Geophysical Research Abstracts
Vol. 12, EGU2010-9145, 2010
EGU General Assembly 2010

Climate reconstructions of the NH mean temperature: Can underestimation of trends and variability be avoided?

Bo Christiansen
Danish Meteorological Institute, Danish Climate Centre, Copenhagen, Denmark (boc@dmi.dk, +45 39 15 74 60)

Knowledge about the climate in the period before instrumental records are available is based on climate proxies obtained from tree-rings, sediments, ice-cores etc. Reconstructing the climate from such proxies is therefore necessary for studies of climate variability and for placing recent climate change into a longer term perspective. More than a decade ago pioneering attempts at using a multi-proxy dataset to reconstruct the Northern Hemisphere (NH) mean temperature resulted in the much published "hockey-stick"; a NH mean temperature that did not vary much before the rapid increase in the last century. Subsequent reconstructions show some differences but the overall "hockey-stick" structure seems to be a persistent feature

However, there has been an increasing awareness of the fact that the applied reconstruction methods underestimate the low-frequency variability and trends. The recognition of the inadequacies of the reconstruction methods has to a large degree originated from pseudo-proxy studies, i.e., from long climate model experiments where artificial proxies have been generated and reconstructions based on these have been compared to the known model climate. It has also been found that reconstructions contain a large element of stochasticity which is revealed as broad distributions of skills. This means that it is very difficult to draw conclusions from a single or a few realizations.

Climate reconstruction methods are based on variants of linear regression models relating temperatures and proxies. In this contribution we review some of the theory of linear regression and error-in-variables models to identify the sources of the underestimation of variability. Based on the gained insight we formulate a reconstruction method supposed to minimize this underestimation. The method is tested by applying it to an ensemble of surrogate temperature fields based on two climate simulations covering the last 500 and 1000 years. Compared to the RegEM TTLS method and a composite plus scale method - two methods recently used in the literature - the new method strongly improves the behavior regarding the low-frequency variability and trends.

The potential importance in real world situations is demonstrated by implying the methods to a set of 14 decadal smoothed proxies. Here the new method shows much larger low-frequency variability and a much colder pre-industrial temperature level than the other reconstruction methods.