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20th December 2010

Presenting a Formal Request to audit BOM and CSIRO Climate Data and Advice

The following is a request and justification for the independent audit of the Bureau of Meteorology (BOM) climate record data, particularly the data and algorithms that contribute to the formal assessments of Australian climate change provided by BOM and CSIRO to the Australian government.

BOM Data is vitally important to the nation

The CSIRO and Bureau of Meteorology (BOM) are publicly funded institutions. The Government relies on advice from these organisations. Decisions based on BOM data and CSIRO may increase taxes and will direct the allocation of billions of dollars in the Government and private sectors.

There are currently no independent audits of climate data

Despite their importance, there are no truly independent audits of the quality and accuracy of some of that data and information provided to the Government and to the public from these organisations. Audits are a safeguard to ensure there is no possibility of politically or ideologically motivated manipulation of records and advice.

Unexplained adjustments and errors have been discovered

Preliminary surveys of the BOM temperature record by independent analysts including engineers and scientists have found large, unexplained, non-random changes to original temperature data and in some cases clear errors. Officials inside the BOM have not to date provided adequate justification or a detailed record of the discrepancies identified.

Artificial adjustments exaggerate the warming

A BOM spokesman has claimed that the adjustments make little difference to the overall trend reported for Australia and are simply made to improve data quality. Yet independent checks suggest that the adjustments may account for ***as much as a third*** of the reported warming trend in Australia.

Some questions that would be answered by the audit are:

- Why have raw temperature records from the middle of the last century been artificially reduced? Are we to believe that 50 years ***after*** the measurements were recorded BOM officials realized they were artificially too high?
- Why were so many thermometers believed to be overestimating temperatures in the first half of the 1900's?
- Where are the records detailing the justification for altering the historical record for each station?
- Does the lowering of temperature records from the middle of last century result in an artificially exaggerated warming rate of the temperature record?

Independent checks also suggest:

- The BOM temperature record includes sites with 100 year long "records" which are based on just 12 years of actual data. An undisclosed method was used to construct an extraordinary ***85% of the graph***. (Appendix I)
- The BOM database appears 'buggy' with averages for an entire month across a large state suddenly changed upwards three months after the readings came in. The "bug" in this case produced a change comparable in size to the **entire reported warming trend over the last hundred years.** (Appendix I)
- It has been shown that nearly 90% of temperature stations in the US are sited too close to artificial heating sources. There has been no independent auditing or checking of Australian temperature station sitings. It is reasonable to assume that some similar siting problems may exist in Australia. Predominantly, poor sitings lead to an exaggeration of warming trends. If an audit is done and changes are made to the temperature record, it must be done so on a site by site and transparent basis to ensure the changes can be checked and justified.
- The US Goddard Institute of Space Studies has produced graphs with copies of the BOM data which are missing values which materially affect the results. BOM apparently does not notice, or is not checking, or does not report errors in order to make sure that international agencies are using accurate Australian records. Scientific conclusions are drawn by Australian, International and IPCC scientists based on the GISS presentation of Australian temperature records.(Appendix I).

Given the acknowledged national importance of our climate data The Australian people should not have to rely on volunteer members of the public to identify these errors and omissions. The Hadley Centre of the British Meteorological Office has accepted the need for a checking and revision of the HADCRUT global temperature record that they supply to the IPCC. So too, **an independent audit of BOM climate data records is needed now.**

Urgent action is needed

These disturbing findings should be referred to the Australian National Audit Office (ANAO) as a matter of urgency to carry out a complete audit of the BOM climate records, if necessary by subcontracting some of the detailed aspects of the work to independent, skilled scientists. It is important that the Australian Government and the Australian public have complete confidence in the BOM records and the reports produced by BOM and CSIRO based on those records. That is not currently the case. The following are more specific, detailed case studies of why an independent audit of BOM data records are urgently needed.

1. **Serious questions have been raised about the quality, accuracy and political motivation driving the Australian temperature records. Recent research as reported in several new articles show that the bulk if not all of the recently recorded temperature data being used by policymakers and being supplied to the media could contain serious flaws and bias.** [Source **APPENDIX I**: Australian Temperatures in cities adjusted up by 70%!?, Australian warming trend adjusted up by 40%, BOM, GISS have record setting bugs affecting a million square miles? From http://joannenova.com.au/]

    a. When Ken Stewart wrote questioning data adjustments with Dr David Jones, Head of Climate Monitoring and Prediction, National Climate Centre, Bureau of Meteorology, Dr Jones replied that their adjustments have ***"a near zero impact on the all Australian temperature".*** Yet when Ken looked at the raw data from Australia's 100 high quality rural sites, the adjustments *increased* the trend in the raw data by 40% — **from a 0.6°C rise over 100 years,** to **0.85°C over 100 years. These are clearly not random, and obviously not "zero impact".** [Source: Appendix I - Joanne Nova]

Ken has written again to BOM, and to MP Tony Burke, asking for explanations for the adjustments, but has not received a reply. We need the answers to the 8 questions Ken Stewart poses in Appendix II.

b. Chris Gillham (Appendix III) noted that on November 17 2009 **the mean temperatures for *all WA recording stations* were** adjusted upward by as much as 0.5 °C for August 2009, making it the "hottest on record". The incorrect temperatures, according to the BOM were due to a "bug". This is a very large correction across 2.5 million square kilometres and over all of the data for an entire month.

c. Andrew Barnham (Appendix IV) has shown that while the Urban Heat Island (UHI) effect is a well recognised phenomenon, the BOM adjustments to "compensate" for this, make almost no difference to the trend, a finding which is contrary to the latest understanding of UHI as shown in Appendix IV.

2. **Multiple problems have been uncovered with temperature records around the world.** There are many examples given of potentially inaccurate or 'fudged' data, including such accusations from the Government or their agencies in Russia, China and India. The matter has been particularly well discussed in this selection of articles. We specifically emphasise the fact that NIWA has backed away from ever having been responsible for providing New Zealand's official temperature records. Information on the NIWA matter and other temperature data problems around the world are detailed in Appendix V.

   All countries' temperature recording authorities share basically the same IPCC approved methods of adjusting data. As mentioned above, Australia's records have been found to be questionable based on the analysis detailed in the Appendices and referred to above. However, as BOM is affiliated with overseas agencies which have been found wanting, it is not surprising similar suspicions are held regarding BOM's data record. Given justifiable doubts are being raised around the world regarding different countries' temperature records it is important Australians have confidence in the records reported by BOM. This can only be achieved through an independent audit of the data record.

3. **There are many examples where other agencies outside of Australia have been using BOM supplied data and it has been discovered the data used by the overseas agencies is wrong**. An audit is necessary to determine whether the errors are originating at the Australian end within BOM. See for example in Appendix V, *'Computer geek uncovers British climate-data errors'* [SMH]

4. **It is important that the Australian Government and the Australian people have confidence in the data provided by BOM** because the data is being used on an almost daily basis by the Governments, it's officials, the media and social commentators to drive public opinion and Government policy. For example: **'***Labor seizes on temperature figures as evidence of global warming***'** Jan 2010 [Source: The Australian]

5. **It is clear the CSIRO are relying on the dubious data published by BOM** as evidenced by the publication of *' State of the Climate'* CSIRO [PDF Copy] In addition an article about the new head of the CSIRO earlier this year titled '*Life science*' it was written that *"a piece of CSIRO work to which McKeon points is the snapshot of Australia's weather patterns during the past 50 years, released in March by the organisation and the Bureau of Meteorology. It said Australia's average temperature had risen 0.7 degrees since 1960, that the average daily maximum temperatures had risen every 10 years for the past 50 and that the past decade was also the hottest on record."*

[Source: The Age] Without an independent audit, there can be no confidence that CSIRO's conclusions, and advice to the Government, are accurate.

Government policy in relation to Climate Change will have a significant impact on the lives of every Australian from the way we live to our financial well-being. The importance of taking action on Climate Change is being justified on the basis of the climate record as proof that humans have significantly contributed to unprecedented and adverse climate change. It should therefore be a top priority to address any possible doubts concerning the assumptions that are being made about climate change in Australia.

The much publicized BOM data record has to stand the test of independent scrutiny if accusations of ideological or political motivation are to be adequately addressed. If the BOM data record is accurate and any adjustments are scientifically justifiable, then the BOM should have no objections to being held to account to the standards they proclaim in their annual report. If there are any areas of doubt, then the policy-makers and public need to be made aware of those areas so that informed decisions can be made regarding how any doubt may influence policy decisions.

In light of the amount of money involved, the number of Australians affected and the imminent proposed changes to current legislation, we the undersigned hereby request immediate attention be given to the implementation of an independent audit of the BOM temperature records with specific but not exclusive reference to areas of concern raised in this letter.

Sincerely,

Signed,

Senator Cory Bernardi	Joanne Nova
Andrew Barnham	Anthony Cox
James Doogue	Chris Gillham
Ken Stewart	Dr David Stockwell

http://jonova.s3.amazonaws.com/audit/final-anao-request-audit-bom.pdf

APPENDIX I

Source: **Australian Temperatures in cities adjusted up by 70%!?, Australian warming trend adjusted up by 40%, BOM, GISS have record setting bugs affecting a million square miles? From http://joannenova.com.au/**

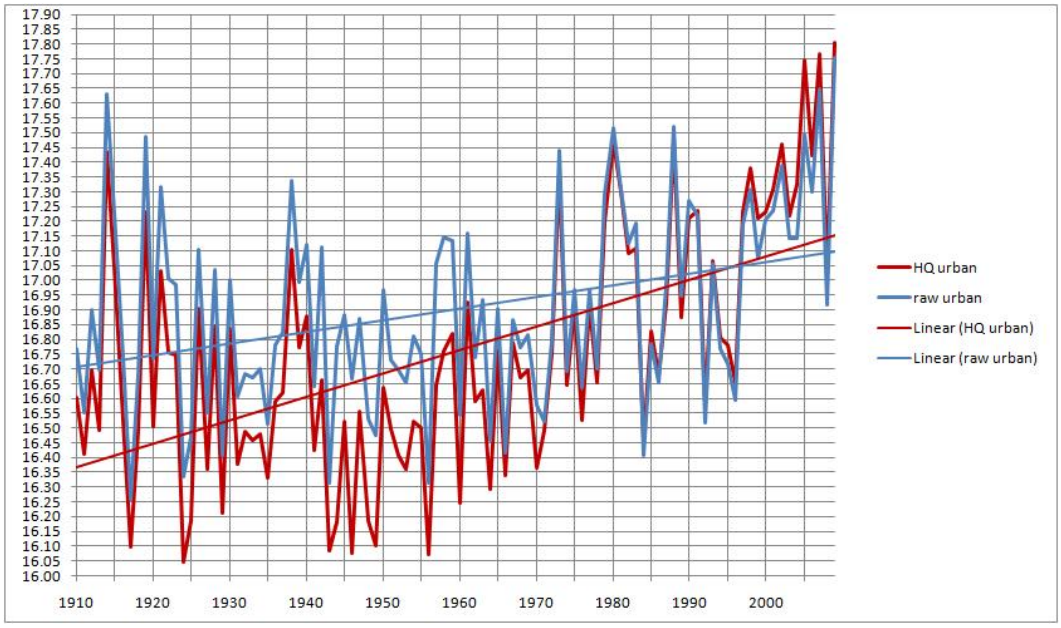
Australian Temperatures in cities adjusted up by 70%!?

September 14th, 2010

Ken Stewart has been hard at work again, this time analyzing the **Australian urban records**. While he expected that the cities and towns would show a larger rise than records in the country due to the Urban Heat Island Effect, what he found was that the raw records showed only a 0.4 degree rise, less than the rural records which went from a raw 0.6 to an adjusted 0.85 (a rise of 40%). What shocked him about the urban records were the adjustments… making the trend a full 70% warmer.

The largest adjustments to the raw records are cooling ones in the middle of last century. So 50 years *after* the measurements were recorded, officials realized they were artificially too high? Hopefully someone who knows can explain why so many thermometers were overestimating temperatures in the first half of the 1900's.

50 years later?

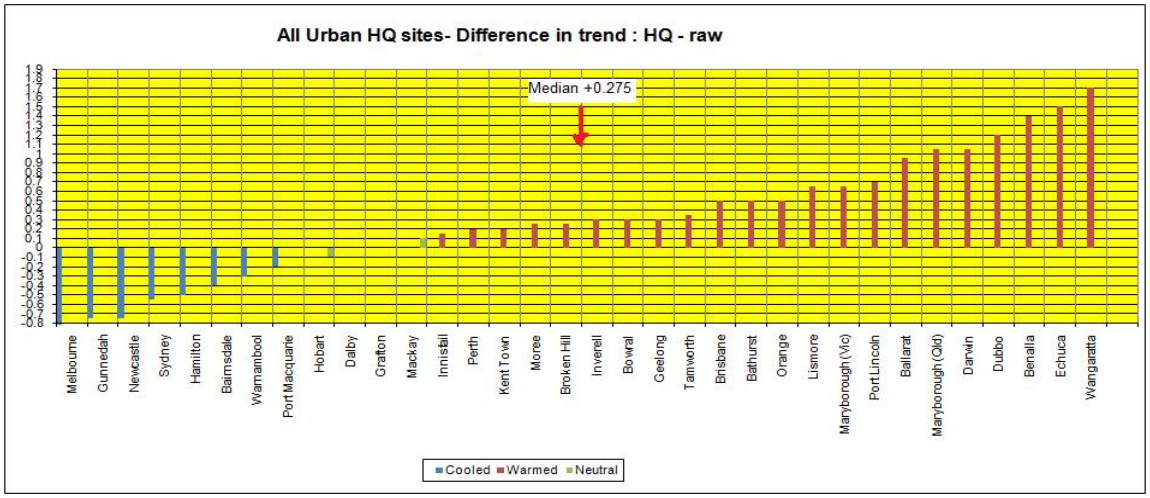


The raw Australian urban temperature records are in blue. The adjusted records in red. Note that temperatures in the middle of last century appear to be adjusted downwards. These are the annual average recordings for all 34 sites.

Remember Dr David Jones, Head of Climate Monitoring and Prediction, National Climate Centre, Bureau of Meteorology said:

"On the issue of adjustments you find that these have a near zero impact on the all Australian temperature because these tend to be equally positive and negative across the network (as would be expected given they are adjustments for random station changes)."

Yet it's obvious that there are far more warming adjustments than cooling ones, and remember, many (almost all?) of these urban sites will be markedly different places than what they were in say 1920. The encroachment of concrete, cars and exhaust vents can surely only go in one direction, though I guess, it's possible all these sites have new sources of shade (why aren't the thermometers moved, if that's the case?) Like the rural records, the temperatures overall are roughly a *quarter of a degree higher* after the "corrections".



Ken explains:

> The raw trend is about 0.4C (actually slightly less than 0.4C)- that's a full 0.2C less than the non-urban raw trend using the same comparison; the adjusted trend is about 0.78C: and that's a warming bias of 95%. (The 70% figure is based on averaging all the changes in trends- from the table of 34 towns. 95% is from plotting the average temperature for all sites each year, then calculating the trend from this average. It's artificial as BOM say they don't do it but it's a way of comparing at the large scale.)
>
> So much for "*these tend to be equally positive and negative across the network*".
>
> Of course, BOM says that this data is not used in their climate analyses, so my trend lines shown above are for illustration and comparison purposes only. However, they illustrate the problem quite well: there is a warming bias apparent in the High Quality data.
>
> As well, the "quality" of the High Quality stations leaves much to be desired. Many of the sites have large slabs of data missing, with the HQ record showing "estimates" to fill in the

missing years. Some sites should not be used at all: Moree, Grafton, Warnambool, Orange, Bowral, and Bairnsdale.

8 of the 34 are Reference Climate Stations (RCS) and *were* used by BOM and CSIRO in their State of the Climate Report released in March 2010.

What does it mean for our weather records?

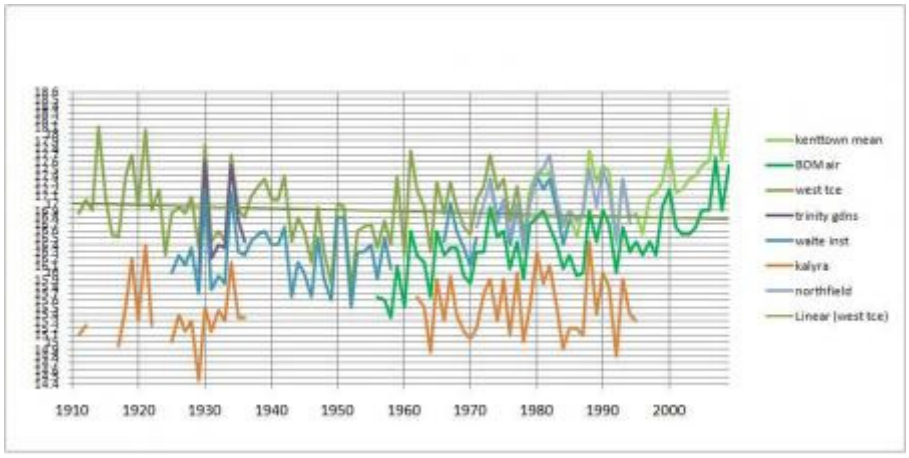
These sites and trends are not used for analysing Australia's climate, but nonetheless, in some cities new records will be set that don't really reflect what the raw data says, and while plenty of scientists don't want to be seen talking about a single hot season (it's weather, remember, not climate), there are plenty of other groups who issue press releases conflating a single season "heat wave" with carbon dioxide.

Ken sums up the problems

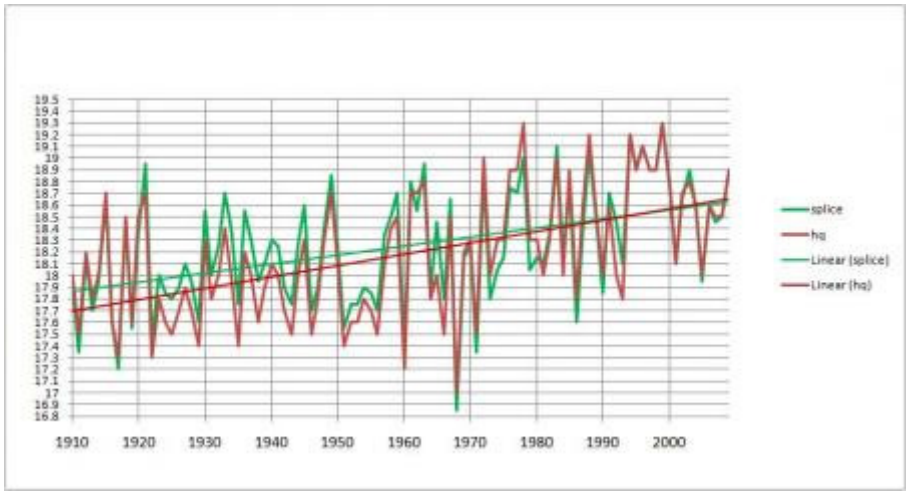
- **BOM's adjustments lead to a warming bias at 34 urban stations of between 70 and 95% depending on which method is used.**
- **BOM's adjustments lead to a warming bias in the temperature trend at 100 non-urban stations of more than 40%.**
- **Many of the unadjusted temperature sites show distinct cooling, especially in south east Australia.**
- **Clearly the data has been subjectively and manually adjusted. BOM admits this.**
- **The High Quality data is suspect because:-**
  - The methodology used is not uniformly followed, or else is not as described.
  - Sites with poor comparative data have been included.
  - Large quantities of data are not available, and have been filled in with estimates.
- **The adjustments are not equally positive and negative, and have produced a major impact on the temperature record of many of the sites.**

Some of the sites:

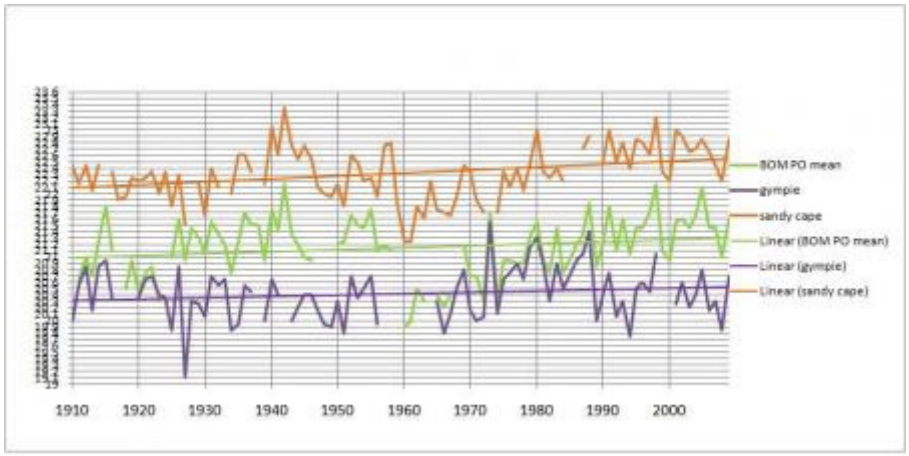
Kent Town (Adelaide): Note Adelaide West Terrace s long record:



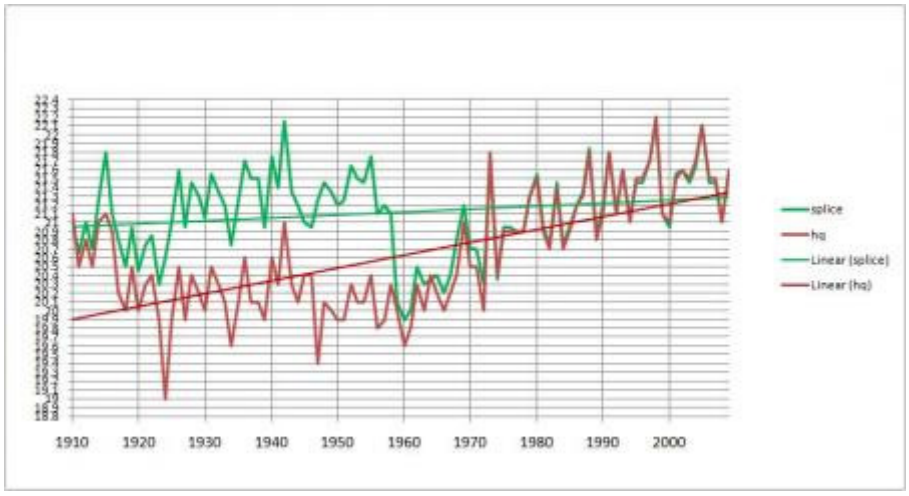
Splice made from Adelaide West -0.28, Kent Town, and Northfield



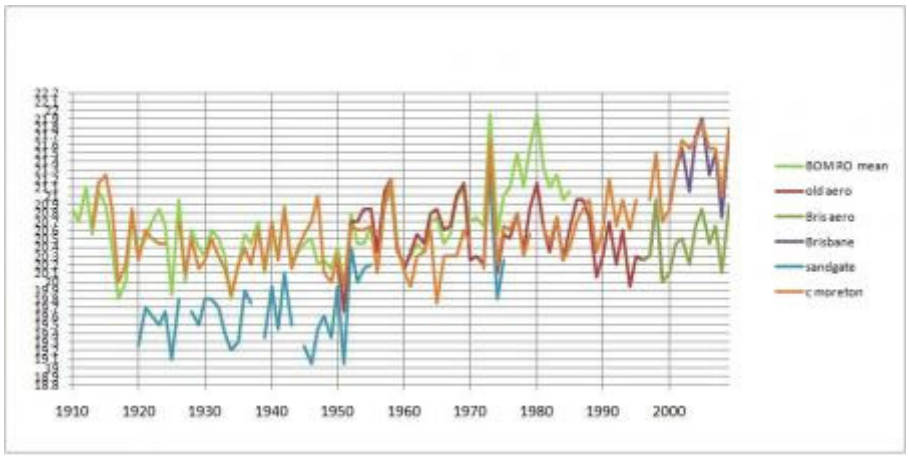
Maryborough (Queensland), and nearby long record stations, Sandy Cape and Gympie, correspond well:



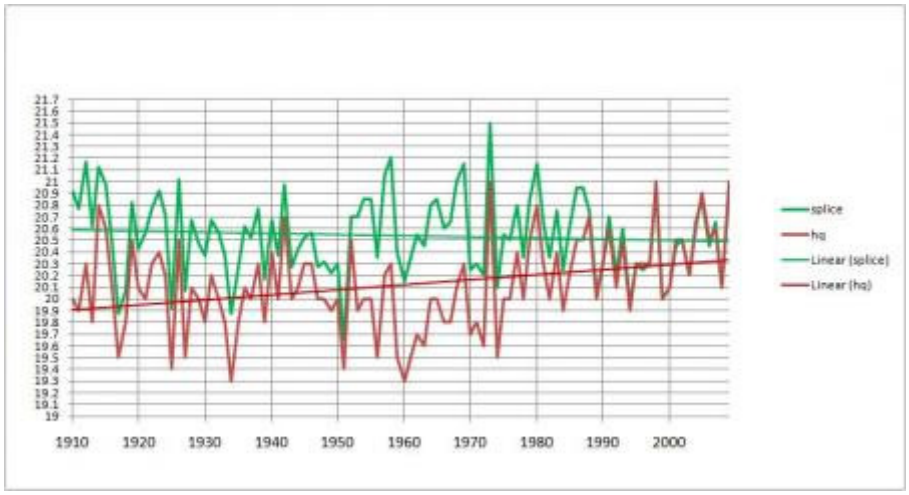
So much data is telling us the trend is minor. So why the adjustment?



