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Interactive comment on “Single ice crystal measurements during nucleation experiments with the depolarization detector IODE” *by* M. Nicolet et al.

M. Nicolet et al.

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First we would like to apologize for uploading a wrong version of the author comment previously. Please disregard the old version.

We would like to thank the referee for the helpful comments and suggestions. All uncertainties and unclear points have been corrected and clarified. We checked all equations and corrected the discussion about the OPC efficiency and its size calibration. We also clarified several aspects related to the coupling between the device and the ZINC chamber. We reply to the individual suggestions below.

1) The threshold value of delta for the discrimination between water and ice is not easy to determine. It is based on 1) Lidar remote sensing experiments and 2) the

value used for the depolarization device of the AIDA chamber. Theoretically, this value should be close to 0.02 as scattering by molecules has to be taken into account. In practice it depends also on the noise and background of the signals from the setup and detectors.

2) In fact, the device was attached to the ZINC chamber by an aluminum profile because we had noticed that the disconnectedness of both devices created detection uncertainties and constant replacement and alignment had to be done prior to this study. Even a small displacement of 1 mm or even less could cause a significant change in the recorded signals. However, the connection between chamber and detector has still been too weak to avoid the described displacements entirely. This will be added in the revised manuscript. As we do not consider particle intensities, we rely on the OPC to have additional information about the particle concentration.

3) The light might come from outside the box directly into the PMT sensors, as strict tightness of the apparatus could not be considered.

Concerning the OPC, it counts actually only 50 to 60% of the real concentrations, according to previous OPC calibrations, but for the lowest detectable particle size which is 0.5 μm. The detection efficiency very likely approaches 100% for our ice particle sizes (a few μm). This value is known from previous calibrations made with a known particle concentration. Sometimes two particles or more can be counted as one (coincidence events) or sometimes particles can be missed. This is taken into account in the experiments.

i) We are thankful for the suggestion to use the wavelet tool for peak detection. However, we realized that the application of these tools is not straightforward. We are working on an implementation of these tools for upcoming projects but it is beyond the scope of this publication.

ii) According to Fluent simulations, it is laminar at this point. This remark will be added in the revised text.

iii) The detector was not perfectly light-tight (but it is in its new version). The PMTs have bandpass filters that let only light with lambda = 407 nm ś 10 nm pass. There is no fluorescence in the optical parts.

iv) ok

v) The detection software requires voltage unit-type for detection. This is why preamplifier units with conversion signals are used. As mentioned, because we are analyzing ratios and not absolute signals, there is no need to use all the factors.

vi) The determination of the background signal is done before every experiment as we are not able to determine the background during a experiment. It is therefore possible to have a change in the background signal while measuring. This unfortunately means that it is not possible to be sure that the background remains at the same level during an experiment.

vii) n is a number related to the statistic normal law used to accept or reject a peak from ice particle validation. It is chosen to prevent false counts. For example, n=3 ensures that every peak above the threshold limit has 99.9% chance of being a real signal i.e. an ice particle and that the peak does not belong to the background signal.

viii) ok

ix) It is 70 IN per cm-3

x) This is a hypothesis. It may indeed be caused by a baseline drift, possibly partly due to scattered light from the walls, which may have come into the line of sight of the detector.

xi) This is not efficiency, but a proportion. The OPC counts approx. 50% to 70% of all particles, but for the lowest detectable particle size which is 0.5 μm. The detection efficiency very likely approaches 100% for our ice particle sizes (a few μm). Unfortunately, we cannot measure this accurately with our equipment but this assumption is reasonable. We have now taken this into account and all data have been checked and

corrected in that way. We will correct this in the revised manuscript.

xii) This aspect was taken from Hallett (1987) and it is effectively possible to have preferential orientation for large ice crystals (above 50 μm), only below this size (which is the case for ZINC) we can expect random orientation.

xiii) Corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20965, 2008.