surface contamination may have a nontrivial effect on the results, like the maritime stratocumulus and midlatitude front cases.

*In the revised version of the paper, we have worked to ensure that the surface contamination is treated appropriately. In all vertical cross sections, the area masked by surface clutter has been grayed out. Likewise, it has been ensured that all statistics presented are derived only after the surface-contaminated area has been removed from the data.*

To motivate the impetus of the ACE mission alluded to, it may be helpful to revisit Figure 1 at the MDR limitations of current missions, namely GPM and CloudSat. This will highlight the improvement in precipitation sensing that the ACE mission affords due to its improved sensitivity in either orbital height.

*We thought that adding to Fig. 1 might make it more confusing, and in any case would not be as general as providing global figures. We have added a paragraph at the end of Sect. 5.1. describing the improvements in single-frequency detection over GPM and*

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*CloudSat.*

Figures 7-17 (odd only) seem repetitive at times, and the differing x scales in each case make them difficult to compare on the fly. Tables could collapse the information into an easier to read and more compact form.

*After discussing the issue with the bar plots of Figs 7,9,11... we decided to keep the plots as we felt they give a quick visual comparison of the different detection classes. The bar plots have been reorganized to make them clearer by using common limits in all plots throughout the paper and by improving the readability of the error percentages.*

Other technical corrections: 1. e.g. page 4140, L25: "cloud resolving". To be consistent with the title, consider hyphenating "cloud resolving"'s appearances.

*All instances of "cloud resolving" have been hyphenated.*

2. Page 4143, Eq (2): no LHS. Consider defining as  $Z =$ .

*Changed as suggested.*

3. Page 4146, Eq (6): b in next to last term in equation. Should be  $\beta$ .

*Corrected in the updated version.*

4. Pages 4150 and 4151: it would be great to rearrange the phrase "dry snow, melting snow, and raindrops" and the respective terms in a consistent order in Eq (23) and Eq (25).

*Equations (23) and (25) were changed to give the variables in consistent order.*

5. Page 4152, L19: "effets". Should be effects.

*This typo has been corrected.*

6. Page 4163, L28: "heavier NUBF". Better adjective?

*Changed to "more significant".*

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7. Fig 14(d): could use a title describing it as a vertical cross section

*This is now noted in the caption.*

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4137, 2015.

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