# Polarimetric Scanning Radiometer C- and X-Band Microwave Observations During SMEX03

Thomas J. Jackson, *Fellow, IEEE*, Rajat Bindlish, *Member, IEEE*, Albin J. Gasiewski, *Fellow, IEEE*, Boba Stankov, Marian Klein, Eni G. Njoku, *Fellow, IEEE*, David Bosch, Tommy L. Coleman, Charles A. Laymon, *Member, IEEE*, and Patrick Starks

***Abstract*—Soil Moisture Experiment 2003 (SMEX03) was the second in a series of field campaigns using the National Oceanic and Atmospheric Administration Polarimetric Scanning Radiometer (PSR/CX) designed to validate brightness temperature ($T_B$) data and soil moisture retrieval algorithms for the Advanced Microwave Scanning Radiometer (AMSR-E) for the Earth Observing System on the Aqua satellite. Objectives related to the PSR/CX during SMEX03 included: calibration and validation of AMSR-E $T_B$ observations over different climate/vegetation regions of the U.S. [Alabama (AL), Georgia (GA), Oklahoma (OK)], identification of possible areas of radio-frequency interference (RFI), comparison of X-band observations from Tropical Rainfall Measurement Mission Microwave Imager (TMI), AMSR-E, and PSR/CX, and exploring the potential of soil moisture retrieval algorithms using C- and X-band imagery in diverse landscapes. In the current investigation, more than 100 flightlines of PSR/CX data were extensively processed to produce gridded $T_B$ products for the four study regions. Due to the lack of significant rainfall in OK, generally dry soil moisture conditions were observed. Observations obtained over AL include a wide range of soil moisture and vegetation conditions. Results from the AL site clearly showed a lack of sensitivity to rainfall/soil moisture under forest canopy cover. Quantitative comparisons made with the TMI validated that both the PSR/CX and AMSR-E X-band channels were well calibrated. Spectral analyses indicated that the PSR/CX observations at C-band also are reasonable. As expected, there were varying degrees of RFI in the AMSR-E C-band data for the study sites that will prevent further soil moisture analysis using these data. X-band comparisons of the PSR/CX high-resolution and AMSR-E and TMI low-resolution data indicated a linear scaling for the range of conditions studied in SMEX03. These results will form the basis for further soil moisture investigations.**

***Index Terms*—Advanced Microwave Scanning Radiometer (AMSR-E), passive microwave, soil moisture, validation.**

## I. Introduction

GLOBAL remote sensing of soil moisture has been a major research goal for more than two decades. Low frequencies are preferable for soil moisture retrieval since perturbing factors such as vegetation are less significant. Recent advances in science and technology have resulted in space agency commitments to L-band (1.4 GHz) missions within the next five years [1], [2]. At present, there are several new satellite sensors operating at somewhat higher frequencies than L-band that show promise for soil moisture mapping under some conditions. The Advanced Microwave Scanning Radiometer (AMSR-E) provided by Japan onboard the National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) Aqua satellite is one such sensor capable of retrieving soil moisture using microwave channels at 6.9 and 10.7 GHz. Aqua was launched in May 2002 and will provide a soil moisture product based on AMSR-E data in regions with low levels of vegetation [3]. Other related satellites are the Advanced Earth Observing Satellite 2 (ADEOS-II) AMSR, which has ceased operations,