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Does using different modern climate datasets impact pollen-based paleoclimate reconstructions in North America during the past 2,000 years

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Paleoclimate reconstructions rely on the accuracy of modern climate datasets for calibration of fossil records under the assumption of climate normality through time, which means that the modern climate operates in a similar manner as over the past 2,000 years. In this study, we show how using different modern climate datasets have an impact on a pollen-based reconstruction of mean temperature of the warmest month (MTWA) during the past 2,000 years for North America. The modern climate datasets used to explore this research question include the: Whitmore et al., (2005) modern climate dataset; North American Regional Reanalysis (NARR); National Center For Environmental Prediction (NCEP); European Center for Medium Range Weather Forecasting (ECMWF) ERA-40 reanalysis; WorldClim, Global Historical Climate Network (GHCN) and New et al., which is derived from the CRU dataset.

Results show that some caution is advised in using the reanalysis data on large-scale reconstructions. Station data appears to dampen out the variability of the reconstruction produced using station based datasets. The reanalysis or model-based datasets are not recommended for paleoclimate large-scale North American reconstructions as they appear to lack some of the dynamics observed in station datasets (CRU) which resulted in warm-biased reconstructions as compared to the station-based reconstructions. The Whitmore et al. (2005) modern climate dataset appears to be a compromise between CRU-based datasets and model-based datasets except for the ERA-40. In addition, an ultra-high resolution gridded climate dataset such as WorldClim may only be useful if the pollen calibration sites in North America have at least the same spatial precision. We reconstruct the MTWA to within +/-0.01ºC by using an average of all curves derived from the different modern climate datasets, demonstrating the robustness of the procedure used. It may be that the use of an average of different modern datasets may reduce the impact of uncertainty of paleoclimate reconstructions, however, this is yet to be determined with certainty. Future evaluation using for example the newly developed Berkeley earth surface temperature datasets should be tested against the paleoclimate record.