Holocene, historic and recent global temperatures from temperature proxies.

Frank Lansner, civil engineer, biotechnology

In the climate debate, the temperatures of the past are used to determine if the present temperatures are unique and alarming. Any viewpoint can be supported by choosing specific science papers as reference This paper is one of many attempts to give a realistic overview of the actual messages we get from the temperature proxies.

("Temperature proxy": Past temperatures reconstructed from samples using a row of techniques.
The "Spaghetti graphs" in the following gives an impression of the huge variability among the datasets. The essence of each graphic is the major trends. To enable display of multiple data series it was often necessary to interpolate temperature values to the specific years used in graphics.
To avoid most calibration problems, I have set specific years to zero for the different graphs I chose a year where practically all graphs has data, and no further calibration needed. In *few* cases I have calibrated from 1980-1990-2000 using UAH trend of approx. +0,1K/decade.)

Recent temperature proxies - 120 years

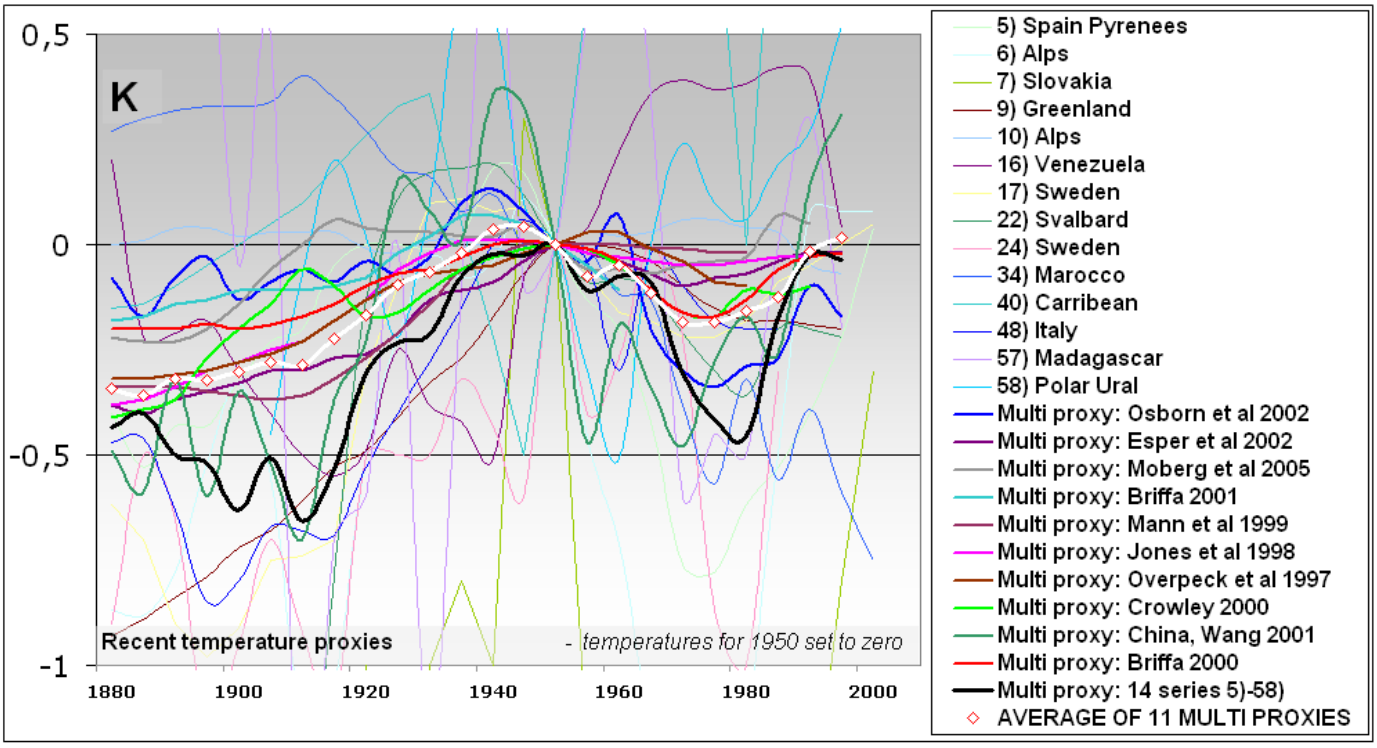


Fig 1: 10 multi proxies shown for the 20´th century. In addition 14 temperature proxy datasets. The black curve shows average of the 14 datasets as 1 multi proxy. This multi proxy + the 10 of the most used bigger multi-proxy series is the basis for the WHITE graph: "Average of 11 multi proxies".

The temperature proxies does not show strong net warming since around 1940. In fact, proxy data does not show any warming since 1940. This is no news, it has been recognised for example here:
http://www.ldeo.columbia.edu/res/fac/trl/downloads/Publications/divergence2007.pdf

The authors call the missing global warming in proxies for "The Divergence problem". And they try to give reasons for this problem using characteristics of trees. But since other proxies than using tree ring proxies

also indicates no global warming after around 1940, the problem seems not related with tree rings measurements.

“The divergence problem”:

