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Terrestrial water and carbon fluxes across climatic gradients: does plant diversity matter?

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Vegetation diversity in many land-surface, ecohydrological, and dynamic vegetation models is crudely represented using a discrete classification of a handful of "plant types" (named Plant Functional Types; PFTs). The parameterization of PFTs typically reflects mean properties of observed plant functional traits over broad categories (e.g., temperate broadleaf deciduous forest) ignoring most of the inter- and intra-specific trait variability. In the present study, taking advantage of well-established plant-trait cross-correlations described by the Leaf Economics Spectrum, we generated coordinated hypothetical species across a continuous spectrum of leaf traits, rather than using pre-defined categories. The behavior of these proxy species is then tested using a mechanistic ecohydrological model (T&C) that operates as a filter of their performance. Simulations are carried out for a range of climates representative of different elevations and wetness conditions in Switzerland. Using this framework the following questions are addressed: (i) how sensitive are the carbon and water dynamics to species diversity? and (ii) which is the correlation between plant physiological traits, plant performance and observed trait distribution across climatic gradients?