

Submillimeter-wave Radiometric Measurements of Ice Clouds

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Recent modeling studies suggest that radiometry can be used to determine the total mass, size distribution, and shape of cirrus ice crystals. At submillimeter wavelengths ($f > 300$ GHz), water vapor near the earth surface emits a relatively uniform flux of thermal radiation. Cirrus clouds scatter this flux back toward earth decreasing the upward flux of submillimeter-wave energy. This reduces the brightness temperature that would be observed by a downward-looking radiometer. The measured depression in brightness temperature depends on the amount and size of scatterers. Radiometric measurements made at multiple frequencies will permit brightness temperature variations caused by changes in mean crystal size to be distinguished from variations in ice content. Additionally, polarization information can be used to discriminate between different particle shapes.

To validate this technique, we are developing a dual-frequency, linear-polarized radiometer to fly on the NASA DC-8. The heart of the cloud ice radiometer will be two, state-of-the-art, SIS heterodyne receivers operating at 500 GHz and 630 GHz. These receivers will be integrated into an aircraft package using a quasi-optical system to allow measurements at each frequency and two orthogonal polarizations. The radiometer will be able to view cirrus either above or below the aircraft. When combined with a 94 GHz radar, it is conjectured that profiles of ice water content, particle size, and shape distributions will be feasible.

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4. IAMAS

5. M4 Radiative Processes in
Climate

6.

7. Any special requests?

8. No