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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Microwave signatures of ice hydrometeors from ground-based observations above Summit, Greenland" *by* C. Pettersen et al.

Anonymous Referee #2

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This study explains the radiometric signatures observed across a wide range of frequencies (∼20 - 225 GHz) and by both active (cloud radar) and passive (microwave radiometer) sensors. To make everything physically consistent, the authors have to improve (modify) existing liquid water retrieval algorithms to account for the influence of ice at high frequencies. By identifying the major contributors to the observed signatures, I think that this study laid the groundwork for future use of all these radiometric data in cloud ice/liquid water retrievals. Therefore, I think this study is valuable and should be published.

But I do have the following comments, and would like the authors to address them.

First, reading the paper, I could not find at what level the "liquid water cloud" was placed when the radiative transfer simulations were conducted, and how its relative position to the profile of ice (dBZ) will alter the conclusions. For example, for high dBZ cases, most of ice should be close to surface, whether the liquid water is placed below or above the major portion of the ice in the vertical should change the downwelling brightness temperatures at high frequencies. Did the authors ever do any sensitivity test to see how big this effect is?

Second, in the paper, the authors mentioned that the TKC15 liquid water absorption model "improved convergence" in doing retrievals compared to other models. Since two of the authors of TKC15 model are also co-authors of this paper, is it possible to give the readers more details on "how the improvements are"? I doubt that the other liquid water dielectric models (for example, the Rosenkranz 2015 model) are so different (therefore, switch to Rosenkranz 2015 model would not alter your result), but I could be wrong. But at least, the readers should be let known whether this uncertainty is a factor in explaining the observed signatures.

Lastly, the authors excluded cases with LWP greater than 40 g/m2 to minimize the influence by liquid water. Since the radiative transfer simulation includes liquid water clouds, why does this constraint have to be placed? Is it because the MWRRET retrievals are completely unreliable for those cases even with the correction proposed in this study? For precipitation studies, those excluded cases may be more important. The reviewer is wondering whether observed radiometric signatures for those high-LWP cases can be used for physical retrievals.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 34497, 2015.