



REWRITING AUSTRALIA'S TEMPERATURE HISTORY

HOT TAKES

- 1 Ongoing adjustments to Australia's official temperature record are making the present appear increasingly hotter compared to the past.
- 2 The most recent adjustment makes Australia appear to 'warm' 23% faster than previously.
- 3 At Rutherglen, the cooling trend was adjusted into a warming trend. At Darwin, adjustment made warming appear 38% faster.
- 4 The warming trend is further exaggerated because temperature measurements prior to 1910 are ignored.

A lot depends on our knowledge of past climate and our ability to predict future trends and events. The Australian Bureau of Meteorology ('the Bureau') holds historic records of temperatures across Australia. This information is critical for monitoring our changing climate. The Bureau does not, however, simply report this information. Rather, complex remodelling (re-adjustment of original measurements) is undertaken in the development and compilation of the official climate change statistics. This fact sheet explores the Bureau's remodelling, or 'homogenisation', of historic temperature measurements using the Rutherglen and Darwin weather stations as examples.

The Bureau's two most recent temperature remodelling campaigns have been carried out to create what is known as the Australian Climate Observations Reference Network – Surface Air Temperature database (ACORN-SAT). The first was in 2012¹. Then, in 2018, an updated version increased the apparent rate of warming for the Australian continent by a further 23%, from 1.00°C to 1.23°C per century between 1910 and 2016.

The calculations involved in remodelling the temperature series are extremely complex. In ACORN-SAT V2 there were 966 adjustments made to just 112 temperature records². The highly complex calculations, intended to remove observation biases in the original records, may create new biases due to the assumptions (calculation 'rules') built into the remodelling computer code, and by the subjective application of the five different statistical methods employed.

The Bureau explains adjustments are needed to allow for the relocation of weather stations, a change in measurement methods, merging of data sets, changes in observation times, and for 'statistical reasons'. The latter are defined as 'a change found by statistical methods *without specific documentary support*'.^{3,6} The procedure involves adjustments to the temperature records via the subjective application of complex statistical algorithms. They use data from numerous surrounding 'comparison stations'. These are other weather

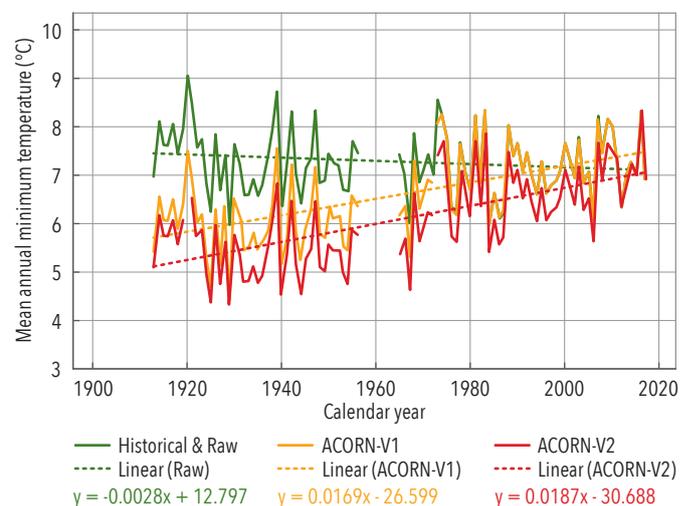
stations that can be hundreds of kilometres away in completely different climate zones. In the case of Rutherglen, the temperature record was remodelled using 40 comparison stations, the farthest one being at Menindee, 551 kilometres away. For Darwin, 15 comparison stations were used, the farthest being at Black Point, 1,233 kilometres away.

Case Study: Rutherglen

Maximum and minimum temperatures have been recorded at Rutherglen since November 1912 in a standard (Stevenson screen) weather station located in an open paddock³. The original trend in the raw minimum temperatures was a slight cooling at a rate of minus 0.28°C per century in response to the staged introduction of irrigation into the region⁴. The same cooling trends are also seen nearby at Deniliquin, Echuca, and Benalla.

Figure 1 shows how the two ACORN-SAT remodelling versions first changed the original cooling trend into warming, followed by a further 12% increase in the warming trend in Version 2, compared to Version 1.

Figure 1: Remodelling of Rutherglen's monthly minimum temperatures⁵



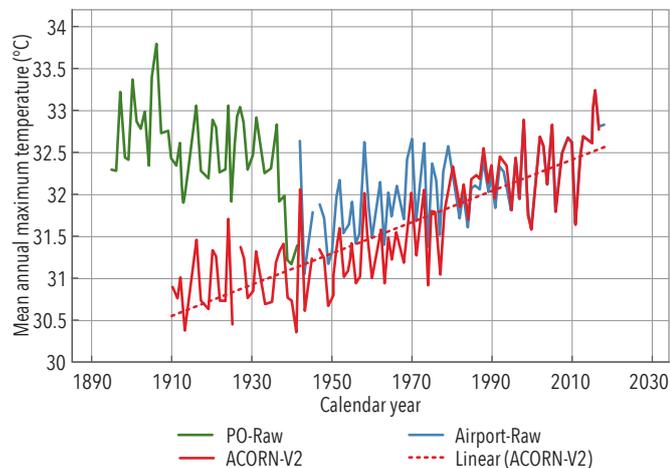
The historical observations (green) show a mild cooling trend of minus 0.28°C per century. This cooling trend has been changed into warming of 1.7°C per century in ACORN-SAT V1 (orange), and into an increased warming trend of 1.9°C per century in ACORN-SAT V2 (red).

