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A new approach to unraveling the contributions to soil moisture dynamics arising from the distinct processes of soil evaporation and plant transpiration

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A current challenge in interpreting direct measurements of evapotranspiration (ET) is inferring the distinct contributions from direct evaporation (E) and plant transpiration (T). A new approach for separating ET into these separate components is used in this study. The approach, which involves the analysis of standard eddy covariance measurements, is based on the assumption that flux-variance similarity for water vapor and carbon dioxide applies separately to the stomatal versus non-stomatal components of the fluxes. Demonstrated in an agricultural setting, this technique provides estimates of E and T over the course of the growing season in which there were a number of wetting and drying cycles. An interesting finding is that T is suppressed immediately following rainfall, most likely due to the consumption of available energy by direct evaporation from the interception store. During dry-down periods, the temporal dynamics of T are primarily governed by radiation and root zone soil moisture, while those of E are governed by the delivery of moisture to the surface via capillary rise. Partitioned flux results are evaluated within the context of observed soil moisture measurements at multiple depths and are shown to improve models of soil moisture dynamics in settings where E and T are both significant contributors to ET.