



Tree-ring $\delta^{18}\text{O}$ dependence on water source isotopic signature in glacial environments of the European Alps: disentangling precipitation and glacier meltwater signals

Giovanni Leonelli and Valter Maggi

Dept. of Earth and Environmental Sciences, Università degli Studi di Milano-Bicocca, Milano, Italy
(giovanni.leonelli@unimib.it)

Climate-sensitive areas close to glacial environments in the European Alps are facing exceptional changes, especially in relation to the ongoing cryosphere contraction and the -temporary- higher availability of glacier meltwaters. Tree-ring stable isotopes in these dynamic areas have proved the possibility of reconstructing past changes in glacier meltwater availability (Leonelli et al., 2014; Leonelli et al., 2017), thus contributing in better tracking the ongoing hydroclimatic changes at the decadal and the century scales.

The cellulose of trees fed by glacial meltwaters are typically meanly more depleted in $\delta^{18}\text{O}$ than trees fed only by precipitation, reflecting the higher depletion of glacial meltwaters with respect to local precipitation: this was found for European larch both at a debris-covered glacier forefield (the Miage Glacier, western Alps) and at a debris free glacier forefield (the Forni Glacier, central Alps).

At the Forni Glacier, in a control site located in the valley bottom further away from the glacier stream, we found that the $\delta^{18}\text{O}$ of tree-ring cellulose reflects the $\delta^{18}\text{O}$ of winter snowfall (November to March), suggesting that during the growing season trees mostly use the snow-melt water of the previous winter. Moreover, the tree-ring cellulose $\delta^{18}\text{O}$ was also influenced by the August precipitation $\delta^{18}\text{O}$ and mean temperature.

By means of an appropriate experimental design, tree-ring stable isotopes may be of great help in reconstructing past hydroclimatic changes in the proglacial environments of debris-free and debris-covered glaciers.

Bibliographic references

Leonelli G., Pelfini M., Battipaglia G., Saurer M., Siegwolf R.T.W., Cherubini P. (2014). First detection of glacial meltwater signature in tree-ring $\delta^{18}\text{O}$: Reconstructing past major glacier runoff events at Lago Verde (Miage Glacier, Italy), *Boreas* 43, 600-607, <https://doi.org/10.1111/bor.12055>

Leonelli G., Battipaglia G., Cherubini P., Saurer M., Siegwolf R.T.W., Maugeri M., Stenni B., Fusco S., Maggi V., Pelfini M. (2017). *Larix decidua* $\delta^{18}\text{O}$ tree-ring cellulose mainly reflects the isotopic signature of winter snow in a high-altitude glacial valley of the European Alps, *Science of the Total Environment* 579, 230-237, <https://doi.org/10.1016/j.scitotenv.2016.11.129>