Is homogenisation of Australian temperature data any good?

Part 4. Carnarvon, Western Australia

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The ACORN-SAT project is deeply flawed, unscientific and should be abandoned.

Read on …

Summary

Raw and homogenised daily maximum temperature data (Tmax) for Carnarvon post office (1907 to 1948; ID 6062) and airport (1948 to 2021; 6011) were analysed objectively using straightforward BomWatch protocols to determine if trends and changes in raw and homogenised data reflect site and instrument changes, or the true climate. A highly significant step-change in 1974 of 0.81°C (0.094_{SE}), and in 2010, of 0.86°C (0.152) accounted for all the naïve 'trend' from 1907 to 2021 (a total of 1.67°C in 114 years = 0.146°C/decade, the same as estimated by Excel). As segments defined by step-changes show no trend, and overall trend calculated by Excel is affected by extraneous factors, it could not be claimed that the climate at Carnarvon has warmed.

The ratio of counts of daily values greater than the 95th and less than the 5th dataset day-of-year percentiles [$\log_{10}(Hi_N/LoN)$] indicated upper-range extremes were less frequent at the watered site at the aerodrome, but stepped-up markedly when the site moved to the current dryland site, and again in 2016 due to low rainfall and accumulated site changes. As they reflected combined weather and site-related effects, changes in extremes do not reflect changes in the true climate.

Homogenisation fails to undertake basic quality assurance so cannot objectively adjust for extraneous factors such as watering, site changes etc., neither can the process correct daily data distributions and extremes if changes in frequencies within Tmax classes, or percentile ranges are not known beforehand. Homogenised ACORN-SAT v.1 and v.3.1 data for Carnarvon embed step-changes related to site changes; thus, ACORN-SAT failed its primary objective, which is to adjust for site and instrument changes so extremes and means are homogeneous.

Changing data to agree with models has no place in science. The models on which public policy is based are wrong to the point being fraudulent. Furthermore, grooming and manipulating innocent minds with myths and climate-porn likely causes long-term harm, and is a form of abuse with which no self-respecting scientist should be associated.

The use of correlated data that likely embed parallel faults to disproportionally correct faults in ACORN-SAT data and thereby embed trends in homogenised data that agree with models, has no statistical or scientific merit. Consequently, as the ACORN-SAT project is irredeemably deeply flawed and should be abandoned.

[1] Former NSW Department of Natural Resources research scientist and weather observer.

Introduction

The main question is whether trends and changes in raw and homogenised maximum temperature data reflect the conditions under which data were observed, site relocations, instrument changes, or the true climate.

Read on …

Situated on the Coral Coast of Western Australia, the strategically important town of Carnarvon lies at the mouth of the Gascoyne River about 600 km north of Perth. Although the river only flows in response to intermittent widespread heavy rain, due to its vast aquifer, the lower Gascoyne is the most productive irrigated agricultural region in WA and being just 1.5° south of the Tropic of Capricorn, vegetables, melons, grapes and tropical fruits are grown throughout the year.

1.1 The post office

A post/telegraph office opened in the heart of Carnarvon at what is now 8 Robinson Street in about 1887 (Figure 1). Plans held by the National Archives of Australia (NAA) show a substantial brick building that included public areas, a mail-sorting room, telephone exchange, battery room, linesman's office etc. and a 3-bedroom postmasters' residence.

Figure 1. The Carnarvon post office in Robinson Street in 1901 (National Archives of Australia collection).

Out in the yard, wet- and dry-bulb, and maximum and minimum Fahrenheit meteorological thermometers observed at 9am and possibly 3pm each day, would have been sheltered from direct and indirect radiation by a standard 230-litre Stevenson screen.

Weather was serious business in the late 19th and early 20th centuries, lives and commerce depended on it and together with barometric pressure, wind-strength, direction cloud etc., data were probably telegraphed initially to the Observatory in Perth, and later after it was established in 1908, to the regional office of the Bureau of Meteorology (BoM) for compiling daily weather reports and synoptic charts. Data would have also been summarised and reported by mail at the end of each month and a register of observations would have been maintained by the postmaster.

That much is certain because that was why weather was observed and that was the established routine. What is ***not*** known is whether post office data were observed, recorded and reported diligently each day, and manually added-up and averaged carefully each month for the almost ½-century from when observations commenced on 1 January 1907 to when the site closed on 31 August 1950. As Carnarvon is one of 112 ACORN-SAT sites (Australian Climate Observations Reference Network – Surface Air Temperature) used to monitor warming of Australia's climate, fidelity of data is central to the truthfulness of claims made by the BoM and CSIRO in *State of the Climate* and other reports. Of the post office, Simon Torok said in his 1996 PhD Thesis[1]:

07/1918: First correspondence (with the Bureau)
09/1931: Screen very poor. New one sent.
04/1944 Site is only fair.
1951: Move to MO 0.5 miles away over flat country (the MO being the ex-RAAF Aerado/met-office at the airport).

[1] Torok SJ (1996). Appendix A1, in: "The development of a high-quality historical temperature data base for Australia". PhD Thesis, School of Earth Sciences, Faculty of Science, The University of Melbourne.