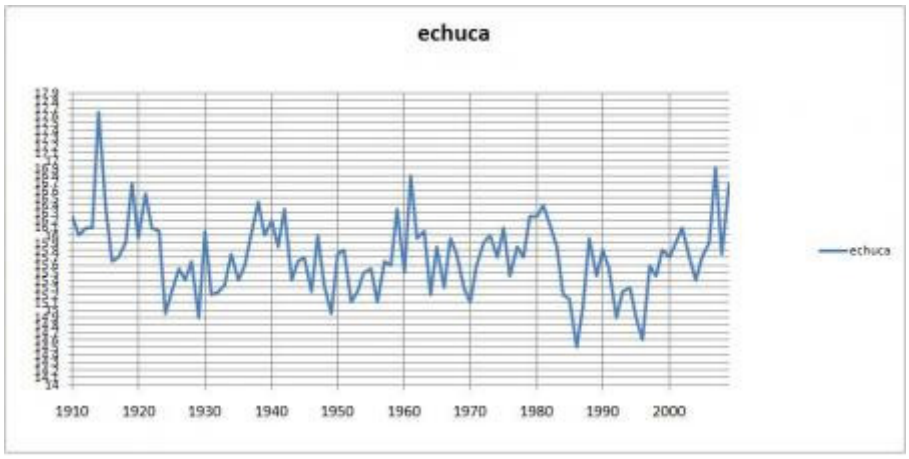
Brisbane Aero- a major city showing cooling!



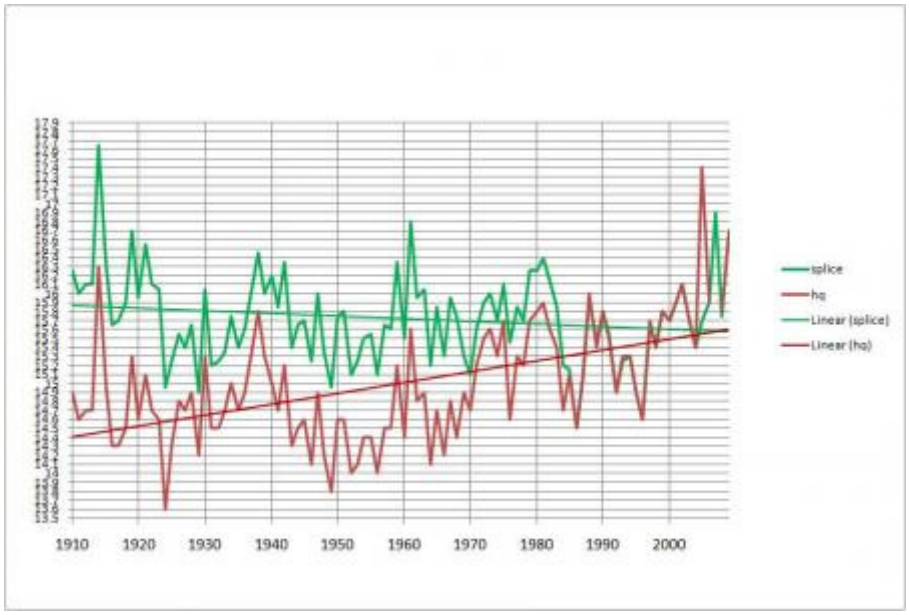
Splice made from regional office + 0.07 to 1949, then the Old Aerodrome and New Aerodrome data:



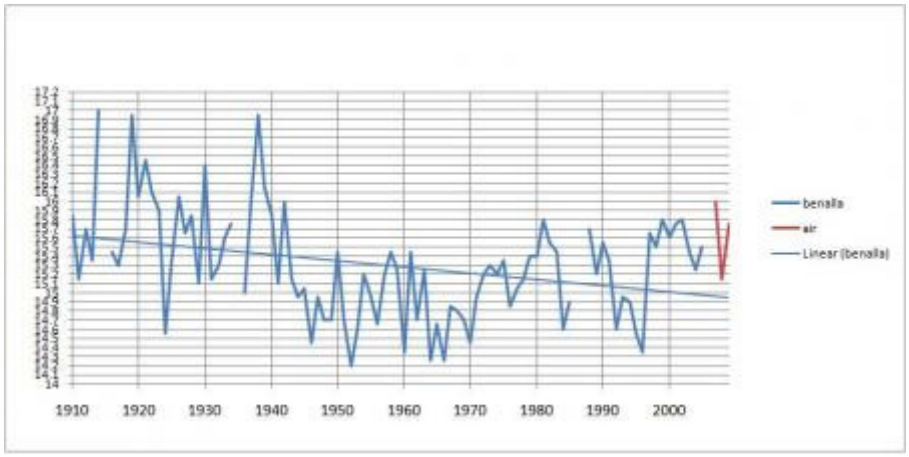
Echuca has a long record with no gaps:



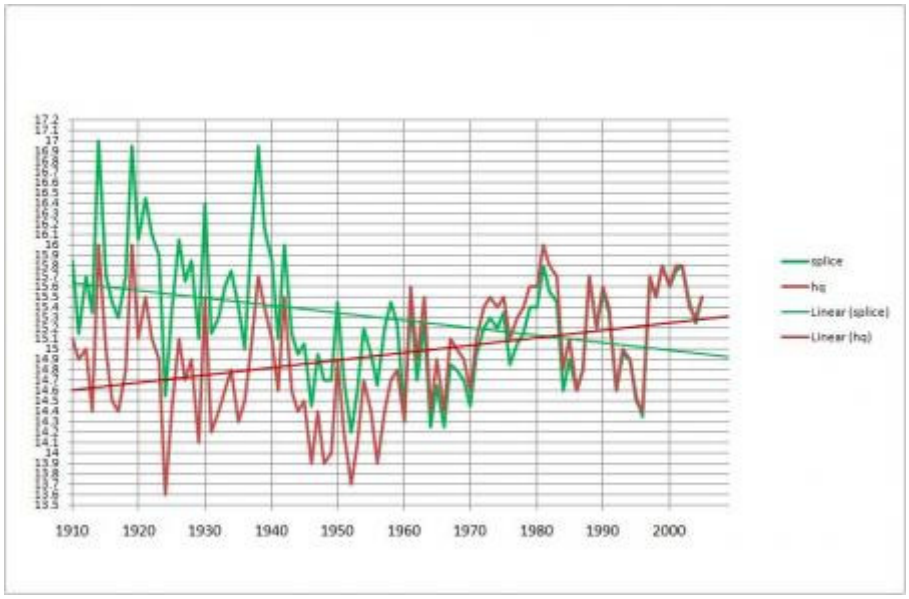
But this becomes



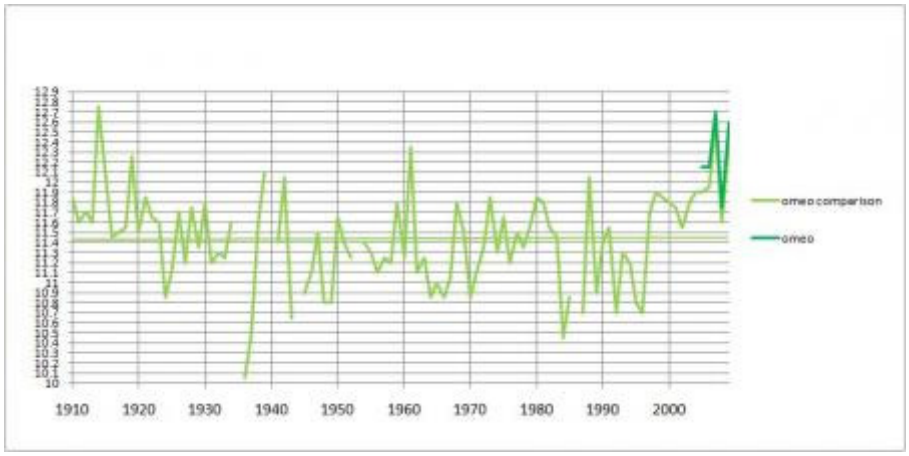
Benalla:



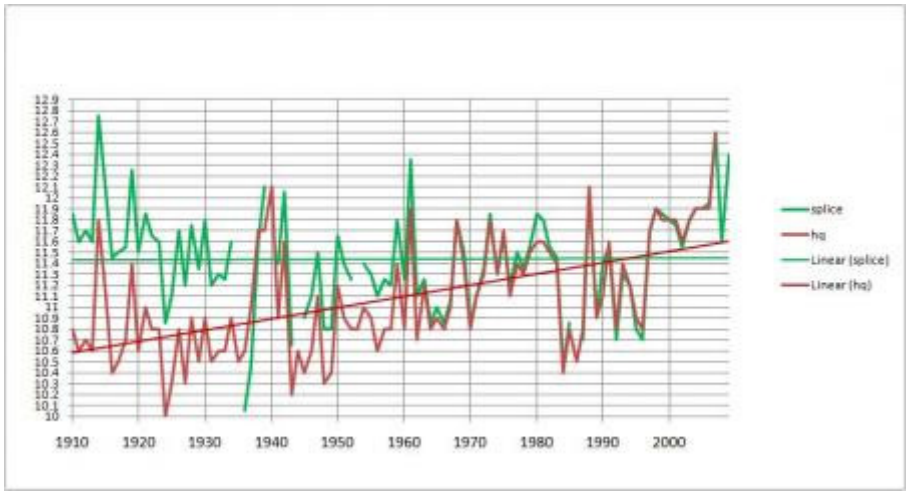
has become



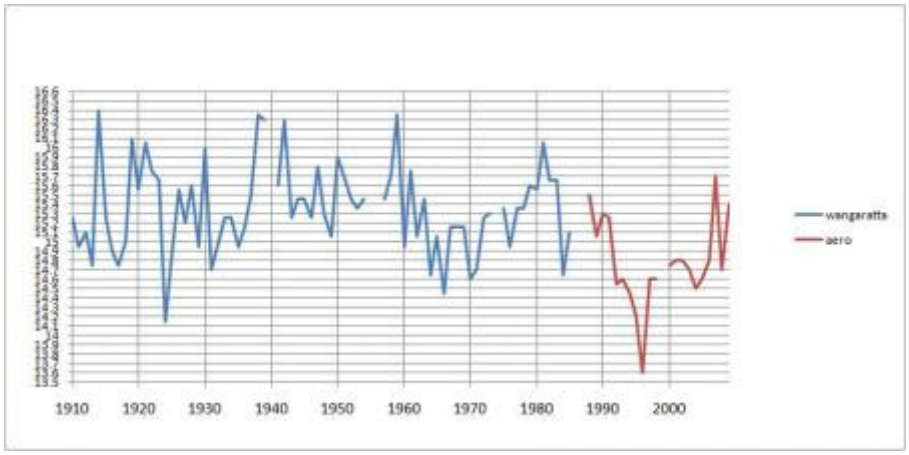
Omeo:



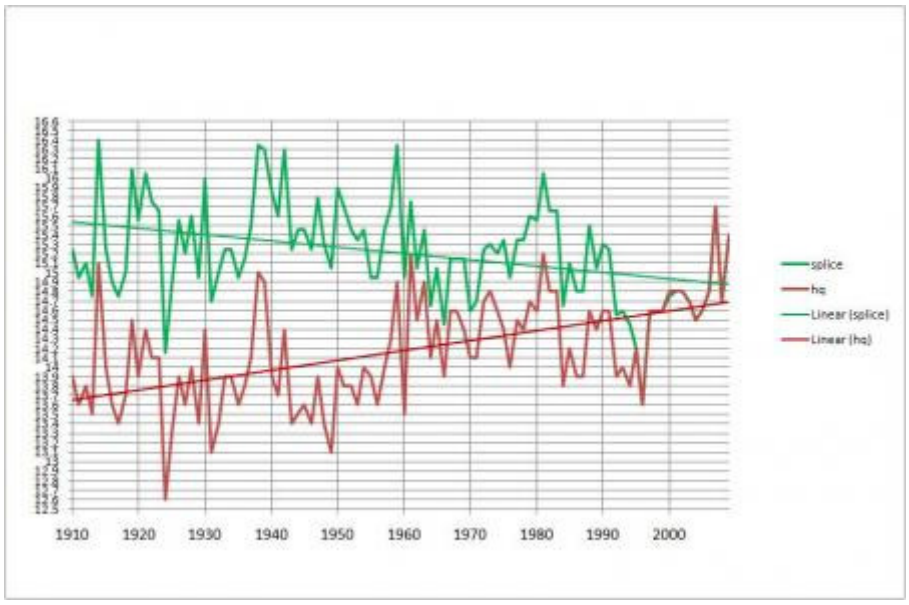
Cooling trend if you ignore 1935! But Omeo has been adjusted:



Worst of all is Wangaratta:

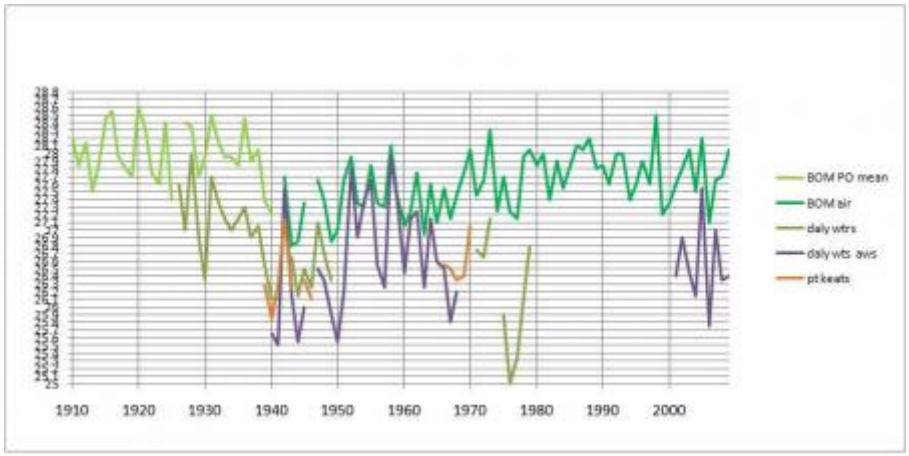


Adjusted:

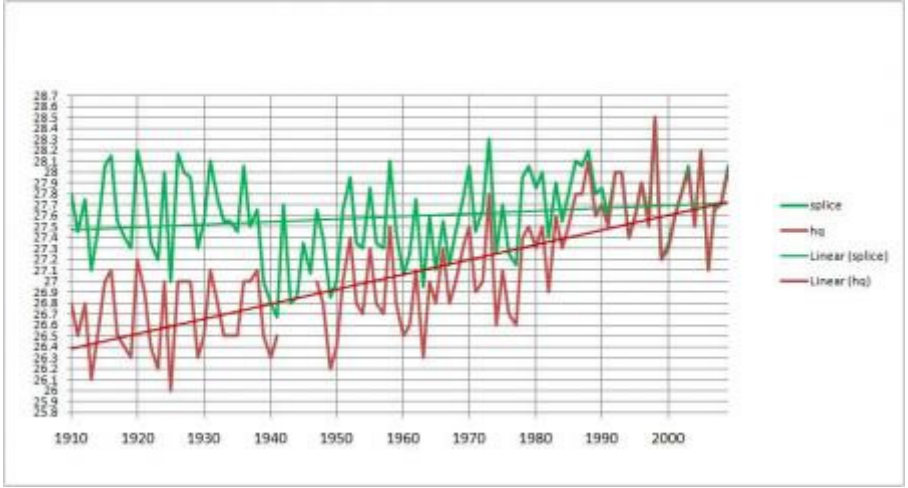


Sydney and Melbourne with their massive urban growth have both been adjusted downwards as we would expect (but are the adjustments enough?)

Darwin still remains one of the most remarkable transformations after adjustment:



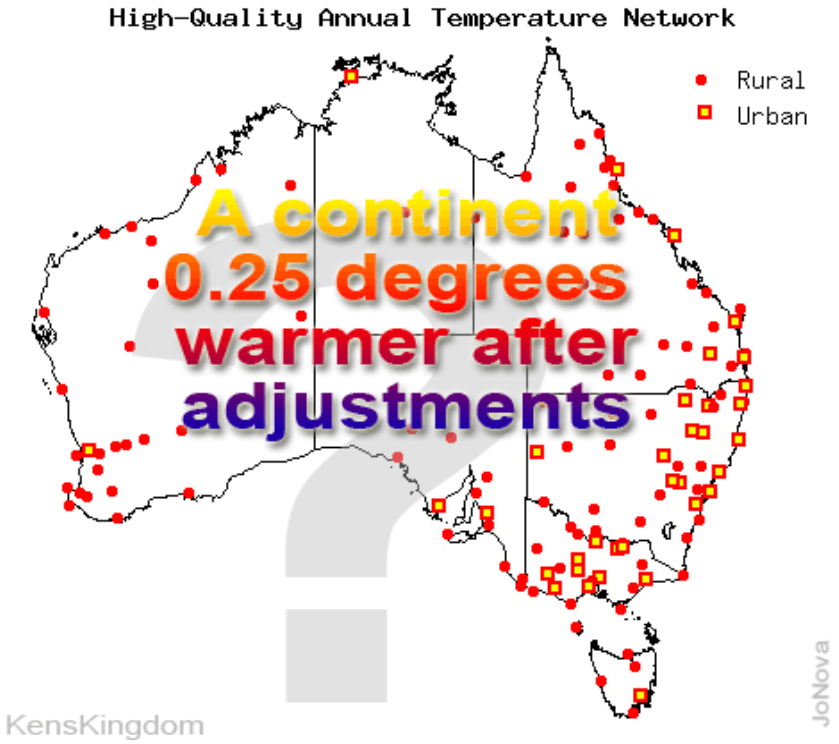
Adjusted: This has been discussed several times before, including on Kens site e.g. Part 2: Northern Territory.



The full record and graphs of all the sites **are at KensKingdom**, so you can check your town or city there. (Why not drop in on him and say thanks to Ken and Lance for their work…)

Last December I looked at towns across Northern Australia but searching across thousands of kilometres, I couldn't find any warming trend to match Darwins adjusted up trend or the IPCC record.

Australian warming trend adjusted UP by 40%



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Ken has been a very busy man. Another soul in the dedicated army of volunteer auditors. He's been going through the entire Australian High Quality Data Set as supplied by the Bureau of Meteorology (BOM). He's been assisted by two readers from this site — Lance and Janama — and we'll be looking to increase the team (see below).

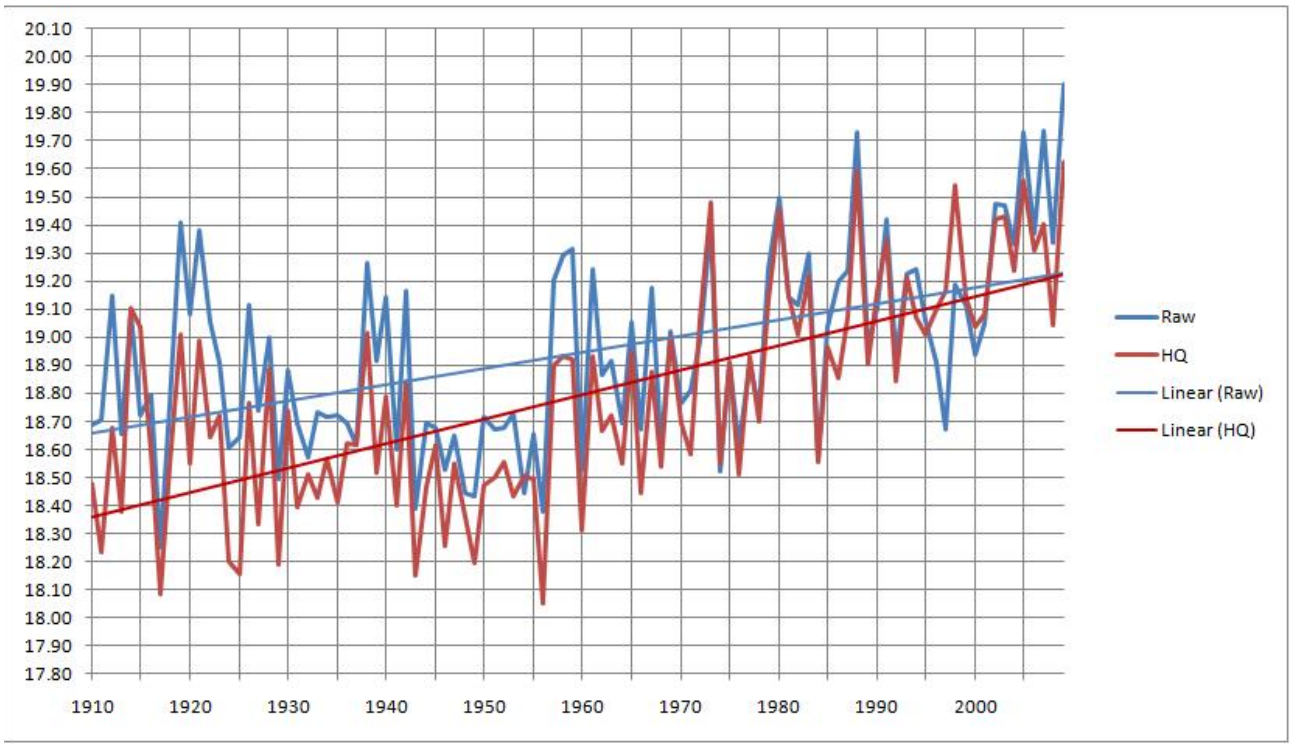
In the State of the Climate report, both the BOM and CSIRO told us that *"since 1960 the mean temperature in Australia has increased by about 0.7 °C. The long term trend in temperature is clear… "* but as usual, what they didn't say was that the raw data since 1910 (not just from 1960) increased only *0.6°C*.

