Surface Renewal Satellite Towers for Gap-Filling Eddy Covariance Sensible Heat Flux

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Fetch limitations for eddy covariance (EC) measurements impact decisions regarding the choice of the tower position and the landscape targeted for observation. Many EC towers are positioned to capture the fluxes from the dominant wind direction, often from near the edge of the canopy of interest. The resulting observation area is narrowed to a smaller range of wind directions (e.g., only 170 degrees out of the full 360). For example, in our experiment over rice paddies the main, EC tower, is set at the north edge of the field to take advantage of the fluxes predominantly caused by southern winds from a 25 ha uniform rice paddy. In addition, we installed a satellite tower near the opposite field edge where only a finewire thermocouple and propeller wind sensor were deployed to gap-fill the sensible heat fluxes (H) using surface renewal method (SR). Namely, the SR method suggested by Castellví (2004) is exempt from calibration, independent from EC measurements and sonic anemometry. The direct comparison between H fluxes determined by EC and SR is not possible due to the presence of the levies and ditches in the fetch of either one of the towers. Therefore, gap-filled EC H fluxes for the northern wind directions and SR H measured fluxes were compared. The original EC fluxes include the correction for flow distortion by transducer shadowing (Horst et. al, 2015) and gap-filling was performed using an artificial neural network method (following Sturtevant, 2015, as presented in Knox et al, 2015; 2016). The research presented aims at addressing the problem of flux measurement spatial resolution. High agreement between the SR satellite tower measurements and the EC gap-filled fluxes suggests an option for more affordable flux measurements that might be beneficial across many Fluxnet towers.