1.2 The airport

With tensions rising across Europe and the western Pacific, the Royal Australian Air Force (RAAF) acquired additional land and established an Advanced Operations Base at the existing aerodrome south of the river on the eastern edge of the town in 1939/40, which was protected from flooding by a levee-bank. A timber, asbestos cement-sheeted building was erected, aerials went up, electricity and telephone lines were connected and towards the end of 1940 an Aerado office fitted-out by AWA, with facilities for met-staff, radio operators, stores, waiting/briefing room and kitchen was operational (Figure 2). A NOTAM (Notice to Airmen) archived by the Civil Aviation Historical Society & Airways Museum (series B, No.6/1940) listed the call-sign as VZCR.

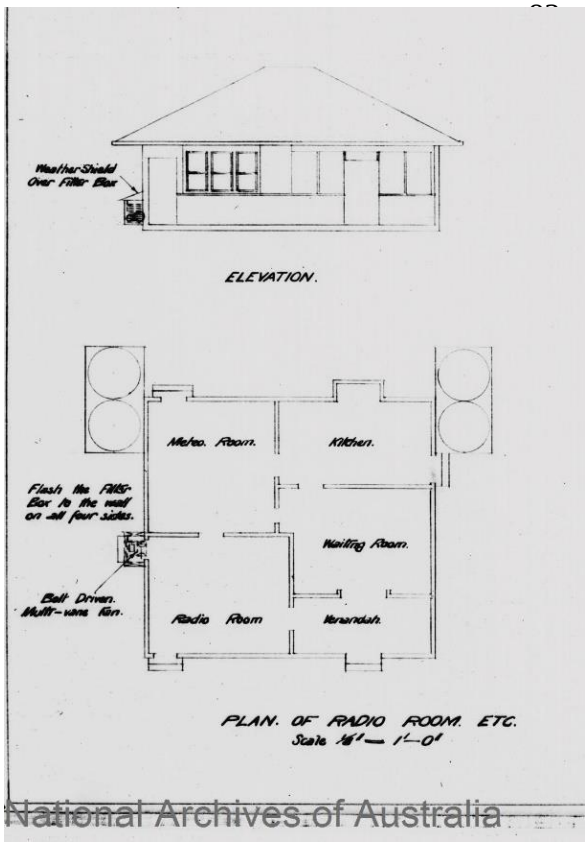

Figure 2. A plan showing ventilation of the radio room, and the layout of the Aeradio office at the Carnarvon aerodrome (NAA, dated 1944).

Meteorologists trained in Melbourne by the BoM undertook observations, including monitoring air wind strength and direction using weather balloons, and provided forecasts and pilot briefings, while radio operators maintained contact with aircraft along the route from Perth to Batavia, now Jakarta on the island of Java in Indonesia, formerly the Dutch East Indies, Cocos Island and Darwin. For slow, unpressurised, low-flying piston-driven aircraft, fog, dust storms, cyclonic winds or other hazards could close an aerodrome needed for refuelling, or endanger a flight, and with stations established every 300 km or so along Australia's main air corridors, Aeradio was a major air safety innovation. From July 1940 to June 1946 Aeradio became a unit of the RAAF (https://www.austehc.unimelb.edu.au/fam/0626.html).

A July 1947 aerial photograph from the National Library of Australia (NLA) shows graded, unsealed, gravel runways in a bisected A-frame layout (an 'A' with another N-S runway from the apex down the centre) that catered for multiple wind directions, and at least eight dispersed splinter-proof pens to protect aircraft from bombardment. It also shows the operational precinct in the vicinity of the Aeradio office and communication aerials was watered and maintained as a grass lawn, probably to protect equipment from wind-blown sand and dust and enhance connectivity of the earth-mat buried in the otherwise dry, red, sandy soil (Figure 3).

ACORN-SAT metadata states "*the current site (6011) is at the Meteorological Office, which is on the eastern side of the airport and about 2 km east of the town centre. The instrument enclosure contains mown unwatered grass with natural grass beyond the enclosure boundary*". It notes that the (Aeradio) office became the primary ACORN-SAT site in 1948, two-years before the post office site closed.

Also, that the "*site moved about 800 m southeast at an unclear date; the data are consistent with it taking place around 1974. An automatic weather station was installed on 22 October 1990 and became the primary instrument on 1 November 1996. There are indications of a possible site move around 1996–1997 but no evidence of any impact on the data*".

A Letter to the Editor of the journal *Weather* in September 2002 by Clive Robertson of Scarborough WA recounted how candles in paper lanterns suspended from weather balloons at Carnarvon in the mid-1960s were tracked using a theodolite, and that windflow over buildings affected their launching (*Weather*, 57, 355-357; doi.org/10.1002/wea.200257910). His note confirmed the location of the hydrogen-filling shed at the end of the long workshop.