The BOM claim their adjustments are random and neutral. Yet when Ken looked at the raw data from Australia's 100 high quality rural sites, the adjustments increased the trend in the raw data by 40% — **from a 0.6°C rise over 100 years,** to **0.85°C over 100 years.**

In an email to Ken, Dr David Jones, Head of Climate Monitoring and Prediction, National Climate Centre, Bureau of Meteorology, made a clear claim that the adjustments had no real effect:

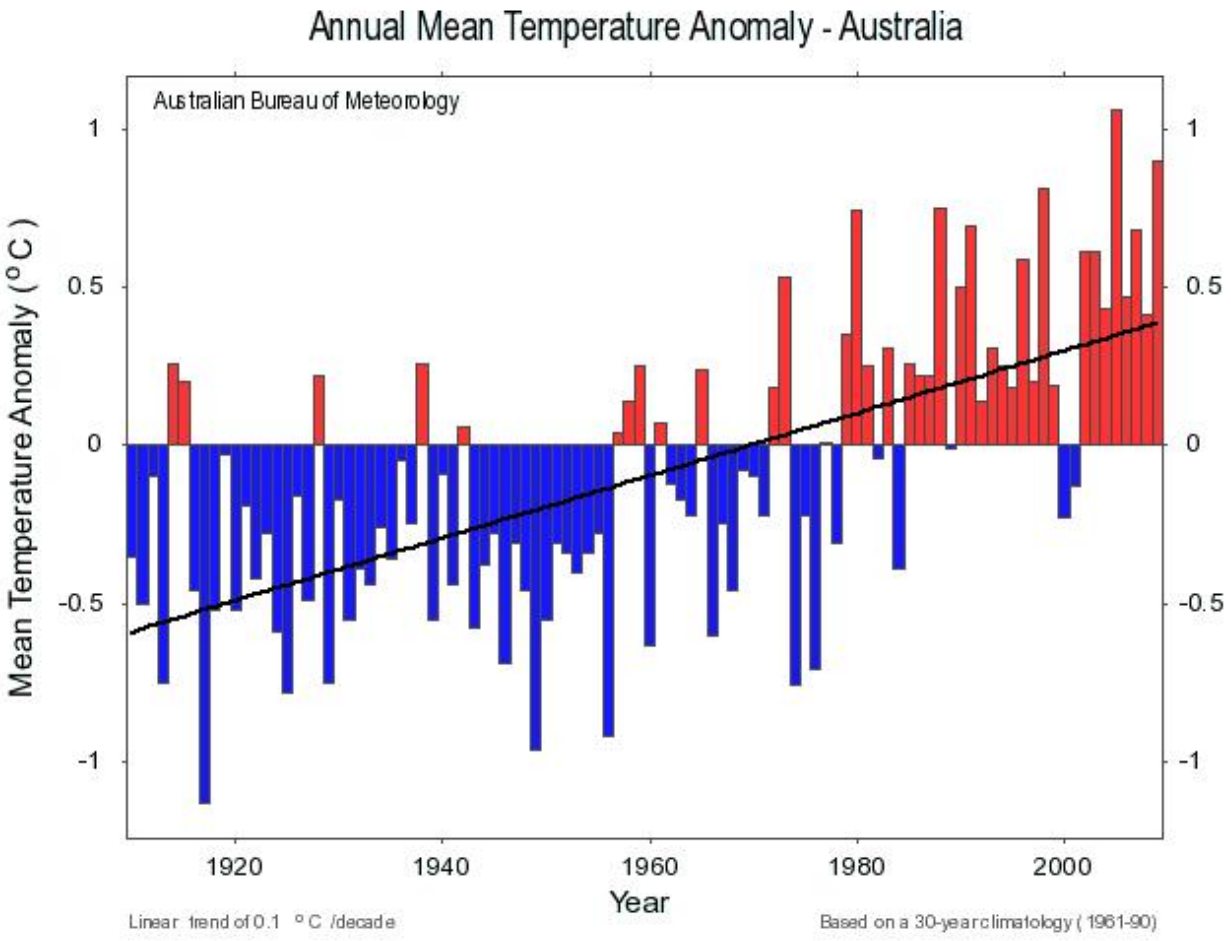
"On the issue of adjustments you find that these have a near zero impact on the all Australian temperature because these tend to be equally positive and negative across the network (as would be expected given they are adjustments for random station changes)."

Once again, the adjusted data shows a temperature change of 0.25°C.



Australian data 1910 - 2010. Blue line - raw data. Red line - adjusted data.

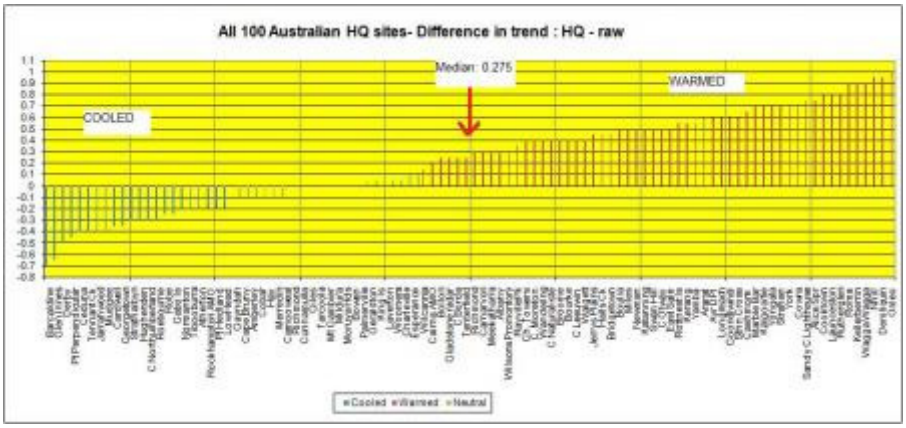
But BOM publishes on their website the following Time Series Graph for Australia showing a warming trend of 0.1°C per decade, or 1.0°C per 100 years:



And that's an increase on the raw data trend of 66%!

Perhaps there are good reasons for all these corrections. But if Ken's analysis is right, the adjustments themselves account for a third of the reported warming trend in Australia.

Since the adjustments are so influential, BOM and CSIRO need to explain clearly why each adjustment is necessary, station by station. Ken graphed the full set. While some adjustments are cooling, the vast majority are warming, and some of the adjustments are as much as 1 whole degree.



Adjustments to raw Australian temperature records station by station. Median adjustment is 0.275. More adjustments are warming (red) rather than cooling (blue).

Rural now, used to be urban?

BOM claim that the top 100 stations are all pure "rural" (and obviously less likely to be affected by the urban heat island effect):

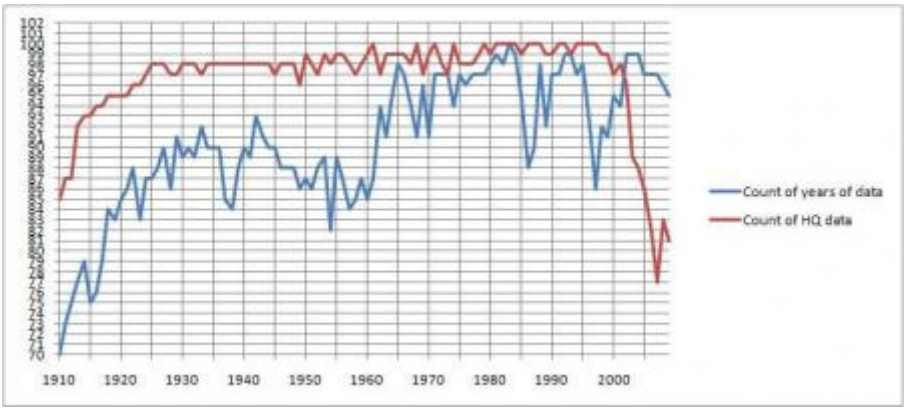
"Please note: Stations classified as urban are excluded from the Australian annual temperature timeseries and trend map analyses. Urban stations have some urban influence during part or all of their record." [Source]

But 15 sites that are included used to be classed as urban at some point in the past. But BOM implies that they only include stations that were never affected by urban influences.

The full list is: Cairns AMO, Rockhampton AMO, Gladstone MO, Port Hedland AMO, Roebourne, Geraldton AMO, Albany AMO, Alice Springs AMO, Strathalbyn, Mount Gambier AMO, Richmond AMO, Mildura AMO, East Sale AMO, Cashmore Airport, Launceston Airport.

Long records?

Stations were originally supposed to have 80 years of data records, but the newer analysis of Della-Marta et al have included six stations with less, including three that started after 1950. Newman has records only from 1966, so data was used from Mundiwindi- 71km away.



The number of stations with data available for each year

Note that only 70% of raw data is available for 1910; 90% by 1930; another drop from 1945 to 1960; and the huge drop off in HQ data this decade.

Ken concludes:

This study shows a number of problems with the Australian High Quality Temperature Sites network, on which the official temperature analyses are based. Problems with the High Quality data include:

- It has been subjectively and manually adjusted.
- The methodology used is not uniformly followed, or else is not as described.

- Urban sites, sites with poor comparative data, and sites with short records have been included.
- Large quantities of data are not available, and have been filled in with estimates.
- The adjustments are not equally positive and negative, and have produced a major impact on the Australian temperature record.
- The adjustments produce a trend in mean temperatures that is roughly a quarter of a degree Celsius greater than the raw data does.
- The warming bias in the temperature trend is 40%, and BOM's published graph implies a warming bias of 66%.

It is most urgent and important that we have a full scientific investigation, completely independent of BOM, CSIRO, or the Department of Climate Change, into the official climate record of Australia.

We are awaiting a reply from the BOM with much interest.

The full post at Kens Kingdom

Janama was involved in looking at the NSW data and commented at WUWT:

There is a site called Bourke Airport in New South Wales – it's listed as a Rural Site as it is out of town and is therefore included in the national temperature analysis.

Yet Bourke Airport was established in 1999 and has only 9 years of data! So where did the data from 1910 – 1999 come from? Well it matches perfectly with Brewarrina Hospital 80kms away in the heart of Brewarrina that has a record back to 1910 – well it's not an exact match because the earlier years have been systematically adjusted downwards along with the typical rural town UHI influence yet it's included as Rural!

The same technique has been used for Glenn Innes airport which was established in 1997 yet by using the Glenn Innes Post Office data with it's typical UHI (increasing min temp) they have a record going back to 1910 yet it's also classified as Rural.

I only studied NSW but I'm pretty sure it is similar throughout the country.

APPENDIX I (cont)

BOM, GISS have record setting bugs affecting a million square miles?
How bad are these datasets? How sloppy are the data records?

Western Australia (WA) covers 2.5 million square kilometres (1 million square miles, about a third as big as the USA). The average of all WA stations over one month last year was *adjusted up by as much as a gobsmacking 0.5 degrees* due to a database "bug" – which contributed to August 2009 being the *hottest August* on record?! That's one heck of a bug!

Could it get worse? Unbelievably, GISS seems to have lost data for key WA locations that an unpaid volunteer found easily in the BoM online records. GISS only has to maintain copies of records

for *sixteen stations* in WA* which have temperatures current to 2010, but in seven of them they are missing data, and it affects the results. Are they random errors? No, shock me, six errors are *upwards:* in one case making the spring 2009 average temperatures for Kalgoorlie-Boulder 1.1 C degrees warmer!

But with no-one auditing our BoM or NASA's GISS, and no team jointly receiving raw data or regulating standards in either agency, temperatures recorded in the field could potentially be listed in official records as being quite different, and who would know? It's left up to volunteers like Chris Gillham, a freelance journalist and web designer in Perth, to run a sharp eye over the data. Chris has been tracking WA data for the last two years and his site, Average Temperature Trends Across Western Australia, has methodically, neatly exposed some major flaws.

Just how much can we trust any of the pronouncements coming out, and how significant are any of the "records", even if the adjustments are fair, unbiased and justified? The whole database is surely not "high quality" when bugs of that magnitude are running rampant and data goes missing that professionals can't find, but people who are not "paid to find warming" dig up without much trouble.

–JN

New questions about reliability of GISS and BoM data

Guest Post by Chris Gillham

Fresh doubts have emerged about the reliability of temperatures within the Goddard Institute of Space Studies Surface Temperature Analysis database with revelations that missing data errors have appeared for various months in the 2009 records of Australian locations, even though the correct mean temperatures are available from the Australian Bureau of Meteorology (BoM).In turn, the BoM data itself has seen adjustments that might leave researchers wondering about claims that Australia has suffered record high temperatures over the past 12 months.

MAP: Western Australia (for scale, it's about 600 km from Perth to Kalgoorlie). Showing some of the sites.

A BoM database bug: Oops, half a degree?

On September 1 last year, the BoM posted mean min and max temperatures on its website for the month of August 2009 at all its recording stations in Western Australia (2.5 million square kilometres).

However, on November 17 the mean temperatures for all WA recording stations were **adjusted upward by as much as .5 C for August 2009.**

When questioned about the adjustments, the BoM confirmed it had suffered a database bug and the upward shift was a consequent correction for August 2009, which the bureau says was the *hottest August ever recorded in Australia*.

GISS is "missing"data

The GISS database shows that in the following month, September 2009, there is missing data (999.9) at three Western Australia recording stations:

Esperance | Kalgoorlie-Boulder | Perth Airport

Despite the missing September data and as is evident in their tables, GISS has calculated the Spring (S-O-N) mean temperatures at those three locations as 17.5 C, 20.5 C and 17.7 C respectively.

Trouble is, the data isn't "missing". A quick search of the BoM website reveals the September 2009 mean temperatures were:

13.2 C at Esperance

13.9 C at Kalgoorlie-Boulder

13.9 C at Perth Airport

This in turn means the Spring mean temperatures were actually 16.6 C at Esperance (not 17.5 C), 19.4 C at Kalgoorlie-Boulder (not 20.5 C) and 17.2 at Perth Airport (not 17.7 C).

The GISS database records for Eucla show missing data for December 2009, but the BoM records once again are available and show the mean temperature was in fact 21.6 during that month. The GISS has calculated the Summer 2009/10 (D-J-F) mean at Eucla as 22.8 C, but with the accurate BoM December data included it turns out to be 22.7 C.

Based on evidence available from the GISS and the BoM websites, it appears several WA locations with records current to 2010 have small to significant upward data adjustments.

Wait, there's more!

I've detailed the BoM bug adjustments and the GISS missing data adjustments.

While researching the GISS adjustments, I noticed yet another odd data shift that left me wondering about the reliability of temperature recordings. I had listed the 2009 monthly mean temperatures on October 4, 2010, for Kalgoorlie-Boulder, but when I returned to the GISS website database the following day, October 5, I found that every month in 2009 for that location had been shifted *up* by .1 C.

This means the newly adjusted GISS record shows Kalgoorlie-Boulder's average mean for Spring 2009 was 20.6C, not 20.5 C anymore, so this historic mining town's seasonal temperature record is now 1.2 degrees higher than the reality of the BoM records.

These inexplicable adjustments to domestic and international datasets raise questions about the reliability of record temperatures reported in Australia over the past year and the reliability of official records used by researchers to try to accurately gauge temperature trends.

****UPDATE (Erratum):** Text has been slightly altered to reflect new information. Hours after the post was put up, it was discovered that GISS maintains records for *sixteen* sites around WA, not just five, but in at least three other sites there is also missing data (Port Hedland, Albany, and Geraldton) making it at least **6 of 16 sites** where data is missing even though it is *readily available*, and in the case of Albany, there are holes in the data, but the raw data for times prior to September 2009 is no longer available on the BOM website. Apologies for the error.

UPDATE 2: Geraldton and Port Hedland mistakes are also "upwards"

The Geraldton Airport GISS data shows missing temperature for April 2010 but the BoM data at for April 2010 shows the mean at 20.95, which means the Autumn 2010 M-A-M is 21.3 C, not 21.5 C as calculated by GISS.
The Port Hedland GISS data shows missing temperature for May 2010 but the BoM data at for May 2010 shows the mean at 25.2, which means the Autumn 2010 M-A-M is 29 C, not 29.1 C as calculated by GISS.

Appendix II

Ken Stewart
539 Eversleigh Road
Sarina Q 4737
25 October 2010

The Hon Tony Burke MP
Minister for Sustainability, Environment, Water, Population and Communities
PO Box 6022
House of Representatives
Parliament House
Canberra ACT 2600

Dear Sir,

Formal Complaint and Request for Information- Bureau of Meteorology

Given the importance of the consequences of a changing climate, the government and the public is justifiably interested in getting the most accurate picture of Australia's temperature record. For some months I have been comparing the Australian High Quality Temperature Sites' adjusted data with raw data from those sites and nearby open and closed sites. Data have been obtained from the Bureau of Meteorology's excellent website. The 100 High Quality (HQ) sites are used by BOM in their analyses of Australia's climate.

I have published the results online at www.kenskingdom.wordpress.com .

My analysis has revealed apparent significant discrepancies between the HQ record and the raw data on which it is based.

This is problematic as Dr David Jones, Head of Climate Monitoring and Prediction, assured me in April that

> *"On the issue of adjustments you find that these have a near zero impact on the all Australian temperature because these tend to be equally positive and negative across the network (as would be expected given they are adjustments for random station changes)."*

Despite numerous requests via email and letter, Dr Jones has not responded to the issues which I have since outlined to him, nor has he answered three simple questions I put to him. The only response was an anonymous email from Webclim suggesting that I publish a scientific paper before I get any answer. Previous correspondence is enclosed.

In view of Dr Jones (and BOM's) apparent refusal to answer my queries, I wish to make a formal complaint, and ask you to investigate this unwillingness to comply with standards of openness explicit in the APS Values and Code of Conduct:

> "Openness is at the core of Australia's modern system of government. It is essential in a healthy democracy that members of the public have the opportunity to contribute to policy development and decision-making, and that there is public scrutiny and accountability of government. Public access to information in the possession of government agencies helps to make this possible."

Further, I am asking for answers, through you, to the following questions:

1. What explanation is there for the large discrepancy between the 100-year trend of the homogenised data from the 100 High Quality sites, and the trend of the raw data from these and nearby sites?

2. Why, if the adjustments "tend to be equally positive and negative across the network", have the great majority of sites had adjustments that have resulted in an increased warming trend?

3. What explanation is there for the inclusion in the High Quality series of 15 sites previously excluded because of urban influence?

4. Why, in a supposedly "High Quality" record, has so much low quality data been included- stations with short records (e.g. Woomera, Giles), large gaps infilled with estimates (e.g. Wilcannia, Cape Borda) or with data from sites many kilometres away (e.g. Newman), and records constructed by combining data from stations with no overlap at all (e.g. Port Hedland, Bourke, Cashmore)?

5. Have there been any other adjustments made to the Australian temperature data apart from those documented at the BOM website? If so, kindly supply details of all reviews and adjustments to the Australian raw temperature data including, but not limited to, Torok and Nichols, and Della-Marta et al.

6. Can you please provide details (including dates, personnel, methods, results) of the quality control checks on the homogenisation adjustments.

7. Can you please provide details of the peer reviews of the two papers referenced by Dr Jones, namely:
    a. Della-Marta, P., Collins, D., Braganza, K. "Updating Australia's high-quality annual temperature dataset" *Australian Meteorological Magazine* Vol. 53, no. 2, June 2004
    b. and
    c. Torok, S.J. and Nicholls, N. 1996. A historical annual temperature dataset for Australia. *Australian Meteorological Magazine*, 45, 251-260.

8. Please provide complete details, including station metadata, of the reasons for the large adjustments to the temperature records of the following sites:

- Omeo
- Deniliquin Post office
- Nhill
- Wagga Wagga AMO
- Kellerberrin

and of the following Urban sites (not used in climate analyses but adjusted):

- Wangaratta Aero
- Echuca Aerodrome
- Benalla Shadford St
- Dubbo Airport AWS.

I look forward to your reply.
Yours sincerely,
Ken Stewart

Appendix III

In December 2009, freelance journalist Chris Gillham noticed while updating his website (www.waclimate.net) that there had been an upward shift in temperatures for the month of August 2009 at the 32 BoM recording stations in Western Australia that he monitors.

On September 1, 2009, the BoM had posted mean minimum and maximum temperatures on its website for August 2009 at all its recording stations in Western Australia.

However, it was apparent that on November 17 the mean temperatures for all WA recording stations in August 2009 had been adjusted upward by as much as .5 C.

Mr Gillham contacted the BoM seeking an explanation for the upward adjustment and received the following reply:

> *"Thanks for pointing this problem out to us. Yes, there was a bug in the Daily Weather Observations (DWO) on the web, when the updated version replaced the old one around mid November. The program rounded temperatures to the nearest degree, resulting in mean maximum/minimum temperature being higher. The bug has been fixed since and the means for August 2009 on the web are corrected."*

Despite thanking Mr Gillham for pointing out the problem several weeks after the upward adjustment had been made, there was no change in the BoM records and **the August 2009 temperatures recorded at all WA locations remain as much as .5 C higher than when originally posted on September 1 2009.**

August 2009 has been nominated by the BoM as the hottest August ever recorded in Australia.

Mr Gillham compares the ongoing monthly data at 32 Western Australia locations against a set mean maximum and minimum calculated as averages in the year 1900. Since the data bug was corrected in November 2009, average temperatures at the 32 locations have increased by an average 0.6 C and have since remained at this higher level.

The Australian public must accept that an acknowledged software or database bug caused the BoM to increase the temperature recording at all locations in the western half of Australia - possibly all of Australia - by as much as 0.5 C, and at the same time accept that this was the hottest August ever recorded.

Furthermore, checking of original BoM recordings since September 2009 shows that either minimum or maximum temperatures have been adjusted up or down for 44 months of recordings at the 32 stations monitored by Mr Gillham.

An independent auditor monitoring the BoM data records would both verify the legitimacy of such adjustments and give the public confidence in the accuracy of historic weather data presented by the BoM.

It should also be noted that research by Mr Gillham has shown that monthly weather recordings relayed by the BoM to the National Oceanic and Atmospheric Administration are not always recorded accurately by the US organisation.

Despite the monthly temperature means being readily available from the BoM website, the NOAA has recorded missing data errors for Albany Airport in February 2009, Esperance, Kalgoorlie and Perth Airport in September 2009, Eucla in December 2009, Geraldton Airport in April 2010, and Port Hedland in May 2010.

NASA's Goddard Institute of Space Studies sources its temperature data from NOAA and to compensate for the missing data has made incorrect calculations for the seasonal and annual temperatures at various Western Australia locations.

In the case of Kalgoorlie-Boulder, the GISS has incorrectly calculated a mean temperature for the Spring of 2009 that is 1.1 C above the true temperature recorded by the BoM.

Although an independent auditor of the BoM could not monitor the use of data by overseas organisations, it could at least ensure that all data transferred to such organisations by the BoM is accurate and complete.

