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The impact of methodological decisions on climate reconstructions using WA-PLS

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Pollen is widely used for quantitative climate reconstructions. Most techniques, including Weighted Averaging Partial Least Squares (WA-PLS) regression, use modern assemblages as a reference data set. Here we examine the implications of methodological choices on reconstructions made with WA-PLS, using records of the last glacial from Europe. We show that the choice of training data set has a significant impact on reconstructions because it determines the climate space sampled, but that density of sampling at any one point in climate space is less important. Although there is no optimum model in terms of number of regressed taxa, the model improves when more taxa are included. Excluding taxa that are climatically insensitive or over-represented in the assemblage does not affect the reconstructions. However, combining taxa to harmonise the taxonomic resolution of the data provides more reliable results. Failure to account for the ecophysiological effects of low CO_2 leads to a systematic bias in moisture-related variable reconstruction. Lack of independence between climate variables, and the pollen response to interacting variables, could also lead to poor reconstructions. There is no universal solution to these issues, but we propose a number of checks to evaluate the robustness of reconstructions using WA-PLS and similar techniques.