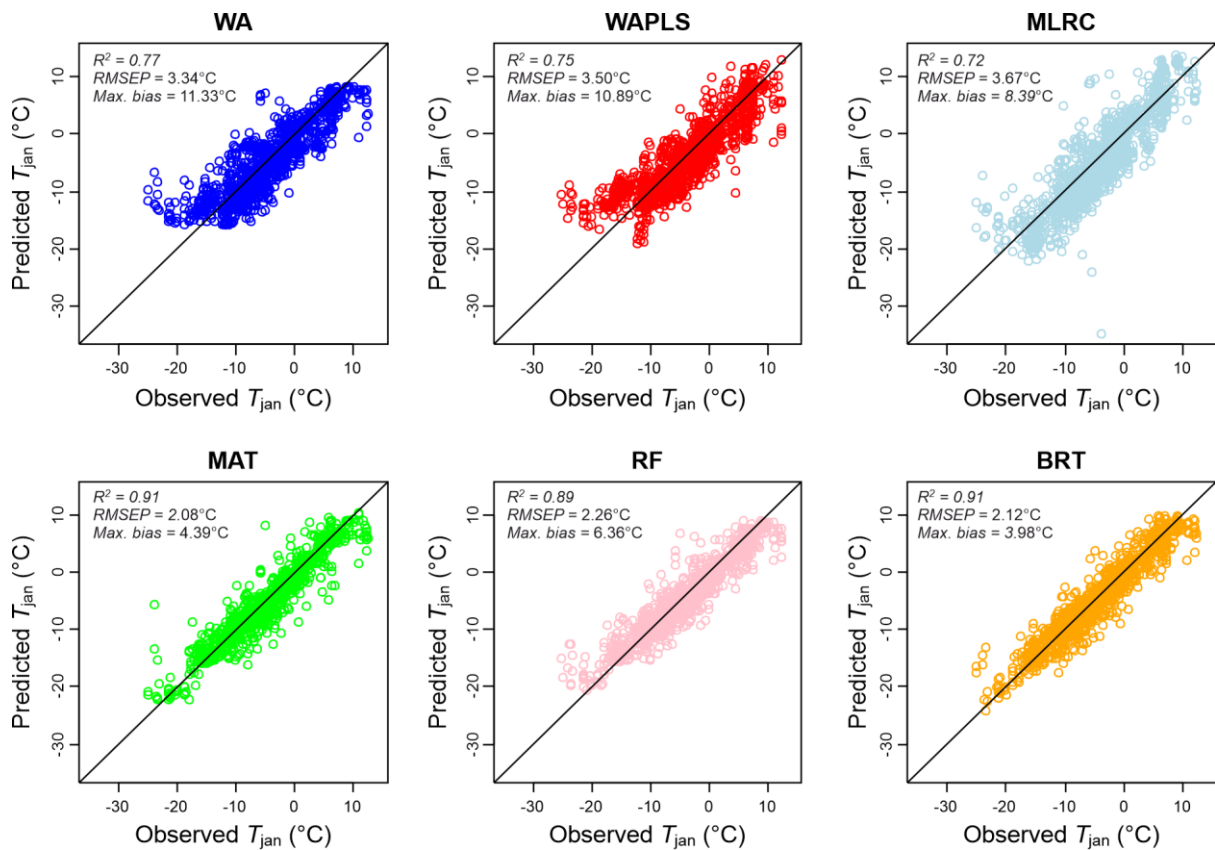


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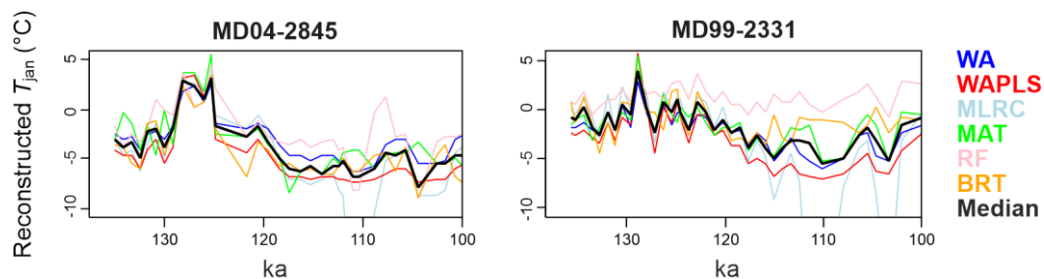
Supplementary Information

Contrasting northern and southern European winter climate trends during the Last Interglacial

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Supplementary Figure 1. Cross-validation performance of the pollen–climate calibration models. Six calibration methods were used: weighted averaging (WA), weighted averaging partial least squares (WAPLS), maximum likelihood response surfaces (MLRC), the modern analogue technique (MAT), random forest (RF) and the boosted regression tree (BRT). For further details about the calibration models, see Supplementary Table 1. The plots show the predicted vs. observed January mean temperature (T_{jan}) values for each of the six models in 10-fold cross-validation. The cross-validation performance is summarized with three figures: coefficient of determination (R^2), the root-mean-square error of prediction (RMSEP), representing a typical prediction error for all samples, and the maximum (max.) bias, calculated as the largest mean of prediction residuals found for any of the 10 equal length segments of the calibration data climate gradient and representing a “worst case” prediction error for a specific environment.



Supplementary Figure 2. January mean temperature (T_{jan}) reconstructions prepared from pollen data from marine cores MD04-2845 and MD99-2331. Reconstructions are prepared with six pollen-calibration models: weighted averaging (WA), weighted averaging partial least squares (WAPLS), maximum likelihood response surfaces (MLRC), the modern analogue technique (MAT), random forest (RF) and the boosted regression tree (BRT). The median of all six reconstructions is also shown (*black*). For further details about the calibration models, see Supplementary Table 1.

Supplementary Table 1. Details and references for the pollen–climate calibration models used. For each model we give the abbreviated and full name of the method, the model parameterization used, and references to papers describing the theory behind the models as well as to the software packages used here to implement the models. All models were run in R (R Core Team, 2020).

Code	Method	Model parameters	Reference (method)	Reference (software)
WA	Weighted averaging	Monotonic deshrinking, tolerance downweighting	Birks et al., 1990	Juggins, 2012
WAPLS	Weighted averaging-partial least squares	2 components	ter Braak and Juggins, 1993	Juggins, 2012
MLRC	Maximum likelihood response surfaces	Default	Birks et al., 1990	Juggins, 2012
MAT	Modern analogue technique	Weighted mean of 5 closest analogues, squared chord distance	Overpeck et al., 1985	Juggins, 2012
RF	Random forest	Number of trees = 100	Breiman, 2001	Liaw and Wiener, 2002
BRT	Boosted regression tree	Learning rate = 0.025, maximum number of trees = 3000, tree complexity = 4, bagging fraction = 0.5	De'ath, 2007	Ridgeway, 2013

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