SIGNATURES OF VARIOUS EARTH SURFACES MEASURED BY THE NIMBUS-5 MICROWAVE SPECTROMETER

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ABSTRACT

The Nimbus-5 Meteorological Satellite is equipped with a 5-channel microwave spectrometer. The two lowest channels (22.2 and 31.4 GHz) provide information on surface brightness temperature. Distinctive microwave signatures can be observed for snow, land ice, and sea ice in both polar regions. Some information on subsurface temperatures can be gained for desert areas.

I. INTRODUCTION

The Nimbus-5 experimental weather satellite, launched 11 December, 1972 is equipped with a five-channel microwave spectrometer (NEMS) viewing nadir at 22.2, 31.4, 53.6, 54.9 and 58.8 GHz with a spatial resolution of ∿200 km. The three upper channels, located in the 60 GHz oxygen absorption band, are used for sounding the atmospheric temperature profile. The two lowest channels, channel 1 on the 22.2 GHz water vapor line and channel 2 in the window region between water vapor and oxygen absorption, are used to estimate integral amounts of water vapor and liquid water over ocean. Because of the low total atmospheric absorption for the two lowest channels we also can determine surface brightness temperatures if the influence of water vapor and liquid water is known or can be neglected.

Microwave radiometric surface observations from satellites have been reported by Basharinov et al. for the Cosmos-satellite experiments at wavelengths from 8.5 cm to 0.08 cm (1), and preliminary results for the present experiment have been reported by the authors (2). A general description of the NEMS experiment can be found in (3)

The two main test areas chosen for surface brightness temperature (TB) determination are both polar regions and large deserts (central Australia and Sahara. For polar areas the total amount of water vapor is very small (typically 0.5 gm/cm^2). Liquid water is also negligible for polar regions, and we restrict our data for desert areas to cloudless conditions. Cloud pictures are available from the Tempera ture-Humidity Infrared Radiometer (THIR) Experiment on board the Nimbus-5 Satellite.

The quantities of main interest are the mean surface brightness temperature MTB