# The Effect of Dew on the X–band Terrestrial Brightness Temperature During SMEX05

J. Du, T. J. Jackson, R. Bindlish, and M. H. Cosh
USDA Agricultural Research Service
Beltsville, MD USA

B. K. Hornbuckle
Iowa State University of Science and Technology
Ames, IA USA

L. Li
Naval Research Laboratory
Washington, DC USA

E. D. Kabela
Savannah River National Laboratory
Aiken, SC USA

Corresponding author contact: bkh@iastate.edu.

Soil moisture is an important yet unobserved reservoir of the hydrologic cycle linked to the spatial and temporal variability of precipitation [1]. The brightness temperature of the land surface at microwave wavelengths is sensitive to soil moisture. Terrestrial brightness temperature also depends on the temperature of the soil and vegetation canopy as well as other canopy and soil properties [2]. In addition, the emission and scattering of microwave radiation in the canopy is determined primarily by the amount of liquid water stored in the vegetation [3], [4]. Water contained within vegetation tissue is the main factor [5], but dew also affects the terrestrial brightness temperature [6]–[8]. In certain cases it may be necessary to quantify and remove the dew signal to effectively use either passive microwave remote sensing observations of the land surface to observe soil moisture.

One of the objectives of a recent field experiment was to determine the extent to which dew effects terrestrial microwave emission and whether this contribution is significant enough to corrupt passive microwave observations. Soil Moisture Experiment 2005 (SMEX05) was a watershed–scale validation and calibration study for passive microwave remote sensing that involved multiple research groups from U.S. universities and the U.S. government. The main focus of the experiment was to model and validate passive microwave observations of the land surface made with the WindSat passive microwave radiometer system on–board the Coriolis satellite [9]. Since WindSat passes over much of Earth's surface in the early morning hours when dew is often present, the effect of leaf wetness on microwave signals must be understood in order to interpret these measurements correctly. Besides WindSat, many other current and planned microwave remote sensing satellites also have overpass times that occur at night or in the early morning hours when dew may be present [10]–[12].

Three activities related to determining the effect of dew on passive microwave observations were performed. First, time–series measurements of leaf wetness and local micrometeorology were made to observe and model the onset, deposition, and dryoff of dew [13]. Second, the time–series measurements were repeated at several sites throughout the watershed in order to observe and model the spatial distribution of dew [14]. Third, passive microwave observations over the experiment area were made with airborne and satellite sensors. Measurements of near–surface soil moisture, fluxes of water and energy between the land surface and atmosphere, vegetation biomass and plant structure, and diurnal temperature changes within the soil and canopy were also made during the experiment.

We will present work associated with the last activity. During SMEX05, we used the Naval Research Laboratory's Airborne Polarimetric Microwave Imaging Radiometer (APMIR) to collect the X–band terrestrial brightness temperature of corn and soybean fields and a deciduous forest. On 30 June, a day of anticipated heavy dew, we flew APMIR continuously along two east–west lines between 6:30 and 10:00 AM CST. At the same time as the APMIR flights we made manual measurements of dew and collected observations of dew duration made with leaf wetness sensors in several of the fields along the flight lines. As APMIR passed over the landscape on that morning, many variables that affect the X–band terrestrial brightness temperature changed: the dew on the vegetation evaporated; vegetation and soil temperatures increased; and near–surface soil moisture may have increased or decreased. We will examine the observed change in the X–band terrestrial brightness temperature during this time period and use a modeling approach to deduce the effect of dew on the brightness temperature. Specifically, we will use observations of soil moisture, soil and vegetation temperatures, and atmospheric conditions in conjunction with a land surface process model called the Atmosphere Land Exchange (ALEX) model [15] and models of terrestrial microwave emission to determine how much of the change in X–band brightness temperature can be attributed to changes in soil and vegetation temperatures, soil moisture, and dew.

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