Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-829-SC1, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Direct evidence for secondary ice formation at around –15 °C in mixed-phase clouds" *by* C. Mignani et al.

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Received and published: 5 September 2018

We thank Anonymous Referee #1 for his or her assessment and valuable suggestions. Before replying point-by-point on behalf of all Co-Authors in an AC we would first like to clarify the main issue of concern in a personal Short Comment (SC):

RC: "These analyses could yield quantitative estimates of ice crystal enhancement, but the data are too few to make a publication-worthy conclusion in my opinion. The authors note that Hoffer and Braham attempted a similar per particle analysis more than 50 years ago. Their sample size was 300 snow pellets, 150% that presented here, and they [Hoffer and Braham, author's note], note in their abstract that "a firm statement could not be made as the number of observations is limited." The burden is

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Discussion paper

on the authors to explain why it is sufficient to show ground-based data from only 10 days."

SC: An ice multiplication factor can be estimated from the total number of analysed snow crystals divided by the number of snow crystals found to have formed through heterogeneous freezing. Hoffer and Braham had analysed 300 snow crystals (or pellets) but ". . .these pellets did not originate through the heterogeneous freezing of cloud drops." (Hoffer and Braham, 1962). Their data (300/0) therefore did not provide for an estimate of the ice multiplication factor in the clouds they had studied. Therefore, "a firm statement could not be made".

In our study we analysed a total of 190 crystals of which 24 had formed through heterogeneous freezing. Therefore, we can conclude that the ice multiplication factor in the clouds we have studied was around eight (190/24). The uncertainty associated with this factor is about 20% (square root of 24 divided by 24). Let us assume, we had done this kind of investigation in another location where one in two crystals is formed through heterogeneous freezing. In such a location we would have been able to determine the ice multiplication factor (two) with an uncertainty of 20% by analysing only 50 crystals in total.

To conclude, it is not the total number of snow crystals analysed but the number of snow crystals found to have formed through heterogeneous freezing that determines how firm a conclusion can be drawn.

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