



Explanations for the unexplained variance of oxygen isotope ratios in tree rings

M. Saurer, A. Kress, O. Sidorova, and R. Siegwolf

Paul Scherrer Institut, Villigen PSI, Switzerland (matthias.saurer@psi.ch)

Correlations between oxygen isotope ratios of tree-rings and temperature are sometimes weaker than expected and often lower than the respective correlations with carbon isotope ratios. This observation could be caused by biological fractionation effects and evaporation in the soil and plant, leading to changes in the isotope ratio that depend on local ecological factors and tree species. However, $\delta^{18}\text{O}$ tree-ring chronologies from different sites often show a strong common signal, as recently observed for several temperate sites in Switzerland. This indicates a common driving force for the oxygen isotope changes, although simple correlations to temperature or precipitation still do not explain a very high amount of the variance. One explanation could be that the “input” oxygen isotope signal for the tree, namely the isotope signal of precipitation and soil water, is also not a simple measure of temperature if the year-to-year variability of summer values is considered. In this study, we (1) compared tree-ring chronologies not only to simple climate parameters like temperature, but also investigated the influence of atmospheric circulation patterns to extract possibly hidden climatic information, and we (2) investigated $\delta^{18}\text{O}$ variations from different species growing at the same site to assess the influence of biological effects.