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The suitability of the dual isotope approach (δ13C and δ18O) in tree ring studies

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The use of stable isotopes, complementary to tree ring width data in tree ring research has proven to be a powerful tool in studying the impact of environmental parameters on tree physiology and growth. These three proxies are thus instrumental for climate reconstruction and improve the understanding of underlying causes of growth changes. In various cases, however, their use suggests non-plausible interpretations. Often the use of one isotope alone does not allow the detection of such "erroneous isotope responses". A careful analysis of these deviating results shows that either the validity of the carbon isotope discrimination concept is no longer true (Farquhar et al. 1982) or the assumptions for the leaf water enrichment model (Cernusak et al., 2003) are violated and thus both fractionation models are not applicable. In this presentation we discuss such cases when the known fractionation concepts fail and do not allow a correct interpretation of the isotope data. With the help of the dual isotope approach (Scheidegger et al.; 2000) it is demonstrated, how to detect and uncover the causes for such anomalous isotope data. The fractionation concepts and their combinations before the background of CO_2 and H_2O gas exchange are briefly explained and the specific use of the dual isotope approach for tree ring data analyses and interpretations are demonstrated.

References:

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