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Pollen/climate calibration based on a near-annual peat sequence from the Swiss Alps

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The objective of this study was to develop a high-resolution pollen-based climate-inference model (using 'calibration in time') for the mire Mauntschas (SE Swiss Alps, 1818 m asl). We focused on eleven types of pollen and spores (referred to as pollen for simplicity) for which we produced 150-year time-series of accumulation rates and percentages. Dating of these series was based on 29 ^{14}C dates from pure *Sphagnum*, spheroidal carbonaceous particles (SCP), larch-bud-moth events, and an age–depth model that took into account probabilities of calibrated ^{14}C ages, the degree of curvature of the age–depth line, and changes in concentrations of all major pollen types. Time resolution was one to five years. We first smoothed the series using a three-year triangular filter, thus removing time-resolution dependent changes in variability, and minimizing effects of potential dating uncertainties. Using redundancy analysis, we then studied the simultaneous response of the selected pollen to 288 different combinations of monthly temperature or precipitation data measured at Sils Maria (1798 m asl), located 9 km from Mauntschas. From AD 1954 to 2002, mean May-August air temperature from the same year explained most (18.1 %) of the variation in pollen accumulation rates (PAR). The amount of explained variation dropped to 9.9 % after detrending all data with a 50-year high-pass filter, which possibly removed non-climatic trends. Temperature explained more variation among PAR than among pollen percentages; however, during the verification period (AD 1864-1953), the former were potentially affected by dating uncertainties, and could not be used. For developing a pollen-based temperature-inference model, we tested ordinary least-squares regression, time-series regression, ridge regression, principal-components regression, and partial-least-squares regression. During the well-dated calibration period (AD 1954-2002), ordinary least-squares regression based on percentages of six pollen types turned out to be the most parsimonious model, having a cross-validated root-mean-square-error of prediction of 0.23°C for mean April-November temperature. A comparison of reconstructed with measured temperature from Sils Maria during the verification period showed that the model best reflected long-term (at least decadal-scale) temperature changes.