Model-Dependent Spatial Skill in Pseudoproxy Experiments Testing Climate Field Reconstruction Methods for the Common Era

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The spatial skill of four climate field reconstruction (CFR) methods is investigated using pseudoproxy experiments (PPEs) based on five Last Millennium (LM) and historical simulations from the Coupled and Paleo Model Intercomparison Projects Phases 5 and 3 (CMIP5/PMIP3) data archives. These simulations are used for the first time in a PPE context, the pseudoproxy frameworks of which are constructed to test a recently assembled multi-proxy network and multiple CFR techniques. The experiments confirm earlier findings demonstrating consistent methodological performance across all of the employed methods and spatially dependent reconstruction errors in the derived CFRs. Spectral biases in the reconstructed fields demonstrate that reconstruction methods can alone alter the ratio of spectral power at all locations in the field, independent of whether there are spectral biases inherent in the underlying proxy series. The patterns of spectral biases are model dependent and indicate the potential for regions in the derived CFRs to be biased by changes in either low or high-frequency spectral power. CFR methods are also shown to alter the pattern of mean differences in the tropical Pacific during the Medieval Climate Anomaly (MCA) and the Little Ice Age (LIA), with some model experiments indicating that CFR methodologies enhance the statistical likelihood of achieving a larger mean difference between the MCA and LIA in the region. All of the characteristics of reconstruction performance are model dependent, indicating that CFR methods must be evaluated across multiple models and that conclusions from PPEs should be carefully connected to the spatial statistics of real-world climatic fields.