

ON THE ESTIMATION OF THE PRECIPITATION RATE AT
EACH ALTITUDE BY A NEW ANALYTICAL METHOD FOR THE
METEOROLOGICAL RADAR ECHO (2) (ABSTRACT)

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A vertical pointing radar was installed at Syowa Station, Antarctica in 1988, and radar echo data from clouds and precipitation have been accumulated. We have studied how to estimate precipitation rate using these observed data. Radar echo is determined by microwave reflection cross section σ , which is a function of back-scattering cross section $Q\pi(r)$ for snowflakes, and snowflake size distribution function $N(r)$. In this paper, we report our evaluated $Q\pi(r)$ at each altitude.

To calculate $Q\pi(r)$ using Mie's theory, we need to evaluate the dielectric constant of snowflakes. This dielectric constant is a function of temperature, frequency and characteristics of snowflakes. We used temperature data at each altitude observed by radiosonde. The radar frequency was 9.41 GHz. And we assumed that the characteristics of snowflakes at each altitude are determined by Nishitsuji's electrical precipitation particle model. To evaluate dielectric constant, we used Wiener's theory for a mixture of dielectrics.

The calculated value of $Q\pi(r)$ at a height of 2.5 km is several percent of that near the ground. Our preliminary result suggests that the observable limitation of this meteorological radar lies near this altitude. This is not inconsistent with the observed echo.

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