Average Temperature Trends Across Western Australia
http://www.waclimate.net

APPENDIX IV

Analysing Australian Temperature Trends

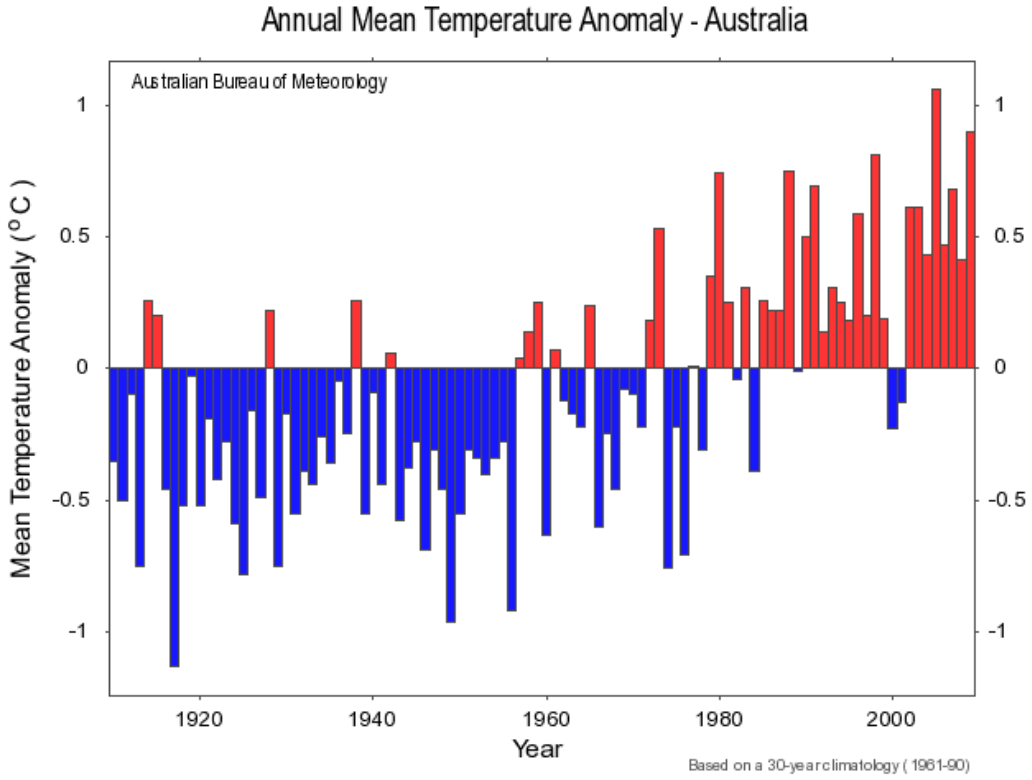
By Andrew Barnham

The article Australian warming trend adjusted up by 40% was published on Jo Nova's blog on 29th July 2010. This work by Ken really caught my attention as it stands in stark contrast with consensus claims that the homogenization process is simply a 'fine tuning' process and that it barely impacts the final trend result. For example, on GISS website, generating anomaly trend graphs using adjusted or unadjusted data yields very little difference. So assuming that Ken's result is accurate, then the Australian dataset stands at odds to this. The following is largely a replication of Ken's work, using slightly different tooling and methodologies. In this I analyse Bureau of Meteorology (BOM) data comparing modern temperature sets used by the BOM to construct Australian land surface anomaly figures used by the BOM for purpose of contributing to the climate change narrative. I scrutinize raw data compared to adjusted data. I also scrutinize the process BOM use to compensate for local climate effects. All computer source codes used in this analysis can be found at the bottom of this article.

Firstly, credit to the BOM for making the information very easy to access and for structuring the data in a consistent and easy to analyse fashion. Because of this, it only took me a few hours to secure and organise the data which allowed me to focus on actual analysis.

Some months ago the Bureau of Meteorology published this now famous image which is readily accessible on their website. It is a temperature anomaly reconstruction of Australian land surface temperatures that shows that based on a 1960-1990 baseline period, Australia has warmed by 0.9°C over the past century.

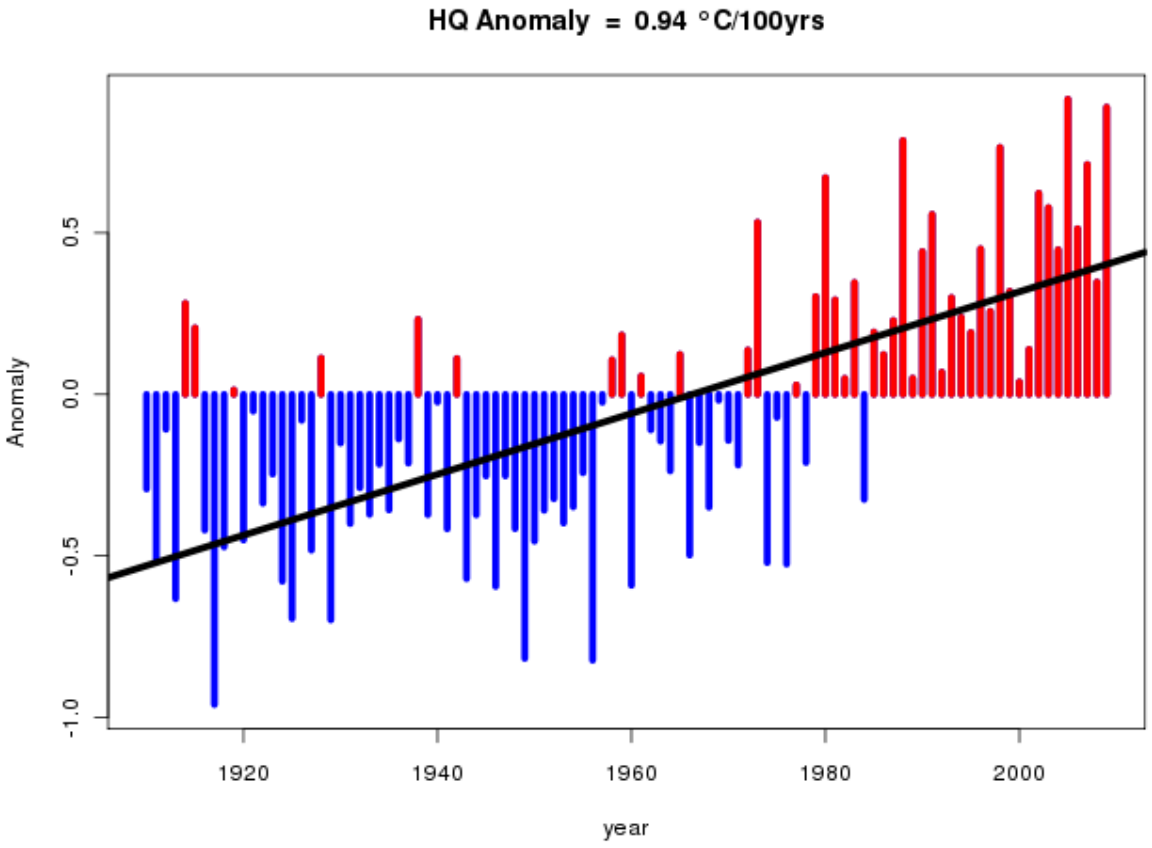
[http://jonova.s3.amazonaws.com/guest/barnham/temp-mean.aus.0112.13002.png]



The image can be accessed directly from their website here: Australian climate variability & change - Time series graphs

Following is my reconstruction of the same data set using their High Quality (HQ) adjusted data series. Visually the results are a very close fit which gives me confidence that I have replicated their process with sufficient accuracy: given that the process they use is not documented.

[http://jonova.s3.amazonaws.com/guest/barnham/hq.png]

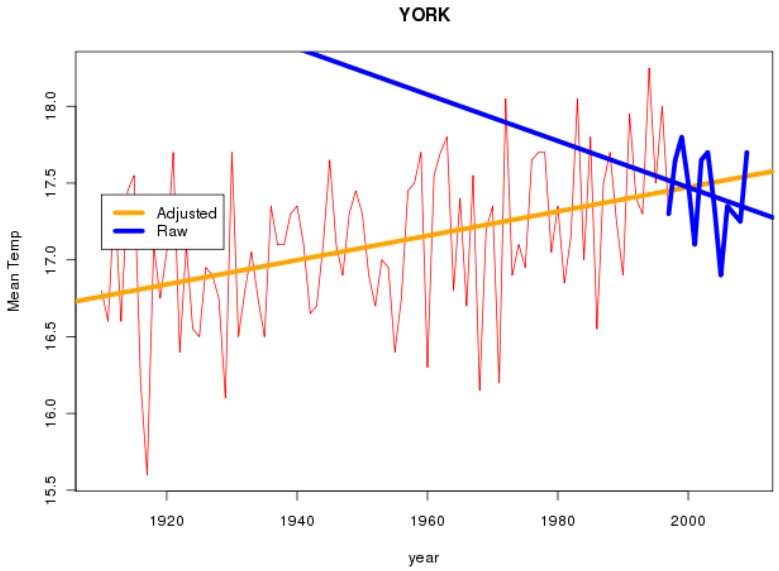


The next logical step is to generate the same image for unadjusted data sets. But it is at this point that problems become evident. The HQ Series the BOM uses is based on the work of two studies, Torok 1995, and Della Marta 2004. These studies define HQ temperature stations which are then used to measure temperature changes on the Australian Continent. Torok states the following:

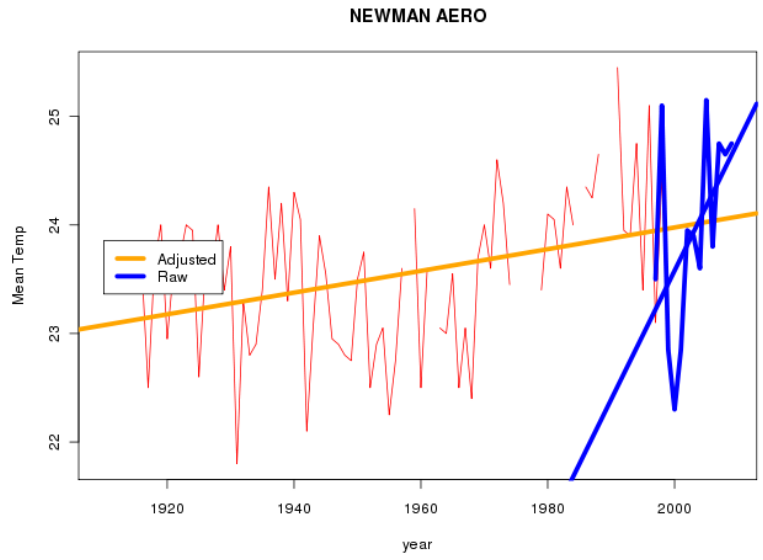
> *"... if only stations currently operating and with at least 80 years of data are considered. To increase the number of long-term stations available, previously unused data were digitized and a number of stations were combined to create composite records".*

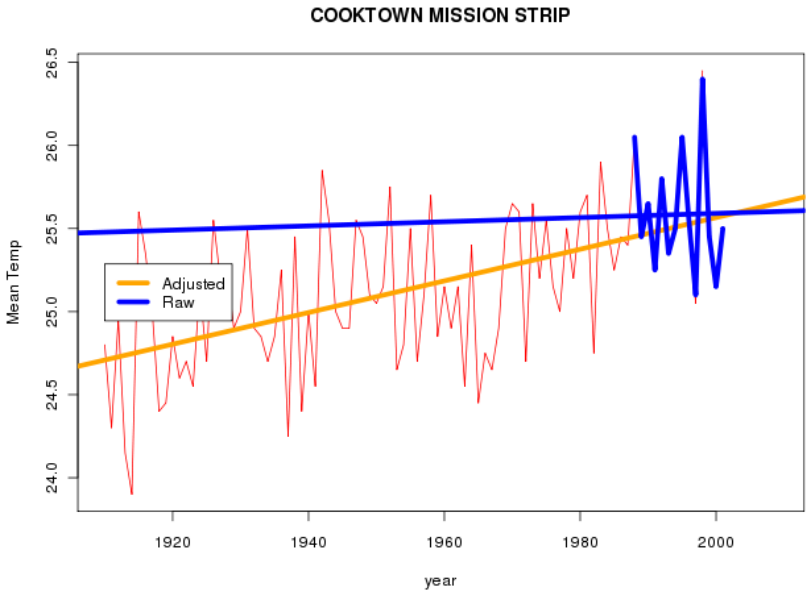
Ideally we want to use stations that provide long term continuous data. Now consider the following three graphs that graph both adjusted and unadjusted temperature series.

[http://jonova.s3.amazonaws.com/guest/barnham/york-site_10311.png]



[http://jonova.s3.amazonaws.com/guest/barnham/newman-aero-site_7176.png]





[http://jonova.s3.amazonaws.com/guest/barnham/cooktown-site_31017.png]

These sites contain hardly any raw data (blue line) at all. In spite of this BOM include these stations and reconstruct 100 years of temperature data using some undisclosed process. It is not documented the precise steps BOM used to reconstruct these phantom records although the Torok study indicates that this is done by splicing data from nearby stations and then correcting for discontinuity using the homogenization process.

Torok states that this is necessary due to an absence of long term station records. What is unusual although is that there is a lot of station data which appears to satisfy the requirements for HQ data, but these stations are ignored by the Torok study and are not included in BOM HQ climate change series.

If we define good stations to mean stations with at least 80 years of data then in Australia we have 86 stations that qualify. Of these 86 stations, 48 are included in the HQ climate group. 38 are ignored. The reason why so many stations are ignored is not clear, maybe they are predominantly Urban stations, or maybe there are undisclosed problems with the data sets. The absence of these stations does not have an undue effect on gridded trend results. Never-the-less it seems unusual and something of a waste that BOM would disregard stations with what appears to be good, long-term data sets; and opt in part to reconstruct temperature series data from presumably poorer quality records.

Returning to the issue of raw data analysis.

For purposes of generating anomaly graphs I used a method known as CAM (Common Anomaly Method), which is a popular method for climate analysis and appears to be the method used by BOM. CAM has one serious limitation: it is essential that station data records have sufficient data in a calibration period in order for the station to be useful. Stations that fail this test need to be discarded (or attempts made to 'fill in' the missing data first) . For generation of graphs I rejected any station which had less than 25 years of data in the 31 year 1960 to 1990 calibration period. In the HQ graph there are 99 stations. But in raw data, I was forced to filter down to 63 stations as 33 stations had insufficient data in the calibration period. Illustrating the distribution of stations after gridding:

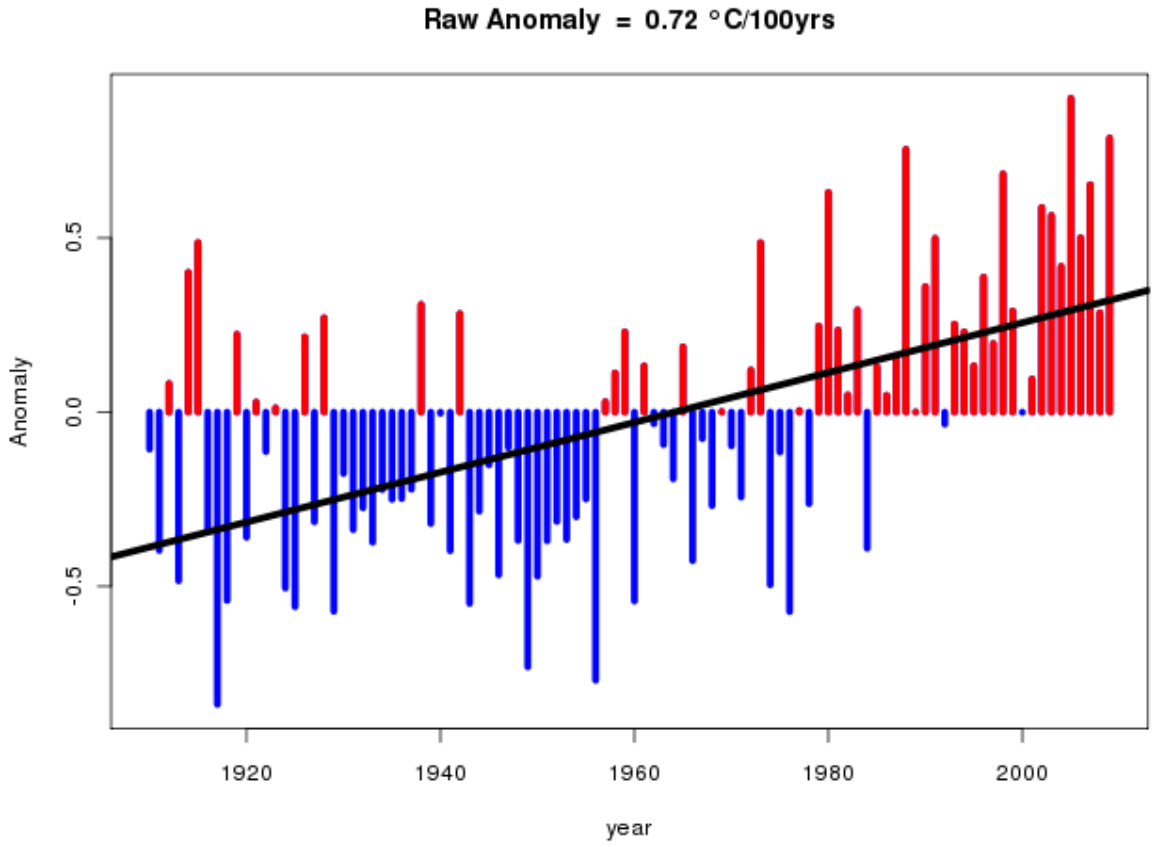
HQ Series (top) VS Raw Series (next page).


[http://jonova.s3.amazonaws.com/guest/barnham/hq_map.png]


[http://jonova.s3.amazonaws.com/guest/barnham/raw_map.png]

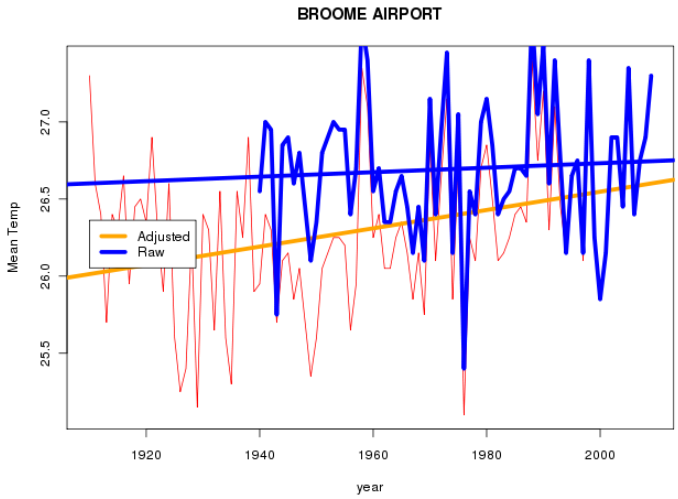
Finally - the Raw graph

[http://jonova.s3.amazonaws.com/guest/barnham/raw.png]

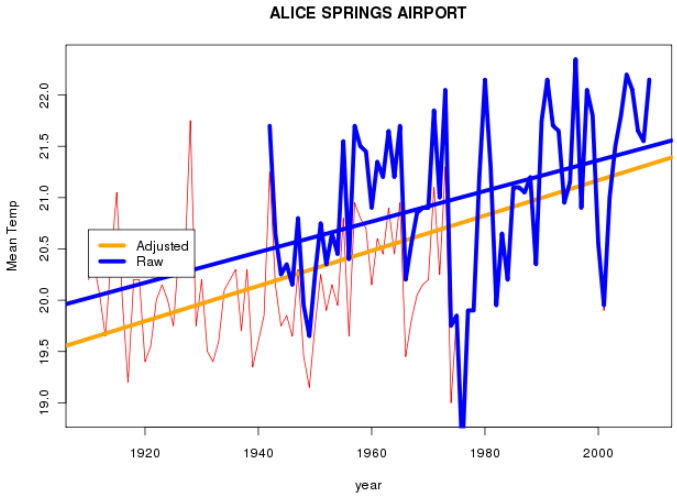


The anomaly difference based on modern data represents a 20% discrepancy. A cursory look at some of the stations, this comes as no surprise. (next page)

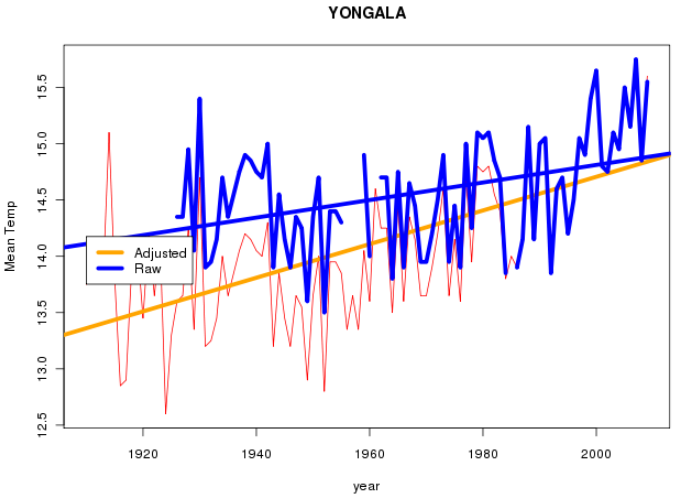
[http://jonova.s3.amazonaws.com/guest/barnham/broome-site_3003.png]



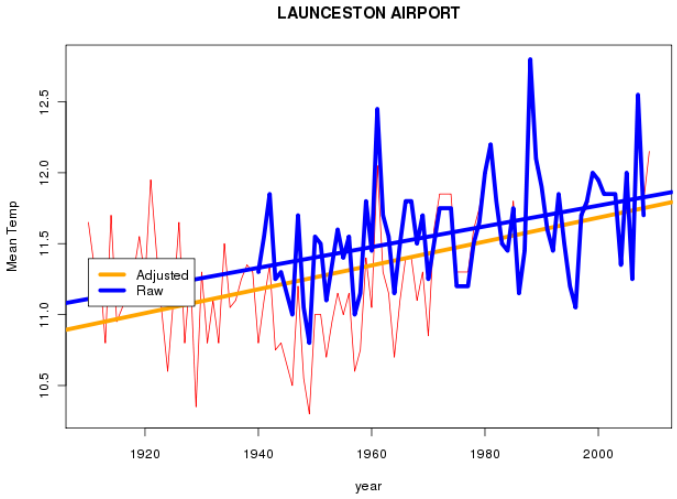
[http://jonova.s3.amazonaws.com/guest/barnham/alice-site_15590.png]



[http://jonova.s3.amazonaws.com/guest/barnham/yongala-site_19062.png]

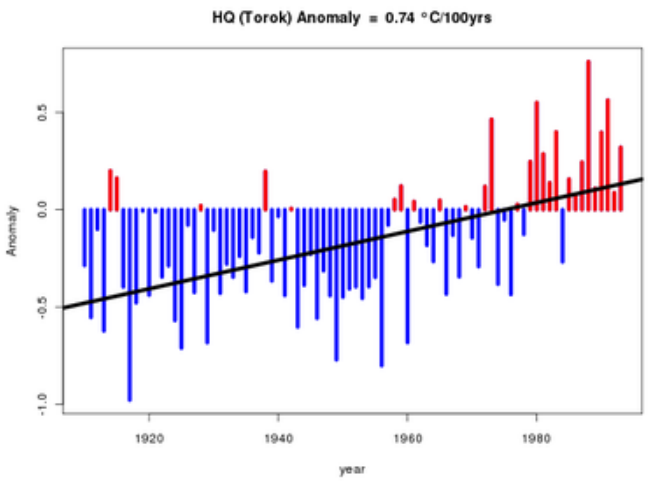


[http://jonova.s3.amazonaws.com/guest/barnham/launceston-site_91104.png]

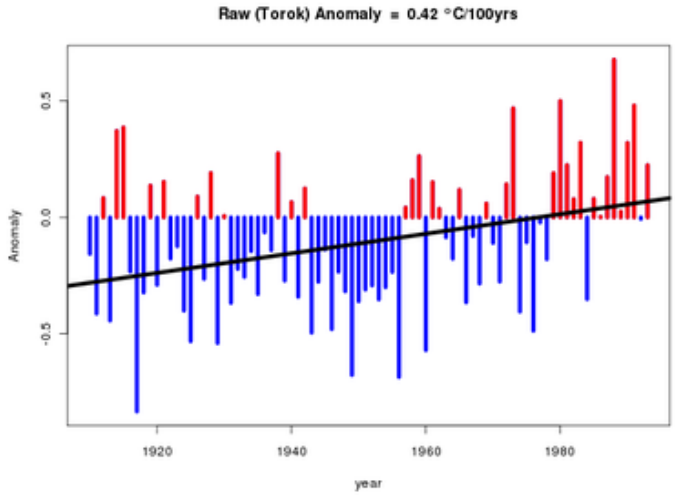


An analysis of the original Torok data yields a larger discrepancy of 40%. Illustrating in brief here:

[http://jonova.s3.amazonaws.com/guest/barnham/torok_hq.png]



[http://jonova.s3.amazonaws.com/guest/barnham/torok_raw.png]



A Brief Discussion on UHI

The Urban Heat Island (UHI) effect is a real effect that requires careful handling when dealing with surface temperature records for purposes of global climate change analysis.