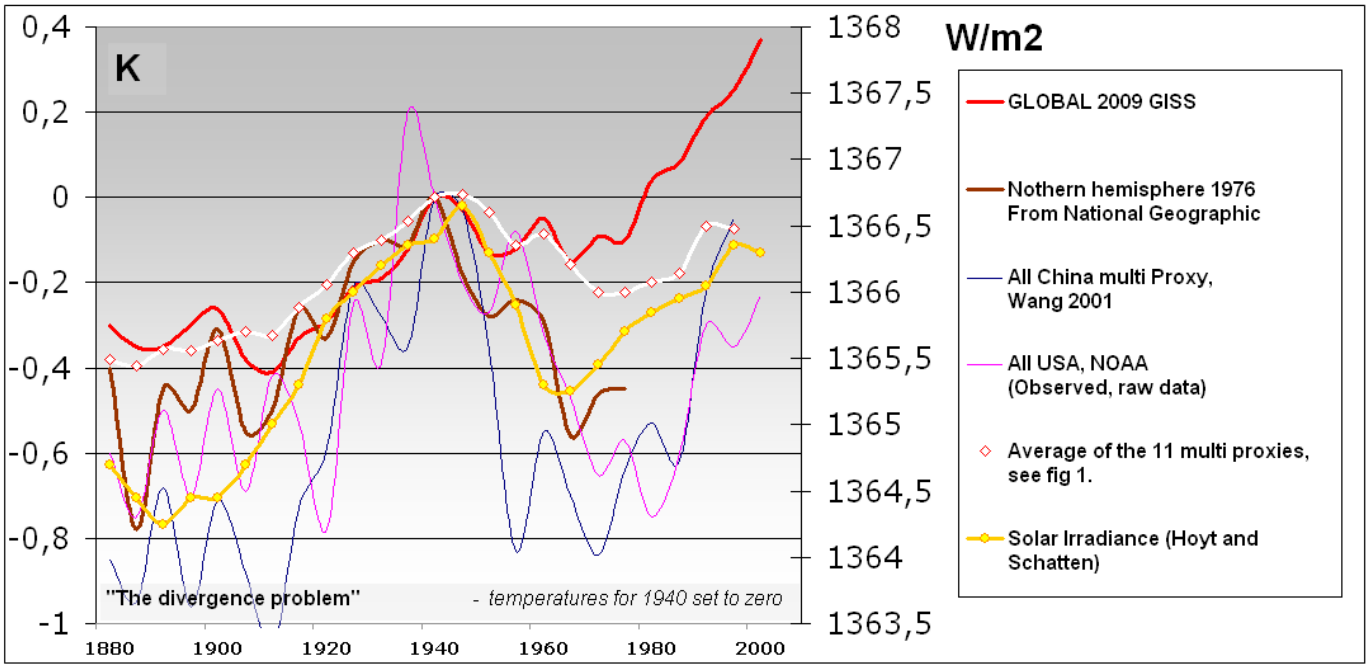


Fig 2: The “divergence problem”.
The “All China” multi proxy: A reliable work where 8 regions of China where studied and then yield the final China multi proxy temperature line. The “All USA”, NOAA raw, is the official measured USA temperatures minus the official correction, that is, the raw USA temperature dataset. I find it stunning how close All-China and All-USA matches each other, see fig 2! (- a dataset of measured temperature compared to a dataset of proxies). And unlike GISS 2009, the Northern Hemisphere temperature set of 1976 supports the raw trends of US and China. Several of the multi proxy series have been smoothed with a “50 year weighted Gaussian filter” etc. and therefore any bigger dive around 1970 could not be seen in the multi proxy graph.

We see a divergence after 1950 between:

- GISS 2009 vs. Average of the multi proxies, that is, the temperature evidence in the ground and trees.
- GISS 2009 vs. USA, CHINA and NH temperatures
- GISS 2009 vs. Solar activity.

So, at least when comparing with mostly raw datasets, the GISS 2009 dataset could seem to be the source of “the divergence problem” – “the outlier”. Problems for the GISS data set might be incorrect adjustments, problems with UHI and poor measuring sites, see www.surfacestations.org!!

The “divergence problem” also seems to vanish when using satellite data (UAH/RSS) in stead of GISS data:

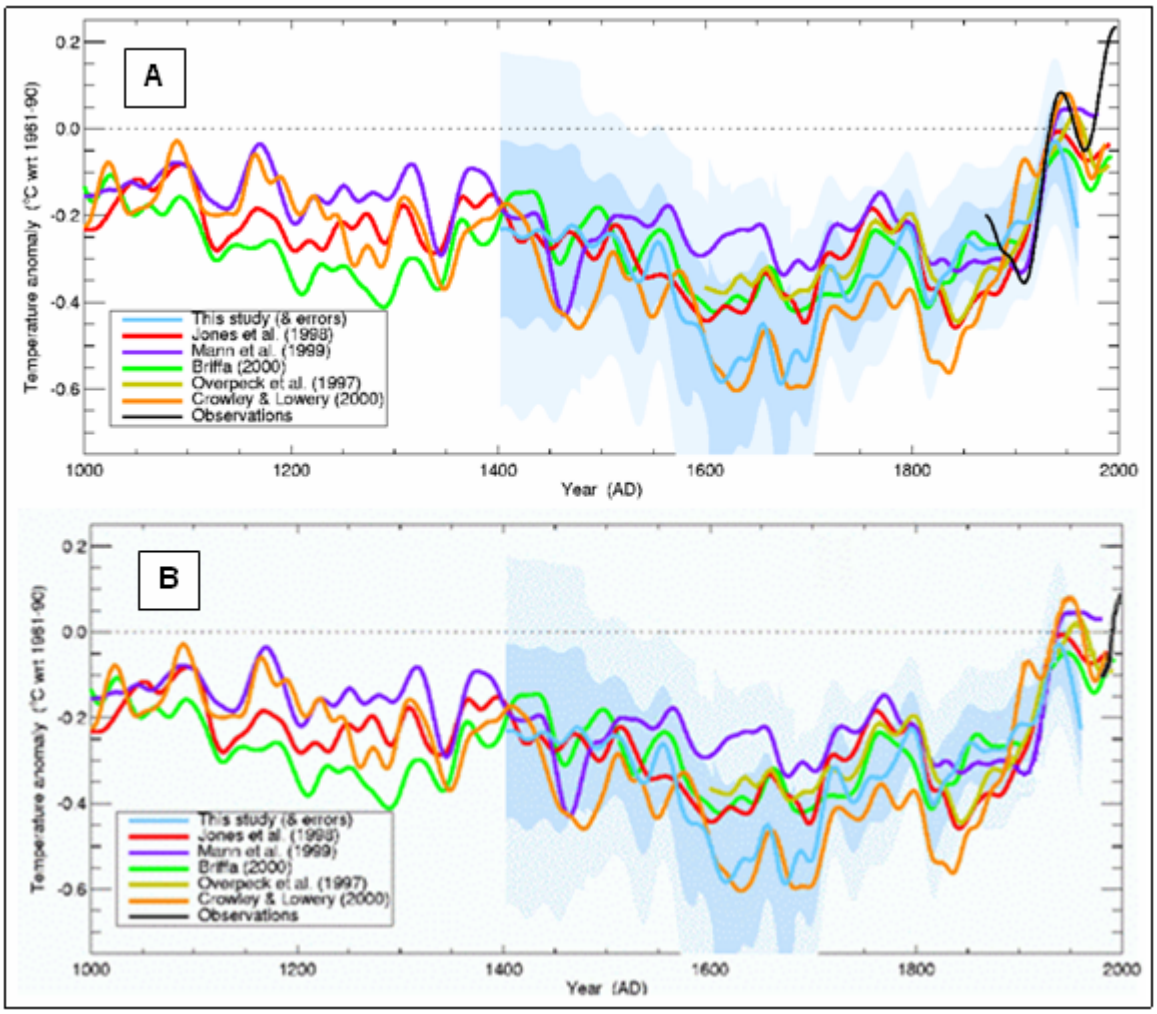


Fig 3: A: Briffa´s 2001 illustration of tree ring proxies combined with the GISS dataset as “Observations” (as the adjusted GISS temperatures are called). B: Same, however this time “Observations” are raw satellite data UAH from 1980 – 2000 with a slope of 0,1K/decade.

There is no divergence problem when using satellite temperature data as “Observations”. We now have total compliance between proxy data and modern temperature measurements stating: No net warming since around 1940-50.

Historic temperature proxies - 1200 years

For this analysis 33 data sets was used. The first that strikes you when working with historic temperature proxies is the apparent chaos of data. However, after keying in 6-8 data sets the well known features “Middle age warm period” and “The little Ice Age” becomes clear. Keying in the rest of datasets doesn’t change much.

