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Analysis of soil moisture received from aircraft and satellite acquisitions from SMEX03 and comparison with *in-situ* measurements.

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The soil moisture experiment in 2003 (SMEX03) focused on the remote sensing of soil moisture over a range of natural vegetation types. For that purpose five different study areas were selected for the simultaneous collection ground truth and remotely sensed data. The main study areas of the experiment were located in southern and northern part of Oklahoma around Stillwater and Chickasha, respectively. My study was focused on the data set collected in the Little Washita Experimental Watershed (LWREW), located in southwest of Oklahoma in the Southern Great Plain region of the United States. The LWREW was the focus of the Oklahoma South Study Region.

The primary objectives of my work meet with the number of aims of the SMEX03 experiment:

1. Validation of radar data received from aircraft (AIRSAR) and space-borne microwave (ASAR) sensors;
2. The mapping of spatial and temporal variability of soil moisture;
3. The relationship of soil moisture to vegetation and the near-surface atmospheric characteristics;

The basic approach used in this experiment has been to collect ground-truth soil moisture in conjunction with satellite and aircraft acquisitions.

The aircraft instruments operate in low frequency microwave wavebands that are well suited for the measurements of soil moisture. During the experiment AIRSAR operated in POLSAR mode, in which the radar instruments collected backscattering coefficients at quad polarization (HH, VV, HV and TP (total power)) in the C-, L- and P-band frequency ranges. The raw AIRSAR data was processed and provided by JPL as separate compressed stokes matrices for C-, L- and P-band.

AIRSAR flights for SMEX03were flown at an altitude of 8 km and were concentrated over the Little Washita Watershed, an area 10 km North-South and 40 km East-West where intensive ground samplings were conducted. Four lines were flown in an East-West racetrack to provide coverage of the watershed at angles between 35 and 45 degrees.

The ASAR acquisitions were provided in the alternating polarization ellipsoid geocoded image format. During the experiment in its alternating polarization mode ASAR acquired backscatter coefficients in VV/VH polarization combination, which is preferred for soil moisture. It has spatial resolution 30 $\times$ 30 m (pixel size) with a pixel spacing of 12.5 $\times$ 12.5 m.

Soil moisture samples were collected from the fields with different type of vegetation cover. In the sampled watershed fields 14 locations were selected for impedance probe measurements. The site-specific calibrated theta probe measurements were averaged to produce a field average value representative for the 0 – 6 cm soil layer, which was used in the analysis.

To derive the backscatter coefficients from the fields with different type of vegetation, it was necessary to obtain the average data number within each sampled field boundary. The fields with the same land cover were grouped together.

Backscatter coefficients measured at lower incidence angles typically gave higher radar returns than observations at higher incidence angles.

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