Paleo-climate research in the Engadine (Switzerland) - the state of the art

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During the last few years, numerous studies with focus on past climate were conducted on lake sediments from the Upper Engadine area (Figure 1). The studies cover different time scales (days to several millennia) and data resolution (days to centuries). Here we present one of the very few cases worldwide of a continuous high-resolution (annual to decadal) quantitative climate reconstruction based on inorganic lake sediment proxies back to A.D. 1580. Comparison with climate reconstructions for the same area based on tree rings and documentary data reveal the high quality of our sediment-based climate reconstruction.
Sediment trap data of Lake Silvaplana with intervals of 3 days in summer and 3 weeks in winter between 2001 and 2006 revealed that summer temperatures are very important for the particle transport from the glaciated catchment to the lake. For example, exceptionally high particle transport occurred in the extremely hot summer 2003 (Blass et al., in press). Further analysis of the trap samples suggest that precipitation significantly influences the mineralogical composition i.e. the ratio of quartz/mica and additionally of chlorite/mica (Bluszcz et al., submitted).
The well-dated (^{137}Cs, ^{210}Pb), annually laminated freeze cores of Lake Silvaplana were sampled year by year back to A.D. 1580. The mass accumulation rates were positively correlated with summer temperatures during the 20th century as observed in the sediment trap record but, interestingly, the correlation was negative during the Little Ice Age. Thus the actualistic principle does not apply in this case, because two different climatic regimes - modern climate and the Little Ice Age – apparently lead to considerably different sediment transport mechanisms (Blass et al., in press). The biogenic silica record, calibrated against instrumental autumn temperatures of Sils (1864 - 2004) is stable in time and agrees closely with two different autumn temperature reconstructions based on documentary evidence suggesting that autumns were generally cooler during the Little Ice Age than during the 20th century (Blass et al., submitted). The ratio of chlorite and mica was further used to reconstruct summer (MJJAS) precipitation over the last 400 years (Trachsel, 2006). In general, relatively low levels of precipitation are observed from 1650 to 1850 with persistent high values between 1580 and 1630. Diatom assemblages of a short core from Lake Tscheppa back to 1600 have been used to quantitatively reconstruct spring temperatures (von Gunten et al., submitted). In accordance with a documentary based spring temperature reconstruction, the diatom based record suggests that springs were cooler between 1650 and 1800 then afterwards. A newly recovered 1.5 m long freeze core extends this record to the mid Holocene with geophysical and geochemical data (Margreth, 2006) and diatoms and chironomids will be further analysed.

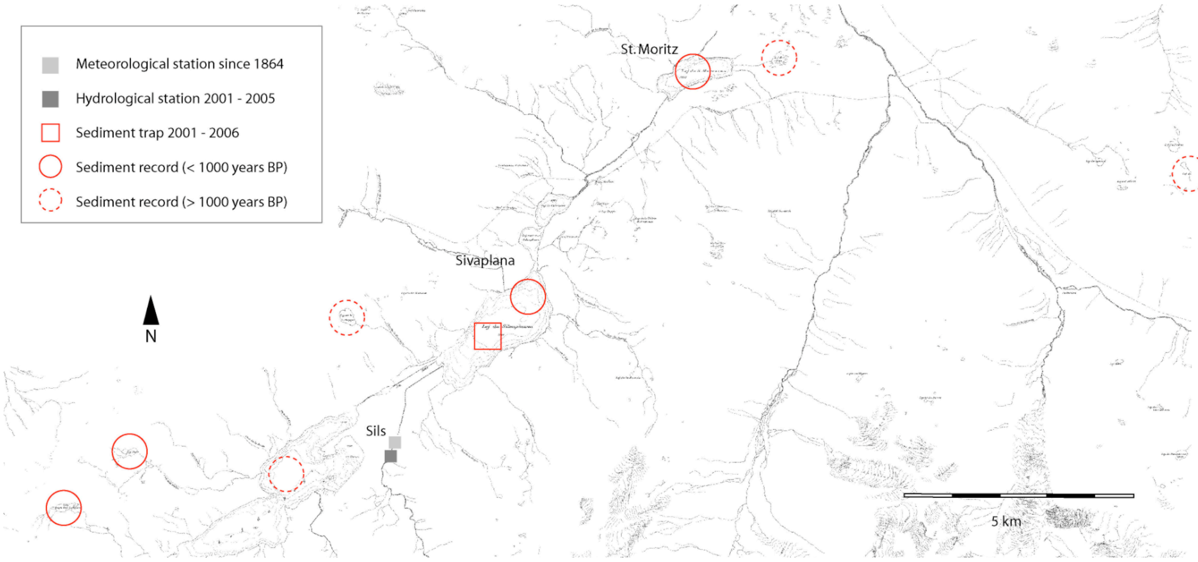

Figure 1. Map of the Upper Engadine area (eastern Swiss Alps) with indicated research sites (background map: Vector 25 © Swisstopo).

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