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Evaluation of sensible heat fluxes derived from Large Aperture Scintillometer measurements over irrigated and dryland cotton during BEAREX08

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The path integrating capabilities of scintillometer over heterogeneous landscapes makes it a powerful tool for validating satellite-based evapotranspiration (ET) maps. Numerous studies have evaluated the accuracy of sensible heat fluxes (H) derived from Large Aperture Scintillometer (LAS) measurements using eddy covariance (EC) measurements. EC systems have the energy balance closure problem (Rn-H-LE-G$\neq$0) up to 20 percent. For that reason we chose to evaluate the accuracy of the LAS-based ET fluxes against lysimeter data. Data used in this study was collected during the Bushland Evapotranspiration and Agricultural Remote Sensing Experiment 2008 (BEAREX08). The BEAREX08 was conducted at the USDA-ARS Conservation and Production Research Laboratory (CPRL) in Bushland [350 11' N, 1020 06' W; 1,170 m elevation MSL] located in the semi-arid Southern High Plains of Texas, USA during the 2008 summer cropping season. The CPRL is equipped with four large (3 x 3 x 2.5 m) monolithic lysimeters, with each lysimeter located in the center of 210 x 225 m fields arranged in a block pattern. One LAS was deployed across two dryland lysimeter fields (designated as NW and SW) and another on two irrigated lysimeter fields (designated as NE and SE), and all four fields were planted to cotton. The structure parameter of the refractive index of air was monitored at a 1-min interval and averaged for 15-minute periods between 10 July and 30 August, synchronized with weather station and lysimeter measurements. In addition, net radiation (Rn) and soil heat fluxes (G) were measured in all four lysimeter fields. Sensible heat fluxes (H) were derived from LAS measurements using a heat flux source area function and estimated ET fluxes as a residual from the energy balance were compared against lysimeter data. Trends in the LAS-based ET fluxes closely followed those in the observed data. However, LAS-based ET fluxes were over predicted by 10-35%. Differences between lysimeter- and LAS-based ET estimates over dryland cotton may be partly due to non-uniform vegetation growth on the NW and SW lysimeter fields. Overall, results indicate that the LAS is a promising tool for estimating ET fluxes.