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Estimates of near-surface soil moistures during SGP97 and SGP99: ESTAR passive microwave radiometer and GEOtop model results

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This is an extension of the study by Bushara et al. (2010, EGU) in which the fully distributed hydrological model, GEOtop (Rigon et al. 2006), was calibrated and validated at basin scale using the extensive field data collected during the Southern Great Plains Hydrology Experiment-1997 (SGP97) and SGP99. The study area is the Little Washita watershed [583 km2], Oklahoma, USA. The energy fluxes (latent heat, sensible heat, net radiation, and ground heat), soil temperature profiles, soil moisture profiles, and streamflows were well-reproduced by the model in both calibration and validation. Bushara et al. (2010, EGU) reported that model and ESTAR (Electronically Scanned Thinned Array Radiometer) showed completely different spatial soil moisture patterns, and they suggested that the ESTAR soil moistures are contaminated with surface runoff and vegetation-intercepted water.

Here we investigate the possibility of using simulated soil moistures and temperatures to produce bias-adjusted ESTAR soil moisture maps. Unfortunately, we were not able to produce such maps because there is no well-defined relationship between the GEOtop simulated soil moisture and the ESTAR measured brightness temperature or between the GEOtop simulated soil temperature and the brightness temperature as given by ESTAR. However, results suggest that there are insignificant effects of vegetation except for interception effects on ESTAR soil moistures. Furthermore, the calculated emissivities, based on the ratio between the ESTAR measured brightness temperature and GEOtop simulated soil temperature, are much lower than the values reported in the literature.