The effect is discussed in detail in a CSIRO report for example(CSIRO is a key Australian, Government funded research body who work closely with BOM on climate change issues) http://www.aer.gov.au/content/item.phtml?itemId=679412&nodeId=0baa620cf5d46010ffbf1a24a9fd0614&fn=Part%203%20-%20Annexures%208-9.pdf

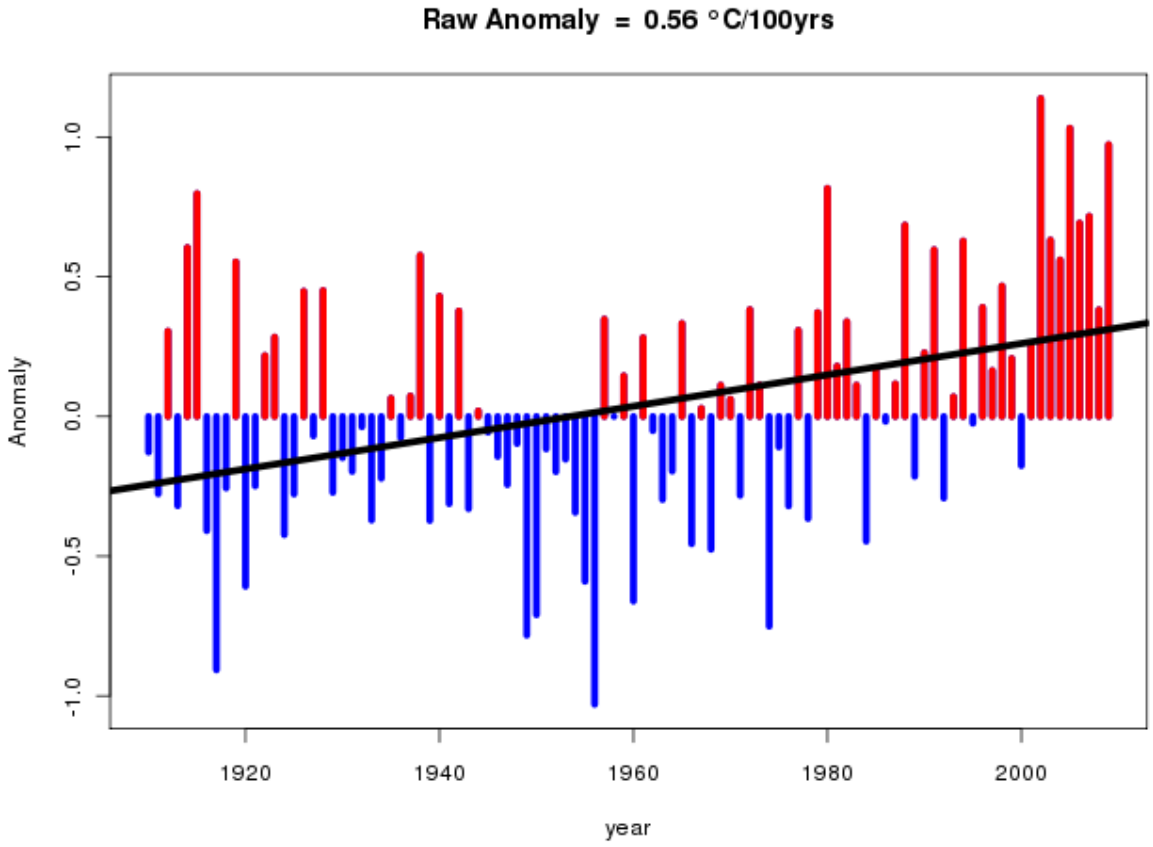
The report makes a number of interesting statements:

> *"It [UHI] is commonly measured as the difference between urban and rural temperatures at night, when the near-surface effect is strongest."*
>
> *"The net effect on mean temperatures is a city-rural [City of Melbourne] difference of 1.O°C in 1950, increasing to about 1.6"C by 2000. For maximum temperature, the average difference is only O.l"C with a slight upward trend mainly due to warming in the 1990s. The effect of urbanisation appears most evident in minimum temperature."*

So a simple, yet somewhat crude, way to remove UHI from the climate change equation is to look at maximum daytime temperatures only as opposed to min/max average. This technique is crude because it likely that the difference between annual maximum trend and minimum trend is attributable to factors other than just UHI. It gives us at least an approximate possible upper margin for UHI. It is likely that there are indeed forces at work whereby emissions based global warming applies itself with different intensities between day and night: just as UHI manifests itself differently between night and day. Following is a graph of the raw data set with daytime temperatures only, presented with intention to better

understand the UHI signal, on the understanding that doing so may also remove some component of the nigh-time global warming signal (if any) at the same time. So the technique is not particularly rigorous, but is presented for purposes of expediency. The issue of UHI is complex and merits its own, more detailed, treatment.

[http://jonova.s3.amazonaws.com/guest/barnham/raw_max.png]



BOM have chosen to deal with UHI by removing entire stations classified as urban: which I have also done so far. The HQ temperature series actually includes 134 stations: 100 are rural and 34 are urban.

But this process is arguably even less rigorous than looking at daytime temperature only. It assumes UHI is a binary effect and this is clearly not the case. UHI is observable for even very modest rural population densities.

Trend anomaly with following combinations (average temperature):

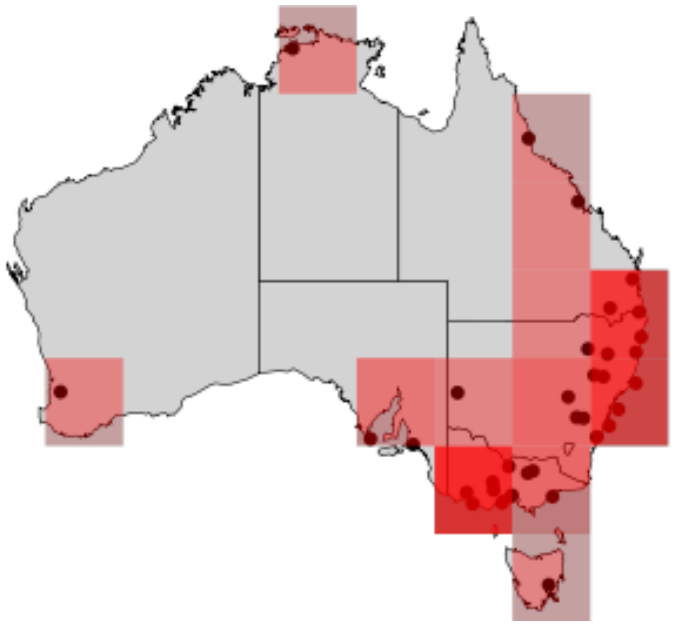
	HQ	**Raw**
Rural Only	0.94	0.72
Rural + Urban	0.94	0.73
Urban Only	0.84	0.51

Extraordinarily, Urban stations only reduces the observed trend. The raw temperature trend goes up and down in such a way that seems to indicate that the data may be harbouring a

statistical paradox known as Simpson's Paradox. Why this comes about merits close examination, which is beyond scope of this article. But a couple of speculative points.

Firstly it could be a statistical artefact of there being too few stations and too few grid cells. Illustrating grid cell map for Urban only:

[http://jonova.s3.amazonaws.com/guest/barnham/hq_urban_map.png]



Gridding is statistically fraught when you consider that stations cluster close to population centres. Some grids within the Rural HQ/Raw analysis only have a single station in them. So the influence of a single temperature station located in the Australian outback is more statistically significant than the readings from 20 or so stations located in a grid on the Australian South/East coast. This doesn't mean gridding is bad, it just means that ideally it would be nice if distribution of stations was more uniform; and the absence of the ideal means that risk of statistical artefacts is higher.

Another, equally wild, speculative point is that UHI in major population centres has already run its course. UHI observations show that the effect of UHI is logarithmic. So a city growing from 3 million to 4 million people will exhibit less UHI than a town growing from 100 to 1000. So stations designated as 'rural' will actually be subject to a stronger UHI anomaly signal because of this.

Of course a counter argument to consider is the point of view that UHI is not a significant effect at all. Yet the trend figures against CSIRO figures for the City of Melbourne (Australia's second largest city), indicate that UHI is indeed a significant climate force and the fact that BOM's processes do not replicate this in the trend numbers suggests that they are possibly not adequately dealing with the issue of UHI.

One last chart of numbers: showing breakdown of min and max in trend:

	HQ (min)	HQ (max)	Raw (min)	Raw (max)
Rural Only	1.2	0.69	0.87	0.56
Rural + Urban	1.24	0.66	0.77	0.60

Urban Only	1.3	0.37	0.52	0.26

It's a confusing array of numbers that raises more questions than answers.

Just one of many possible questions: why is Urban Max so different from Rural Max? According to the CSIRO, UHI does not significantly impact max temperatures so why the distinct discrepancy (in both HQ and Raw)? What else could possibly explain this variation?

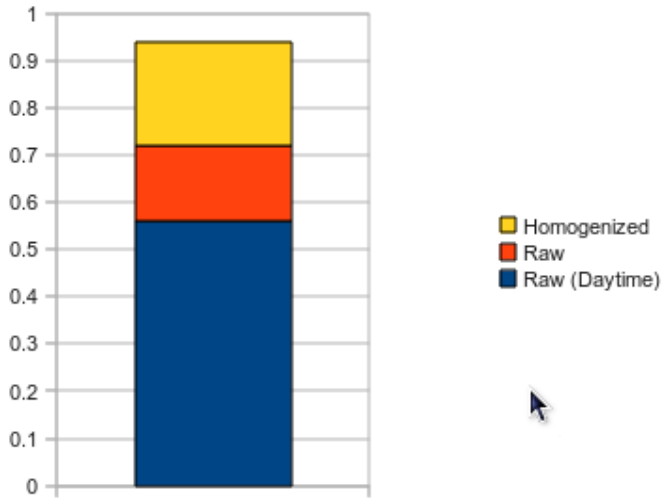
Finally, a word on the homogenization process and its relevance to the issue of UHI. The homogenization process is concerned with correcting for a number of items that can affect temperature data, such as station moves, changes to immediate station environment (construction of new nearby buildings), station equipment etc. No attempt to correct for UHI forms part of homogenization process; nor can it. Homogenization applies discrete step-wise adjustments which is likely a poor model for UHI where UHI is a continuous function of population and the process of urbanization.

Conclusions

Looking at land surface record of a single continent doesn't necessarily deepen our understanding of the climate system and the extent of human industrial impact on that system in terms of emissions such as CO2. Yet results of studies such as Torok and Della-Marta and BOM climate change artifacts in general are used to justify policymaking that potentially has a significant impact on daily Australian life. My results raise a number of issues with the quality of the data and supporting analysis provided by BOM.

Trend temperature in Australia over the past 100 years can be simply represented as follows:

[http://jonova.s3.amazonaws.com/guest/barnham/simple_chart.png]



Of the 0.94 trend reported by the BOM at least 20% and possibly as much as 40% is certainly man made but not as a consequence of global warming. UHI is man made, and statistical artefacts of the homogenization process are strictly speaking man made too: made by BOM employees to be precise. But neither of these are caused by global emissions. Of the remaining 60%-80% what precise component of which can be directly attributed to global human emissions remains uncertain and is beyond the scope of this article.

Some closing points:

The homogenization process is a very blunt and un-subtle analysis tool. When it is wielded by some groups it generates outcomes that are barely discernible (such as GISS). Yet when it is yielded by the BOM the impact on the final anomaly figures are quite dramatic.

BOM implicitly claim to compensate for UHI by virtue of removing stations designated as urban. But the methodology they use has no appreciable effect on resulting trends and as such it seems likely that it is an inappropriate methodology.

BOM disregard a number of stations with long term data. Instead they utilise a process of merging data from multiple nearby stations and attempt to correct for discontinuities in the resulting dataset via the homogenization process in order to boost the number of stations in their data set. A highly fraught and subjective process that exposes them to further criticism.

Finally it is important to note that although the HQ series is adjusted upwards as much as 20% as a consequence of BOM homogenization, the raw temperature series still demonstrates an upward trend of 0.72°C per century. This figure, without attempts to compensate for UHI, is consistent with what is reported in global land surface temperature series sets such as GISS. Precisely what component of this trend represents a signal that indicates Co2 emissions driven AGW is outside the scope of this analysis.

Recent thoughts on the Urban Heat Island Effect

http://pielkeclimatesci.wordpress.com/2010/05/12/my-comment-on-the-new-paper-urban-heat-island-effects-on-estimates-of-observed-climate-change-by-david-e-parker/

"The latest report from the Intergovernmental Panel on Climate Change recognises that urbanisation is missing from climate model projections [Christensen et al., 2007], and the potential for differential rates of radiatively-forced climate change in urban compared to rural areas has received little attention."

http://wires.wiley.com/WileyCDA/WiresArticle/wisId-WCC21.html

(i) the annual mean urban bias (AMUB) on minimum temperature is rising at a higher rate (almost 3 times more) than on maximum temperature, with a linear trend of 0.14° C and 0.05°C (10 yr) respectively,

(ii) The 40-yr AMUB on mean temperature is estimated to be 0.62°C,

(iii) 45% of the overall warming trend is attributed to intensifying urban heat island effects rather than to changes in local regional climate, and

(iv) During summertime, a stronger dependence between the increase of urban bias on minimum temperature and the change in percentage of impervious surfaces is found.

APPENDIX V

Some of the more recent articles discussing errors in the temperature records around the world which serves to undermine any confidence in the Australian Bureau of Meteorology temperature records and adjustments which are not independently audited.

Climate change data dumped

The Sunday Times November 29, 2009 Jonathan Leake, Environment Editor

SCIENTISTS at the University of East Anglia (UEA) have **admitted throwing away much of the raw temperature data on which their predictions of global warming are based**.

It means that other academics are **not able to check basic calculations** said to show a long-term rise in temperature over the past 150 years.

The UEA's Climatic Research Unit (CRU) was forced to reveal the loss following requests for the data under Freedom of Information legislation.

The data were gathered from weather stations around the world and then adjusted to take account of variables in the way they were collected. The revised figures were kept, but the originals — stored on paper and magnetic tape — were dumped to save space when the CRU moved to a new building.

The admission follows the leaking of a thousand private emails sent and received by Professor Phil Jones, the CRU's director. In them he discusses thwarting climate sceptics seeking access to such data.

In a statement on its website, the CRU said: "We do not hold the original raw data but only the value-added (quality controlled and homogenised) data."

The CRU is the world's leading centre for reconstructing past climate and temperatures. Climate change sceptics have long been keen to examine exactly how its data were compiled. That is now impossible.

Roger Pielke, professor of environmental studies at Colorado University, discovered data had been lost when he asked for original records. "The CRU is basically saying, 'Trust us'. So much for settling questions and resolving debates with science," he said.

Jones was not in charge of the CRU when the data were thrown away in the 1980s, a time when climate change was seen as a less pressing issue. The lost material was used to build the databases that have been his life's work, showing how the world has warmed by 0.8C over the past 157 years.

He and his colleagues say this temperature rise is "unequivocally" linked to greenhouse gas emissions generated by humans. Their findings are one of the main pieces of evidence used by the Intergovernmental Panel on Climate Change, which says global warming is a threat to humanity.

Legal Defeat for Global Warming in Kiwigate Scandal

By John O'Sullivan *Last Updated Oct 9, 2010, Published Oct 6, 2010*

Read the entire article at Suite101: Legal Defeat for Global Warming in Kiwigate Scandal http://www.suite101.com/content/legal-defeat-for-global-warming-in-kiwigate-scandal-a294157#ixzz14U8vG5rg

The following is an excerpt:

In the climate controversy dubbed Kiwigate,New Zealand skeptics inflict shock courtroom defeat on climatologists implicated in temperature data fraud.

New Zealand's government via its National Institute of Water and Atmospheric Research (NIWA) has announced it has nothing to do with the country's "official" climate record in what commentators are calling a capitulation from the tainted climate reconstruction. The story is also covered on web news aggregator site, *icecap.com.*

NIWA's statement of defense claims they were never responsible for the national temperature record (NZTR).The climb down is seen as a legal triumph for skeptics of the New Zealand Climate Science Coalition (NZCSC) who had initiated their challenge last August when petitioning the high court of New Zealand to invalidate the weather service's reconstruction of antipodean temperatures. The NZCSC Petition may be read here.

According to the August official statement of the claim from NZCSC, climate scientists cooked the books by using the same alleged 'trick' employed by British and American scientists. This involves subtly imposing a warming bias during what is known as the 'homogenisation' process that occurs when climate data needs to be adjusted.

The specific charge brought against the Kiwi government was that its climate scientists had taken the raw temperature records of the country and then adjusted them artificially with the result that a steeper warming trend was created than would otherwise exist by examination of the raw data alone.

Indeed, the original Kiwi records show no warming during the 20th century, but after government sponsored climatologists had manipulated the data a warming trend of 1C appeared.

New Zealand Government Abandons 'Official' Climate Record

The NZCSC story reports that the NZ authorities, "formally stated that, in their opinion, they are not required to use the best available information nor to apply the best scientific practices and techniques available at any given time. They don't think that forms any part of their statutory obligation to pursue "excellence."

NIWA now denies there was any such thing as an "official" NZ Temperature Record, although there was an official acronym for it (NZTR). However, the position now taken by the NZ government is that all such records are now to be deemed as unofficial and strictly for internal research purposes.

The article urges that if the government will not affirm that their temperature reconstruction is official then, "Nobody else should rely on it."

Researcher from Climategate University Implicated in Data Fraud

As reported in a Suite101 article by the same writer of April 2010 'Kiwigate is a Carbon Copy of Climategate' it was shown that the scientist who made the controversial "bold adjustments" is none other than Jim Salinger who is also a lead author for the Intergovernmental Panel on Climate Change (IPCC). Because very few temperature records exist for the Pacific Ocean, the NIWA record is given extra weight by the UN's IPCC for determining multi-decadal trends in global average temperatures.

Salinger was dismissed by NIWA earlier this year for speaking without authorization to the media. The researcher originally worked at Britain's Climatic Research Unit (CRU), the institution at the center of the Climategate scandal.

Salinger was also among the inner circle of climate scientists whose leaked emails precipitated the original climate controversy in November 2009. In an email (August 4, 2003) to fellow American climate professor, Michael Mann, Salinger stated he was "extremely concerned about academic standards" among climate skeptics.

Data Destroyed Before it Could be Independently Verified

In circumstances strangely similar to those witnessed in the Climategate controversy, Kiwigate appears to match Climategate in three key facets. First, climate scientists declined to submit their data for independent analysis. Second, when backed into a corner the scientists claimed their adjustments had been 'lost'. Third, the raw data itself proves no warming trend.

Downloadable pdf files of letters between Coalition chairman and barrister Barry Brill and NIWA chairman Chris Mace may be read here.

Surface Temperature Records: Policy Driven Deception?

UPDATED, AUGUST 27, 2010 Written by Joseph D'Aleo & Anthony Watts
http://scienceandpublicpolicy.org/originals/policy_driven_deception.html

Authors veteran meteorologists Joe D'Aleo and Anthony Watts analyzed temperature records from all around the world for a major SPPI paper, Surface Temperature Records – Policy-driven Deception? The startling conclusion that we cannot tell whether there was any significant "global

warming" at all in the 20th century is based on numerous astonishing examples of manipulation and exaggeration of the true level and rate of "global warming".

That is to say, leading meteorological institutions in the USA and around the world have so systematically tampered with instrumental temperature data that it cannot be safely said that there has been any significant net "global warming" in the 20th century.

Last Updated on Thursday, 04 November 2010 09:50

You can download the full 209 page Pdf report from
http://scienceandpublicpolicy.org/images/stories/papers/originals/surface_temp.pdf

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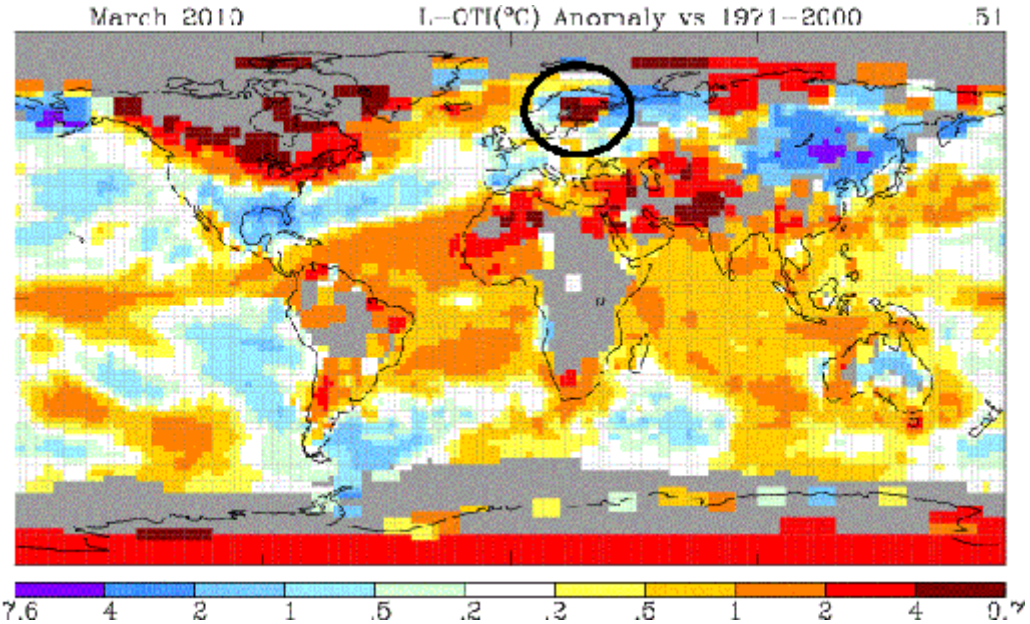
GISS & METAR – dial "M" for missing minus signs: it's worse than we thought

Posted on April 17, 2010 by Anthony Watts

http://wattsupwiththat.com/2010/04/17/giss-metar-dial-m-for-missing-minus-signs-its-worse-than-we-thought/#more-18590

Here's a story about how one missing letter, an M, can wreck a whole month's worth of climate data. It is one of the longest posts ever made on WUWT, I spent almost my entire Saturday on it. I think it might also be one of the most important because it demonstrates a serious weakness in surface data reporting.

In my **last post**, we talked about the **a curious temperature anomaly** that Jean S. found in the March GISS data and posted at Climate Audit:



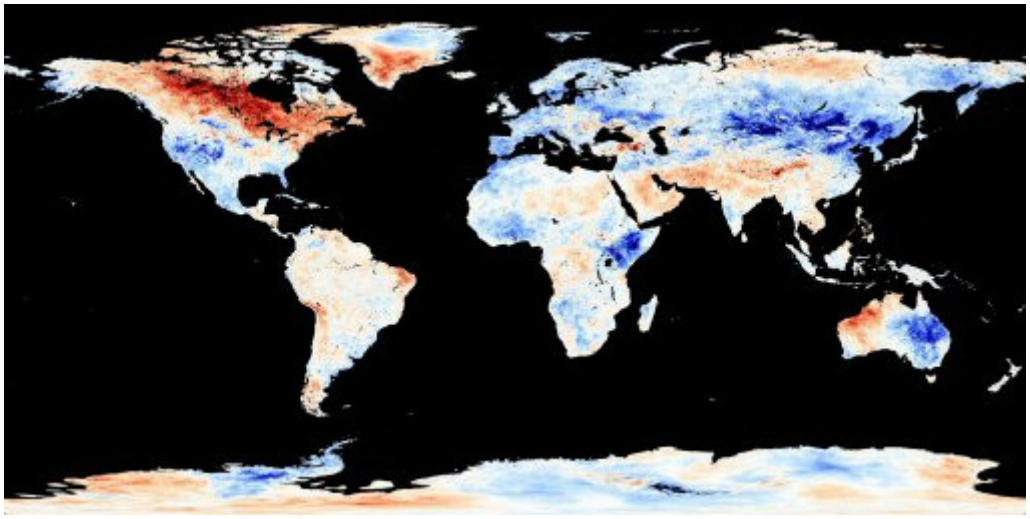
The anomaly over Finland has an interesting signature to it, and the correction that GISS posted on their **website** confirms something I've been looking at for a few months.

