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DISCUSSION OF: A STATISTICAL ANALYSIS OF MULTIPLE TEMPERATURE PROXIES: ARE RECONSTRUCTIONS OF SURFACE TEMPERATURES OVER THE LAST 1000 YEARS RELIABLE?[1]

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McShane and Wyner (2011) (hereinafter MW2011) demonstrated that in many cases a comprehensive data set of $p = 1138$ proxies [Mann et al. (2008)] did not predict Northern Hemisphere (NH) mean temperatures significantly better than random numbers. This fact is not very surprising in itself: the unsupervised selection of good predictors from a set of $p \gg n$ proxies of varying sensitivities might be too challenging a task for any statistical method ($p/n_c \approx 10$; only $n_c = 119$ out of total $n = 149$ years were used for calibration in MW2011 cross-validated reconstructions). However, some types of noise[3] systematically outperformed the real proxies (see two bottom panels of MW2011, Figure 10). This finding begs further investigation: what do these random numbers have that real proxies do not?

To investigate this question, the present analysis uses ridge regression [RR, Hoerl and Kennard (1970)] instead of the Lasso [Tibshirani (1996)].[4] The regression model used by MW2011 with Lasso and here with RR is

$$y = X\beta + \beta_0 \mathbb{1}_n + \varepsilon,$$

where y is a column vector of n observations (annual NH temperatures), ε is random error, X is a known $n \times p$ matrix of predictors (climate proxies). A vector of regression coefficients β and an intercept constant β_0 are to be determined. A column n-vector $\mathbb{1}_n$ has all components equal one. Proxy records are standardized before use; in cross-validation experiments standardization is repeated for each calibration period.

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[3]Pseudoproxies used by MW2011 are called "noise" here; in climate research, pseudoproxies are synthetic combinations of a climate signal with some noise; without the former, it is a pure noise.

[4]The difference is in the penalty norm: Lasso uses L_1 while RR uses L_2. MW2011 have also argued that a rough performance similarity should exist between different methods for $p \gg n$ problems.