Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11470, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11470
EGU General Assembly 2008

Leaf water ^{18}O enrichment is controlled by stomatal conductance, ambient vapor pressure and oxygen isotope ratio of water vapor

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Stable oxygen isotopes in trees are used to study water relations in a changing climate from the local to the global scale. While no isotopic fractionation occurs during transport of water from roots to leaves, leaf water ^{18}O ($\delta^{18}O_{LW}$) is governed during transpiration, physically by kinetic and equilibrium fractionation factors, morphologically by boundary layer conditions and leaf properties (e.g. water pools and diffusion pathways), and physiologically by stomatal conductance. Yet, leaf water enrichment is not only controlled by its environment (leaf temperature and ambient humidity), but also altered by the composition of the water vapor ($\delta^{18}O_v$) entering the leaf. The degree to which $\delta^{18}O_v$ alters $\delta^{18}O_{LW}$ depends on stomatal conductance, ambient water vapor pressure and the δ^{18}O of the ambient water vapor.

This presentation demonstrates the effect of stomatal conductance, ambient water vapor pressure and $\delta^{18}O_v$ on $\delta^{18}O_{LW}$ enrichment. Strongly-δ^{18}O-depleted water vapor (-330‰ vs VSMOW) was used to study leaf isotopic composition of 5 y-old *Quercus robur* and four months old *Mucuna pruriens* in a climate-controlled cuvette under a range of environmental conditions. When stomatal conductance and relative air humidity (RH) were high, ambient vapor modified $\delta^{18}O_{LW}$ by up to -70‰ and -215‰ respectively, within 90 min. Conversely, at low humidity and stomatal conductance, $\delta^{18}O_{LW}$ differed only slightly from pretreatment leaves. With the help of

this extended leaf water model the night-time depression of diurnal $\delta^{18}O_{LW}$ can be explained.