The data shown between 4/13 and 4/15 were based on data downloaded on 4/12 and included some station reports from Finland in which the minus sign may have been dropped.

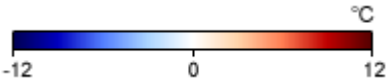
With some work I started back in late December and through January, and with GISS putting stamp of approval on "missing minus signs" I can now demonstrate that missing minus signs aren't just an odd event, they happen with regularity, and the effect is quite pronounced when it does happen. This goes to the very heart of data gathering integrity and is rooted in simple human error. The fault lies not with GISS (though now they need a new quality control feature) but mostly with NOAA/NCDC who manages the GHCN and who also needs better quality control. The error originates at the airport, likely with a guy sitting in the control tower. Readers who are pilots will understand this when they see what I'm talking about.

I've seen this error happen all over the world. Please read on and be patient, there is a lot of minutiae that must be discussed to properly frame the issue. I have to start at the very bottom of the climate data food-chain and work upwards.

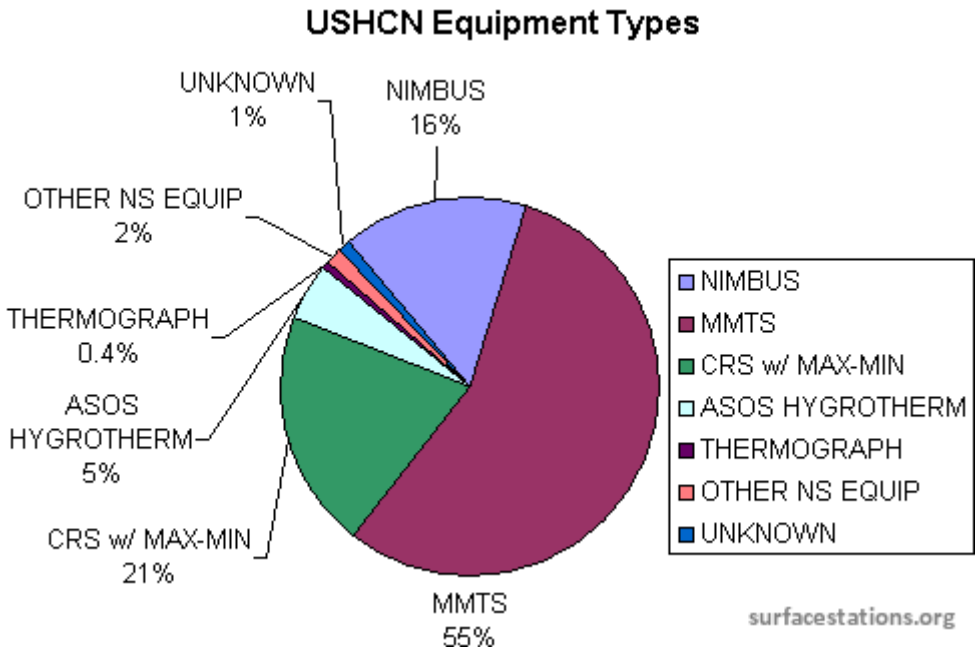
First, a discussion about the root of error and the differences between the surface and satellite dataset. I should mention that in the satellite image from **NASA's Earth Observation**s (NEO), we don't see the same error as we see in the GISTEMP map above.



NASA NEO March 1-31 2010 day satellite measured temp anomaly – click for larger image



Why? Better sensors, maybe, but mostly it has to do with a different data gathering methodology. In the surface data sets, including land and ocean data, most every datapoint is touched by a human hand, even airport data that gets done by automated airport sensors sometimes gets transcribed manually (often in third world and technologically stunted countries). In the surface data, thousands of sensors are spread across the globe, many different designs, many different exposures, many different people with different standards of measurement and reporting. The precision, accuracy, and calibration of the vast surface network varies, especially when we have broad mix of instrumentation types.For example in the US Historical Climatological Network the equipment varies significantly.



In satellite data, the data is measured at a single point with one sensor type, the Microwave Sounder Unit on the satellite, calibrated to a precision source on-board. On-board redundant precision platinum resistance thermometers (PRTs) carried on the satellite radiometers. The PRT's are individually calibrated in a laboratory before being installed in the instruments. The satellite data is automatically measured and transmitted. In contrast to the surface temperature record, no human hands touch the data gathering or data reporting process. Satellite data generation is far more homogeneous than the mish-mash of surface data.

I think it would be safe to say that the chances of human error in raw surface data are at least an order of magnitude greater (if not several) than error in raw satellite data. Post measurement processing is another issue, but for the purposes of this essay, I'm focusing only on raw data gathering and transmittal.

As mentioned in the recently updated compendium of issues with the surface temperature data by Joe D'Aleo and myself, there has been a move in the Global Historical Climatological Network (GHCN) to rely more and more on airports for climate data. This, in my opinion, is a huge mistake because in addition to those issues

E.M. Smith aka "Chiefio" reports that in GISS (which uses GHCN) worldwide, there has been a **wholesale migration towards airport weather data** as a climatic data source. In an email sent to me on Jan 20, 2010 he says that

Look at:

http://chiefio.wordpress.com/2009/08/26/agw-gistemp-measure-jet-age-airport-growth/

which as a fairly good descriptions of the problems in the data, we have a global report for GHCN as of that August data. There is more deail in the link, but I think you care about "now":

```
Percentage of sites that are AIRPORTS NOW, by decade of record

Year    S.P    S.C    S.T    S.W    EQ.    N.W    N.T    N.C    N.P  Total

1909    0.0   42.0   15.1   28.2   29.2   36.7   22.8   33.3   44.4   25.4
```

1919	0.0	36.4	12.8	23.5	25.1	37.7	20.9	35.0	39.8	24.1
1929	0.0	37.0	11.9	27.4	27.7	32.7	20.4	35.9	56.4	24.1
1939	0.0	43.9	17.6	32.0	33.8	29.1	20.2	36.2	51.0	25.1
1949	0.0	32.3	24.4	37.6	44.4	31.8	23.3	39.3	60.9	29.1
1959	0.0	24.0	35.0	50.0	59.4	39.4	30.9	41.0	62.9	37.3
1969	0.0	18.1	39.3	53.2	63.2	40.2	31.4	41.1	61.5	39.0
1979	0.0	17.9	39.1	52.0	64.2	40.7	28.8	41.1	62.3	37.7
1989	0.0	20.7	41.5	52.5	67.8	41.9	29.1	40.8	64.9	37.7
1999	0.0	21.0	53.5	57.4	68.0	53.0	32.6	49.0	59.0	41.6
2009	0.0	17.9	74.0	64.7	66.5	51.5	30.2	45.4	57.3	41.0

This is by major climate latitude band, the total is 41% for the globe (and rising daily ;-)
Also in:
http://chiefio.wordpress.com/2009/12/08/ncdc-ghcn-airports-by-year-by-latitude/

I do break outs by continent and by some countries. For the USA, I further do a specific with / without USHCN (the older version, not the USHCN.v2 put in 15Nov09) and findFor COUNTRY CODE: 425

But it masks the rather astounding effect of deletions in GHCN without the USHCN set added in:

LATpct:	2006	3.7	18.3	29.5	33.2	14.4	0.0	0.4	0.3	0.1	0.1 100.0
AIRpct:		1.3	4.0	6.3	6.7	3.2	0.0	0.4	0.3	0.1	0.1 22.4
LATpct:	2007	8.2	17.2	28.4	26.9	11.2	0.0	3.7	3.0	0.7	0.7 100.0
AIRpct:		8.2	15.7	27.6	23.1	9.0	0.0	3.7	3.0	0.7	0.7 **91.8**
LATpct:	2008	8.8	16.9	28.7	26.5	11.0	0.0	3.7	2.9	0.7	0.7 100.0
AIRpct:		8.8	15.4	27.9	22.8	8.8	0.0	3.7	2.9	0.7	0.7 **91.9**
LATpct:	2009	8.1	17.8	28.1	26.7	11.1	0.0	3.7	3.0	0.7	0.7 100.0
AIRpct:		8.1	16.3	27.4	23.0	8.9	0.0	3.7	3.0	0.7	0.7 **91.9**
DLaPct:	2009	4.3	18.4	29.5	32.5	13.6	0.0	0.7	0.9	0.2	0.1 100.0
DArPct:		2.1	5.7	8.8	8.9	3.7	0.0	0.6	0.8	0.2	0.1 30.7

That in the YEAR 2009 the USA has almost 92% airports in GHCN.

So clearly, airports make up a significant portion of the climate data.

On the issues of airports as climate station, obvious issues with siting, UHI, failing ASOS instrumentation, and conflicting missions (aviation safety -vs-climate) aside, I'm going to focus on one other thing unique to airports: **METAR**

What is METAR you ask? Well in my opinion, a government invented mess.

When I was a private pilot (which I had to give up due to worsening hearing loss – tower controllers talk like auctioneers on the radio and one day I got the active runway backwards and found myself head-on to traffic. I decided then I was a danger to myself and others.) I learned to read SA reports from airports all over the country. SA reports were manually coded teletype reports sent hourly worldwide so that pilots could know what the weather was in airport destinations. They were also used by the NWS to plot synoptic weather maps. Some readers may remember Alden Weatherfax maps hung up at FAA Flight service stations which were filled with hundreds of plotted airport station SA (surface aviation) reports.

The SA reports were easy to visually decode right off the teletype printout:

```
PIT   SA  0053 M80 BKN 140 OVC 10RW-239/55/38/2305/023
      /RB29
RGC   SA  0054 E80 BKN 150 OVC 8RW- 58/29/2105/021/RB45
ERI   SA  0053 55 SCT M80 OVC 7 218/50/45/1810/016/RE50
BFD   SA  0054 250 SCT 10 241/49/36/2106/021
DUJ   SA  0055 250 SCT 10 237/51/34/2105/021
PSB   SA  0052 250 SCT 7 250/40/37/0000/023
JST   SA  0050 CLR 15 50/32/2010/021
AOO   SA  0051 120 SCT E250 BKN 12 246/49/35/1906/022
DXY   SA  0050 -X 5H 253/47/38/0000/027/H4
MDT   SA  0040 CLR 6H 44/36/0000/027
IPT   SA  0054 130 SCT 300 -SCT 7 245/42/40/0000/024
AVP   SA  0057 250 -SCT 10 251/53/39/1608/026
ABE   SA  0057 CLR 4H 260/48/43/0605/029
RDG   SA  0040 CLR 12 46/37/0000/026
LNS   SA  0045 CLR 5H 50/41/1006/022
```

A Teletype weather report for pilots.

For air safety, major airports have stations operated by the Federal Aviation Administration or National Weather Service to give pilots complete information. Teletype reports like that shown at the top of the page and decoded at the bottom are available. While in flight the pilot receives weather reports and forecasts every half hour, and can request information at any time. The growth of private and commercial aviation has been paced by the growth of the National Weather Service, which has made safe flying possible.

Following is an interpretation of the first line of the Teletype above.

PIT Reporting station: Pittsburgh, Pa.
SA 0053 Scheduled observation, taken at 0053 GMT
M80 BKN Measured ceiling at 8,000 ft., broken cloudiness
140 OVC Overcast cloudiness at 14,000 ft.
10RW- Visibility: 10 miles; weather: light rain showers
239 Barometric pressure: 1023.9 millibars
55 Temperature in degrees Fahrenheit
38 Dew point in degrees Fahrenheit
2305 Wind: blowing from 230° (southwest) at 5 knots
023 Altimeter setting: 30.23
RB29 Remarks: Rain Began at 0029 GMT

From page 115 of the book "Weather" By Paul E. Lehr, R. Will Burnett, Herbert S. Zim, Harry McNaught - click for source image

Note that in the example above, temperature and dewpoint are clearly delineated by slashes. Also, when a minus temperature occurs, such as -10 degrees Fahrenheit, it was reported as "-10″. Hang on to that, it is important.

The SA method originated with airmen and teletype machines in the 1920′s and lasted well into the 1990′s. But like anything these days, government stepped in and decided it could do it better. You can thank the United Nations, the French, and the World Meteorological Organization (WMO) for this one. SA reports were replaced by METAR in 1996.

From Wikipedia's section on METAR

METAR reports typically come from airports or permanent weather observation stations. Reports are typically generated once an hour; if conditions change significantly, however, they can be updated in special reports called SPECIs. Some reports are encoded by automated airport weather stations located at airports, military bases, and other sites. Some locations still use augmented observations, which are recorded by digital sensors, encoded via software, and then reviewed by certified weather observers or forecasters prior to being transmitted. Observations may also be taken by trained observers or forecasters who manually observe and encode their observations prior to transmission.

History

The METAR format was introduced 1 January 1968 internationally and has been modified a number of times since. North American countries continued to use a Surface Aviation Observation (SAO) for current weather conditions until 1 June 1996, when this report was replaced with an approved variant of the METAR agreed upon in a 1989 Geneva agreement. The World Meteorological Organization's (WMO) publication No. 782 "Aerodrome Reports and Forecasts" contains the base METAR code as adopted by the WMO member countries.[1]

Naming

The name METAR is commonly believed to have its origins in the French phrase *message d'observation météorologique pour l'aviation régulière* ("Aviation routine weather observation message" or "report") and would therefore be a contraction of *MÉTéorologique Aviation Régulière*. The United States Federal Aviation Administration (FAA) lays down the definition in its publication the Aeronautical Information Manual as *aviation routine weather report*[2] while the international authority for the code form, the WMO, holds the definition to be *aerodrome routine meteorological report.* The National Oceanic and Atmospheric Administration (part of the United States Department of Commerce) and the United Kingdom's Met Office both employ the definition used by the FAA. METAR is also known as Meteorological Terminal Aviation Routine Weather Report or Meteorological Aviation Report.

I've always thought METAR coding was a step backwards, for reasons I'll discuss shortly.

But first, quick! Spot the temperature and dewpoint in this METAR report:

The following is an example METAR from Burgas Airport in Burgas, Bulgaria, and was taken on 4 February 2005 at 16:00 Coordinated Universal Time (UTC).

METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 M04/M07 Q1020 NOSIG 9949//91=

Could you read this and know what the weather is in Burgas? I can, only becuase I've looked at hundreds the past few months, but I still have to pick through the report to find it. The reason is that METAR is a *variable field* reporting format. Data isn't always in the same position.

In the report above. The temperature and dewpoint is: **M04/M07**

M04/M07 indicates the temperature is −4 °C (25 °F) and the dewpoint is −7 °C (19 °F). An M in front of the number indicates that the temperature/dew point is below zero (0) Celsius.

Notice also that the entire METAR report is visually more complex. This is fine if you are having computers code it, but many METAR reports are still hand coded by technicians at airports, and thus begins the introduction of human error into the climate data process. Complexity is not a good thing when manual labor is involved as it increases the likelihood of error.

Here is where METAR coding departs from normal numeric convention. SA reports did not have this problem.

In the METAR report above, instead of using the normal way we treat and write negative numbers, some policy wonk decided that we'll use the letter "M" to report a negative number. Only a bureaucrat could think like this.

So instead of a below zero Centigrade temperature and dewpoint looking like this:

-04/-07

in the "new and improved" METAR coding, it looks like this:

M04/M07

OK not a problem you say? Well I beg to differ, because it forces technicians who manually code METAR reports for transmission to do something they would not do anywhere else, and that's write down an "M" instead of a minus sign. Using an M is totally counter-intuitive and against basic math training, and increases the likelihood of error.

It gets worse. Let's say the technician makes a boo-boo and puts a minus sign instead of an "M" in front of the numbers for temperature/dewpoint. You'd think this would be alright, and the system would correctly interpret it, right?

Let's put the METAR report from Burgas Airport into an online METAR decoder.

http://www.wx-now.com/Weather/MetarDecode.aspx

Here's the report with the easy to make mistake, using minus sign instead of M for the temperature.

METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 -04/M07 Q1020 NOSIG 9949//91=

The output from the online METAR decoder reads:

Latest weather	
Observation time	Sunday 4 April 2010 4:00 PM UTC
Local time	Saturday 17 April 2010 7:51 PM UTC
Flight conditions	Low Instrument Meterological Conditions
Winds	Wind direction East-Southeast (120°) Winds variable from 310° to 290° Wind speed 7 mph
Visibility	0.9 mi.
Present weather	heavy snow
Sky condition	Ceiling 2,200 ft. broken clouds Cloud layer broken clouds 2,200 ft. Cloud layer overcast 5,000 ft.
Temperature	39°F
Altimeter	30.12 in.Hg
Derived measurements	Wind chill 34°F
Remarks	No significant changes expected in the next two hours.
METAR	METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 -04/M07 Q1020 NOSIG 9949//91=
For information only: do not use for flight planning or navigation.	

Hey look at that, the temperature is 39°F (3.8°C). Minus signs are discarded from METAR decoding. Note that decoded METAR temperature also comes out the same if the "M" is missing in front of the 04/-07 or 04/M07

If it had been decoded correctly we would have gotten:

(-4) degrees Celsius = 24.8 degrees Fahrenheit

A whole 14.2 degrees F difference!

Reference for METAR decoding:

http://www.met.tamu.edu/class/METAR/quick-metar.html

Also note that METAR data has no year stamp component to the data, so the METAR decoder has no way of knowing this was a report from 2005, not 2010. Since each METAR report is essentially disposable within 24 hours, this presents no problem for pilots, they don't care. But if you are tracking climate over years using METAR data, not having a year time stamp increases the likelihood of error.

Also the temperature error itself in this case has no bearing on a pilot's decision to takeoff or land. Unless they are worried about **density altitude** on hot humid days, the temperature is a throwaway datum. They are mostly concerned about winds, sky conditions, and barometer (altimeter setting). In fact cool/cold days are far better for aviators; see AOPA's **Why Airplanes Like Cool Days Better.**

My point here is this:

If a pilot or tower controller sees an erroneous METAR report like this:

METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 -04/M07 Q1020 NOSIG 9949//91=

Or this:

METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 04/M07 Q1020 NOSIG 9949//91=

Pilots/controllers/dispatchers aren't likely to care, since current temperature and dewpoint are not important to them at these cooler temperatures. They also aren't likely to call up the tower and holler at the technician to say "Hey, the temperature is wrong!". Further, since the METAR report may be reissued sometime within the hour if somebody DOES spot the error, problem solved.

Point is that updates/corrections to METAR data may not be logged for climate purposes, since they are likely to be seen as duplicate reports because of the hourly timestamp.

So, in the case of M's and minus signs, the propensity exists for erroneous METAR reports to *not* get corrected and to stay logged in the system, eventually finding their way into the climate database if that airport happens to be part of GISS, CRU, or GHCN datasets.

Maddeningly, even when egregious errors in aviation weather data are pointed out and even acknowledged by the reporting agency, NOAA keep them in the climate record as was demonstrated last year in Honolulu, HI International Airport when a string of new **high temperature records were set by a faulty ASOS reporting station**. NOAA declined to fix the issue in the records:

NOAA: FUBAR high temp/climate records from faulty sensor to remain in place at Honolulu

The key sentence from that story from KITV-TV:

The National Weather Service said that is not significant enough to throw out the data and recent records.

Hmmm, look at another nearby station and **compare the differences**. You be the judge.

Does NOAA consider this a climate reporting station? Yes according to **NCDC MMS database**, it is part of the "A" network, designated for climate:

Stn Name	Name Type	Stn Type	COOP	WBAN	Call Sign	ICAO	WMO
ROGERS FIELD	ALIAS	ASOS, ASOS-NWS, COOP, COOPERATIVE SUB-NETWORK- AB, LAND SURFACE	511919	22521	HNL	PHNL	91182
HONOLULU WSFO AP 703	COOP NAME						
HONOLULU INTL AP	PRINCIPAL NAME						

Clearly, NOAA simply doesn't seem to care that erroneous records finds their way into the climatic database.

- **OK back to the METAR issue.**

The problem with METAR reporting errors is worldwide. I've found many examples easily in my spare time. Let's take for example, a station in **Mirnvy**, Russia. It is in Siberia at 62.5° N 113.9° E and has an airport, is part of GHCN, and reports in METAR format.

Weather Underground logs and plots METAR reports worldwide, and these METAR reports are from their database on November 11th, 2009.

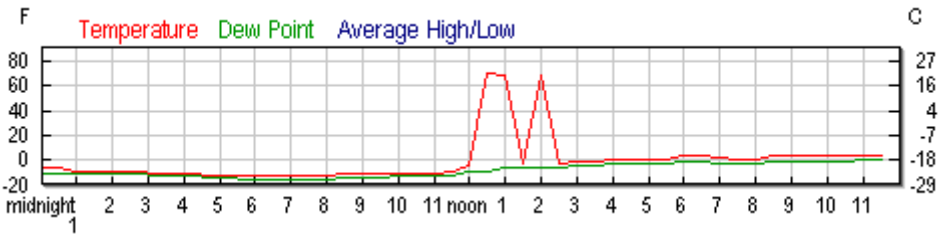
It shows a clear error in the 12:30PM (330Z) and 1 PM (400Z) METAR report for that day:

http://www.wunderground.com/history/airport/UERR/2009/11/1/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA

```
UERR 010330Z    22005G08MPS 9999 -SN 21/M23 Q1026 NOSIG RMK QFE738 24450245
UERR 010400Z    22005G08MPS 9999 -SN SCT100 OVC200 20/M22 Q1025 NOSIG RMK QFE737
24450245
UERR 010430Z    21005G08MPS 4000 -SN SCT100 OVC200 M20/M22 Q1024 NOSIG RMK
QFE737 24450245
UERR 010430Z    21005G08MPS 4000 -SN SCT100 OVC200 M20/M22 Q1024 NOSIG RMK
QFE737 24450245
UERR 010500Z    21005G08MPS 4000 -SN SCT100 OVC200 20/M22 Q1023 NOSIG RMK QFE736
24450245
```

Note the missing " M" on the 12:30PM (330Z) and 1 PM (400Z). It happens again at 2PM (500Z). Of course it isn't very noticeable looking at the METAR reports, but like the GISS plot of Finland, stands out like a sore thumb when plotted visually thanks to Weather Underground:

Mirnvy, Russia



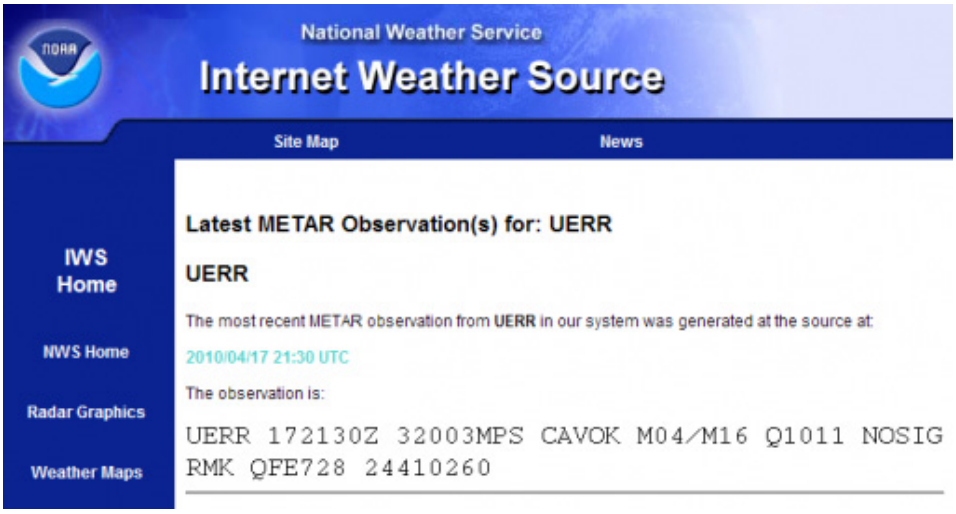
The effect of the missing "M" is plotted above, which coincidentally looks like an "M".

