Reply

JAMES E. JIUSTO AND G. GARLAND LALA
Atmospheric Sciences Research Center, State University of New York, Albany 12222

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Huffman has raised a legitimate point in questioning the validity of a 4π diffusion field for crystals growing on a Millipore filter. He further states that 1) filters are coated with a lubricant to render them hydrophobic and suggests that a flat surface results, and 2) a 1% increase in computed humidities—though small—can lead to a large increase in activated ice nuclei.

During the reported work, we gave considerable thought to the complex diffusion field surrounding a crystal and concluded that a 4π factor in Eq. (5), while not entirely correct, was more appropriate than a flat-surface 2π factor. The objective of filter coating is not to render the filter hydrophobic—an impossibility in view of the numerous hydrophilic condensation nuclei

collected to say nothing of normal adsorption effects—but to *partly* fill the pores and prevent water vapor penetration. Stevenson (1968) specifically warns against overcoating that might allow the sealant to pass right through the pores and flood the upper surface. The latter procedure indeed would produce a rather flat upper surface but would also submerge many nuclei along the sides of upper filter fibers and perhaps poison some of those sitting on top. Thus, a correctly prepared filter, which requires considerable technique development and perhaps an abiding faith, should result in an irregular top surface of fibers with generally some open space below the uppermost nuclei. Correspondingly, 4π seemed the best approximation factor to use.

We have since experimentally observed that processed crystals rarely grow in a plane parallel to the filter surface. Rather, they are more likely to extend upward at some oblique angle into free space. Though unexpected, this provided added justification for the formulation chosen.

In view of the many types of aerosol filters available and differences in individual coating techniques, we cannot categorically rule out the possibility of a 2π hemispheric diffusion field. If such cases exist, Huffman has correctly deduced from our data that the computed peak humidities would increase by about 1% (see Figs. 3b or 4). Regardless, the main point of the paper remains unaltered, namely that water saturation at the filter surface is not likely to be achieved. The statement that a 1% humidity increase can lead to a large increase in IN, while not entirely relevant to these computations employing fixed nucleus concentrations, is certainly of interest and in need of substantiation. More data of the type obtained by Gagin and Aroyo (1969) over an accurately determined 94–100+% relative humidity range are required to clarify the matter.

It has recently been discovered by one of us (G. Lala) that the nucleation time lag of ice crystals has a considerable effect on the peak humidities reached in these diffusion chambers. A report is in preparation; suffice it to say now that slight sub-saturations with respect to water are still indicated under the most favorable nucleation conditions assumed.

REFERENCES

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