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The eddy covariance technique allows the estimation of the evapotranspiration (evaporation and transpiration) at the stand level. Sap flow sensors have become widely used in combination with eddy covariance to assess the contribution of plant transpiration to the ecosystem evapotranspiration. Among the different techniques, the thermal dissipation (TD) is one of the most popular methods for sap flow measurements due to its straightforward use. As other methods, the TD technique implies a damage of the wood tissue, consequently changing wood thermal properties due to healing reactions. This may lead to an underestimation of sap flow and thus, to a lack of convergence with the ecosystem water flux at the ecosystem level measured by eddy covariance. However, the wound effect has not yet been experimentally assessed for the TD method.

In this study we conducted an experiment to investigate the effect of wound healing on sap flux densities measured with TD probes. Our main goal is to establish specific correction factors for both ring-porous and diffuse-porous species, according to the time that passed since installation. Successive sets of TD probes were installed in early-, mid- and end-growing season in diffuse- and ring-porous trees (Fagus sylvatica and Quercus petraea) in order to test the effects of dynamic wound formation. The trees were cut in autumn and, afterwards, additional sets of sensors were installed in each stem segment, thus without wound reaction. Natural ranges of flux densities were applied through the segments in the laboratory and measured gravimetrically and by the TD sensors simultaneously. Gravimetric flow was then compared to the TD sensors with and without wound reactions.

Preliminary results show that the utilization of the original calibration function, for sensors located in older measuring points (wounded tissue) measured lower sap flux densities than sensors installed after the tree harvest (without wound). Production of thick-walled xylem may have disturbed the flow path and heat conductivity around the inserted aluminium tubes of the TD probes, leading to the sap flow underestimation. In beech, sensors located in wounded tissue measured 35±15% lower sap flux densities than sensors installed in non-wounded tissue, whereas in oak the reduction was 60±20%. This divergence is probably due to their wider vessels in ring-porous species and therefore, more vulnerability to cavitation and microorganism invasion. However, no significant relation was found between the decrease of sap flow densities and the time since installation. This suggests that the wound formation takes place within the first weeks after sensor installation. This first data evaluation points out that a species-specific correction factor may be necessary for TD sensors to account for the underestimation of sap flow due to the wound formation. In this sense, wound correction factors obtained in this study could be implemented to any other TD measurements in the same species in order to improve the accuracy of the transpiration contribution to the ecosystem evapotranspiration.