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ABSTRACT TITLE: A New Method for Reducing Uncertainty in Biospheric CO_2 flux: A case study at Tonzi AmeriFlux Site

ABSTRACT: While gaps in trace-gas fluxes measured via eddy-covariance occur for a variety of reasons, many occur at night due to a stratified (stable) atmosphere close to the surface. Currently, the community standard for eliminating data during periods of stability is to apply a threshold of friction velocity (u_*). Despite applying the u_* threshold, data often indicate net CO_2 uptake at night, casting doubt on whether a u_* threshold is accurately eliminating data from stable periods. Because most flux sites are only equipped with one set of instruments (usually just above the canopy), vertical profiles of turbulent transfer within and above the canopy are generally not available providing few alternatives to the u_* correction method within the FLUXNET community. The ability to better quantify atmospheric stability within and above the canopy would improve data quality assessment.

Here we present progress in applying the Advanced Canopy-Atmosphere-Soil Algorithm (ACASA) model to simulate turbulent exchanges of CO_2 and H_2O at the Tonzi oak savanna AmeriFlux site (Ione, CA). We also present vertical profiles of turbulence and wind shear measured within and above the canopy with an upward facing atmospheric LIDAR system. We validate ACASA flux outputs against eddy-covariance data and ACASA-generated profiles of wind shear and turbulence kinetic energy (TKE) against data from the LIDAR deployed at the site during multiple campaigns. We show the effect of assessing within- and above-canopy turbulent transfer (and thus vertical flux quality) via thresholds based on u_* (from eddy-covariance) versus vertical profiles of TKE (from ACASA and LIDAR). We especially focus on achieving an atmospheric understanding of why the commonly used u_* method for flux quality assessment diverges from results based on TKE.

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