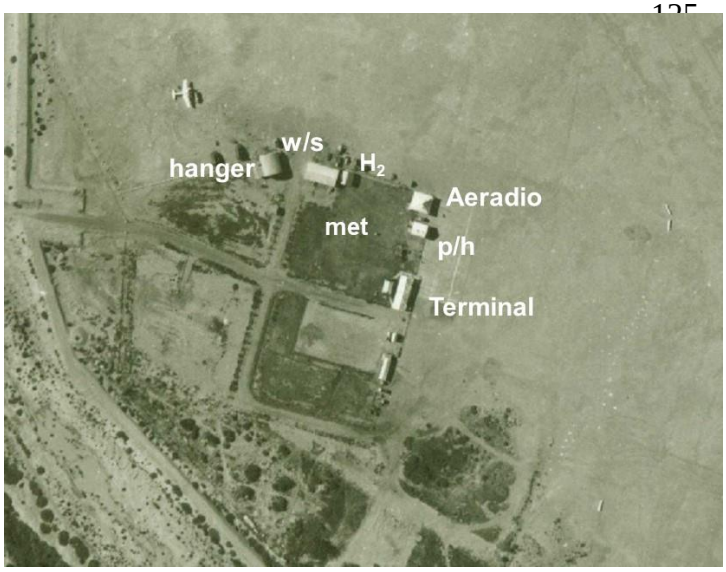

Figure 3. The Carnarvon aerodrome operational precinct photographed from an altitude of 25,000-feet (7.6 km) on 30 May 1949, showing buildings and watered lawns in the vicinity of the meteorological (met) enclosure. Shadows show one of three aerial pylons was located between the power house (p/h) and terminal, a recording anometer protruded from the roof of the Aeradio office, and the Stevenson screen was near the the letter 'm' in 'met'. Surveyed relative to mean sea level, a stout post would have supported the theodolite for tracking weather balloons released in the vicinity of the workshop (w/s) and hydrogen shed (H_2). (NLA aerial photograph.)

Files held by NAA show a new radio-aids building constructed at Carnarvon in 1960 was furnished in 1961. However, only one of four files held in Perth relating to its operation to 1972, is open for inspection. Radio-aids was a technical division within the BoM that used radar and radiosondes for upper-atmosphere monitoring that became increasingly important with the introduction of long-range jet aircraft (the Boeing 707 entered service with Qantas in 1959).

Reginald Stout (1921-2001) installed a AA3 Mk Vll radar at Carnarvon in April 1961, (https://www.austehc.unimelb.edu.au /fam/1290.html), and an overlay comparison of Google Earth Pro satellite images and a grainy, high level aerial photograph from NLA (dated 16 May 1981) identified the radio-aids building *about 800m southeast* of the former Aeradio office at a similar location to the current meteorological office. Although the site moved, it did not necessarily do so *around 1974*. ACORN-SAT metadata is vague and the former Aeradio site may have operated in parallel with the new site for a period sufficient to smooth the transition.

Aerial photographs also show that by 1968 the long NE to SW runway had been sealed, by 1981 the shorter N-S runways had also been sealed and much of the WWII infrastructure including the Aeradio office had been demolished or re-purposed.

Recent Google earth Pro satellite images show a non-directional beacon (NDB) suspended on 80-foot (24m) towers installed 140m NW of the met-enclosure, probably in 2010, was mowed or cleared around to a radius of 80m between August 2011 and March 2012, and that a new sealed access road to the MO required the 1974 enclosure to be relocated about 30m north (Figure 4). Also, that between March and June 2012 some 0.7 ha had been disturbed west of the office to accommodate a large wind-profiler array (vertical radar for monitoring upper-atmosphere wind speed and direction). Following de-manning of the office in about 2016, site-summary metadata shows that by 2017 the entire area was encircled by a 2.2m-high Cyclone fence.

While site-summary metadata places the original site near the centre of the airport at Latitude -24.8819°, Longitude 113.6708°, cross-referenced by Google Earth Pro, Figure 3 shows it was behind the Aeradio office at Latitude -24.8832°, Longitude 113.6659°. Thus, as site-summary

and ACORN-SAT metadata is inaccurate, data are best analysed objectively and results compared with what is known about the site *post hoc*.

Figure 4. Location of the non-directional beacon (NDB) relative to the transmitter hut (TH) and instrument enclosure (X) which had earlier been moved when the new access road to the MO was installed before November 1999 (Google Earth Pro satellite image, March 2012).

The question is whether trends and changes in raw and homogenised Tmax data reflect site and instrument changes, or the true climate.

2. Methods

Temperature data should be analysed using rigorous, objective, and replicable methods.

Read on …

Maximum daily temperature (Tmax) and daily and monthly rainfall for Carnarvon post office (BoM ID 6062) and airport (6011) were downloaded from BoM's climate data on line facility. To avoid a period of missing Aeradio observations, temperature datasets were merged from 6 September 1948, summarised into an annual series, aligned with annual rainfall and analysed using the same BomWatch protocols, procedures and software as detailed previously for Parafield, Marble Bar and Meekatharra. (Carnarvon datasets are provided as an Excel workbook accompanying this report.) Daily SILO data for Carnarvon airport were also acquired and summarised into a year by month dataset. As SILO data are interpolated, they may better represent the broader climate.

