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Quantitative high-resolution reconstruction of the Alpine climate since 1600 AD from varved Lake Silvaplana, eastern Swiss Alps: How stable are 20th century calibration models?

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Quantitative reconstructions of climate variables from natural archives is among the most important but delicate tasks. One of the general assumptions is that statistical calibration models developed for the instrumental period are applicable to past proxy series. The annually resolved 400-years long sediment record of Lake Silvaplana (Engadine, Swiss Alps, 1800 m) is unique to test this assumption: two new high resolution climate reconstructions are available for this region, (i) the Alpine tree-ring series (Büntgen et al., 2005, JJA temperatures) and (ii) the multi-proxy reconstruction for the grid Engadine (Casty et al., in press). All three reconstructions are fully independent and do not share any common predictor. A close relation between annual Mass Accumulation Rate MAR in Lake Silvaplana and summer temperature is not stable in time. Comparison with instrumental station data from 1900 onwards reveal that about 40 % of the variation in the annual MARs is explained by summer temperature whereas 10 % is controlled by summer precipitation. In contrast, running regression analysis shows that this relation disappears between 1864 - 1900 AD (end of the Little Ice Age) and turns, when compared with the Büntgen et al. reconstruction (2005) into a significantly negative correlation ($r = -0.4$, $p<0.001$, smoothed 21-yr triangular) between 1580 - 1900 AD (Little Ice Age). It is suggested that different state conditions of the catchment (LIA, modern) result in very different sediment transport mechanisms. Thus reconstruction models cannot be applied outside the range of the calibration period. Different factors such as enhanced glacial activity during the LIA and higher sensitivity of MAR to precipitation may play a major role. Annual biogenic

silica flux to the sediments shows significant correlations with autumn temperatures ($rs=0.4$, $p<0.001$) for the instrumental period. Comparison with the Engadine temperature reconstruction (Casty et al., in press) suggests that this relation is stable over the period 1580 - 1950 AD, i.e. before eutrophication became significant.

References:

Büntgen, U., Esper, J., Frank, D. C., Nicolussi, K., and Schmidhalter, M. (2005). A 1052-year tree-ring proxy for Alpine summer temperatures. Climate Dynamics.

Casty, C., Wanner, H., Luterbacher, J., Esper, J., and Boehm, R. (in press). Temperature and precipitation variability in the European Alps since AD 1500. Int. J. Climatol.