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## Separating the contributions of vegetation and soil to evapotranspiration using stable isotopes

Matthias Cuntz (1), Maren Dubbert (2), Arndt Piayda (1), Alexandra Correia (3), Filipe Costa e Silva (3), Olaf Kolle (4), Cristina Maguás (5), Alexander Mosena (2), João S Pereira (3), Corinna Rebmann (1), and Christiane Werner (2)

(1) UFZ - Helmholtz Centre for Environmental Research, Computational Hydrosystems, Leipzig, Germany (matthias.cuntz@ufz.de), (2) Agroecosystem Research, BayCEER, University of Bayreuth, Bayreuth, Germany, (3) Department of Forestry, Instituto Superior de Agronomia, Technical University of Lisbon, Lisbon, Portugal, (4) Field Experiments & Instrumentation, Max Planck Institute for Biogeochemistry, Jena, Germany, (5) Centro da Biologia Ambiental, Faculdade de Ciências, University of Lisbon, Portugal

Semi-arid ecosystems contribute about 40% to global net primary productivity, although water-availability limits carbon uptake. Precipitation shows periodical summer droughts and evapotranspiration accounts for up to 95% of water loss of the ecosystem. Thus functional understanding of evapotranspiration and the contributions of evaporation and transpiration from over- and understorey vegetation to water cycling in semi-arid regions is key knowledge in forest management under future climate change.

Water isotopes trace water through the compartments of an ecosystem from soil and the vegetation to the atmosphere. They are used to partition evapotranspiration  $ET$  into its components evaporation  $E$  and transpiration  $T$ . The method is, however, sensitive to the knowledge of the isotopic composition of water at the evaporating sites. This led to a discussion recently about the dominance of transpiration in water loss from the terrestrial biosphere, and also how methodological problems could bias these results.

Here we present observations from a Portuguese cork-oak woodland. It is a bi-layered system of widely spaced cork-oak trees and a herbaceous layer dominated by native annual forbs and grasses. Water fluxes and their isotopic compositions were measured on bare soil and vegetated plots with a transparent through-flow chamber and a water isotope laser. Soil moisture and temperature were measured in several depths and soil samples were taken for soil water isotope analysis.

Based on these observations, we review current strategies of  $ET$  partitioning. We highlight pitfalls in the presented strategies and show uncertainty analyses for the different approaches. We show that the isotopic composition of evaporation is very sensitive to the sampling strategy but is described well by a steady-state formulation (Dubbert *et al.*, J Hydrolo 2013). The isotopic composition of transpiration, on the other hand, is not in steady state, most of the time (Dubbert *et al.*, New Phytolo 2014). We will demonstrate the consequences for the partitioning of  $ET$  of current simplifications in soil moisture isotope descriptions and current steady-state assumption for transpiration isotopes.