3. Results

3.1 The climate of Carnarvon

The local climate is neither tropical nor Mediterranean, but pan-tropical and extremely arid …

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Although Carnarvon is located in northwest WA close to the Tropic of Capricorn, and it occasionally experiences on-shore cyclones that originate in the tropical Indian Ocean and Timor Sea, winds are predominantly from the south, southwest and east (Figure 5). Winds spin-off eastward moving sub-polar low-pressure systems that oscillate from south to north and back between the autumn Equinox on 21 March, until the sun returns south of the Equator after 23 September.

Frontal systems that originate in the Southern Ocean bring winter rains; however, rain-bearing tropical systems from further north (the summer Monsoon) rarely migrate down the WA coast as far south as Carnarvon. Consequently, the local energy balance is dominated by solar radiation and high potential evaporation for most of the year (Figure 6).

As median rainfall is only 202mm and 50% of years experience between 133.7mm (1st Quartile) and 304.9mm (Q_3) the climate is arid and being neither tropical nor Mediterranean it is best described as pan-tropical.

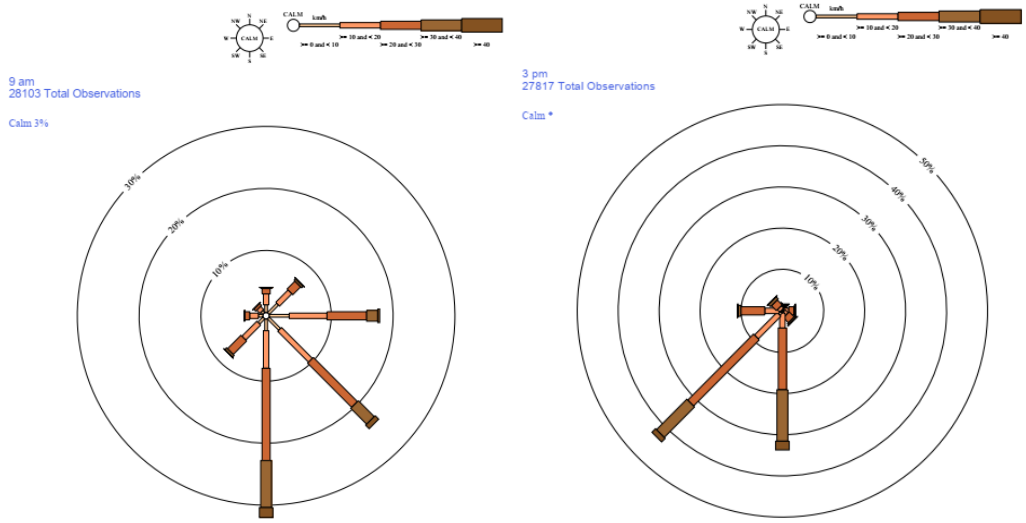

Figure 5. Annual average 9 AM and 3 PM wind-roses for Carnarvon airport showing the percentage of total observations within compass quadrants as a circle graph. Wind is predominantly from the south in the morning, turning to the southwest in the afternoon with few observations being from the north and in particular from the arid northeast. (Snapshot from BoM annual wind-rose charts.)

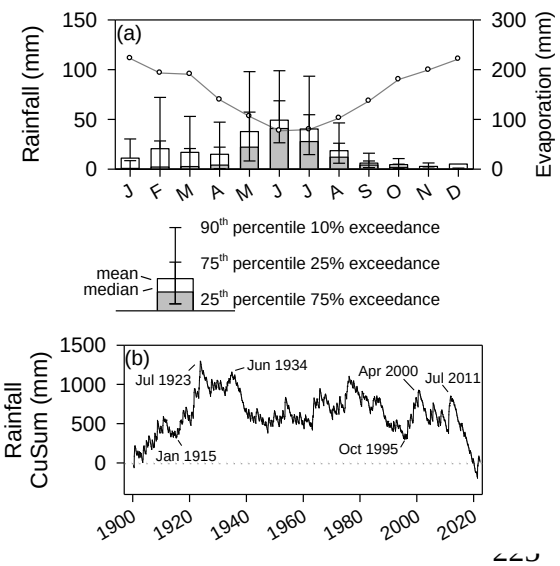

Figure 6. Rainfall at Carnarvon is restricted almost entirely to the winter months of from March to August (a). However, as potential evaporation exceeds rainfall by a factor of about two, the likelihood of a sustained positive soil moisture balance even in winter, occurs less often than in 10% of years. The rainfall CuSum curve in (b) shows the period from 1900 to July 1923 was generally moist (the curve ascends); it was drier from June 1934 to about 1940 (the curve declined), it was more-or-less average until 1978 (trend was inconsistent), declined, then was cumulatively higher from October 1995 to 2000 and declined steeply after July 2011 (summarised from daily SILO data.)

Climatic averages for the airport show 9am relative humidity falls slightly from 60-68% in summer to 50-57% in spring, and at 3pm, from around 59% in summer to 52% in spring. Average maximum and minimum temperatures range from 32.7°C and 23.1°C in February to 22.4°C and 10.9°C in July (Figure 7).

