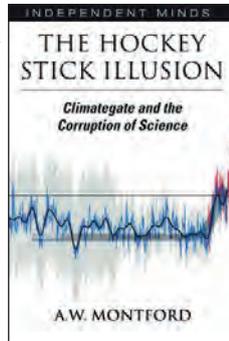


# The Hockey Stick Illusion: Climategate and the Corruption of Science

A.W. Montford

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**T**he **Hockey Stick Illusion** is a passionate but partisan account of a major battle in the 'Climate Wars'. The title refers to the shape of a graph supposedly showing steady average temperatures for a thousand years (the shaft) then a sharp rise around the twentieth century (the blade), giving us an ice hockey stick. The chief protagonists for the global warming hypothesis are the American climatologist Michael Mann and the so-called 'Hockey Team'. On the other side, backed by the author, are two Canadian skeptics: retired mining consultant Steve McIntyre and economist Ross McKittrick. The Hockey Stick appeared in a paper published by Mann along with two colleagues [1].



This paper claims specifically that three years in the 1990s decade were the warmest since 1400. Reliable temperature records only go back around 150 years, so those for the more distant past are estimated using so-called 'proxies': clues in nature such as tree-rings or ice cores. This requires three stages: **Calibration** to determine the mathematical relationship between proxy data and known instrumental temperatures; **Verification** against a different period with known temperatures, and then **Reconstruction** of temperatures in the more distant past. A later paper [2] extended temperature reconstructions back to the year 1000.

The book is largely an account of the efforts of McKintyre and McKittrick to challenge Mann's temperature reconstructions. From their standpoint, Mann and his associates stubbornly withhold reasonable access to their data and computer programs. There is also a strong critique of the peer-review process, and an impression of an elite paleoclimatology establishment closing ranks against critics. One diagram (p. 254) shows links of co-authorship between 43 paleoclimatologists with Mann at the centre – but arguably this would be expected in any specialist branch of science. Montford certainly scores important points, but on closer inspection there are weaknesses in his arguments, and by extension in the sceptics' case.

There are specific allegations over Mann's methodology including the correct use of Principal Component Analysis (PCA) and the statistics used for calibration and verification, and a general charge of 'cherry-picking', i.e. selecting data that fits their chosen hypothesis – a late twentieth century upturn in temperatures of historic magnitude.

On PCA the central criticism is that Mann used an incorrect 'short centring' method which 'created a bias towards hockey stick shaped series – any series with either a twentieth century uptick (or a downtick) would be heavily weighted in the PC1' (PC1 being the first principal component). The criticism appears valid but it is questionable how much it affects the result. Given that temperatures have risen *somewhat* in the twentieth century, it makes sense to give weight to proxies that match temperature trends: this is the Fritts' method which is explained but derided by the author (p. 47).

For the verification statistics Mann used RE (Reduction of Error) which is almost exclusive to climatology. McIntyre and the author prefer the more familiar coefficient of determination,  $R^2$ . The text does explain (p.162) how Mann obtained a 99% confidence level

for the RE statistic, using a Monte Carlo benchmarking method to simulate its distribution.

Referring to the calibration statistics used in [2] McIntyre reports (quoted on p. 67): ' $R^2$  ... ranges from -0.006 to 0.454; on this basis only 2 out of 13 proxies have  $R^2$  adjusted over 0.25'.  $R^2$  must be positive, so the -0.006 may be a simple mistake, but the statement is still misleading. An  $R^2$  value of 0.25 indicates that only 25% of the variability in the proxy can be explained by its relationship with temperature. However there may be enough information over *several* proxies to make reliable temperature reconstructions.

The suggestion of cherry picking is not clear-cut. Referring to a later paper [3] it is explained that 14 proxies were selected by 'eliminating those not genuinely responding to temperature' (p. 299). It is argued that this approach is biased: 'If you take a set of random series and select only those with twentieth century upticks you will get a hockey stick.... The earlier periods are still random numbers, so they continue to cancel out giving the long flat shaft' (p. 300), the essential sceptics' argument. But the selection of proxies is *evidence* based, and the verification stage provides a safeguard against spurious correlations.

The final chapter details the 2009 hack into the e-mails of the Climate Research Unit at the University of East Anglia. These do not support any conspiracy theory but give an impression of scientists, strongly partisan like the sceptics, defensive under siege. On the availability of data and programs, there is clearly an issue of Intellectual Property Rights and simply the burden of dealing with frequent requests (pp. 436–438).

Overall it is a good read for anyone following the Global Warming debate. It is well written and referenced, but it should be read alongside other points of view. The technicalities may be beyond the scope of the general reader and even the mathematician will need to do some background research. The argument clearly comes down to the fundamentals of statistics, which can be misconstrued by either side, where views are held passionately.

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## REFERENCES:

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- 2 Mann M.E., Bradley R.S. and Hughes M.K. (1999). Northern Hemisphere temperature during the last millennium: inferences, uncertainties and limitations, *Geophysical Research Letters*, vol. 26, pp. 759–62.
- 3 Osborne T.J. and Briffa K.R (2006) The spatial extent of 20th century warmth in the context of the past 1200 years, *Science*, vol. 311, pp. 841–844.

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