First, take a good look at the period 1900 to 2000..
Notice how these 33 datasets confirms the trends from fig 1, the recent temperature proxies. We can conclude that we have a good ability to reproduce the result quite accurate with quite different datasets, and thus, neither of the graphs (fig 1 and fig 4) are likely to reflect “random” results. All data evidence used in fig 1. + fig 4. actually suggests that today’s temperatures resemble the temperatures of 1940-50. Yes, a divergence problem for the temperature data from GISS and Hadcrut.

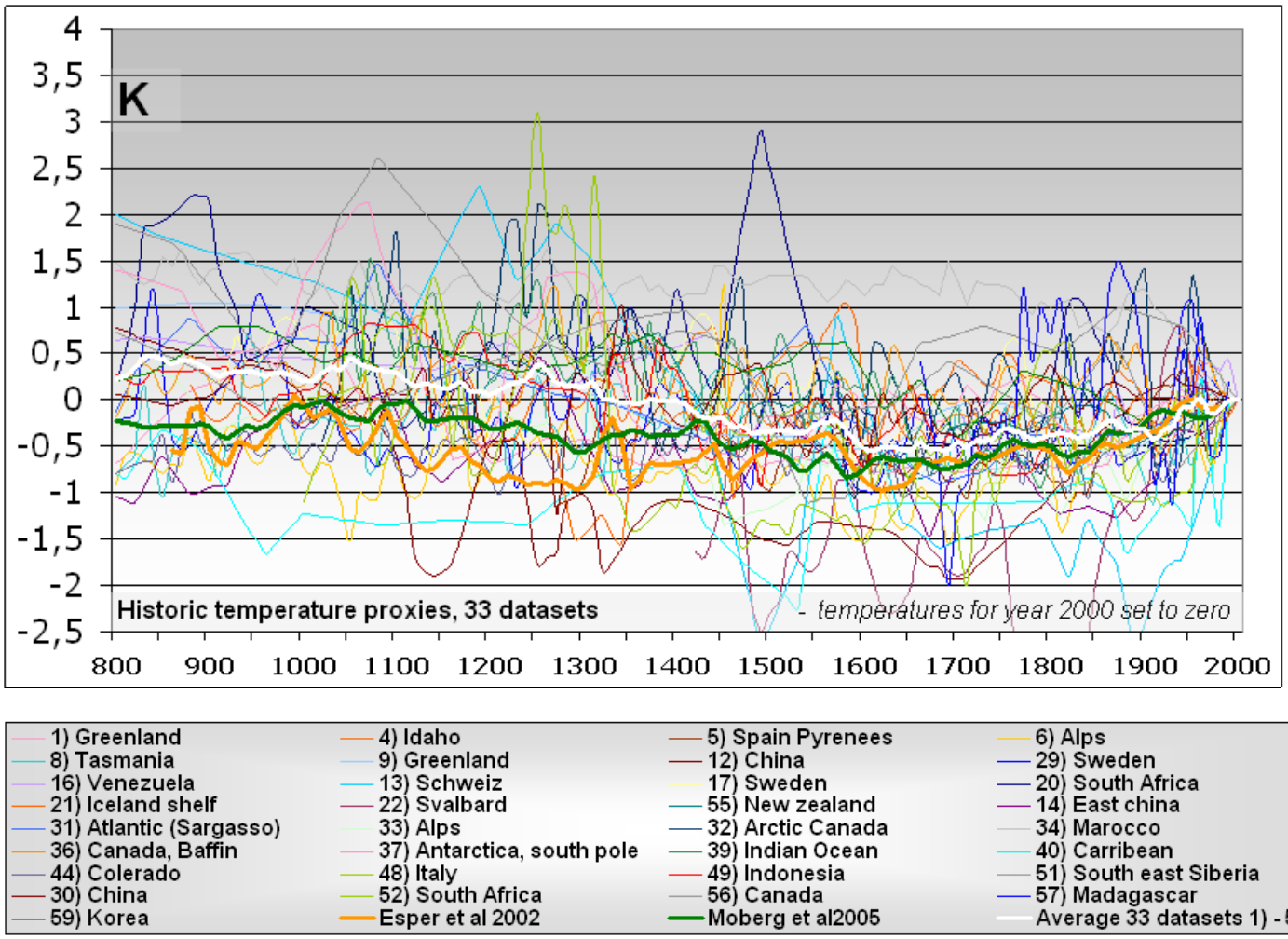


Fig 4: Historic temperature proxy data. Practically all methods and regions of the globe are represented. 6 of the data sets originate from tree ring data.

We see the Medieval Warm Period apparently ongoing already in year 800 and goes on for 5-600 years. First around year 1400 the Little Ice Age really takes over. It was around year 1400 the Vikings left the freezing Greenland.

From year 800 to year 1300 temperatures appears around 0,3 K higher than today. And from around year 1400 to 1900 temperatures appears to be are around 0,4 K lower than today. A difference from MWP to LIA of 0,7 K in average globally. (Max difference approx 1,1 K),

We will return to these historic data later, but lets first take a look even further back in time.

Holocene temperature proxies - 12000 years

For this analysis 29 long datasets where used. All graphs are calibrated to zero for year 1000.

First focus on years 800 to 2000...
Once again we see a reproduced trend between 2 different data sets. And again, the accuracy is nice. The MWP here appears almost **0,8 K** degrees celcius warmer than the LIA, very close to what we saw it on fig 4, the historic data **0,7K**. This once again confirms the impressing usefulness of data despite the chaotic and random appearance. There is however a tiny difference between the 2 graphs, around **0,1K**. But it should be noted, that for the Holocene temperatures, no tree ring data was used. According to Loehle 2007, tree ring data tends to suppress the MWP somewhat. This we will return to.

