Towards mechanistic unraveling of plant physiological response to increasing vapor pressure deficit

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Recent forest mortality related to drought has been attributed to the increased vapor pressure deficit (VPD) worldwide. It has become important to understand the link between the plant hydraulic traits and climate. However, most Earth system models lack mechanistic representations of plant responses to a changing climate. Recent development of plant hydraulics schemes (PHS) in ELM and FATES, as well as a growing database of plant hydraulic traits, have provided us an opportunity to mechanistically unravel how plants respond to drying soil and increasing VPD. Compared to the 0.0025º evapotranspiration (ET) product based on a synthesis of six global products, an E3SM AMIP simulation that includes a simple steady-state plant hydraulics model in ELM shows improved simulation of ET in the dry season due to hydraulic redistribution, particularly for deciduous tropical forest trees in the Amazon. Precipitation in the wet season is better correlated with the GPCP dataset than a simulation without PHS. AMIP simulation results and offline ELM simulations for sensitivity analysis will be performed to evaluate if VPD is a dominant driver constraining stomatal conductance.