Challenges and potential in the interpretation of global temperature proxy data compilations

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As the availability of high-resolution proxy records increases, the number of large-scale compilations that are built and analyzed continues to grow. Such datasets allow us to disentangle regional and global climate changes from local and proxy specific effects, to better bridge the spatial scales of local proxy recorders vs. global climate models and they support more objective statistical analyses. However, compilations also often combine data for multiple proxy types and which may record different climate variables (e.g. different seasonal or atmospheric vs. water temperatures). Datasets may also vary in quality, and compilations often ignore the expert knowledge of the authors of the original individual paleoclimate datasets as well as site-specific and proxy-specific effects.

Here I review current and recent studies that have used global compilations of temperature related proxy data to infer the glacial and Holocene climate evolution and the temporal and spatial structures of climate variability. I demonstrate how the analysis of large-scale compilations can not only improve our knowledge of the evolution of past climate but also provide insight into the potential and limitations of specific paleoclimate proxies and emphasize the importance of realistic uncertainty estimates.

Finally I discuss possible future approaches to better use the climate information contained in large-scale compilations without ignoring the idiosyncrasies associated with the specific proxy types and reconstruction techniques.