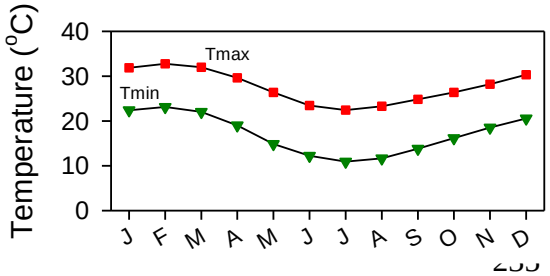

Figure 7. Average monthly temperature profiles for Carnarvon (SILO data).

3.2 Naïve trends in Tmax data

Although useful for exposing residual artefacts, spreadsheet applications are limited in their ability to analyse trends in data comprised of multiple overlaid signals.

Read on …

While it is tempting to analyse the combined dataset using Excel or other spreadsheet application and thereby show that Tmax is increasing at the rate of 0.143°C/decade, or to undertake split-time analysis (averages from early in the record *vs*. recent data averages); without quality assurance and accounting for site and instrument changes, both approaches are likely to result in spurious outcomes (Figure 8(a)). Furthermore, as site-summary and ACORN-SAT metadata are unreliable and potentially misleading, artefacts in residuals (that portion of the data not contributing to trend) may indicate underlying problems.

Should linear trend (Tmax ~ Year) fully explain the process generating the data, time-ordered residuals (zero-centred residuals rescaled by the Tmax grand-mean) would be independent, homogeneous and random and thus show no consistent patterns. Conversely, systematic variation such as data-clusters less than or greater than the rescaled mean, or apparent sub-trends (Figure 8(b)), show underlying variables have not been accounted for. As it is confounded with another signal, conclusions about the 'trend' are invalid.

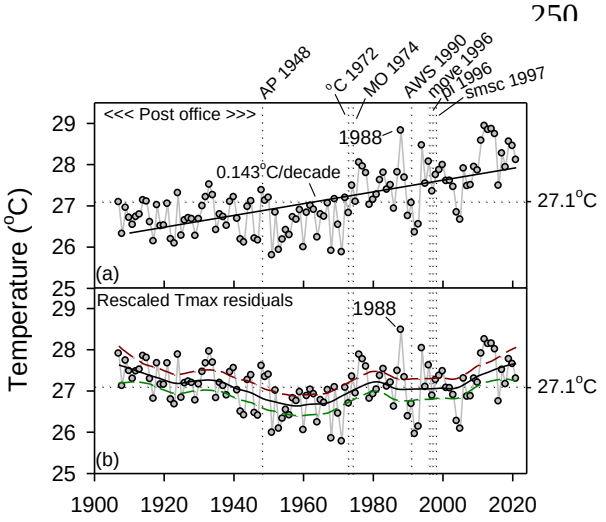

Figure 8. While average Tmax for the combined Carnarvon post office and airport dataset increased 0.143°C/decade since 1907 (a), the LOWESS (locally weighted scatterplot smoothing) curve in (b) shown with 95% bootstrapped confidence intervals, indicates naïve trend did not fully explain the dataset.

Clusters/portions of the residual timeseries above and below the rescaled mean in Figure 8(b) caused autocorrelation, and shows data are affected by parallel signals not explained by trend alone. The 'dip' between when the site moved to the aerodrome in 1950 and then to the meteorological office in *around 1974* is particularly concerning.

Moving sites even short distances was not done without approval, adherence to protocols and a budget, and before observers relocated to the radio-aids office the new site required survey, new equipment, instruments and infrastructure. As costs and approvals would have been documented in local and regional files, the comment in ACORN-SAT metadata that "*site moved about 800 m southeast at an unclear date*" shows scientists did not undertake the detailed site research they claimed to have done[1].

It is also likely that parallel observations were made at both sites for two to three years and that the overlap was used to smooth the transition to the new site. A logical starting date for those would have been 1972 when temperature observations were metricated (rainfall continued to be measured in inches and points until 1 January 1974).

[1] Section 5.2 in: Trewin, Blair (2012). Techniques involved in developing the Australian Climate Observations Reference Network – Surface Air Temperature (ACORN-SAT) dataset. CAWCR Technical Report No. 049

3.3 Relationships between Tmax and rainfall

While Tmax was negatively correlated with rainfall overall, relationships were imprecise (R^2_{adj} = 0.033) or not significant. Step-changes related to site changes were therefore the predominant factor affecting Tmax.

Read on …

While Tmax was negatively correlated with rainfall, the overall relationship was barely significant (P = 0.020) and explained only 3.3% of Tmax variation (R^2_{adj} = 0.033) (Figure 9). Nevertheless STARS (Sequential Three-step Analysis of Regime Shifts[1]) detected highly significant step-changes in rescaled Tmax residuals in 1974, corresponding with the move to the MO (or possibly the cessation of parallel observations), and in 2010, possibly related to installation of the NDB navigational beacon and other site changes before August 2011, which is the earliest available satellite image.

Relationships between Tmax and rainfall for the three segments defined by step-changes were not significant. Thus, although moving from the previously watered site at the Aeradio office to the MO *around* 1974 caused Tmax to step-up 0.81°C (0.094$_{SE}$), and due to another factor, 0.86°C (0.152) in 2010 (total = 1.67°C (0.143)), as within-segment trends were not significant, it could not be argued that step-changes were caused by climate changes.

