L-band Soil Moisture Mapping Using a Small Unmanned Aerial System

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Soil moisture is of fundamental importance to many hydrological, biological and biogeochemical processes, plays an important role in the development and evolution of convective weather and precipitation, and impacts water resource management, agriculture, and flood runoff prediction. The launch of NASA's Soil Moisture Active/Passive (SMAP) mission in 2015 promises to provide new passive global measurements of soil moisture and surface freeze/thaw state at fixed crossing times and spatial resolutions of ~30 km. With the failure of the SMAP radar there exists a need for measurements of soil moisture on much smaller spatial scales and arbitrary diurnal times for SMAP validation, precision agriculture, evaporation and transpiration studies of boundary layer heat transport, and tundra thaw studies. The Lobe Differencing Correlation Radiometer (LDCR) provides a means of mapping soil moisture on spatial scales as small as several meters (i.e., the height of the platform). Compared with various other proposed methods of validation based on either *in situ* measurements or existing airborne sensors suitable for manned aircraft deployment, the integrated design of the LDCR on a lightweight small unmanned aerial system (sUAS) is capable of providing sub-watershed (~km scale) coverage at very high spatial resolution (~15 m) suitable for scaling scale studies. This sUAS, the Tempest, flies at very low operator cost compared to manned aircraft.

To demonstrate the LDCR several flights had been performed during a field experiment at the Canton Oklahoma Soilscape site on September 8th and 9th, 2015. A total of five parallel track mapping missions were flown during three tests using autopilot technology. The tests were flown at 30-60 m altitude to obtain differing spatial resolutions. The LDCR brightness temperature and soil moisture mapping algorithm will be analyzed, and scientific intercomparisons of LDCR, SMAP and SMOS data along with situ measurements will be presented. LDCR sensitivity to RFI at the L-band will be discussed.