



Climate signal in d13C of wood lignin methoxyl groups from high-elevation alpine larch trees

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Tree-rings of high alpine larch trees (*Larix decidua*) were investigated by a recently established method that measures d13C values of the wood lignin methoxyl groups (Greule et al. 2009). The resulting d13C time series were tested for their potential as a climate proxy. For this 37 larch trees were sampled at the tree line near Simplon Village (Southern Switzerland). They were analysed for their tree-ring width (TRW) and from five individuals d13C of the wood lignin methoxyl groups (d13Cmethoxyl) were measured at annual resolution from 1971-2009 and at pentadal resolution from 1747-2009.

The d13Cmethoxyl chronologies were corrected for the anthropogenic change in atmospheric CO₂ concentration and its decreasing d13C value. Further, the physiological response of the trees to these atmospheric changes was corrected using the flexible correction factor approach of Treydte et al. (2009), which minimise the residuals with the target climate data. This approach results in the highest so far reported correction factors of 0.032 – 0.036‰ppmv CO₂, which are explained by a low water-use efficiency of deciduous larch.

The climate response of the new d13Cmethoxyl proxy shows a significant correlation of 0.75 for the annually and 0.87 for the pentadally resolved data with June to August temperatures. TRW shows also significant correlations with June to August temperatures, but they are lower than the correlations observed for the d13Cmethoxyl chronologies. These results indicate the potential of d13Cmethoxyl chronologies as a summer temperature proxy from high-elevation alpine trees with an even stronger signal than reported from earlier published tree-ring width and maximum latewood density temperature reconstructions.

References:

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