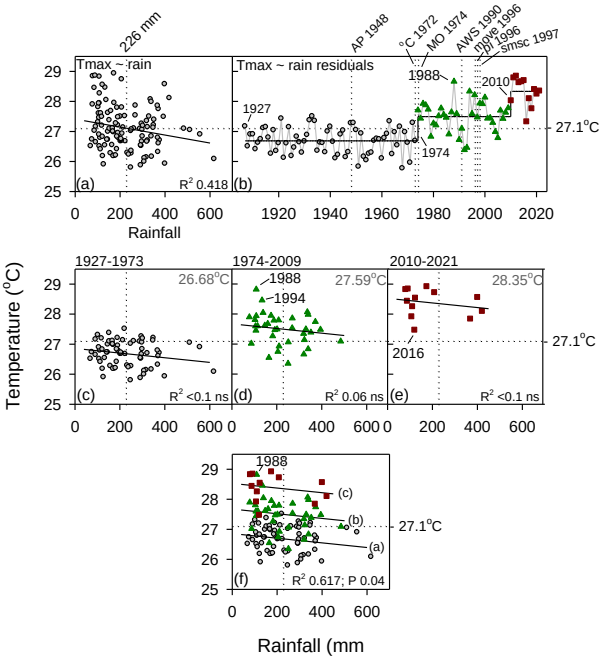

Figure 9. Although the relationship between Tmax and rainfall in (a) was barely significant (P = 0.03), step-changes in the mean of rescaled residuals detected by STARS (b) were highly so (P ≤0.001). While segmented Tmax ~ rainfall relationships ((c) to (e)) were not significant, Tmax stepped-up relative to long-term averages (dotted lines). Segmented Tmax ~ Year trends (not shown) were also not significant. Multiple linear regression (f) found that rainfall and step-changes simultaneously explained 61.7% of Tmax variation overall.

Analysis of the pooled dataset (Figure 9(f)) showed that although relationships for individual segments were not significant, segments were offset (means were different) and responses to rainfall were the same (lines were parallel, not coincident and interaction was not significant).

While step-changes and rainfall together explained 61.7% of Tmax variation (R^2_{adj} = 0.617), the step-change variable explained 61.1% of total variation not explained by rainfall alone (i.e., $R^2_{partial}$ = 0.611), thus rainfall played a minor role in determining the Tmax response.

3.4 Precision of daily observations

Tmax at the post office was mainly observed in whole and ½ degrees Fahrenheit. Precision improved step-wise, when observations transferred to the Aerado office, with metrication and after the AWS was installed.

Read on …

Frequency of decimal fractions index the precision with which daily data are observed and for data observed consistently to one decimal place, each decimal fraction (x.0, x.1, … x.9)) would

[1] https://sites.google.com/view/regime-shift-test

represent 10% of the total number of fractions/year, and their average ((∑x.0 + x.1 +.. x.9)/10) would be 0.45 (Figure 10).

However, as explained in the Meekatharra Report, because the second decimal place was not preserved when Fahrenheit data were entered to the BoM database, whole-degrees Fahrenheit rounded to 1-decimal place Celsius, back-transform from the database (i.e., from °C to °F) in the ratio of about 55% x.0, and 22% each of x.9 and x.1. Also, data observed in whole and ½°F, back-transform from °C to °F in the ratios of about 30% x.0 and 9% to 11% x.9 and x.1; and, about 26%, x.5 and 10% x.4 and x.6. (Monte-Carlo simulations show that if stored to 2-decimal places, °F-data would back-transform to their original value.)

To be clear, precision is an index of accuracy, training and diligence, which may or may not impact on long-term Tmax trend. However, observations consistently rounded up or down to the next index (whole °F or °C, or 1/2°C) may result in biased averages.

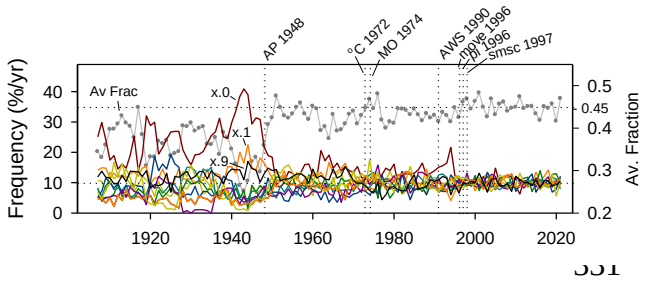

Figure 10. Maximum temperature measured at the post office were mainly reported in whole and ½ degrees Fahrenheit (x.0, x.1 and x.9 predominate). Observations by staff at the Aeradio office were more precise, particularly after metrication on 1 September 1972, and after the AWS became the primary instrument (pi) at the MO in 1996.

3.5 Temperature extremes

Counts of daily observations ≤5th and ≥95th day-of-year dataset percentiles/year and their Hi_N/Lo_N ratio, showed temperature extremes overwhelmingly reflected site changes: watering up to 1973 and changes at the MO site after 2010.

