Geophysical Research Abstracts
Vol. 20, EGU2018-10001, 2018
EGU General Assembly 2018

No evidence for globally synchronous cold and warm periods during the pre-industrial Common Era

Nathan Steiger (1), Raphael Neukom (2), Juan José Gómez-Navarro (3), and Jianghao Wang (4)

(1) Columbia University, Lamont-Doherty Earth Observatory, Palisades, United States (nsteiger@ldeo.columbia.edu), (2) Oeschger Centre for Climate Change Research & Institute of Geography, University of Bern, Bern, Switzerland, (3) Department of Physics, University of Murcia, Murcia, Spain, (4) The MathWorks, Inc., Natick, United States

Nearly all global and hemispheric temperature reconstructions over the Common Era have been based on widely different reconstruction techniques, methodological assumptions, and heterogeneous proxy collections. This general lack of comparable reconstructions limits our ability to make robust inferences about past climate. Here, we present a new set of global temperature reconstructions over the last two millennia using a wide range of climate field reconstruction methodologies yet all sharing the common PAGES2k v2.0.0 proxy dataset. These methodologies vary from basic proxy composites to widely used linear temperature-proxy covariance methods (Principal Component Regression, Canonical Correlation Analysis), as well as more recent techniques (GraphEM, Offline Data Assimilation, and a variant of the Analog Method). We use ensemble reconstructions from all the methods to uncover the robust features of temperature variability over the Common Era. Specifically, we explore the spatial synchronicity of some key climatic periods of the past two millennia: the Roman Warm Period, the Dark Ages Cold Period, the Medieval Climate Anomaly, the Little Ice Age and the Modern Warm Period. We find, for example, that the coldest 101-year period of the last millennium is most probable during the mid-19th century for over 72% of the globe. However, the coldest 101-year period most probably occurs during the 17th century in northwestern Europe and southeastern North America and during the 15th century over most of the central and eastern Pacific. Additionally, there is not broad agreement among the reconstruction ensemble members for the timing of this minimum: on average over all grid point locations, the minimum occurs within the same century for only 43% of the ensemble members. This lack of spatio-temporal coherence is ubiquitous in nearly all periods studied, and suggests that pre-industrial forcing was not sufficient to produce globally synchronous phenomena at centennial timescales. In contrast to this, the warmest period of the last two millennia is more robustly identified, with a probability of 0.78 that the warmest period occurred simultaneously in the 20th century for over 98% of the globe.