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The interplay between rainfall infiltration depth, rooting depth and water table depth in regulating Amazon evapotranspiration (ET)

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Plants link the subsurface to the atmosphere via water and carbon fluxes and are therefore a key player in climate. The Amazon, one of Earth's largest ecosystems, is an important climate regulator. As a large source of evapotranspiration, it has significant influence on regional and remote precipitation dynamics. For its equatorial position, it impacts significantly the global climate engine. The Amazon receives abundant annual rainfall but parts of it experience a multi-month dry season. Here we elucidate the interplay among three hydrological depths: precipitation infiltration depth, root water uptake-depth, and the water table depth in regulating dry-season ET, using inverse modeling based on observed productivity, ERA Interim reanalysis atmosphere, and a novel integrated soil-surface-groundwater model with dynamic root uptake to meet the transpiration demand. We perform high-resolution (∼1km) multi-year simulations over the region, with shallow soil, deep soil, with and without groundwater, with and without dynamic rooting depth; attempting to tease out these components. The results demonstrate the strong interactions among the three depths and what each factor does in regulating dry season ET, shedding light on how future global change may preferentially impact Amazon ecosystem functioning.