Put those METAR reports in this online METAR decoder: http://www.wx-now.com/Weather/MetarDecode.aspx and you get 70F for 12:30PM and 68F for 1PM

What do you think 70 degree F spike this will do to monthly averaged climate data in a place where the temperature stays mostly below freezing the entire month?

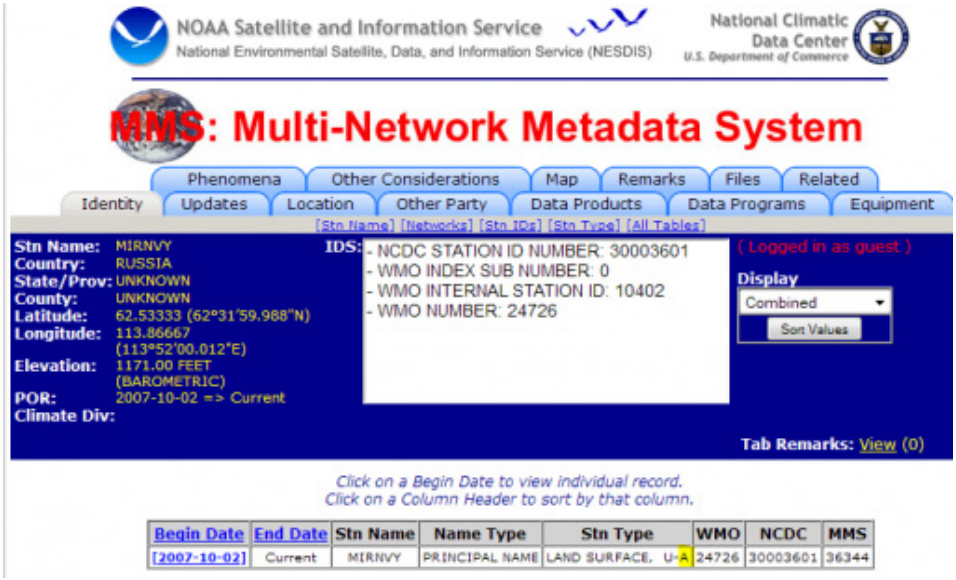
http://www.wunderground.com/history/airport/UERR/2009/11/1/MonthlyHistory.html?MR=1

Does NOAA log METAR data from Mirnvy Russia (ICAO code UERR)?



Yes, they do. Plus many other METAR reporting stations discussed here.

Does NCDC classify it as a climate station?



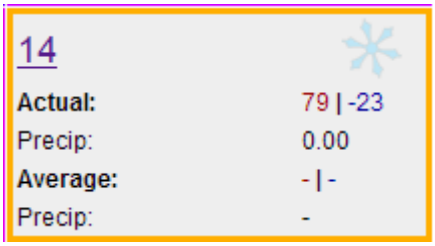
Yep, it is part of the "A" network. Which means it either directly reports climate data and/or is used to adjust data at other stations, such as GHCN stations.

List of GHCN stations:

http://www1.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd-stations.txt

It is not however, part of GHCN. But there are plenty stations that have this error that are part of GHCN. Yakutsk, Russia, also in Siberia is part of GHCN and has a METAR reporting error. Here's an example what one off-coded hourly reading will do to the climate database.

The city of **Yakutsk**, one of the coldest cities on earth, **reported a high of 79˚F on November 14th with a low of -23˚F**.

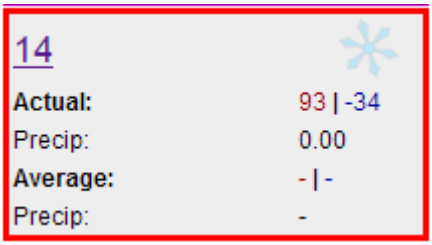


Weather Underground seems to have done some quality control to the METAR reports, but the erroneous high temp remains in the daily and monthly report:

http://www.wunderground.com/history/station/24959/2009/11/14/DailyHistory.html

http://www.wunderground.com/history/station/24959/2009/11/14/MonthlyHistory.html

A month later, it happened again **reporting a high of 93˚F on December 14th with a low of -34˚F**



And the erroneous **93F high temp** remains in both the daily and monthly reports, but has been removed from the METAR report, so I can't show you the missing "M" I observed back in January. I wish I had made a page screen cap.

http://www.wunderground.com/history/station/24959/2009/12/14/DailyHistory.html

http://www.wunderground.com/history/station/24959/2009/12/14/MonthlyHistory.html

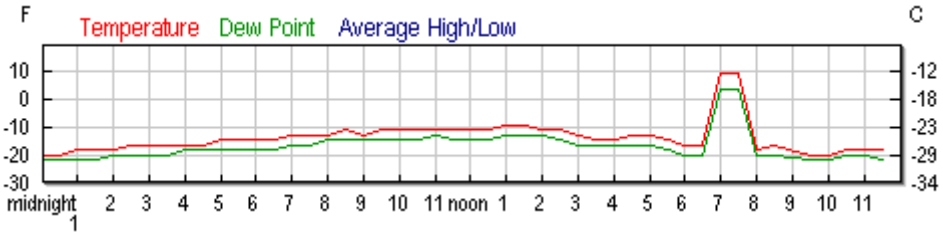
When the temperature data was calculated with that error then, this was found:

The average for the day, 30˚F, was some 67˚F above normal, pushing the anomaly for the month of December from 3.6˚F above normal to 5.9˚F above normal… quite a shift!

More examples:

Here's an example of a properly coded METAR report from **Nizhnevartovsk**, Russia, for December 11, 2009, but the data is wrong. I'm thinking it was supposed to be M30 but came out M13. The dewpoint value M16 is also erroneous.

Nizhnevartovsk, Russia Dec 7, 2009




```
METAR USNN 111230Z 00000MPS P6000 SCT026 OVC066 M27/M29 Q1014 NOSIG RMK QFE755
SC062
METAR USNN 111300Z 12005G08MPS P6000 SCT066 OVC200 M13/M16 Q1035 NOSIG RMK
QFE772 SC063
METAR USNN 111330Z 12005G08MPS P6000 SCT066 OVC200 M13/M16 Q1035 NOSIG RMK
QFE772 SC063
METAR USNN 111400Z 00000MPS P6000 SCT020 OVC066 M28/M29 Q1014 NOSIG RMK QFE755
SC065
```

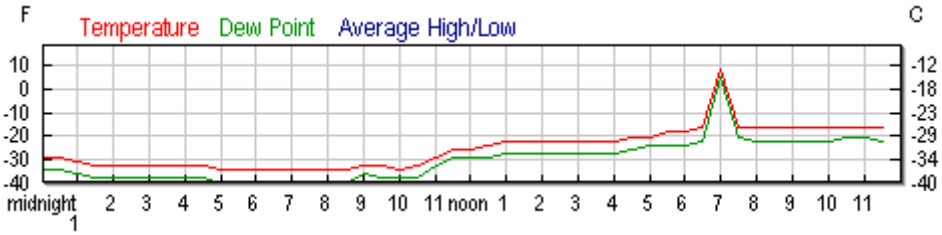
And it was not a one time occurrence, happening again on Dec 25th as shown in the Monthly graph:

Nizhnevartovsk, Russia, December 2009

http://www.wunderground.com/history/airport/USNN/2009/12/25/MonthlyHistory.html

The daily graph and METAR reports, notice it happened about the same time (1300Z) and in the same way (M27 then M13) , perhaps pointing to the same technician on duty making the same habitual mistake again. Maybe too much Vodka having to work the Xmas night shift?

Nizhnevartovsk, Russia Dec 25, 2009



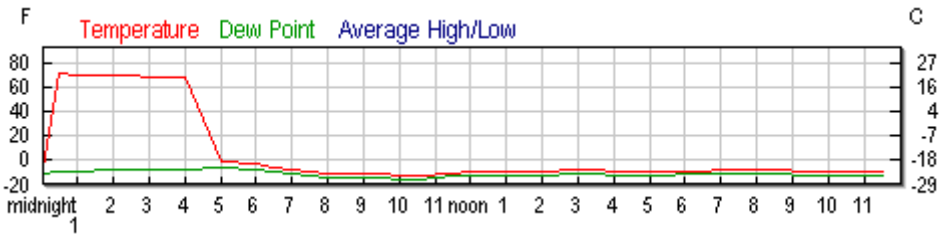
```
METAR USNN 251230Z 11006MPS 2200 -SN SCT014 OVC066 M27/M30 Q1015 NOSIG RMK
QFE757 SC055
METAR USNN 251300Z 35002MPS 6000 -SN SCT015 OVC066 M13/M15 Q1010 NOSIG RMK
QFE752 SC03
METAR USNN 251330Z 12006MPS 4100 -SN SCT015 OVC066 M27/M29 Q1014 NOSIG RMK
QFE756 SC055
```

http://www.wunderground.com/history/airport/USNN/2009/12/25/DailyHistory.html

It did not appear initially to be in the GHCN list or on the GISS list, but I've found that some of the names on Weather Underground are different from the place names in the GHCN and GISS lists. It turns out that if you search in Weather Underground for the station **ALEKSANDROVSKOE** it will point you to use the data from **Nizhnevartovsk.** ALEKSANDROVSKOE is a GHCN/GISS station.

I found other instance of METAR errors for that station, this one was quite pronounced on Jan 16th, 2009, lasting for 7 hours before it was corrected.

Nizhnevartovsk, Russia Jan 16, 2009



Here's the METAR reports

```
METAR USNN 151800Z 23002MPS P6000 BKN066 OVC200 M22/M24 Q1009 NOSIG RMK QFE751
SC038
METAR USNN 151830Z 23002MPS 2900 -SHSN SCT020CB OVC066 22/M23 Q1009 NOSIG RMK
QFE751 SC038
METAR USNN 151900Z 23002MPS 2100 -SHSN SCT019CB OVC066 21/M23 Q1009 NOSIG RMK
QFE751 SC038
METAR USNN 152000Z 24001MPS 5000 -SHSN SCT022CB OVC066 21/M22 Q1009 NOSIG RMK
QFE751 SC038
METAR USNN 152030Z 24002MPS 4300 -SHSN SCT020CB OVC066 21/M22 Q1009 NOSIG RMK
QFE751 SC038
METAR USNN 152100Z 24002MPS 6000 -SHSN SCT018CB OVC066 20/M22 Q1009 NOSIG RMK
QFE751 SC038
METAR USNN 152130Z 25002MPS P6000 SCT020CB OVC066 20/M22 Q1009 NOSIG RMK QFE751
SC038
METAR USNN 152200Z 28002MPS P6000 SCT022CB OVC066 20/M22 Q1009 NOSIG RMK QFE752
SC038
METAR USNN 152300Z 27003MPS P6000 -SHSN SCT016CB OVC066 M19/M21 Q1010 NOSIG RMK
QFE752 SC038
```

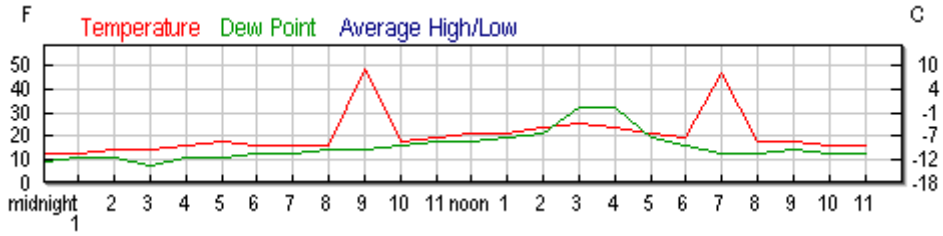
http://www.wunderground.com/history/airport/USNN/2009/1/16/DailyHistory.html

The monthly report shows the event:

Nizhnevartovsk, Russia, January 2009

http://www.wunderground.com/history/airport/USNN/2009/1/16/MonthlyHistory.html

It happened twice on Feb 2nd, 2007, and with a space added between the M and 09 on the 0300Z report, it is a clear case of human error:




```
METAR USNN 020100Z 11010G15MPS 0500 R03/1200 +SN +BLSN VV002 M09/M11 Q1003 TEMPO
0400 +SN +BLSN VV002 RMK QFE748 QWW060 MOD ICE MOD TURB S
METAR USNN 020200Z 12009G14MPS 0500 R03/1200 +SN +BLSN VV002 M09/M10 Q1001 TEMPO
0400 +SN +BLSN VV002 RMK QFE747 QWW060 MOD ICE MOD TURB S
METAR USNN 020300Z 11008G13MPS 1100 R03/1200 SN +BLSN BKN004 OVC066 M 09/M10
Q1000 NOSIG RMK QFE745 QRD120 MOD ICE MOD TURB SC045
...
METAR USNN 021200Z 18009MPS P6000 -SHSN DRSN SCT017CB OVC066 M07/M09 Q0989 TEMPO
2000 SHSN RMK QFE736 MOD ICE MOD TURB SC042
METAR USNN 021300Z 16009MPS P6000 DRSN SCT016CB OVC066 08/M11 Q0989 NOSIG RMK
QFE736 MOD ICE MOD TURB SC042
METAR USNN 021400Z 16008MPS P6000 DRSN SCT016CB OVC066 M08/M11 Q0989 NOSIG RMK
QFE736 MOD ICE MOD TURB SC042
```

http://www.wunderground.com/history/airport/USNN/2007/2/2/DailyHistory.html

The monthly data shows the double peak:

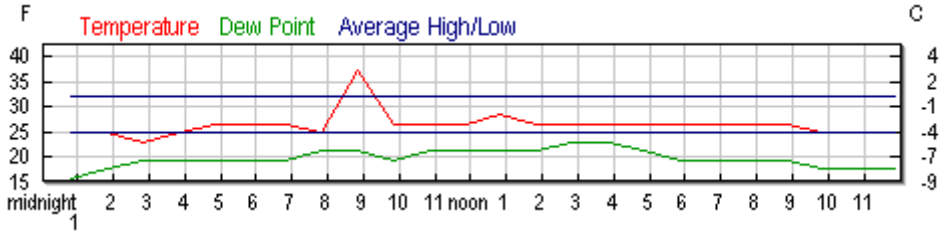
http://www.wunderground.com/history/airport/USNN/2007/2/2/MonthlyHistory.html

I'm sure many more can be found, I invite readers to have a look for themselves by looking for such events at Weather Underground

- **It is not just Russia that has METAR reporting errors**

Lest you think this a fault of Russia exclusively, it also happens in other northern hemisphere Arctic site and also in Antarctica.

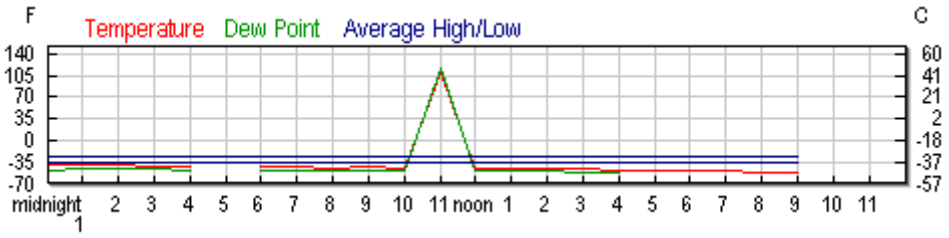
Svalbard, Oct 2, 2008




```
METAR ENSB 020550Z 13012KT 6000 -SN FEW010 SCT015 BKN030 M04/M06 Q1013 TEMPO
4000 SN BKN012
METAR ENSB 020650Z 14013KT 9000 -SN FEW010 SCT018 BKN040 03/M06 Q1013 TEMPO 4000
SN BKN012
METAR ENSB 020750Z 15011KT 9999 -SN FEW015 SCT025 BKN040 M03/M07 Q1013 TEMPO
4000 SN BKN012
```

http://www.wunderground.com/history/airport/ENSB/2008/10/2/DailyHistory.html

Eureka, Northwest Territory, Canada March 3 2007



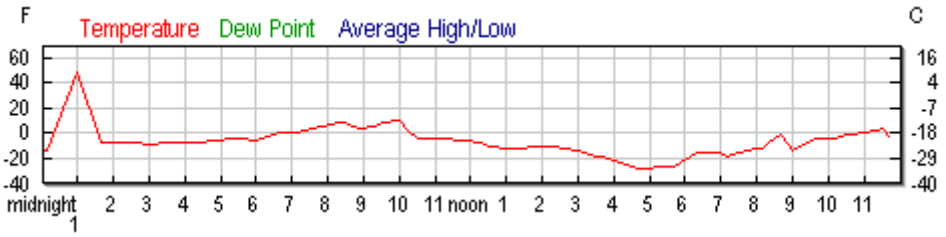
It hit 109.4 F (43C) there on March 3rd 2007 according to this METAR report. Eureka is the northernmost GHCN station remaining for Canada. It's temperature gets interpolated into adjacent grid cells.

```
CWEU 031600Z 14004KT 15SM FEW065 BKN120 M43/M45 A2999 RMK ST1AS2 VIA YQD SLP150
CWEU 031700Z 15005KT 10SM FEW065 BKN012 43/46 A3000 RMK SF1AS1 VIA YQD SLP163
Decoded: 11:00 AM 109.4 °F 114.8 °F 100% 30.01 in 10.0 miles SSE 5.8 mph -
Mostly Cloudy
CWEU 031800Z 11003KT 15SM FEW050 FEW065 OVC130 M43/M46 A3001 RMK SF2SC1AS1 VIA
YQD SLP164
```

http://www.wunderground.com/history/airport/CWEU/2007/3/3/DailyHistory.html

In these cases below for Antarctic stations Dome C and Nico, the METAR reports seem to have all sorts of format issues and I'm not even sure how where the error occurs, except that Weather Underground reports a spike just like we see in Russia.

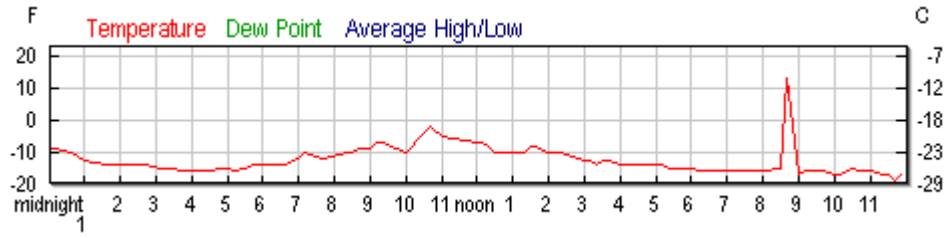
Dome C station Dec 9, 2009




```
AAXX 0900/ 89828 46/// ///// 11255 36514 4//// 5//// 90010
AAXX 0901/ 89828 46/// ///// 10091 36514 4//// 5////
AAXX 09014 89828 46/// /1604 11225 36480 4//// 5//// 9014
```

http://www.wunderground.com/history/station/89828/2009/12/9/DailyHistory.html

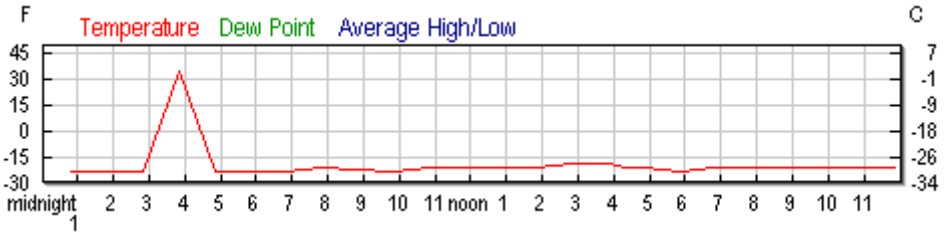
Nico Station, University of Wisconsin Dec 9, 2009




```
AAXX 0920/ 89799 46/// ///// 11261 4//// 5//// 92030
AAXX 0920/ 89799 46/// ///// 11103 4//// 5//// 92040
AAXX 0921/ 89799 46/// ///// 11270 4//// 5////
```

http://www.wunderground.com/history/station/89799/2009/12/9/DailyHistory.html

Admusen Scott Station Jan 14th, 2003



Here's generally properly formatted METAR data, but note where the technician coded the extra space, oops!

```
NZSP 131350Z GRID36007KT 9999 IC SCT020 BKN060 M31/ A2918 RMK SDG/HDG
NZSP 131450Z GRID36007KT 9999 IC FEW010 FEW020 SCT035 SCT050 M3 1/ A2918 RM K
SDG/HDG
NZSP 131550Z GRID10008KT 9999 IC BCFG FEW010 SCT020 BKN050 M31/ A2919 RMK VIS E
2400 BCFG E SDG/HDG
```

http://www.wunderground.com/history/station/89009/2003/1/14/DailyHistory.html

And I'm sure there are many more METAR coding errors yet to be discovered. What you see above is just a sampling of a few likely candidates I looked at over a couple of hours.

- **Missing M's – Instant Polar Amplification?**

It has been said that the global warming signature will show up at the poles first. **Polar Amplification** is defined as:

"Polar amplification (greater temperature increases in the *Arctic* compared to the earth as a whole) is a result of the collective effect of these feedbacks and other processes." It does not apply to the Antarctic, because the Southern Ocean acts as a heat sink. It is common to see it stated that "Climate models generally predict amplified warming in polar regions", e.g. Doran et al. However, climate models predict amplified warming for the Arctic but *only modest warming for Antarctica*.

Interestingly, the METAR coding error has its greatest magnitude at the poles, becuase the differences in the missing minus sign become larger as the temperature grows colder. Eureka, NWT is a great example, going from -43°C to +43°C (-45.4°F to 109.4°F) with one missing "M".

You wouldn't notice METAR coding errors at the equator, because the temperature never gets below 0°C. Nobody would have to code it. In middle latitudes, you might see it happen, but it is much more seasonal and the difference is not that great.

For example:

M05/M08 to 05/M08 brings the temp from -5°C to +5°C, but in a place like Boston, Chicago, Denver, etc a plus 5C temperature could easily happen in any winter month a -5C temperature occurred. So the error slips into the noise of "weather", likely never to be noticed. But it does bump up the temperature average a little bit for the month if uncorrected.

But in the Arctic and Antarctic, a missing M on a M20/M25 METAR report makes a 40°C difference when it becomes +20°C. And it doesn't seem likely that we'd see a winter month in Siberia or Antarctica that would normally hit 20°C, so it does *not* get lost in the "weather" noise, but becomes a strong signal if uncorrected.

Confirmation bias, expecting to see polar amplification may be one reason why until now, nobody seems to have pointed it out. Plus, the organizations that present surface derived climate data, GISS, CRU, only seem to deal in monthly and yearly averages. Daily or hourly data is not presented that I am aware of, and so if errors occur at those time scales, they would not be noticed. Obviously GISS didn't notice the recent Finland error, even though it was glaringly obvious once plotted.

With NASA GISS admitting that missing minus signs contributed to the hot anomaly over Finland in March, and with the many METAR coding error events I've demonstrated on opposite sides of the globe, it seems reasonable to conclude that our METAR data from cold places might very well be systemically corrupted with instances of coding errors.

The data shown between 4/13 and 4/15 were based on data downloaded on 4/12 and included some station reports from Finland in which the minus sign may have been dropped.

4/15/10 http://data.giss.nasa.gov/gistemp/

That darned missing M, or an extra space, or even writing "-" when you mean "M" (which is counterintuituve to basic math) all seem to have a factor in the human error contributing to data errors in our global surface temperature database. To determine just how much of a problem this is,

a comprehensive bottom up review of all the data, from source to product is needed. This needs to start with NOAA/NCDC as they are ultimately responsible for data quality control.

It has been said that "humans cause global warming". I think a more accurate statement would be "human error causes global warming".