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Extreme temperatures are those comprising the tails of daily data distributions, namely the number of values ≤5th, and ≥95th day-of-year dataset percentiles/year (Lo and Hi extremes respectively). Their Hi_N/Lo_N ratio is expected to vary randomly and to be homogeneous in the long-term. Log_{10}transformed so they are symmetrical about their mean (i.e., normally distributed), temporal changes detected by STARS are shown in Figure 11.

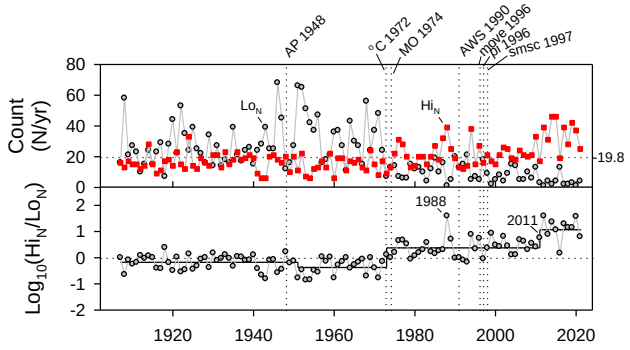

Figure 11. Number of days/year that Tmax is ≤5th (grey circles) and ≥95th day-of-year percentiles (red squares), and step-changes in their log_{10}-transformed Hi_N/Lo_N ratio. The average of Lo + Hi counts (19.8/yr) provides a reference.

Variation in counts in Figure 11 suggests that surroundings at the aerodrome after 1950 were watered less consistently than at the post office. While counts ≥95th day-of-year percentiles were less frequent the Aeradio site than at the post office (P_{step} = 0.012), ratios stepped-up in 1973 suggesting the move in *about 1974* occurred earlier or was preceded by a period of parallel observations intended to smooth the transition to the new unwatered site, where counts of high extremes predominated, particularly after 2010.

3.6 Frequency and STARS analysis of daily rainfall and Tmax

While it appears that small falls of rain often accumulated in the gauge at the post office until the next notable event, there is no indication that daily rainfalls >30mm/wet day have become more prevalent over recent decades. Likewise, although the frequency of daily Tmax within classes were affected by site changes, no trends were unequivocally attributable to the climate.

Read on …

Expressed as percentages within classes, the annual frequency of daily rainfall/wet day and daily temperatures were analysed to determine if they were homogeneous.

Like the conversion of Fahrenheit to Celsius, metric conversion of rainfall (1/100th of an inch) to mm is not direct (1-point = 0.254 mm, and 0.2mm = 0.567 points) and due to the way daily rainfall data round-up or down prior to metrication on 1 January 1974, no data were reported within classes of 0.2mm, 0.4mm, 0.6mm, 0.7mm and 0.9mm per day. It also appears that small falls of rain were often left to accumulate in the gauge at the post office until the next notable event. Most daily rainfalls were less than 30mm/wet day and aside from data before 1924 which were possibly inaccurate, there is no indication that daily rainfall has become more extreme over recent decades (Figure 12).

The frequencies of daily Tmax between 25°C and 30°C was homogeneous. However, the frequency of temperatures less than 30°C stepped-down in lock-step with those equal to or exceeding 30°C, which stepped-up in 1972 when the site moved to the MO, and 2011 due to changes in the vicinity of the weather station. (Not shown is that ignoring data for 2012-2013, daily Tmax ≥37.8°C (≥100°F) showed no consistent change over the period of record.)

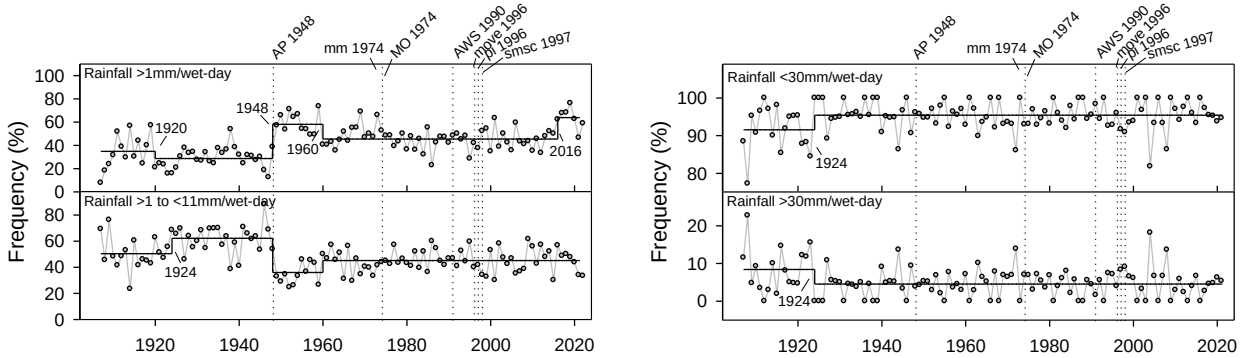

Figure 12. STARS analysis of rainfall frequency within nominated classes. It appears that rainfalls ≤1mm/day at the post office often accumulated in the raingauge. There is no evidence that extreme rainfalls (≥30mm/day) are becoming more prevalent.

