

## Connolly and Connolly, 2014

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This is a very thorough and accurate review of temperature reconstruction methods and controversy. You are to be commended for putting this together. I agree with most of your conclusions. I also agree with your criticisms of PCA and the practice of weighting proxies. Neither technique is useful in these reconstructions in my opinion. The first 9 of your 10 recommendations are excellent, especially #1.

I would quibble a bit with #10. There is overwhelming evidence that the Medieval Warm Period and the Little Ice Age actually occurred and that they existed over the whole Northern Hemisphere and in many places (at least) in the Southern Hemisphere. The most compelling evidence for these climate anomalies comes of the historical records left by people who were there. Abundant evidence is given by Wolfgang Behringer in his book "A Cultural History of Climate."

The Medieval Warm Period mapping project

([https://www.google.com/maps/d/viewer?mid=1akl\\_yGSUIO\\_qEvrmlYv9kHknq4](https://www.google.com/maps/d/viewer?mid=1akl_yGSUIO_qEvrmlYv9kHknq4)) provides further evidence of the Medieval Warm Period.

So, at least in my opinion, a first validity check of any temperature reconstruction would be to look for warming from 900 to 1200 AD and cooling from about 1400 to 1850 AD or so. The reconstruction will have to match what we know from historical records. Is the Medieval Warm Period warmer than the Modern Warm Period? There is not enough evidence to say. Is the Medieval Warm Period warmer than the Little Ice Age? Yes, we can say that for sure in the Northern Hemisphere and probably many places in the Southern Hemisphere. There is less evidence for the Roman Warm Period and for the Minoan Warm Period.

Finally, I would add one more recommendation based on my own work in this area. Looking over a number of reconstructions it was apparent that the more proxies used, the flatter, less defined and more "Hockey Stick like" the reconstruction was. I'm sure that McIntyre's explanation of Mann's hockey stick errors is correct, but as you add proxies you also move into a hockey stick shape even without the silly PCA methodology. Just averaging a lot of proxies generates a hockey stick like shape.

The proxies are all matched to the rising temperatures seen since 1880, so this is baked into the reconstruction. Prior to 1880, when using a lot of proxies, they tend to cancel each other out due to errors in time and amplitude. When one goes up another goes down when you use a lot of them. This gives the hockey stick handle. The more proxies you add the flatter the handle gets. More is not better. So in addition to your first recommendation to validate the proxies used, I would emphasize that as few proxies as possible be used in any reconstruction. Great attention must also be used in the chronology of each proxy, the dating of the peaks and valleys is very important. All of the proxies must be very robust.

This is a great article and a great reference, I'm sure I will return to it a lot.