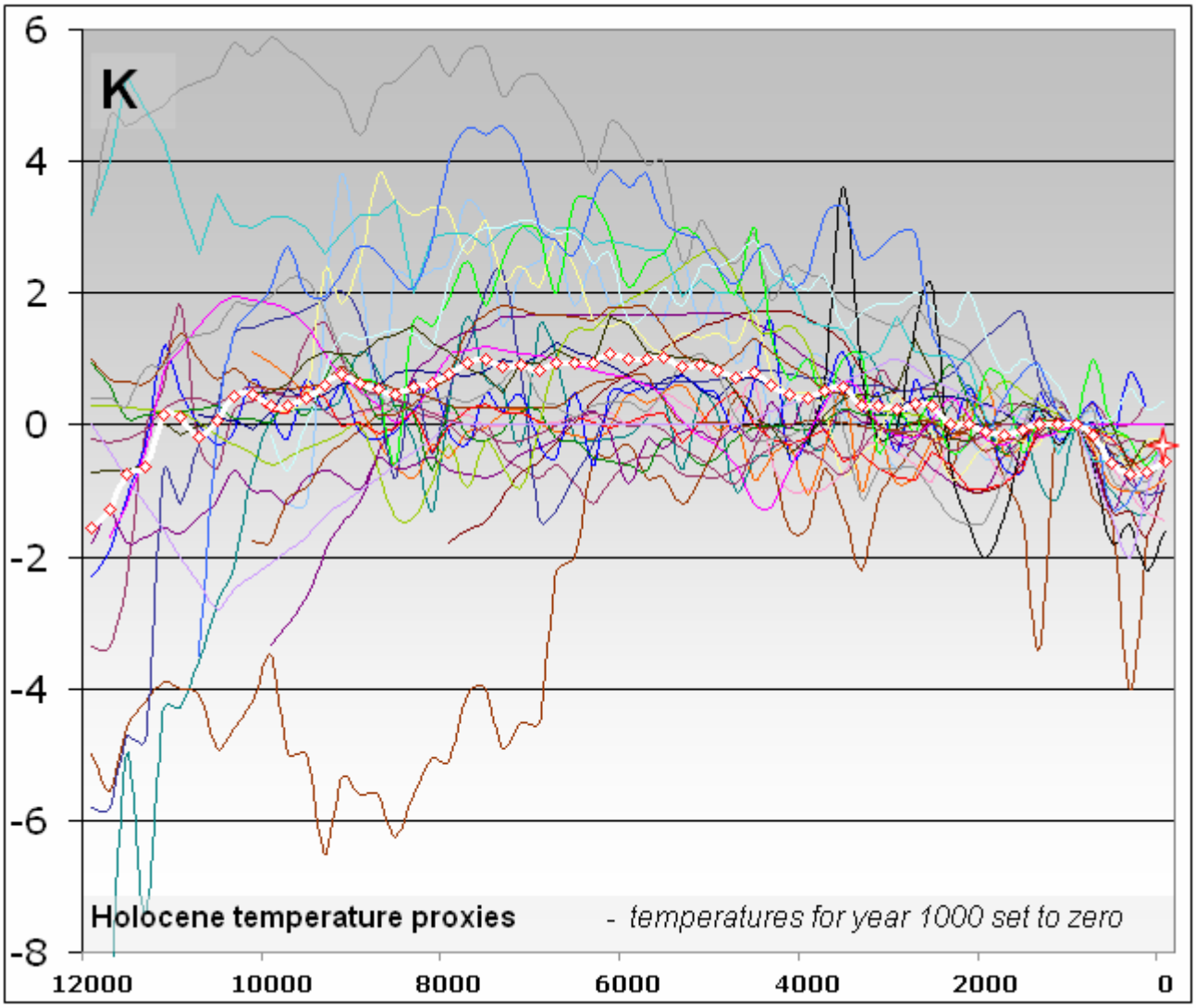


Fig 5: Holocene temperature data.

The data point for year 2000 are based on too few datasets to be really trustworthy. Therefore I have inserted the red star where I use the value of todays temperature taken from fig 4, historic temperatures. By doing so, temperature for year 2000 got 0,2 K warmer than from Holocene data.

Fig 5 also shows that the whole debate about MWP is irrelevant. Imagine there was no MWP. Practically ALL of the Holocene period the eath appears to be between 0,5 and 1,5 K warmer than today. The little ice age does resemble a mini ice age or at least it appears to be the coldest period in over 10.000 years.

Finally, the overall picture from the graph is an almost perfect mathematical curve that tops around 5-6000 years ago. These Data tells the story quite clear: We are on a down trend in temperatures globally, we should not fear warmth by now. How much lower can the temperatures on earth go before we reach a tipping point to much colder temperatures at earth?

Medieval warm period

Arguments against the MWP often focus on the “fact” that the warmer temperatures from that period are a phenomenon exclusively to have appeared on the northern hemisphere.

Fortunately, the results from fig 4 and fig 5 shows an excellent match for the period year 800 to year 2000. It thus makes very good sense to combine the datasets and then obtain a better data foundation to analyse the MWP.

Datasets from fig 4 and fig 5 combined, a northern/southern hemisphere display of the Medieval Warm Period:

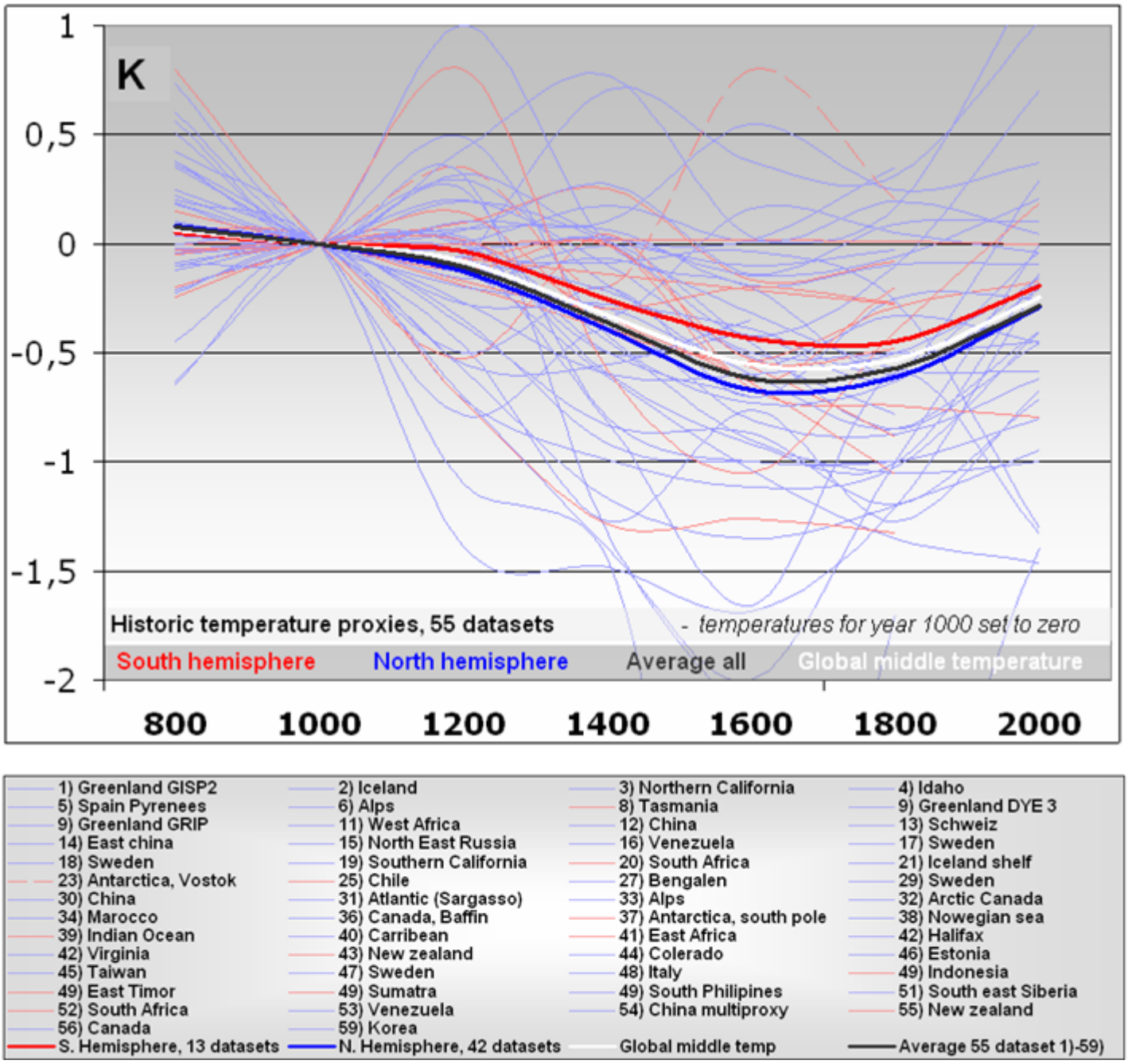


Fig 6: Historic temperatures, North and south hemispheres separated. Let’s first see what the graph actually says, very roughly:

NH MWP, 42 datasets:
Ongoing in year 800, **temperatures mostly 0,3-0,4 K higher than today.**
The temperature creeps below today's level and **ends around year 1300**.

