EXPERIMENTAL RESULTS FROM A SPECTRAL SCANNING TECHNIQUE FOR PASSIVE REMOTE SENSING OF SOIL MOISTURE

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Global scale use of microwave hardware in industrial, business, and consumer electronics is rapidly increasing the terrestrial anthropogenic interference encountered by passive remote sensors of soil moisture at C-band, including the JAXA AMSR-E sensor on the NASA EOS Aqua satellite and the WindSat sensor on the U.S. Navys Coriolis satellite. To facilitate continued accurate passive remote sensing of soil moisture and other microwave environmental observables, the NOAA Environmental Technology Laboratory (ETL) has developed a C-band frequency-scanning spectrometer for use within its Polarimetric Scanning Radiometer (PSR) system. The spectrometer observes emissions between 5.8 and 7.5 GHz within step-tunable 10 and 100 MHz bandwidths selectable to within 3 MHz precision. The spectrometer is integrated within the 4-subband C-band radiometer scanhead, PSR/CX, and used successfully for several airborne soil moisture mapping missions within the past 6 years.

In 2002, Gasiewski et al. developed an algorithm for interference mitigation for use with ETL's PSR/CX C-band radiometer based on chi-squared statistical analysis of brightness temperature spectra observed in parallel C-band subbands. A similar algorithm was implemented for use with the new C-band spectrometer to provide estimates of upwelling brightness temperatures with mitigation of anthropogenic radio frequency interference. The algorithm also quantifies the spectral distribution and intensity of such interference.

The NOAA/ETL spectrometer has been used to collect data during four recent experiments, including the 2004 Soil Moisture Experiment (SMEX) over Arizona and Mexico, the 2004 Antarctic AMSR-E Sea Ice Experiment (AASI), one flight over the NASA Wallops Flight Facility in Virginia, and two separate high-altitude experiments on the NASA Johnson Space Centers WB-57F aircraft over Texas. During each experiment the spectrometer was rapidly swept to observe emissions in eighteen 100 MHz-wide subbands. Experimental results to be presented are based on the performance of the mitigation algorithm with respect to raw brightness temperatures observed in these eighteen subbands. A summary of instrument hardware, algorithm implementation, and results of recent experiments will be discussed.

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