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An Intercomparison of Stable Isotopes in Tree-Ring Earlywood and Latewood from Two European Tree Line Sites

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Annually resolved and replicated stable isotope series obtained from tree-rings have the potential to reconstruct climate parameters, such as temperature, at multi-millennial timescales, at all temporal frequencies as they appear to require no statistical detrending. Over such timescales, sample numbers are large and preparation is costly and time consuming. To date, many studies have utilised only latewood rather than using the entire tree-ring to maximise the annual resolution and to avoid carry-over effects from reserves. However, the old trees from tree-line locations that are required to build long chronologies often display narrow ring-widths (< 0.5 mm), making accurate earlywood-latewood separation difficult, often inaccurate and time consuming.

In this study tree-ring stable isotopes from two European tree-line locations were analysed to test the homogeneity of signal between latewood, earlywood and whole-ring cellulose. Scots pine (Pinus sylvestris) from Northern Norway and European larch (Larix decidua Mill.) from Southern Switzerland were chosen as tree-ring stable isotopes at both these sites are strongly linked to temperature. As a part of the EU funded Millennium project, which seeks to investigate European climate variability over the last 1,000 years, it is essential to clarify if the separation of earlywood and latewood is necessary to obtain reliable climate reconstructions.

Our results demonstrate a high common signal between isotopes from earlywood and latewood in both species, correlating strongly with summer temperature. High turnover rates and small reserve pools at these tree-line locations may account for such a high common signal between earlywood and latewood. These results suggest that, for European tree-line conifers, the separation of earlywood from latewood is unnecessary to resolve an annual isotopic signal and to make accurate climate calibrations. Indeed, using the whole-ring may even improve climate correlations and therefore climate reconstructions.