Evaluating the ACASA model as a tool for flux interpretation at 4 AmeriFlux Sites

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Many eddy-covariance flux sites are equipped with one measurement height above the canopy. Due to power requirements, instrument cost, and the maintenance involved it is often unrealistic to expand measurements across the full profile of of the canopy. However, an understanding of the turbulence dynamics throughout the canopy could be valuable in interpreting flux data at measurements height. We apply a higher-order closure turbulence and flux model to 4 distinct flux sites in order to model fluxes and profiles of turbulence in and above canopies. We used the UC-Davis Advanced Canopy-Atmosphere-Soil Algorithm (ACASA) to study a range of ecosystems including a tall old-growth forest with a complex canopy (Wind River Ameriflux), a two-layered oak savanna (Tonzi Ameriflux), a grassland (Diablo Ameriflux), and a wheat field (Southern Great Plains Ameriflux). We modeled each ecosystem for at least the duration of the growing season. At each site, the model was reinitialized twice per month using data of soil moisture and temperature. We assess the conditions under which applying a complex model like ACASA is beneficial in interpreting within-canopy dynamics and flux signal quality. We describe ACASA performance at the 4 sites as well as the changes to the model and the tuning necessary to optimize performance for each of the unique sites. Novel improvements to the model include the incorporation of seasonal dynamics in leaf area index and photosynthetic capacity, adjustment of plant water use during seasonal drought, and adjustments for a clumped canopy.

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