Case Study: Darwin

The original Darwin station was at the post office. The site deteriorated progressively from the mid-1930s, becoming overshadowed by trees⁶. In February 1941 a second weather station was established at the airport.

The effect of the ACORN-SAT V2 remodelling at Darwin was dramatic, as shown in Figure 2.

Figure 2: Measured maximum monthly temperatures and remodelled ACORN-SAT Version 2 temperatures at Darwin⁵



There is a drastic difference between the remodelled ACORN-SAT V2 temperature series (red line) after merging the historical measurements from the post office and the airport (green and blue lines respectively).

The warming trend of 1.3°C per century in the 2012 ACORN-SAT V1 was further increased to 1.8°C per century with the creation of ACORN-SAT V2 in 2018. That's a 38% increase in the warming rate at Darwin. Note that hotter pre-1910 historic data have been arbitrarily truncated from the ACORN-SAT record.

Conclusion

Cooling the past relative to the present, as shown in the two case studies above, makes the present appear much hotter compared to the past than before. As a result it could create many new 'record' hottest days for the same weather. It can affect future scientific analysis of climate change and fuel ever more sensationalist media claims every time there is a heatwave.

For Rutherglen and Darwin there have been no changes to the equipment and no relocations between ACORN-SAT V1 and V2. Despite this, the official temperature records are now quite different, resulting in 12% and 38% increases in the warming rates respectively. Such differences can only be due to changes in the calculation rules built into the remodelling code, or changes to the statistical treatment, or both between Versions 1 and 2.

The aggregate effect across all of the 112 remodelled stations comprising ACORN-SAT V2 is a *calculated* 23% increase in the overall warming rate for the Australian continent, compared with Version 1.

The apparent warming is further compounded because of the arbitrary selection of the commencement time frame. When selecting the 112 stations that make up the ACORN-SAT network, the thousands of available temperature measurements prior to 1910 were ignored. If earlier data were included, the calculated warming rate for Australia would be considerably less, because the years immediately prior (including the well-known 'Federation Drought' of 1895-1903), were hotter than average.

Official historical temperature series are assumed to be scientific, and to represent actual observations. Yet clearly temperature series are significantly remodelled by the Bureau to the extent that they differ in direction and magnitude from the original. In short, the official series are *calculated constructs* that accord with popular global warming theory, fuelling claims of a continual increase in temperatures through the twentieth century, but this has not been the directly observed reality everywhere.

ACORN-SAT V2 is currently the official temperature record for Australia. It was completed just in time for the new remodelled values to be included in the next report of the United Nations Intergovernmental Panel on Climate Change (IPCC). This *rewritten* version of our temperature history will also underpin annual state-of-the-climate reports widely reported in the mainstream media. But these are 'second-hand' statistics and not original measurements.

The Bureau's remodelled temperatures are a function of the calculation methods and the inbuilt assumptions. These evolve over time, so will the inevitable future third round of remodelling *calculate* even *faster* warming?

SEE ALSO

FACT SHEET #18: Climate Science and Policy-based Evidence.

FACT SHEET #20: A Descent into Sceptics' Hell.

Information in this fact sheet has been drawn from *Climate Change: The Facts 2020* (IPA 2020), Chapter 16, by Dr Jennifer Marohasy. Fact Sheet series general editor: Dr Arthur Day

1. See: <http://www.bom.gov.au/climate/change/acorn-sat/documents/ACORN-SAT-Station-Catalogue-2012-WEB.pdf>
2. Trewin, B 2018, 'The Australian Climate Observations Reference Network - Surface Air Temperature (ACORN-SAT) Version 2, Bureau Research Report 032', October, <http://www.bom.gov.au/climate/change/acorn-sat/documents/BRR-032.pdf>
3. See: <http://www.bom.gov.au/climate/data/acorn-sat/stations/#/82039>
4. Marohasy, J 2016, 'Temperature change at Rutherglen in south-east Australia,' *New Climate*, <http://dx.doi.org/10.22221/nc.2016.001>
5. Source: Raw data downloaded from <http://www.bom.gov.au/climate/data/> and ACORN-SAT 2 data downloaded from ftp://ftp.bom.gov.au/anon/home/ncc/www/change/ACORN_SAT_daily
6. See: <http://www.bom.gov.au/climate/data/acorn-sat/stations/#/14015>

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