Note: In this post I've demonstrated the errors. In a later post, I hope to do some data analysis with the numbers provided to see how much effect these errors actually have. Of course anyone who wants to do this is welcome to leave links to graphics and tables. -Anthony

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The Accidental Tourist

by Statistician Steve McIntyre May 20, 2008

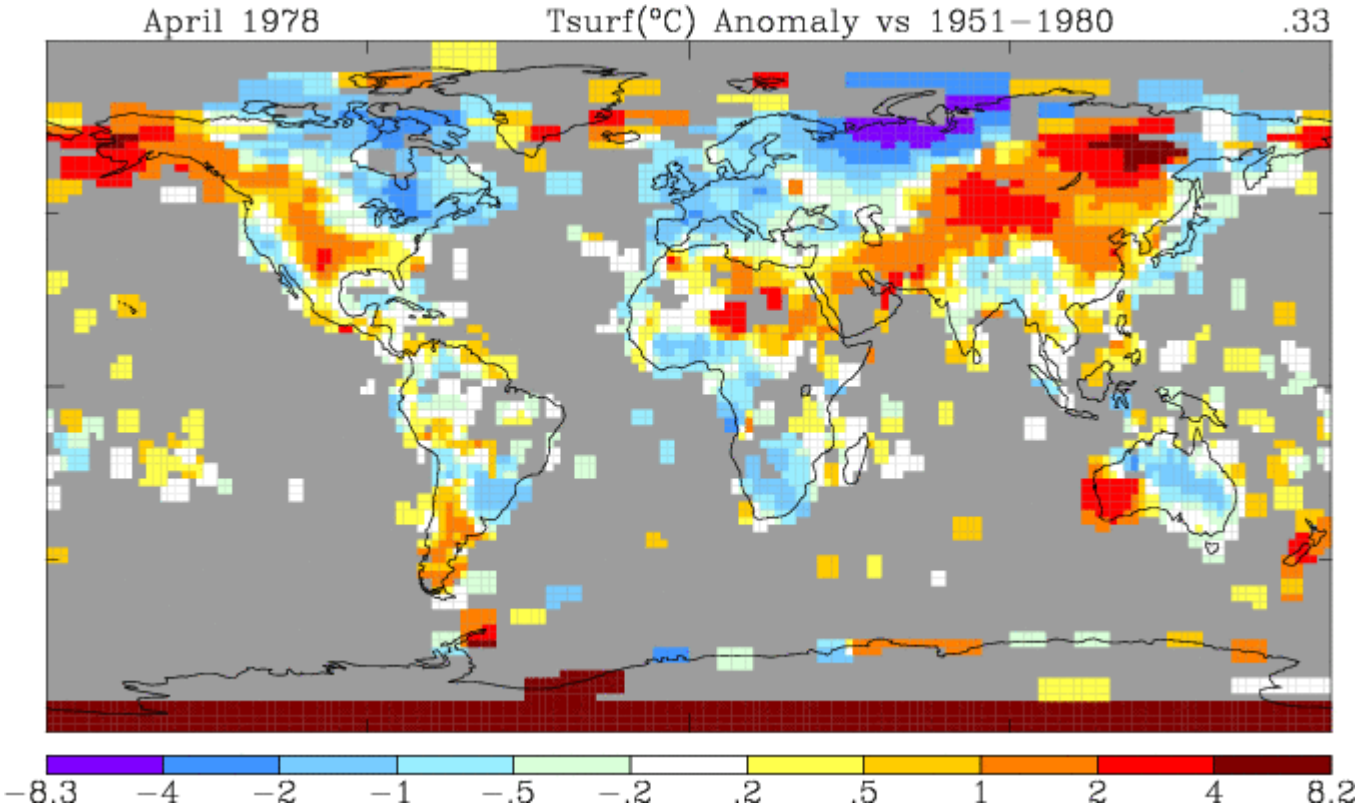
http://climateaudit.org/2008/05/20/the-accidental-tourist/

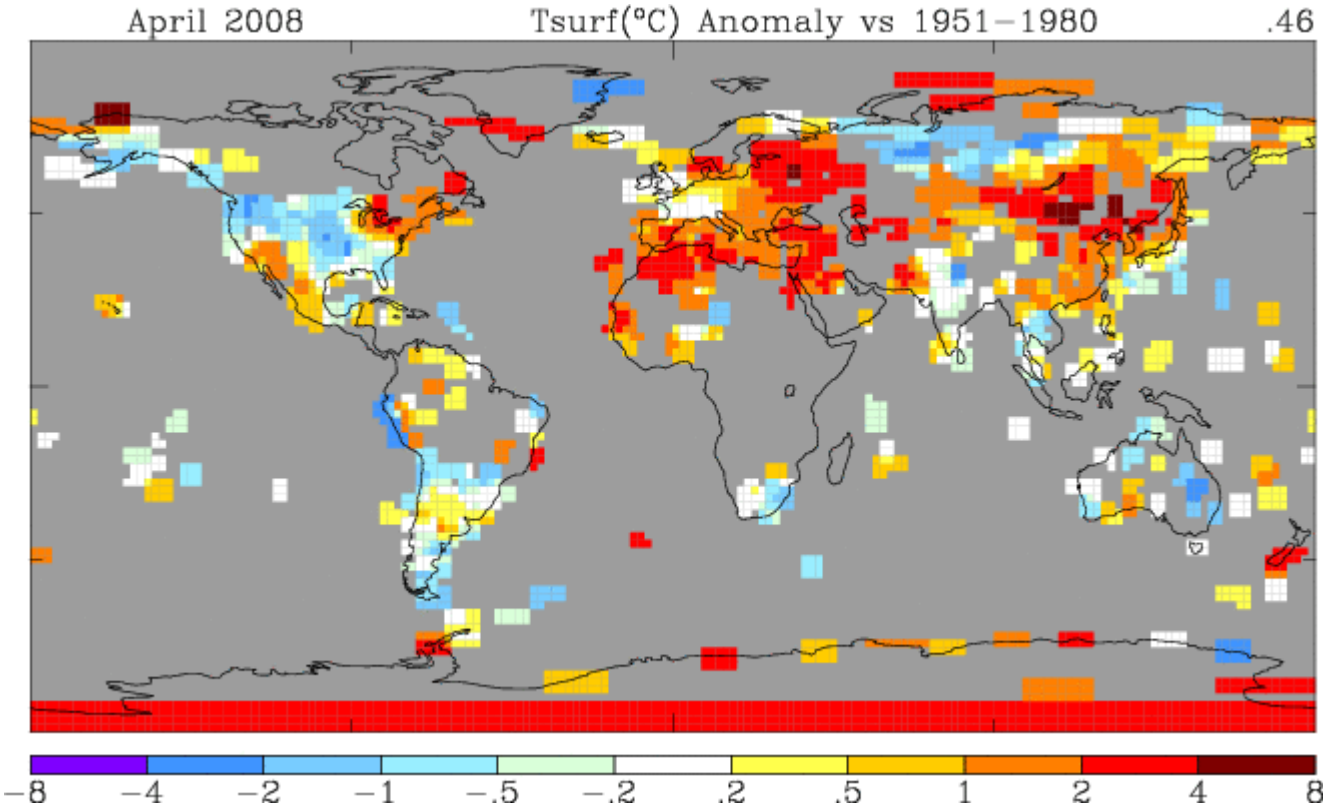
Occasionally I will take a trip after much careful planning and preparation, only to find myself going off into uncharted territory soon after embarking on my adventure. That is what happened to me recently when I started to take a fresh look at worldwide station coverage. Where I ended up and what I found when I got there was incredibly surprising.

It all began last week when GISS released their global mean summary for April, 2008. Following this release I went to view their global maps to get an idea as to where the "hot" and "cold" spots were last month. I viewed the data using both a 1200km and a 250km smoothing radius. Doing so helped me gauge the station coverage and the extent the 1200km smoothing algorithm estimates temperatures over the vast unsampled swaths of the planet.

It occurred to me that it would be interesting to compare April 2008 with April 1978 using a 250km smoothing radius. I was looking for "holes" in 2008 station coverage not present in 1978. I selected 1978 for two reasons. One was that the worldwide station coverage was near its peak that year. The second reason was that 1978 fell in the 1951-1980 30-year base period for calculating anomalies.

My thought was to identify multiple stations within a hole that were still reporting data today but were not being captured by GHCN. I wanted to see if the data from those stations supported the anomaly estimated by the 1200km smoothing. The 250km smoothed plots would be ideal for visually identifying holes. Here are the plots for April 1978 and April 2008:





There were lots of holes to choose from: Russia, China, Australia, Canada, Africa, and South America. I decided to start with Russia as I already knew where to look for recent temperature data from "discontinued" GHCN sites: meteo.ru. But first, I had to locate some stations to examine.

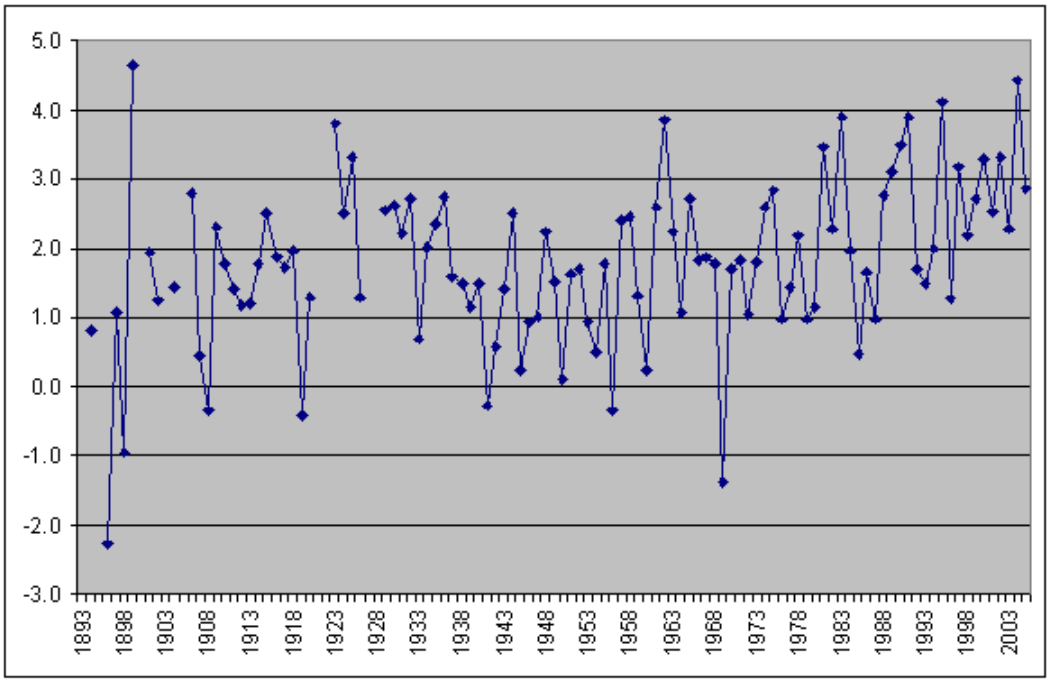
Looking at the April 2008 plot, the hole to the northeast of the Caspian Sea seemed like a good place to start. I went this time to the station data page at GISS and simply clicked my mouse on the map to the northeast of the Caspian Sea. GISS gave me a list of stations – sorted by increasing distance from where I clicked. At the top of the list was Kurgan, so I decided to go there first.

Wikipedia says Kurgan "is the administrative center of Kurgan Oblast, Russia; one of the oldest cities in Siberia." The view from Google Earth indicates it is pretty remote as well, but apparently has a population of 310,000 (according to the GISS data page).

GHCN records for Kurgan extend from November 1893 to April 1990. These are actually comprised of three scribal records: (0) November 1893 to December 1989, (1) May 1929 to December 1989, (2) January 1931 to April 1990. Because I grabbed the data from the GISS website I will refer to the records as GISS.0, GISS.1, and GISS.2 respectively. Remember, however, that GISS takes the data from GHCN.

I was hoping that the Meteo record for Kurgan would match one of the three GISS records. What I had forgotten was that the Meteo records were of daily readings rather than monthly averages. This meant I was going to have to calculate monthly averages for Meteo before I compared it with the GISS records. It is at this point my journey took an unexpected turn.

The Meteo records have three daily temperature records: Min, Mid, and Max. The Mid value is described simply as "Daily air temperature". I have not been able to find out when that value is recorded each day or how it is otherwise calculated. However, one thing that is certain: Mid does not represent the average of Min and Max. In fact, many of the early records only include Min and Mid. In the Meteo record for Kurgan, Mid records are available from November 1893 to December 2005. Following is a plot of that record:



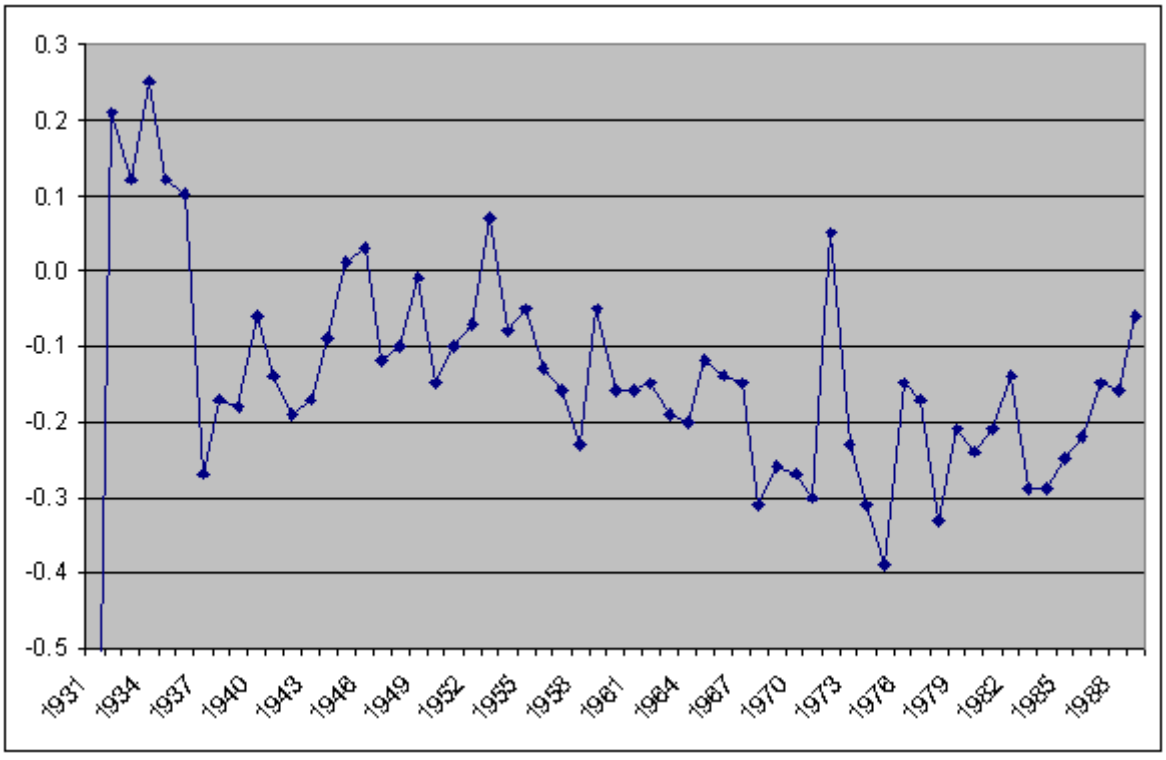
I calculated the monthly averages using the Mid values in the Meteo record. I then compared this monthly record with GISS.0 and found they very closely match in the months that overlap. The values for just nine months differ by 0.1, likely due to rounding differences. Another eleven monthly records not present in the GISS record were present in the Meteo record. I went back to the

Meteo record and found that in ten of those months, one or two days were flagged as having a quality issue. The quality issue turned out to be a Mid value that was lower than the Min value, so in the case of GISS.0, the entire month's worth of data was discarded when just one or two data points were suspect. Interestingly, the GISS algorithm later creates an estimate for the missing month when calculating the annual average!

With the exception of June 1967 (which is missing from the GISS record) and the fact that the GISS record ends in December 1989, I was able to use the Meteo Mid data to reproduce GISS.0 for Kurgan.

Max data values begin appearing in the Meteo record May 1, 1929. I happened to notice that GISS.1 also begins with May 1929. On a whim, I decided to calculate the monthly averages using the daily averages in the Meteo record when both the Min and Max values were present. To my surprise, this variant of the Meteo record matched the GISS.1 record!

At this point I have not been able to determine whether or not GISS.2 is also derived from the same record, but it is likely that it is not. *Clearly, however, GISS.0 and GISS.1 are derived from the same record.* If you recall, the GISS algorithms will combine the two derived records using the "bias method", which assumes that one record is biased warmer or lower than the other record. Here is a plot of the difference between the Meteo record calculated using Mid values and the Meteo record calculated using the average of Min and Max. Can you determine the relative bias?



Update 5/21/08:

There are several points to be made here:

1. **GISS (from GHCN) ultimately uses the Meteo record twice.** In GISS.0 they use the "Mid" values from the record. In GISS.1 they use the average of Min/Max where possible.

Those two variations of the same record are then combined with a third record GISS.2 whose origin is unknown to me at this time.

2. **The bias method is used to combine GISS.0 with GISS.1** (and GISS.2). The bias method assumes that one record is running warmer or cooler than the other, and adjusts one of them accordingly. In the case of the Meteo record Mid is cooler than the average of Min/Max most of the time, but not always, and not by a constant amount. The bias method is an inappropriate method for combining these records.
3. **GHCN throws out an entire month's worth of data** when just one or two day's are suspect. This is done rather than estimating the suspect days. In doing so, GHCN has left it to GISS to come back later and estimate the temperature for the entire missing month.

Computer geek uncovers British climate-data errors

Paola Totaro *February 27, 2010* http://www.smh.com.au/environment/computer-geek-uncovers-british-climatedata-errors-20100226-p92h.html

LONDON: The British Meteorological Office has been forced to correct its global temperature records after a science blogger discovered that Australian weather data had been misused or discarded.

The mistakes were discovered by Dr John Graham-Cumming when the temperature records were made public by the office in December in the wake of the East Anglia University email scandal.

Dr Graham-Cumming, a London mathematician and computer programmer who describes himself as a "computer geek", found that data from seven weather stations in Australia had been accidentally discarded while another 112 Australian stations - or 28 per cent of the Oceania total - had not been fully included in the calculations.

"What appears to have happened is that the Met Office calculated the averages and then got more data from Oceania and then failed to update the averages," Dr Graham-Cumming said.

"The site with the greatest error was Napier Nelson Park, in New Zealand, where the average temperature was off by more than 1 degree. That's a lot given that the total warming seen since the 1970s is less than 1 degree and for this location the Met Office had it more than 1 degree hotter than it is. Had the error I'd found been more widespread, it could have had a real effect on the overall picture."

He said that when the office checked his findings it discovered similar problems with US weather data, with 121 stations assigned to the wrong location or overwritten in the calculations.

Dr Graham-Cumming was at pains to point out that errors made by the office do not alter the big picture on climate change.

"It does not change the scientific story, and that is that the world is getting hotter," he said.

"But it does show the need for open-source data. We open up software and data and it eliminates problems.

"There are lots of people with a background in maths and programming. If you open it up, there will be many eyes cast across the data and you can find problems without having to go to expensive reviews.

"There are hundreds of enthusiastic amateurs who will have a go and do it non-politically."

The land-based temperature records collected by the British Meteorological Office form a central plank of the scientific evidence for global warming.

The office has collated global temperature readings back to 1850, and while the raw data have not been freely available, graphs representing it have been.

The office provided details this week of its self-imposed review of global temperature records, announced last month, in an effort to try to regain public trust in climate science in the wake of the East Anglia University debacle.

In a document entitled "Proposal for a New International Analysis of Land Surface Air Temperature Data", the office argued that it was time to propose an international effort to reanalyse surface temperature data in collaboration with the World Meteorological Organisation.

The new analysis, which is expected to take three years, aims to test the conclusions reached by the United Nations Intergovernmental Panel on Climate Change that "warming of the climate system is unequivocal".

The Times reported that the World Meteorological Organisation said the Met Office proposal had been approved in principle by delegates at a meeting in Antalya, Turkey.

Labor seizes on temperature figures as evidence of global warming

Samantha Maiden, Online Political Editor From: *The Australian* January 05, 2010

AUSTRALIA had the second warmest year on record last year, the Bureau of Meterology confirmed today in a finding the Rudd government has seized on as fresh evidence of climate change.

The BOM said 2009 “will be remembered for extreme bushfires, dust-storms, lingering rainfall deficiencies, areas of flooding and record-breaking heatwaves”.

Extreme heatwaves across southern Australia during late January/early February set a new Melbourne maximum temperature record of 46.4C, new State maximum temperature records for

Victoria (48.8C at Hopetoun) and Tasmania (42.2C at Scamander), and contributing to the Black Saturday bushfires.

Victoria, South Australia and NSW also recorded their warmest July-December periods on record.

Environment Minister Peter Garrett said today the finding that Australia's annual mean temperature for 2009 was 0.9C above the 1961-90 average exposed Tony Abbott's false climate change claim that global warming has stopped.

"This false and misleading claim is today shown to be completely at odds with the rigorous scientific findings of the independent experts at the Bureau of Meteorology," Mr Garrett said.

"This is the latest Abbott climate-change clanger to be exposed by the independent experts and once again shows why Mr Abbott cannot be trusted when it comes to climate change."

Mr Garrett said the weather records underlined the need for a carbon pollution reduction scheme to reduce global warming.

Australia's hottest year was 2005, where temperatures rose 1.5C avove the 1961-90 average.

The Rudd government will reintroduce legislation to introduce an emissions trading scheme in the first sitting of Parliament next year, but already holds a double dissolution election trigger over the issue because the Senate has twice rejected the laws.

But it is likely to fail because Mr Abbott has abandoned bipartisan support for the reform, arguing it is a "giant tax" and will not reduce global warming.

Weather records also confirmed an unusual winter-time heatwave occurred during August over large parts of inland Australia and resulted in Australia's warmest August on record.

A third prolonged heatwave occurred during November across central and southeast Australia, leading to a record eight consecutive days of maximum temperatures above 35C in Adelaide, and numerous maximum temperature records across southern and eastern Australia, especially in South Australia and NSW.

"2009 ends Australia's warmest decade on record, with a decadal mean temperature anomaly of +0.48C (above the 1961-90 average)," the Bureau of Meterology said.

"In Australia, each decade since the 1940s has been warmer than the preceding decade. In contrast, decadal temperature variations during the first few decades of Australia's climate record do not display any specific trend. This suggests an apparent shift in Australia's climate from one characterised by natural variability to one increasingly characterised also by a trend to warmer temperatures."

In a statement, the bureau also noted that the World Meteorological Organisation stated that 2009 is expected to be the globe's fifth warmest year on record (about 0.44C above the 1961-90 average)

"A cooler-than-average global mean temperature has not been recorded since 1985, with the last decade also being the globe's warmest on record. Increasing global mean temperatures derived from instrumental measurements are consistent with other independent indicators of climate change, such as reductions in sea-ice and snow cover, and record high global sea levels," it said.

On December 8, Mr Abbott told 2GB Radio that the world's warming had stopped.

“I mean in the end this whole thing is a question of fact, not faith, or it should be a question of fact not faith and we can discover whether the planet is warming or not by measurement. And it seems that notwithstanding the dramatic increases in man made CO2 emissions over the last decade, the world's warming has stopped,” he said.

Mr Garrett said the Liberal leader had also made false claims that Labor's Carbon Pollution Reduction Scheme would cost the average family about $1100, which was informed by nothing more than a Google news search.

“Mr Abbott must today release his own scientific evidence to prove the globe has stopped warming, or admit he got it wrong,” Mr Garrett said.

“Australia is one of the hottest and driest inhabited places on earth and our environment and economy will be one of the hardest and fastest hit by climate change.”