COMBINED ACTIVE AND PASSIVE OBSERVATIONS AT L-BAND DURING THE EIGHTH MICROWAVE, WATER AND ENERGY BALANCE EXPERIMENT

Jasmeet Judge[1], Roger De Roo[2**], Mahta Moghaddam[3***], Anthony England[2], Xueyang Duan[3], Alejandro Monsivais-Huertero[1], Heather Enos[1], Tara Bongiovanni[1], Yuriy Goykhman[3], Daniel Preston[1], Blaire Colvin[1], and Karthik Nagarajan[1]*

[1]Center for Remote Sensing, Agricultural and Biological Engineering, University of Florida, Gainesville, FL, 32611, USA; *Email: jasmeet@ufl.edu

[2]Department of Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI 48109, USA; **Email: deroo@umich.edu

[3]Electrical Engineering and Computer Science Department, University of Michigan, Ann Arbor, MI 48109, USA, *** Email: mmoghadd@umich.edu

1. INTRODUCTION

Knowledge regarding distribution and availability of fresh water on earth is critical for accurate predictions of weather and near-term climate, nutrient cycles, crop-yield, and ecosystem productivity. On the land surface, soil moisture in the root-zone is the key factor governing water and energy fluxes. These fluxes can be simulated for dynamic vegetation using coupled Land surface models (LSMs) and vegetation growth models (e.g. [1]). The flux estimates diverge over time due to errors in computation, initialization, forcings, and model parameters. Assimilation of microwave observations that are sensitive to soil moisture, such as those at L-band, in the upper few centimeters (near-surface) can to significantly improve root zone soil moisture estimates by the models [2-5]. Even though both active and passive (AP) observations are sensitive to near-surface moisture, the information from the two is complementary [6,7]. The NASA Soil Moisture Active Passive (SMAP) mission will provide global active and passive microwave observations at L-band (1.2 – 1.4 GHz), with a repeat coverage of every 2-3 days.

Significant progress has been made in developing soil moisture algorithms that utilize passive (e.g. [8-10],[2,3]) and active (e.g., [11-14]) microwave observations to retrieve soil moisture information at various spatio-temporal scales and in developing statistical techniques to scale these observations (e.g., [15]). Studies that utilize both active and passive observations directly in SVAT models are recent and few (e.g., [16-17]). Combined active and passive observations (e.g. [18]), particularly during dynamic vegetation conditions are critical to improving forward models for effective assimilation and for soil moisture retrieval. In this study, we present combined active and passive L-band observations during our eighth Microwave, Water and Experiment (MicroWEX-8) conducted for sweet corn in North Central Florida.

2. MICROWEX-8

The MicroWEX-8 was conducted during the growing season of sweet corn from June 16 (DoY 167) to August 24 (DoY 236) in 2009. The field size was 0.04 km^2. The soil at the site was Lakeland fine sand with 89% sand content by volume. During the MicroWEX-8, every 15 minute observations were conducted for ground-based L-band microwave brightness at H-pol, soil moisture, temperature, heat flux at various depths in the root zone, along with concurrent micrometeorological conditions. Weekly vegetation sampling included measurements of LAI, green and dry biomass of stems, leaves, and ears, crop height and width, vertical distribution of moisture in the canopy, leaf size and orientation, other phonological observations. Tower based measurements of combined active (L-band; HH and VV-pol) and passive (L-band; H-pol) signatures were obtained at an incidence angle of 40° for a mature canopy, close to harvest. After harvest, the footprint was cleared of vegetation and additional AP observations were conducted or the bare soil for two days. There was a rain event prior to the harvest that allowed for combined observations during a dry-down period for a mature corn canopy.

3. RESULTS AND CONCLUSION

We found that both active and passive microwave signatures at L-band were sensitive to changes in soil moisture even for a mature corn canopy. The H-pol brightness captured the pulses of soil moisture from rain and irrigation events through the vegetation canopy. The backscattering coefficients at HH pol were higher than those at VV-pol due to higher specular reflection coefficient for the double bounce mechanism. This unique dataset will be used to develop forward active and passive algorithms and for testing assimilation methodologies.

4. REFERENCES

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