Atmos. Meas. Tech. Discuss., 2, S18–S20, 2009
www.atmos-meas-tech-discuss.net/2/S18/2009/

Atmospheric Measurement Techniques Discussions

Interactive comment on "A new thermal gradient ice nucleation diffusion chamber instrument: design, development and first results using Saharan mineral dust" *by* G. Kulkarni et al.

Anonymous Referee #3

Received and published: 27 February 2009

General comments

This paper presents a new design of a static thermal gradient diffusion chamber (TGDC) for the measurement of the conditions of ice nucleation onset on particles that may be relevant to the formation of ice in clouds. Thermal gradient diffusion chambers have been widely used for cloud physics studies since many years. The novelty of the experimental setup presented here builds on the relatively simple introduction of a movable sample plate, that allows to vary the position of the sample in the chamber along the stationary gradient of supersaturation that occurs between the chambers cold (bottom) and warm (top) ice-covered plane parallel plates. Thus the supersaturation of

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water vapour to which the sample is exposed can be varied with little effort from one nucleation experiment to the next. In addition temperature can of course be varied. The occurrence of ice is viewed through an optical microscope by digital photography, and images are adequately processed.

The experimental objectives of the work were to measure ice onset conditions for atmospherically important aerosols. The present setup of this experiment is indeed useful for mechanistic studies of ice onset onto samples of test substances or bulk material that can be spread over the Teflon substrate and introduced into the chamber. However, I have major reservations against considering the sieved Sahara soil sample of dp $<$ 38 μm that the authors analyzed as being atmospherically important aerosol. The production of meaningful data related to heterogeneous nucleation of ice in the atmosphere would require the coupling to a sampling technique that allows to introduce representative samples of airborne particles into the chamber. Inertial separation or electrostatic precipitation of aerosols onto a substrate might be favourably combined with the experiment presented here.

Specific comments:

It is unclear to me, how the occurrence of ice is detected objectively a) in general and b) on the Sahara sample of Fig. 6 in particular.

How is ice distinguished from other material ?

Can you give dimensions of the particle and of its growth in the Figures 6a through d ?

What was the temperature ?

Is there a threshold in growth above which nucleation is detected ?

What is the size of the sample holder, and of the field of view, what is the magnification ?

Technical comments:

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P.159, L.5: The reference FLUENT (2004) is not in the list of references

P162, L.8: replace period by colon at the end

P162, L20: omit Where

P163, L1: This sentence is incomplete and makes no sense as it is.

P164, L9: change to "For experiments ..." ?

P167, L1: change Fig. 6 to Fig. 6a

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 153, 2009.

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