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Atmospheric Measurement Techniques Discussions

Interactive comment on "BINARY: an optical freezing array for assessing temperature and time dependence of heterogeneous ice nucleation" *by* C. Budke and T. Koop

Anonymous Referee #1

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This is an excellent paper regarding the development of a new optical freezing array. The aim of this study is to supply the necessary measurement technology for assessing a detailed understanding of heterogeneous ice nucleation in laboratory experiments. Here it is important to distinguish between a singular and a stochastical approach. For the latter, temperature and time are important parameter, thus, the set-up has too meet high demands in accuracy, which has been solved in an excellent way by the new developed freezing array and the related instrumentation for controlling and observation.

As an IN model sample the commercial product Snomax has been investigated. This

is good choice since Snomax offers two classes of IN, which are ideal candidates for the testing of the new set-up.

Comments:

You might comment on the fact that the volume of your droplets (1μL) corresponds to a diameter of about 1.24mm. This is more than one orders of magnitude larger than the droplets in real clouds at high altitudes (20μm, 4 pL), where freezing processes are currently under investigation. What are the consequences for your results taking the differences in volume into account?

You mention a purging of your cell. What is the flow velocity of the N2 stream? Do you purge during the measurement? If yes, what is the impact on the results? Does it cause heat input? Can droplets evaporate due to the N2 stream, which might transport water vapor out of the cell?

The gray value is a very clever concept which produces excellent results. However, it comes not clear if you work with an inverted gray scale or not?

When comparing the volume and the respective observed diameter of your droplets, it becomes obvious that there are small differences with the calculated diameter assuming sphericity. Thus, I may conclude that the droplets exhibit a certain spreading on the surface of the support. Could you supply contact angle measurements to quantify this effect and its impact?

On page 9144, line 23 you mention previously condensed water, which evaporates subsequently to the freezing process and finally freezes on the already frozen droplets. However, you also mention spacers around every droplet, which suggests that every droplet is situated in its own compartment suppressing the infiltration of humidity from outside. Please explain this situation in more detail.

On page 9149 you explain in detail the fundamentals for equations 3 to 6. However, the simplification from eq. 4 to eq. 5 is difficult to understand. Please explain this step

in more detail.

Minor comments:

page 9138, line 14: The abbreviation for ice nucleator (IN) should be introduced

page 9149, line 15: The value of temperature uncertainty might be mentioned in parenthesis.

I recommend this manuscript for publication in Atmos. Meas. Tech. after some minor changes.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 9137, 2014.