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$\delta^{18}O$ in *Sphagnum* and *Polytrichum* moss from a Swiss mire — an archive of summer temperature and humidity

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Abstract

Ecotopes like peat bogs which are rich in endangered plants are especially sensitive and vulnerable in a changing climate. *Sphagnum* and *Polytrichum* moss are therefore expected to react immediately to habitat changes. Reactions to environmental changes can e.g. be stored in stable isotope composition of plant mass that is well preserved in peat bogs. In order to investigate climate signals in mosses, we analyzed $\delta^{18}O$ and $\delta^{13}C$ in a millennial *Sphagnum* and *Polytrichum* chronology from a partly ombrotrophic mire in Switzerland. All proxies, namely *Sphagnum* stem, branch and *Polytrichum* cover the period 1850–2004 AD with a close to annual resolution. The older part of the peat core is covered by *Sphagnum* stem with a multi–annual resolution. The stable isotope datasets are compared to meteo data to assess climate signals in *Sphagnum*. Hereby, climate signals in the isotope signals might be hampered by dating errors due to the radiocarbon method. While temperature and precipitation signals are not imprinted in the $\delta^{18}O$ and $\delta^{13}C$ chronologies, $\delta^{18}O$ series of *Sphagnum* branch and *Polytrichum* show high correlations with relative humidity and water vapor pressure, which is a function of absolute humidity, i.e. the quantity of water in a particular volume of air, and temperature. Best correlations with vapor pressure are found in summer months (JJA) and explain 35% of the variance in *Sphagnum* branch and 30% of the variance in *Polytrichum* with a consistent significant signal in the past century. $\delta^{18}O$ of *Sphagnum* stem shows significantly weaker humidity signals. For $\delta^{13}C$, no causal correlations are found within the growing season. We assume that the variable water layer between *Sphagnum* and the atmosphere depending on the water table of the mire leads to diffusion effects and affects the photosynthetic capacity. Results from a regression analysis between *Sphagnum* and *Polytrichum* point to different fractionation processes during storage of carbon in organic material in different moss species.