Geophysical Research Abstracts
Vol. 18, EGU2016-15805, 2016
EGU General Assembly 2016
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# Reconstructions of global near-surface temperature change since the mid 19th century

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Incomplete and non-uniform global observational coverage is a prominent source of uncertainty in instrumental records of global near-surface temperature change. In this study statistical methods are applied to the HadCRUT4 near-surface temperature data set to obtain improved estimates of global near-surface temperature change since the mid 19th century. Methods applied include those that interpolate according to local correlation structure (kriging) and reduced space methods that learn large-scale temperature patterns.

The performance of each statistical reconstruction method has been benchmarked in application to a subset of CMIP5 simulations. Model fields are sub-sampled and simulated observational errors added to emulate observational data, permitting assessment of temperature field reconstruction algorithms in controlled tests in which globally complete temperature fields are known.

In application to HadCRUT4 data the statistical reconstructions show relatively increased warming in the global average over the 21st century owing to reconstruction of temperatures in high northern latitudes, supporting the findings of Cowtan & Way (2014) and Karl et al. (2015). There is broad agreement between estimates of global and hemispheric changes throughout much of the 20th and 21st century. Agreement is reduced in data sparse periods and regions, notably in the 19th century and in the southern hemisphere. This finding is supported by the results of the climate model based benchmarks and highlights the importance of continued data rescue activities, such as those of the International Surface Temperature Initiative and ACRE.

The results of this study will form an addition to the HadCRUT4 global near-surface temperature data set.