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Climate sensitivity of stable isotopes in wood and cellulose of larch and spruce (Swiss Alps)

Angela Grieder (1,2), Michael W. I. Schmidt (2), and Kerstin Treydte (1)

(1) Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Zürcherstrasse 111, 8903 Birmensdorf, Switzerland, (2) University of Zurich, Department of Geography, Winterthurerstrasse 190, 8057 Zurich, Switzerland

Different components of wood vary isotopically and there is on-going discussion how good the relationship between climate variables and the isotopic values in the different wood components is. It is currently common procedure to extract cellulose, as it is the wood component easiest to extract, the biggest contingent of wood and stable over geologic time periods. But the extraction of cellulose from whole wood is time and cost consuming and a better knowledge of the potential to use whole wood instead of cellulose or specific ecological questions based on living trees is needed. Several studies assessed the necessity of the cellulose extraction and differ in their recommendations depending on site and species. Besides the strength of the environmental signal, also the mean offset in the isotope values between wood and cellulose can vary strongly. This offset is site and species specific and for example of interest in the context of the application of isotope models to describe the mechanistic processes of isotope fixation in the tree rings.

We study the differences in the isotopic signatures and and climate signals between tree-ring cellulose and solvent extracted wood of *Larix decidua* and *Picea abies* at two sites in the Loetschental (Swiss Alps). The sites are located at the upper tree line (2100 m asl, larch only) and at the valley bottom (1300 m asl, larch and spruce) and are characterized as cool-moist and warm-dry. Four trees per species and site were cored and analysed individually. Offsets between the two different tree-ring materials were quantified and correlations calculated between δ^{18}O and δ^{13}C of cellulose and solvent extracted wood of the last thirty years (1982-2011) and monthly external variables such as temperature, precipitation and relative air humidity.

First analysis of our cellulose and wood δ^{18}O data indicate a mean offset of 4.54‰(±0.97‰) and 4.62‰(±0.17‰) for larch at the tree line and the valley bottom respectively. The mean offset for spruce accounts for 4.93‰(±0.93‰). The mean year-to-year variability in the offset is 0.62‰(±0.27‰) for larch at the treeline, 0.65‰(±0.27‰) for larch at the valley bottom and 0.44‰(±0.20‰) for spruce. First correlation results between δ^{18}O of the different wood components and climate variables suggest that (i) relative air humidity is most important for both sites and species, (ii) the climate signal in wood of both sites and both species is as strong as in cellulose, (iii) the climate signal is stronger at the treeline and dominated by summer conditions whereas winter conditions seem to play a major role at the valley bottom, (iv) the climate signal in both species is similar. We hypothesize that these systematic patterns are mainly driven by precipitation and soil water availability and relative air humidity controlled evaporation effects influencing the isotopic signature of the source water. Analyses of tree-ring δ^{13}C are in progress, will help to verify/falsify our hypothesis and will be included in the presentation.