Geophysical Research Abstracts
Vol. 20, EGU2018-13881, 2018
EGU General Assembly 2018

Coherent reconstructions of Common Era global mean temperature using the latest PAGES2k data compilation

Raphael Neukom (1) and the PAGES2k Consortium members (2)

(1) Oeschger Centre for Climate Change Research and Institute of Geography, University of Bern, Switzerland (neukom@giub.unibe.ch), (2) PAGES International Project Office, Bern, Switzerland

Existing global mean surface temperature reconstructions of the past 2000 years show some important differences in trends and variability on interannual to multi-centennial time scales. A systematic assessment of these discrepancies has been hampered by the different input datasets, instrumental targets, and reconstruction parameters and methods.

Here, we present a new set of coordinated global mean temperature reconstructions based on consistent proxy and target datasets and, as far as possible, reconstruction parameters, but using different statistical reconstruction techniques.

We use the global database of temperature proxy records for the Common Era (PAGES2k Consortium, 2017). This global collection contains 692 records of subannual to centennial resolution from eleven different archive types.

Seven different reconstruction techniques are used to generate 2000-year time series of global mean temperatures. These methods range from basic Composite-Plus-Scale, regression-based techniques that have been widely used in the past (Principal Component Regression, Regularized Expectation Maximization) to newer methods (Optimal Information Extraction, Bayesian Hierarchical Models, Pairwise Comparison, and offline Data Assimilation), some of which can account for non-linear relations between proxy values and temperature, quantify uncertainties more explicitly, combine information from proxy data and climate models, or are otherwise based on a spatially explicit reconstruction.

The temperature evolution and validation performance of the different methods are compared to each other and to previous reconstructions and climate model simulations. The agreement across the reconstructions from the various methods is much better over the past millennium (median correlation r=0.76 and RMSD=0.18°C) compared to the first millennium CE (r=0.54, RMSD=0.27°C), when the number of available proxy records is considerably lower.

Our reconstructions show the highest agreement, and remarkably synchronous variability, at multi-decadal timescales. At these timescales, temperature minima are almost exclusively associated with volcanic eruptions. Also, pre-industrial (1-1850 CE) periods of large positive temperature trends are strongly associated with the recovery from volcanic cooling.

Warming trends over recent decades are larger than during pre-industrial times for most ensemble members and exceed the values obtained by proxy surrogates based on random noise on timescales larger than 20 years.