SH MWP, 13 datasets:
Ongoing in year 800, **temperatures mostly 0,2-0,3 K higher than today**.
The temperature creeps below today's level and **ends around year 1350.**

Northern hemisphere is still much better represented than the southern hemisphere, so what can we conclude on this ground? Can we conclude anything?
On this ground I find it safe to accept the NH M**W**P approximately as described above.

To accept that globally there where no M**W**P, we will have to accept the following:

The 2 hemispheres have the ability to maintain a quite different temperature development for at least 500 years and did so from year 800 to year 1300.

What can we demand to accept this idea? We can demand solid evidence.
Anyone claiming the above must present solid evidence for a **M**EDIEVAL **C**OLD **P**ERIOD on the southern hemisphere.

IF data showed that the southern hemisphere had a M**C**P where temperatures for 500 years was 0,3-0,4 degrees colder than today, would this "kill" the MWP? Certainly not. Because, then we would have had 500 years with global temperatures just like today globally… - In that case, certainly no reason to be alarmed about the temperatures today.

No, if today's temperatures should be alarmingly warm, the S. hemisphere temperature should show a very strong M**C**P at least 0,4 degrees colder than today in the 500 year period.

Is there ANY indication of a 500-year strong M**C**P in the southern hemisphere indicated in the data above? No, certainly not. There are not that many SH data, but still, there is not the slightest indication of a strong M**C**P on the S. Hemisphere.

Until the strong 500 year long M**C**P on SH has been proven, there is nothing that shakes the acceptance of a global MWP with temperatures resembling or higher than today's temperatures.

I believe a massive use of tree ring graphs exclusively might show a strong southern M**C**P. In this case, the idea that there is no MWP globally is dependent on only on one specific method of making temperature proxies, tree rings. Tree rings are 1 of at least 20 different methods to measure temperatures of the past. As such, they should never dominate the measurements.

The South pole and MWP:
While examining temperature proxies, I found some odd results:

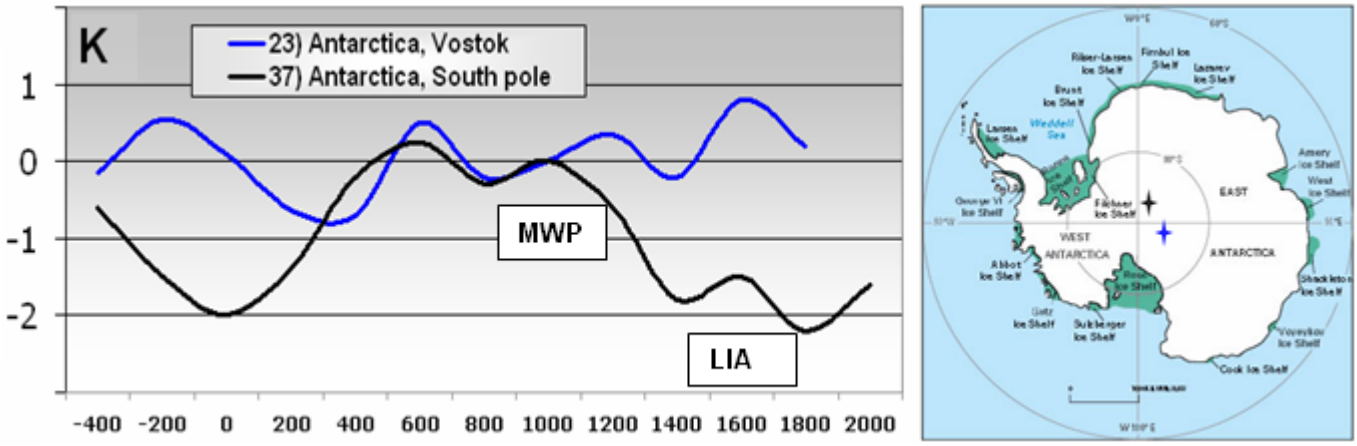


Fig 7: -A stunning mismatch between 2 Antarctic data series.
Not only are they both from Antarctica, but they are both from near the south pole. The well known **"MWP-signature"** has found its way not only to the Southern hemisphere, but to the south pole. But in the near by Vostok location, for many centuries, there has been absolutely no sign of the MWP? Obviously this is absurd, so at least one of the two results is not accurate.
The black graph (from "Remote Plateau") has a resolution of 1 – 3 years per sample, excellent. The blue graph (vostok) has approx 23 years between data points. Both series should be considered fine quality then. How likely is it, that the "MWP/LIA-signature" has come up in "Remote plateau" (black graph) data by a coincidence? When it has also been spotted many other places on the SH? See **fig 6**: The Vostok data has a dotted red line. How well does vostok data then fit the rest of the Southern hemisphere data?
The use of vostok data also moves the SH temperature profile away from the NH average.

Tree rings

If the MWP only disappears using one a specific measuring method, the idea as well as the method is invalid. Proxy temperature data from tree rings are easy to get, but the quality?

Craig Loehle: "There are reasons to believe that tree ring data may not capture long-term climate changes".

Indeed. A good warm year will obviously help a tree growing, but decades of increasing temperatures could affect the whole area so for example more trees might be able to survive, the root nets would only be able to grow to some extend for other trees etc.
Example: Imagine that a warming after decades is accompanied by 10% more trees surviving in an area and eventually demands their "place in the sun". By measuring tree rings for an individual tree you are not measuring the overall tree growth of the area. And measuring 10.000 trees does not change anything as all trees would have the same problem. Measuring tree pollen or isotopes etc in sediment cores avoids these problems and it makes me wonder how come so much energy has been used for tree ring analyses.

Selective adjustments?
Many kinds of adjustments are used in connection with climate results. But one adjustment I haven't heard of is the down-adjustment of recent temperatures from temperature proxy data due to CO2-induced extra growth. If the CO2 level is indeed extraordinary high, then it is a fact that plants grow markedly more. And they grow at higher altitude etc.

Here is an impressing overview of plant response to extra CO2 in the atmosphere:
http://www.co2science.org/data/plant_growth/dry/dry_subject_p.php

I have chosen the letter P for the link since several tree ring analysis are made for pine trees. Check the responses for pine trees when adding extra CO2.

