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Potential and limitations of a global dendrometer network to describe tree transpiration patterns

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Dendrometers have proven useful to understand water fluxes and storage in tree stems as well as growth dynamics. To date, dendrometer data have been primarily employed at the site level with little attention given to large-scale links among climate, stress, and growing season characteristics. Within the framework of the COST Action STReESS (FP 1106) we are collecting and harmonizing sub-daily dendrometer data over multi-annual periods from all over the globe (see project DendroGlobal, http://www.wsl.ch/fe/landschaftsdynamik/projekte/DendroGlobal) with the ultimate goal to advance knowledge of climatic stressors and growing season variation across the Earth's forested biomes.

In this specific study we aimed at using the currently collected datasets (∼600 individual series from ∼80 sites with an average length of ∼3.5 years) to derive large-scale tree transpiration patterns from the analysis of diurnal dendrometer metrics. More specifically, we assessed co-variability among dendrometer, sapflow, and environmental data. We then tested standardized methods to derive the presence and magnitude of daily transpiration activity, and analyzed variability in space, time, among species, and along ecological gradients.

Preliminary results indicate that our approach is able to track the expected shortening of transpiration season with increasing elevation and latitude, and also showed the expected dependence of transpiration intensity on climate the tree species. These promising results highlight the usefulness of a global dendrometer network to quantify ecological patterns of tree water and growth related responses to environment conditions. These and other results will be presented, together with a discussion of the further potential and remaining challenges.