FIELD OBSERVATIONS OF MICROWAVE RADIOMETRIC PROPERTIES OF SNOW COVER IN JAPAN BY MEANS OF PASSIVE RADIOMETERS (Abstract)

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For the studies of snow and ice in the polar regions, microwave remote-sensing from both aircraft and spacecraft is becoming indispensable. A major goal of the present study is the use of airborne microwave radiometers in the Antarctic region. However, difficulties inhere in the studies of electric properties of the snow cover in the range of microwave band, because the snow cover is an aggregate of ice crystals, air, water and sometimes dust particles. A dual-microwave radiometer for aircraft use was constructed, which is the Dicke's type with 12.00 GHz and 19.35 GHz. Before introducing into it the Antarctic, a series of field observations of the snow cover in Japan have been carried out since 1981. According to the result of the wet snow observations in 1981 and 1982, the brightness temperatures showed an inverse relationship with the liquid-water content in the surface snow layer. Snow depth and the ground soil conditions gave little effect on the brightness temperatures.

For the use of the radiometers in the dry snow area, experiments were carried out in northern Hokkaido, Moshiri district, in January-February 1983. Air temperatures were $-10\sim-25$°C and no melting was observed during the experiments. The radiometers were set 2 meters above the snow surface and the snow cover depth was changed artificially. This gave the decrease in the surface brightness temperature with the increase of snow depth up to about 2 meters or less than 100 g·cm^{-2} in water equivalent. Accordingly, when the snow cover depth is thin, the effects of the ground in terms of penetration depth of microwave were obvious. The present studies are preliminary in nature, but the internal and intrinsic properties of dry snow are important to determine the emissivity of the snow cover.

(*Received May 13, 1984*)

SNOW STRATIGRAPHY MEASURED WITH AN ACTIVE MICROWAVE SYSTEM (Abstract)

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Measurements were carried out for dry and wet snow-packs in the field and also in the laboratory, using an active microwave system to determine the stratigraphic layering of the snow-pack.

Frequencies in the ranges 2–8 GHz and 6–12 GHz were used respectively. A single rectangular aperture horn was used for emitting and receiving signals and was set at normal incidence with respect to surface. Data collected in the time domain were processed with a Fast Fourier Transformer to convert to the frequency domain.

The results obtained in the field indicated that thicknesses of layers could be determined from response profiles, although large anomalies of the responses might produce misleading results in case of wet snow-packs.

These anomalies were caused by multi-reflection between stratified layers within the snow-pack and also residual mismatch reflection in the system components.

In the laboratory, using a multi-layered model consisting of artificial snow such as glass beads or polystyrene plastic, penetrability and reflection at the interface within the model were investigated together with actual thickness of the layer related to electric path length.

Results obtained indicated that free water content of the layer strongly effected the intensity of response from the dry-wet interface, and masking of responses from the layers below occurred.

These results obtained in the laboratory clarified the complex interrelationship among the physical parameters in the snow-pack and their effects on the responses and made the interpretation of the profiles obtained possible.

(*Received April 6, 1984*)

SIMULATION FOR ANALYSIS OF THE ECHO BY A MULTIFREQUENCY RADIO WAVE SOUNDER (Abstract)

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A survey of bedrock topography and radio-echo layering within the ice sheet by airborne and oversnow radio echo sounder was carried out on the Mizuho Plateau, East Antarctica, in 1980. A great deal of A-scope data taken on an oscilloscope with range of time display were obtained near the Yamato Mountains and the Shirase Glacier. So we investigate these data to obtain temperature and density profiles of the ice sheet. But the analysis is difficult because there are many unknown parameters, and we get plural temperature and density profiles from these data. Analysis of a multifrequency radio wave sounder is studied to get a correct profile from one of the data.

The multifrequency radio wave sounder uses plural radio waves with different frequency and it will get plural A-scope data from the same place. Intensity of radio echoes with sounder is different from each other. We make use of these differences to obtain temperature T, temperature gradient dT/dZ (Z: depth), and gradient of dT/dZ: d^2T/dZ^2. By repeating the calculation, temperature profiles from the surface to the bottom are obtained.

The only one problem is that the density profile cannot be obtained by this method.

(*Received March 23, 1984*)