Therefore any temperature proxy based on plant growth should be adjusted down in times of high CO2. Otherwise you will measure CO2 and not heat. But this obvious kind of adjustment seems not to happen?

Or? Can it really be, that the crew of alarmists so happy for adjusting for all kinds of tiny issues, simply don't adjust when there is a really good reason to do so?

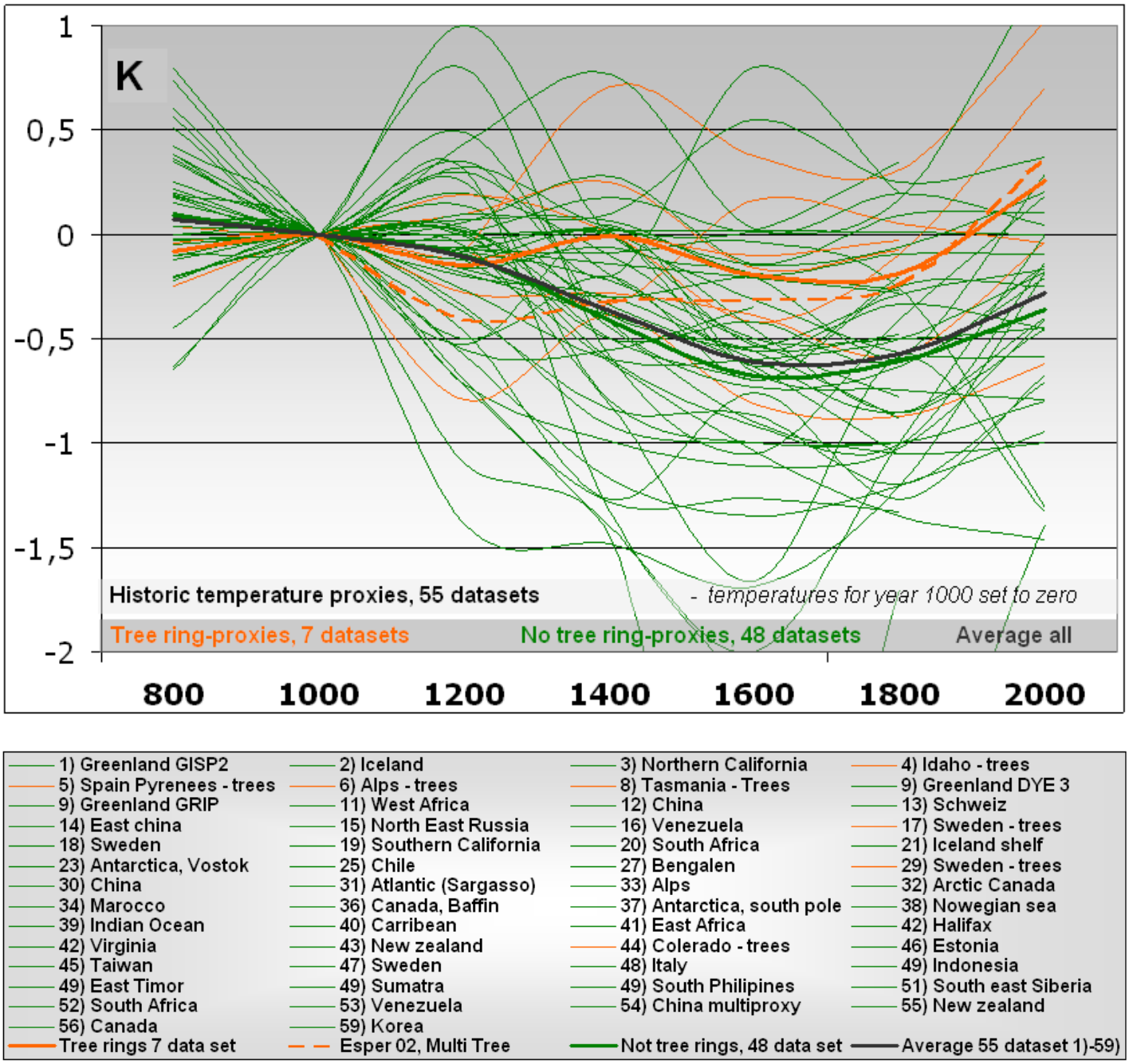


Fig 8: Historic temperature proxy data with focus on tree ring-method. In the analyses I have used, it turned out that 7 of 55 datasets where from tree rings. On this figure, these 7 datasets actually does seem to differ in trend from all the rest. The 7 tree ring datasets suggests no MWP, in fact, they suggest that the MWP was 0,3-0,4 K COLDER than today's temperatures. Quite the opposite result than the majority of datasets concerning MWP.

On might say that these 7 datasets are too little a basis for any conclusion, and therefore I have included a bigger tree ring multi proxi, "Esper et al 2002" and the trend from the 7 tree ring datasets are confirmed: Unlike all other methods, tree rings shows no warm MWP.

Example, the European Alps:

