Geophysical Research Abstracts,
Vol. 11, EGU2009-8077, 2009
EGU General Assembly 2009

Stochasticity and error sources in climate reconstructions.

B. Christiansen, T. Schmith, and P. Thejll
Danish Meteorological Institute, Climate Centre, Copenhagen, Denmark (boc@dmi.dk, +45 39 15 74 60)

We present a systematic study of the properties of reconstruction methods used recently in the literature including regularized expectation maximization algorithms. The study is based on temperature fields where the target of the reconstructions is known. We are in particular interested in how well the reconstructions reproduce low-frequency variability, biases, and trends.

Based on the surface temperature field from a climate model simulation of the period AD 1500-1999 we generate an ensemble of surrogate fields with the same temporal and spatial characteristics as the original surface temperature field. Pseudo-proxies are generated by degrading a number of grid-box time-series. The ensemble approach is necessary as reconstructions include a large element of stochasticity. This means that very different results can be obtained using the same reconstruction method on different surrogate fields. This might explain some of the recently published divergent results.

We find that the amplitude of the low-frequency variability in general is underestimated. All methods systematically give large biases and underestimate both trends and the amplitude of the low-frequency variability. The underestimation is typically 20-50 %. The shape of the low-frequency variability, however, is in general well reconstructed.

Reconstruction errors are decomposed into contributions from the unknown relation between proxies and local temperatures, the incomplete coverage of proxies, and the incomplete knowledge of the covariance structure of the surface temperature field. The latter error source is related to the risk of non-stationarity - the variability in the calibration period may not be representative for the low-frequency changes with time-scales of centuries.