Variation of Ice Nuclei Effectiveness with Liquid Water

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It has recently become possible to ascertain the effect of liquid water on the ice nucleating effectiveness of silver iodide. While much research remains to be done, the results to date should be reported since the effects of liquid water are quite marked. Similar effects have been observed by Ohtake (1964).

The research was carried out in the Colorado State University isothermal cloud chamber in which cloud conditions can be controlled and maintained over a range of liquid water content of 0.5–6.0 gm m^{-3}. Briefly, the experimental procedure (Steele, 1968) involves cloud water production by an ultrasonic nebulizer which delivers a warm fog to a pre-cooler. The fog is supercooled in this device to a temperature about 4C greater than that of the cloud chamber air at which time it is introduced into the chamber. The nucleation temperture is taken as the lowest temperature inside the lines. The vertical thermal gradient in the chamber is 1C m^{-1}. The moisture is introduced continuously and is monitored by a lithium chloride dew-point sensor together with associated instrumentation and apparatus.

Experiments have shown that liquid water has little if any effect at −20C. However, at a cloud temperature of −12C the ice nucleating effectiveness increases by 3 orders of magnitude when the liquid water is increased from 0.8 to 2.5 gm m^{-3}. An effectiveness of 10^{15} ice crystals gm^{-1} of AgI at a liquid water content of 2.5 gm m^{-3} has been measured at −12C for a steady state thermal generator using silver iodide in isopropylamine. This is about the same as the effectiveness at −20C for this nuclei source.

It is perhaps premature to offer a hypothesis to explain the above observations, but at this time it is believed that the marked liquid water effect at warmer

temperatures can be explained by contact nucleation phenomena while the passive effect of liquid water at −20C is explained by the sublimation nucleation process.

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