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STEMMUS-SCOPE for PLUMBER2: Understanding Water-Energy-Carbon Fluxes with a Physically Consistent Dataset Across the Soil-Plant-Atmosphere (SPAC) Continuum

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High-quality and long-term measurements of water, energy, and carbon fluxes between the land and atmosphere are critical for eco-hydrological monitoring and land surface model (LSM) benchmarking. Eddy Covariance has become the most widely used method for theory development and LSM evaluation. On the other hand, flux tower data as measured (even after site post-processing and gap-filling based on empirical formulation) cannot be used directly for validating LSMs, and most of time, lacking physically-consistent measurement across the soil-plant-atmosphere continuum (SPAC) (e.g., other than surface fluxes, lacking the measurement of soil moisture, soil water potential, leaf water potential, fluorescence, and reflectance). Here we present high-quality and long-term fluxes and corresponding above/below-ground hydrological, physiological, photosynthetic data derived from the STEMMUS-SCOPE model simulations for PLUMBER2 project with 170 FLUXNET sites. Fluxes data from PLUMBER2 and SM data from FLUXNET2015 are used to further validate the effectiveness of the STEMMUS-SCOPE dataset. Results show that the simulated fluxes and SM dataset have reasonable agreements with the in-situ measurements, using the available global input/forcing datasets without any model tunning. This dataset adds to the existing ecosystem flux and SM network to help increase our understanding of ecosystem responses to extreme events.