A pseudo proxy evaluation of pattern-based vs. localised climate field reconstructions

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We present a new comparison of two different climate field reconstruction (CFR) methods: The eigenfunction (pattern) based principal component regression (PCR) and a localised stochastic method using a Bayesian hierarchical model (BHM), first proposed by Tingley and Huybers (2010).

We compare the results from both reconstruction methods in a model world, a so-called pseudo proxy experiment. Here, climate field output is taken from a long transient palaeo climate run (the CCSM4 last millennium run with 20th century extension). Time series at locations mimicking real-world data availability are selected: undistorted time series during the instrumental period and a signal distorted by noise during the reconstruction period. As the true target field is know, we can assess the reconstruction quality without resorting to estimates based purely on a short verification period and use error measures such as cross-correlation or reconstruction biases.

While regression based CFRs are based on the decomposition of the climate field into empirical orthogonal functions (EOFs), using spatial teleconnections of the climate field by construction, the presented localised BHM-based CFR does include those not ab inito. Unless the stochastic model is modified to explicitly model these interdependences, the long range information can be lost. However, performance is not reduced should the teleconnections be unstable in time.

We show that even when using a very simple model without explicit long range relationships for the climate field, the BHM-based CFR can outperform the pattern-based CFR, at least in areas with proxy information. Over areas with sparse data, performance decreases for both methods, leading to high reconstruction errors.

Tingley, M.P. and Huybers P. (2010), J.Clim. 23, 2759-2781
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