Publication

The multifaceted relationship between leaf water 18O enrichment and transpiration rate

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 2226759
Author(s) Cernusak, Lucas; Kahmen, Ansgar
Author(s) at UniBasel Kahmen, Ansgar ;
Year 2013
Title The multifaceted relationship between leaf water 18O enrichment and transpiration rate
Journal Plant, Cell and Environment
Volume 36
Number 7
Pages / Article-Number 1239-1241
Keywords Transpiration rate relates to within- and across-species variations in effective path length in a leaf water model of oxygen isotope enrichment
Leaf water becomes enriched in the heavy isotope 18 O through the process of transpiration. The leaf water 18 O signal is recorded in plant organic material (Barbour 2007), in atmospheric CO 2 via the activity of carbonic anhydrase (Farquhar et. 1993), and in atmospheric O 2 through photosynthetic O 2 evolution (Guy, Fogel & Berry 1993). These signals can be harnessed for a range of applications in global change research and plant science, including reconstruction of climate, estimation of primary productivity, and analysis of environmental and genetic effects on stomatal conductance. Mechanistic models of leaf water 18 O enrichment are required for these applications. A model to predict the 18 O enrichment of an evaporating water surface was initially developed by Craig & Gordon (1965) and refined for application to leaves by Dongmann et. (1974). Building upon this, Farquhar & Lloyd (1993) proposed a model to relate the average, or bulk, leaf water 18 O enrichment (Δ 18 O L) to that at the evaporative sites in the leaf (Δ 18 O e), whereby the diffusion of 18 O enriched water away from the evaporative sites is opposed by the convection of unenriched vein water towards the evaporative sites (Fig. 1). They referred to this as a Péclet effect. As a result of the Péclet effect, the Δ 18 O L is predicted to decrease as stomata open and transpiration increases for a given set of environmental conditions. This means that for plants growing alongside one another, the 18 O enrichment of organic material can potentially provide an integrated measure of variability in stomatal conductance, which would be especially useful in ecophysiology and plant breeding
Publisher Wiley
ISSN/ISBN 0140-7791 ; 1365-3040
edoc-URL http://edoc.unibas.ch/49556/
Full Text on edoc No;
Digital Object Identifier DOI 10.1111/pce.12081
ISI-Number WOS:000319875100001
Document type (ISI) Article