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Sapfluxnet: a global database of sap flow measurements to unravel the ecological factors of transpiration regulation in woody plants

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Plant transpiration is one of the main components of the global water cycle, it controls land energy balance, determines catchment hydrological responses and exerts strong feedbacks on regional and global climate. At the same time, plant productivity, growth and survival are severely constrained by water availability, which is expected to decline in many areas of the world because of global-change driven increases in drought conditions. While global surveys of drought tolerance traits at the organ level are rapidly increasing our knowledge of the diversity in plant functional strategies to cope with drought stress, a whole-plant perspective of drought vulnerability is still lacking. Sap flow measurements using thermal methods have now been applied to measure seasonal patterns in water use and the response of transpiration to environmental drivers across hundreds of species of woody plants worldwide, covering a wide range of climates, soils and stand structural characteristics. Here, we present the first effort to build a global database of sub-daily, tree-level sap flow (SAPFLUXNET) that will be used to improve our understanding of physiological and structural determinants of plant transpiration and to further investigate the role of vegetation in controlling global water balance. We already have the expression of interest of data contributors representing >115 globally distributed sites, > 185 species and > 700 trees, measured over at least one growing season. However, the potential number of available sites and species is probably much higher given that > 2500 sap flow-related papers have been identified in a Scopus literature search conducted in November 2015. We will give an overview of how data collection, harmonisation and quality control procedures are implemented within the project. We will also discuss potential analytical strategies to synthesize hydroclimatic controls on sap flow into biologically meaningful traits related to whole-plant transpiration regulation and hydraulic status. SAPFLUXNET will lead to the first comprehensive study of the ecological drivers of tree-level transpiration across the globe and will aid to constrain the empirical upscaling between plant traits and ecosystem function. Finally, we anticipate that, once SAPFLUXNET is populated with sufficient observations, it will complement existing ecological networks like FLUXNET and it will also contribute to the evaluation of Earth-system models.