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Ecosystem scale estimates of transpiration: an overview of methods for eddy covariance data.

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Demand for ecosystem and global scale transpiration (T) estimates has driven interest in methods for partitioning the total evaporative fluxes (evapotranspiration, ET) from eddy covariance data-sets. Here we look at three recent partitioning methods applied to the FLUXNET data-set based on recent publications: Zhou et al. (2016), Perez-Priego et al. (2018), and Nelson et al. (2018). As an initial benchmark, we shows that all T estimates show higher correlations to independent sap flow measurements compared to ET alone, based on sap flow measurements from sites which intersect the new SAPFLUXNET database. Correlation coefficients between eddy co-variance T estimates and sap flow was higher than 0.8 for most sites. Furthermore, as the methods make different assumptions on how ecosystems react to drying conditions, we look at T, T/ET, and water use efficiency (WUE) during dry down events where bio-available moisture is progressively limited. These dry down studies suggest that though the values of T are highly correlated across partitioning methods, the different methodologies can cause divergent dynamics, such as contrasting predictions as to whether the proportion of transpiration will increase or decrease during the course of some dry down events. Finally, we show that eddy co-variance based T/ET estimates are comparable to current global estimates of around 60% T/ET via a simple up-scaling from site to global scale.

Nelson et al. 2018. “Coupling Water and Carbon Fluxes to Constrain Estimates of Transpiration: The TEA Algorithm.” Journal of Geophysical Research: Biogeosciences, December. https://doi.org/10.1029/2018JG004727.

Perez-Priego et al. 2018. “Partitioning Eddy Covariance Water Flux Components Using Physiological and Micrometeorological Approaches.” Journal of Geophysical Research: Biogeosciences, October. https://doi.org/10.1029/2018JG004637.

Zhou et al. 2016. “Partitioning Evapotranspiration Based on the Concept of Underlying Water Use Efficiency.” Water Resources Research 52 (2): 1160–75. https://doi.org/10.1002/2015WR017766.