

Interactive comment on “On the verification of climate reconstructions” by G. Bürger and U. Cubasch

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The present manuscript by Bürger and Cubasch is focused on the problem of attaching physical significance to statistical relationships derived from non-stationary timeseries. This problem was recognized almost 80 years ago by Yule (1926) and has been extensively analysed in areas, such as econometrics, where trend time series are the rule.

For instance, the introduction of a paper written by one of the best known authors in econometrics is worth a careful reading:

‘Spurious regression, or nonsense correlation as they were originally called, have a long history in statistics, dating back at least to Yule (1926). Textbooks and the literature

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of statistics and econometrics abound with interesting examples, many of them quite humorous. One is the high correlation between the number of ordained ministers and the rate of alcoholism in Britain in the nineteenth century. Another is that of Yule (1926), reporting a correlation of 0.95 between the proportion of Church of England marriages to all marriages and the mortality rate of the period 1866-1911. Yet another is the econometric example of alchemy reported by Henry (1980) between the price level and cumulative rainfall in the UK. The latter “relation” proved resilient to many econometric diagnostic test and was humorously advanced by its author as a new theory of inflation. With so many well known examples like these, the pitfalls of regression and correlation studies are now common knowledge even to nonspecialists. The situation is especially difficult in cases where the data are trending- as indeed they are in the examples above- because third factors that drive the trends come into play in the behavior of the regression, although these factors may not be at all evident in the data.’

Phillips (1998).

Phillips is alluding at the possibility that correlations between timeseries may arise just because a third factor is driving the trend in both timeseries. Is this possible in paleo-climatological applications? I think it is very well possible. For instance, a proxy indicator sensitive to rainfall, nutrients or other environmental factors may exhibit a trend that can be erroneously interpreted as an indication of temperature trend. A regression analysis between a proxy and temperature that overlooks this possibility takes the risk of not properly estimating regression parameters. If the validation of the regression model is performed in periods where this trend is continued, a high, but perhaps spurious, validation skill is likely to be the answer, specially when using measures of skill that do not hedge against such risks.

Trend-like behaviour may also arise in timeseries series for reasons other than deterministic processes, so called non-stationary unit-root processes. They can also produce spurious correlations between timeseries that are not physically related. There exist a large statistical literature to deal with such situations (see for instance the clas-

sical paper by Granger and Newbold (1974). Unfortunately, the applications of these methods in climate research has been so far very limited (Kaufmann and Stern, 1997).

The National Academy of Sciences includes in its recent report on 'Surface Temperature reconstructions of the last 2000 years' clear recommendations to our community as a whole: 'New analytical methods, or the more carefully application of existing ones, may also help circumvent some of the existing limitations associated with surface temperature reconstructions based on multiple proxies'. I think we all would be well advised paying attention to these recommendations. The Bürger and Cubasch manuscript represents a step in this direction

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