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J. R. Wang

J. C. Shiue

T. J. Schmugge

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REMOTE SENSING OF SOIL MOISTURE OVER BARE AND VEGETATED FIELDS BY MICROWAVE RADIOMETERS

J. R. WANG, J. C. SHIUE AND T. J. SCHMUGGE
NASA/Goddard Space Flight Center

Remote measurements of soil moisture contents over bare fields and fields covered with grass and soybeans were made during October 1979 with 1.4 GHz and 5 GHz microwave radiometers mounted on a mobile truck. The radiometric measurements of microwave brightness temperature T_B , covered the range of incidence angles from 10° to 70° in 10° steps. The system operation was controlled by a Hewlett Packard 9835 mini-computer which also provided real-time and post-measurement data processing. Ground truth on soil moisture content, ambient air and soil temperatures was acquired concurrently with the radiometric measurements. The biomass of the vegetation was sampled about once a week. All the fields in the test site were smooth. There were two types of grasslands, one covered with 8-cm high grass and the other with 30-cm grass. The soybeans were fully grown with a height of ~60-cm during the time of measurements.

The values of T_B for the bare field measurements were compared with those of radiative transfer model calculations using as inputs the acquired soil moisture and temperature data with appropriate values of dielectric constants for soil-water mixtures. A good agreement was found between the calculated and the measured results. Similar calculations were performed for the vegetated fields treating the canopy as a pure absorbing and emitting medium. The results showed: 1) the presence of vegetation reduces the sensitivity of soil moisture sensing by ~30% at 1.4 GHz and by ~90% at 5 GHz even for the 8-cm grassland; 2) the imaginary part of the dielectric constant for vegetation containing water at 1.4 GHz and 5 GHz is comparable. More elaborate calculations taking into account the microwave scattering by vegetation are now being performed and the progress will be discussed.

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