ROBUSTNESS OF THE MANN, BRADLEY, HUGHES RECONSTRUCTION OF SURFACE TEMPERATURES: EXAMINATION OF CRITICISMS BASED ON THE NATURE AND PROCESSING OF PROXY CLIMATE EVIDENCE

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Abstract

The Mann et al. (1998) Northern Hemisphere annual temperature reconstruction over 1400-1980 is examined in light of recent criticisms concerning the nature and processing of climate proxy data used in the reconstruction. A systematic sequence of analyses is presented to examine issues concerning the proxy evidence, utilizing both indirect analysis via exclusion of proxies and processing steps subject to criticism, and direct analysis of principal component (PC) processing methods in question. Altogether new reconstructions over 1400-1980 are developed in both the indirect and direct analyses, which demonstrate that the Mann et al. reconstruction is robust against the proxy-based criticisms addressed. In particular, reconstructed temperatures are demonstrated to be largely unaffected by the use or non-use of PCs to summarize proxy evidence from the data-rich North American region. When proxy PCs are employed, neither the time period used to "center" the data before PC calculation nor the way the PC calculations are performed significantly affects the results, as long as the climate information actually in the proxy data is represented by the PC time series. Clear convergence of the resulting climate reconstructions is a strong indicator for achieving this criterion. Also, recent "corrections" to the Mann et al. reconstruction that suggest 15th century temperatures could have been as high as those of the late-20th century are shown to be without climatological merit. Our examination does suggest that a slight modification to the original Mann et al. reconstruction is potentially appropriate for the early 15th century (~ +0.05°), which leaves entirely unaltered the primary conclusion of Mann et al. (as well as many other reconstructions) that both the 20th century upward trend and high late-20th century hemispheric surface temperatures are anomalous over at least the last 600 years. Our results are also used to evaluate the separate criticism of reduced amplitude in the Mann et al. reconstructions over significant portions of 1400-1900, in relation to some other climate reconstructions and model-based examinations. We find that, from the perspective of the proxy data themselves, such losses may be smaller than those reported in other recent work.

Use R-Code of MBH Reconstruction

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