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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The origins of ice crystals measured in mixed phase clouds at High-Alpine site Jungfraujoch" *by* G. Lloyd et al.

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This study of the microphysics of mountaintop clouds presents a number of interesting aspects of possible sources of high concentrations of small ice crystals. Although I tend to agree with their general conclusions, that the most likely explanation of these high concentrations are from surface sources, I am reluctant to recommend publication in ACP until a more rigorous analysis is presented of the expected uncertainties in the measurements, particularly those that are associated with determining the ice fraction. I was disappointed that with as many instruments that are being implemented in this study, the results that are presented are mostly from only the CDP and the 2D-S.

The problem that I have with the way the data are presented is that the CDP measure-

ments are always described as "droplet" measurements. This automatically assumes that all the cloud particles < 50 um are water droplets but in fact, there is no justification for this. Secondly, there is no discussion of how many pixels are needed to determine the "roundness" of an image from the 2D-S and what is the accuracy of this derived separation between liquid and ice. Similarly the use of holography to differentiate liquid and ice is not sufficiently described or justified.

It is my understanding that the CAS is actually a CAS-POL. If this is so, then there are already publications that show that it can be used to differentiate between liquid and ice in particles below 50 um, e.g. Baumgardner, D., R. Newton, M. Krämer, J. Meyer, A. Beyer, M. Wendisch, P. Vochezer, 2014: The Cloud Particle Spectrometer with Polarization Detection (CPSPD): A next generation open-path cloud probe for distinguishing liquid cloud droplets from ice crystals, Atmos. Res., 142, 2-14.

This publication shows comparisons in mixed phase mountain clouds of measurements from several instruments and justifies using the polarization ratio as a means to estimate ice phase. Without this measurement, the current study has no accurate means to prove that the CDP is only measuring water droplets and this leads to an uncertainty in the IMF of as much as +/- 50-100%.

This study is a very good opportunity to compare results from multiple instruments and better show the robustness of the conclusions that are drawn. Without a more extended error analysis and instrument intercomparison of size distributions and derived water contents (e.g. where is a CDP and PVM comparison?), the results that are presented cannot be properly interpreted within the expected uncertainties and the resulting conclusions remain on shaky ground.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 18181, 2015.