



Correlation between glaciers' mass balances and tree growth: a case study from the central Alps

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High altitude environments are strongly regulated by climate both in their biotic and abiotic components. Among the many natural indicators that nowadays are used to evaluate climate change through time, glaciers' mass balances and tree growth at high altitude are two of the most sensitive proxies providing yearly information on climate. With this study we confront four tree-ring chronologies with two mass balances series: one from the Careser glacier (Ortles-Cevedale Group), a mountain glacier on the Italian side, and one from the Hintereis (Ötztaler Group), a valley glacier on the Austrian side. These glaciers have long record of mass balances, they are distant about 40 km from each other and are on the two opposite side of the Alpine range. Their series of mass balances show both a high intercorrelation ($r = 0.89$) and a high agreement (Gleichläufigkeit, $Glk = 97$). For the tree-ring data we built two chronologies of stone pine (*Pinus cembra* L.) and other two of Norway spruce (*Picea abies* (L.) Karst.), sampling in three different sites on the West facing slope of the Trafoi valley (Ortler-Cevedale Group, Central Italian Alps). Two sites are close to the glaciated area, but at different altitude: respectively, almost at the tree limit, 2100 m (stone pine and spruce sampled), and at the valley bottom, 1620 m (spruce). The third site is about 3 km to the North, towards the lower part of the valley, at the tree limit, 2150 m (stone pine). The relationships between tree growth and the Careser and Hintereis mass balances was established comparing each standard chronology with the mass balance series on the common period, by mean of inverse Glk , correlation coefficient and t-value. We found that stone pine chronologies show higher negative correlation with mass balances than Norway spruce; both sites of stone pine have similar values, with the further site showing higher absolute values: inverse Glk values of 69** (vs Careser) and 64* (vs Hin-

tereis) and correlation values of -0.51^{**} (Careser) and -0.55^{***} (Hintereis). For the two Norway spruce chronologies, the correlation with the mass balances series is less strong, with inverse Glk values about 50 and correlation coefficients about 0. These results stress the importance of using stone pine for dendroglaciological works concerning glaciers' mass balance reconstruction in the Central Alps.