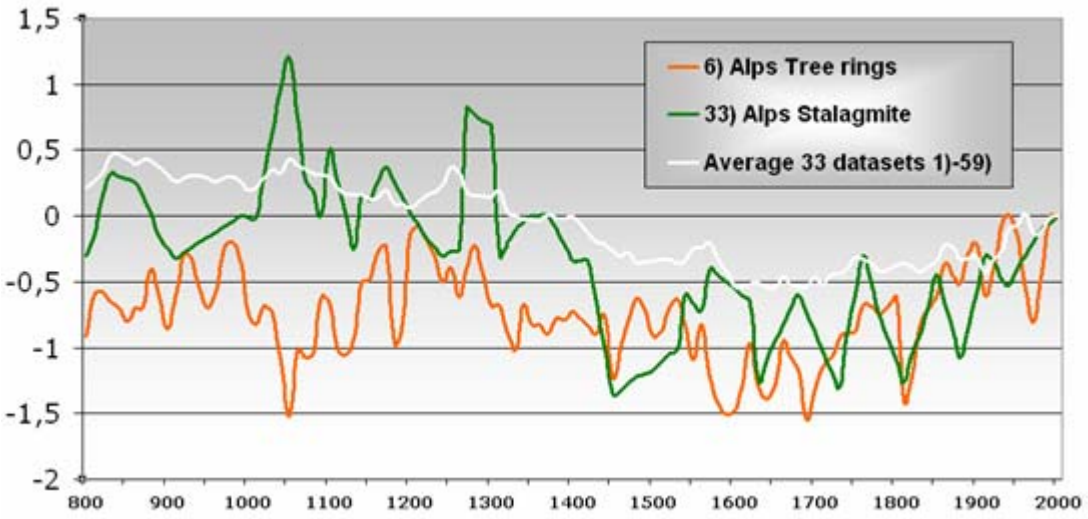
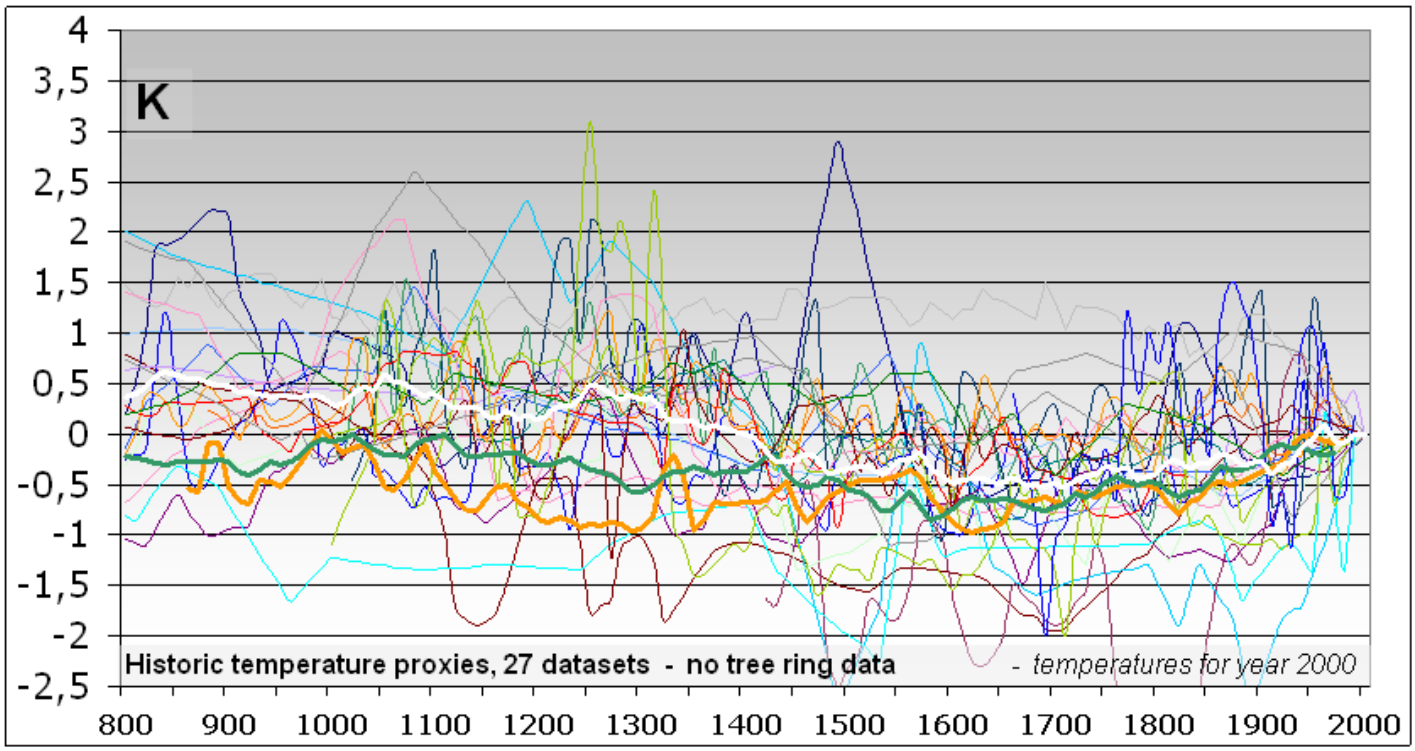


Fig 9: Here from fig 4, we have 2 different temperatures in the same area, the European Alps.
Quite like Antarctica, we have 2 datasets, one showing the well known **"MWP/LIA-signature"** and one not showing this. Both cannot be correct, so we know that at least one of the datasets is faulty.
In addition, these measurements where taken in the middle of Europe where we have an overwhelming amount of non-tree temperature proxy datasets confirming a very warm MWP.
Therefore, if the tree ring method was useful, we definitely should see a warm MWP from tree ring data in Europe. But we don't. And unless all the other temperature proxy methods just shows a very warm MWP in Europe by coincidence, the tree ring method does appear to be the faulty method.

The tree graph appears flat compared to the other methods (– a "yummy" to use if you want to produce a hockey stick), but we are not here to produce a hockey stick, we seek the temperatures of the past.
Now it becomes relevant to examine jus non-tree temperature proxies (As Loehle concluded) for better accuracy:



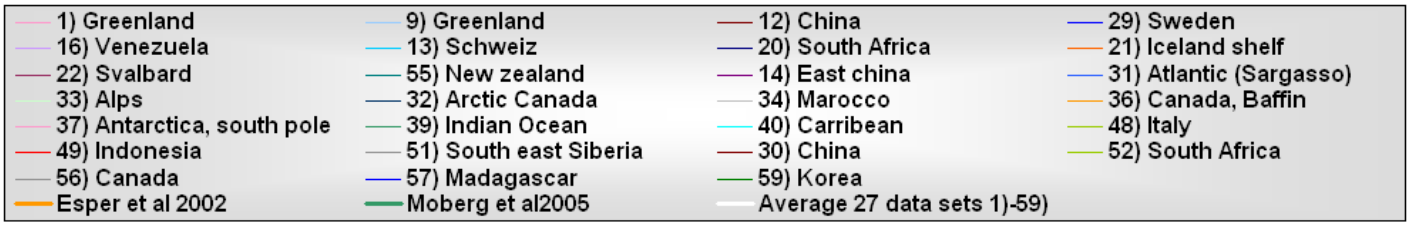


Fig 10: The Historic temperature proxy trend based on 27 non tree ring proxies show a slightly warmer MWP than when including tree rings, fig 4. The average temperature for year 800-1400 is approx **0,4 K** warmer than today, and the years 1400-1900 is around **0,4 K** colder than today. So the non tree historic temperatures now gives a MWP/LIA difference of **0,8 K** like the (non tree) Holocene temperatures, fig 5.

We even see "peaks" in the MWP up to **0,6K** warmer than today, and now 1950 actually appears slightly warmer than today.

