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DIELECTRIC PROPERTIES OF ICE AT 5.1 AND 9.7 GHz USING CAVITY RESONATOR (ABSTRACT)

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The relative complex dielectric permittivity ($\varepsilon^* = \varepsilon' - i\varepsilon''$) of ice was investigated at 5.1 and 9.7 GHz by the cavity resonator method. The purpose of the measurement was to clarify the dielectric properties, especially the loss tangent ($\tan\delta = \varepsilon''/\varepsilon'$), of ice at microwave frequencies. Because the $\tan\delta$ values of ice at microwave frequencies reported in past investigations were contradictory among several investigators by factors larger than 10, it was necessary to obtain the precise values of $\tan\delta$ for application to microwave remote sensing of the cryosphere. In this study, we used the cavity resonator method, which is suitable for low loss materials such as ice. Ice samples were polycrystalline and made from deionized water.

The experimental results were as follows: The values of $\tan\delta$ were $1.9\text{–}2.8\times10^{-4}$ at 9.7 GHz and $1.5\text{–}2.5\times10^{-4}$ at 5.1 GHz in the temperature range -20°C to -2°C. Thus, the values of $\tan\delta$ of ice at 9.7 GHz were larger than that of ice at 5.1 GHz; both of them were of the order of 10^{-4}. It was confirmed that the values of $\tan\delta$ of ice at 9.7 and 5.1 GHz were not of the order of 10^{-3} (experimental results of CUMMING (J. Appl. Phys., **23**, 768, 1952)) but 10^{-4} (similar to the experimental results of MÄTZLER and WEGMÜLLER (J. Phys. D: Appl. Phys., **20**, 1623, 1987)).

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