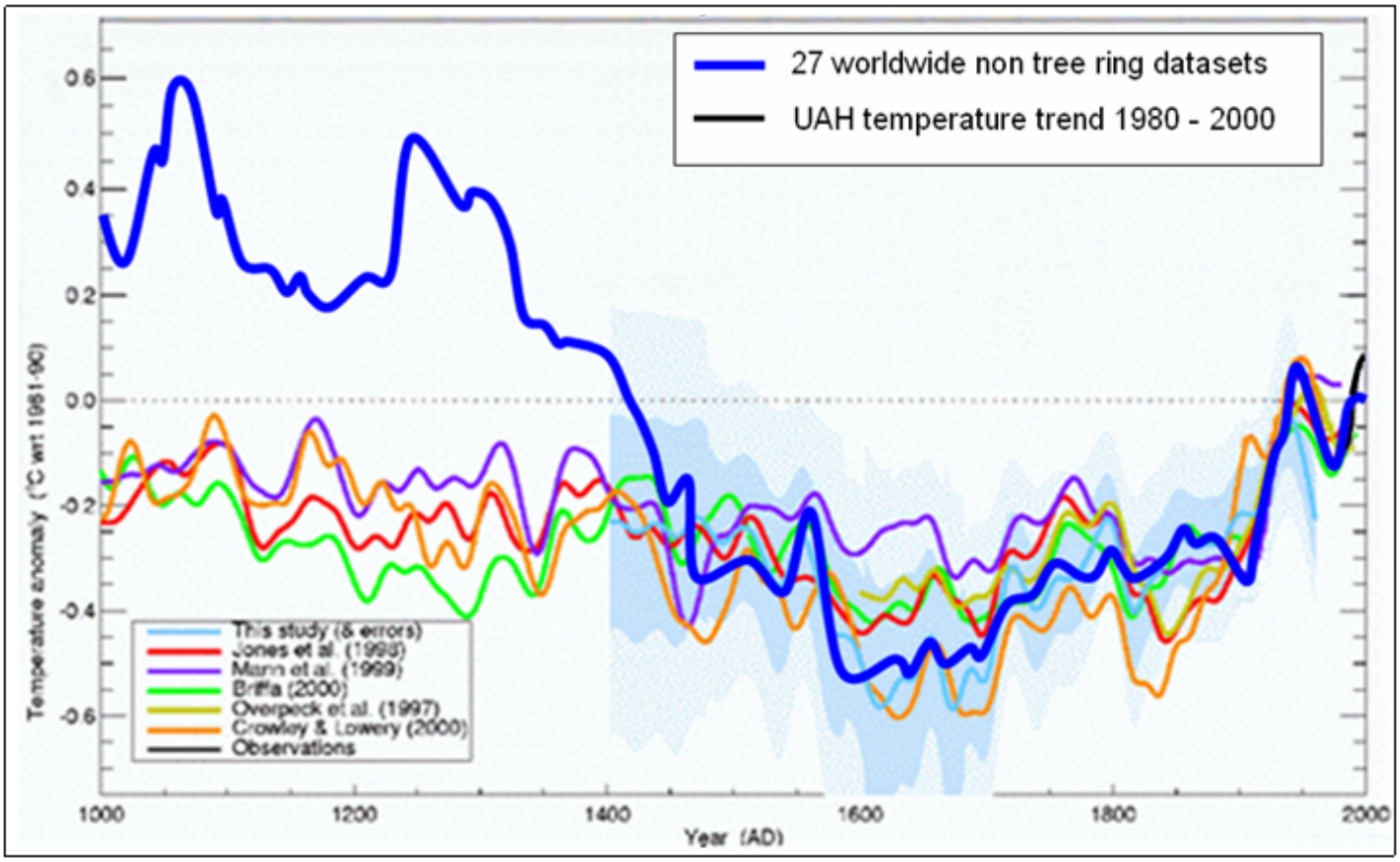


Fig 11: Briffa's 2001 all tree ring proxy data, compared with non tree ring data.
First of all, I have every respect for the huge work done using tree rings. There are indeed many sources to errors (like the idea about different SH/NH temperature development etc.) – but despite all, this graph speaks a very clear language.
Here we see the 27 datasets of non-tree rings, together with the well known tree ring graphs.
It becomes clear, that the non tree rings world wide - THICK BLUE CURVE – matches extremely well in the 20'th century and all the way back to year 1450. Then exactly as the MWP starts, the tree rings and the non tree rings simply "looses contact".

What ever the reason for the differences between tree ring or non tree ring temperature proxies, it becomes evident, that choosing tree rings or not is the same as choosing a MWP or not.

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One partly explanation for this huge mismatch could be CO2. If indeed the CO2 concentration today is a lot higher in the atmosphere than it was in the MWP, then trees simply grows faster than in the MWP, apparently even though temperatures are not higher.

Some of the non-tree-ring measurement methods includes Be, O and C isotopes etc, that in some cases are more independent of changing tree growth or the like. These methods would be preferable if we wanted to clear CO2-induced errors on temperature measurements.

Conclusion:
- Its way too early to consider the MWP gone. There is a lot of scientific work to be done before any such conclusion has any weight. MWP disappears when using tree ring data.

- In this writing we see that 48 non tree ring temperature proxies combined shows a MWP around 0,4 K warmer than today, lasting at least 500 years.

- Besides the MWP discussion: 80-90% of the Holocene period (last 10-12.000 years) has been warmer than today. The last 6000 years, the general temperature trend has been steady cooling. The temperature levels in the Little Ice Age were the lowest in the Holocene period.
I find it relevant to study the consequences of further cooling.

- Except for strongly adjusted temperature data, there is compliance between recent temperatures measured from satellites, evidence from tree-proxies, evidence from non-tree-proxies and more showing that: It does not appear warmer today than around 1940-50.
This is in compliance with solar activity in the 20'th century.
This does not suggest a warming effect of CO2 in the atmosphere.

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2) Andersen et al., 2004	A high unstable Holocene climate in the subpolar North Atlantic: evidence from diatoms
3) Barron et al., 2003	High-resolution climatic evolution of coastal northern California during the past 16,000 years.
4) Biondi et al., 1999	July temperatures during the second millenium reconstructed from Idaho tree rings.
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7) Büntgen et al., 2007	Growth responses to climate in a multi-species tree-ring network in the Western Carpathian Tatra Mountains, Poland and Slovakia
8) Cook, E.R., et al. 1998	Tasmania Temperature Reconstruction
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10) D'Arrigo et al., 2006	Alpine Spruce Composite tree-ring record - living and historical material
11) DeMenocal and Ortiz 2000	Coherent High- and Low-Latitude Climate Variability During the Holocene Warm Period
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19) Hendy and Kennett, 2000	SST estimates from planktonic foraminiferalassembl ages
20) Holmgren., et al. 2001.	A preliminary 3000-year regional temperature reconstruction for South Africa
21) Hui Jiang et al., 2005	Evidence for solar forcing of sea-surface temperature on the North Icelandic Shelf during the late Holocene
22) Isaksson., et al., 2006	Austfonna ice core - Svalbard
23) J. R. Petit et al., 2000	Historical Isotopic Temperature Record from the Vostok Ice Core
24) K. Antonsson,. et al. 2008	Anticyclonic atmospheric circulation as an analogue for the warm and dry mid-Holocene summer climate in central Scandinavia
25) Kaiser, J., et al 2005	A 70-kyr sea surface temperature record off southern Chile
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27) Kim et al., 2002	Alkenone-base sea surface temperature record (8C) for core from the Benguela Current
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30) Liu, Z., 2006	Alkenone-based reconstruction of late-Holocene surface temperature and salinity changes in Lake Qinghai, China
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32) M.R. Besonen., 2008	A record of climate over the last millennium based on varved lake sediments from the Canadian High Arctic
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1996

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46) Seppa et al., 2003	Holocene annual mean temperature changes in Estonia and their relationship to solar insolation and atmospheric circulation patterns
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51) Tarasov., et al 2009	Late Glacial and Holocene changes in vegetation cover and climate in southern Siberia derived from a 15 kyr long pollen record from Lake Kotokel
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