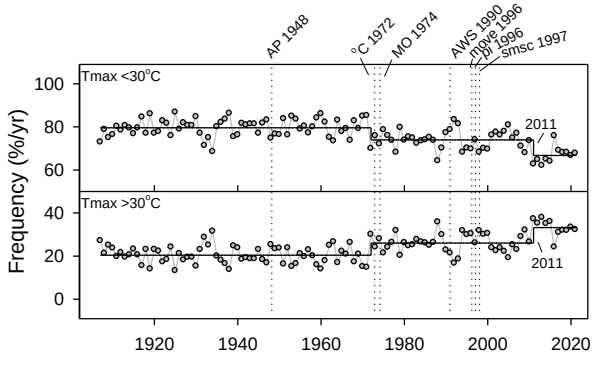

Figure 13. Frequency of daily Tmax less than, and exceeding 30°C.

3.7 interim discussion

Watering at the post office and at the Aeradio site was not mentioned in site-summary or ACORN-SAT metadata, but it had a major effect on naïve Tmax trend. Moving to the dryland site at the MO, and changes there identified in satellite images were responsible for extreme temperatures measured by the electronic probe housed in a 60-litre screen after 2010.

Read on …

While rainfall had virtually zero impact on Tmax, it is unarguable that conditions under which observations were made changed when the site moved to the unwatered enclosure at the radio-aids/met-office *around 1974*. Watering kept the town habitable during the long dry season from September to March and the lack of a step-change on moving to the Aeradio office indicates the yard at post office was also watered. Watering also affected the range of temperatures observed and the sensitivity of rainfall as the deterministic covariable.

While it is unlikely from a wind direction perspective that the NDB-navaid would markedly affect temperatures measured in the enclosure at the met-office (Figure 14), changes there (Figure 15), including erecting the new radar in May 2009, a new air-conditioned office and wind-profiler array before 2013 were the likely cause of the highly significant Tmax step-change in 2010 (Figure 9).

Figure 14. The Carnarvon met-enclosure photographed on 20 June 2009. The evaporation pan was removed on 16 October 2020 (ACORN-SAT catalogue photograph).

Confounded with those changes, rainfall in 2013 was the 4th lowest on record, 2014 was the 7th lowest and 2020 the 5th lowest. Exposing red desert sand that could reach temperatures exceeding 50^{o}C on hot summer days by denuding areas around the enclosure would contribute to the abrupt up-step in Tmax measured by the sensitive probe housed in the 60-litre Stevenson screen in 2010/11.

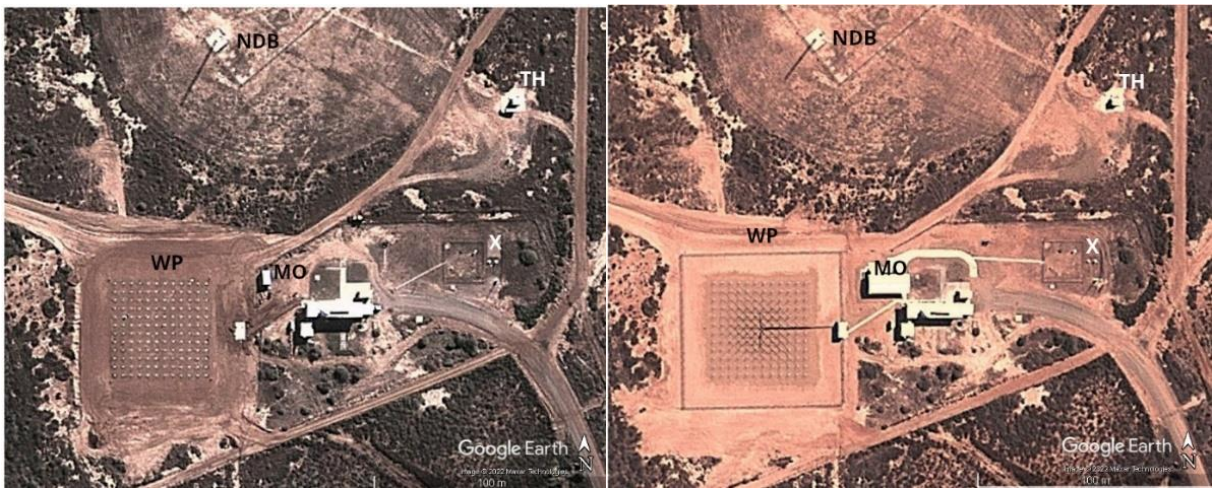

Figure 15. Developments in the vicinity of the met-enclosure (X) before June 2012 (left) included installing the non-directional beacon (NDB) and transmitter hut (TH), the vertical wind profiler array (WP), earthworks etc. and before April 2013 (right) building a new meteorological office (MO) (Google earth Pro satellite images). While the weather station stayed the same, removal of groundcover, new buildings, concrete aprons and extensive earthworks irreversibly changed the microclimate.

4. Homogenisation of Carnarvon Tmax

The objective of homogenising temperature records is to remove the effects of site and instrument changes so homogenised data reflect the climate alone. However, there are many ways to create pre-determined trends, the most obvious being to adjust for site changes that made no difference while ignoring those that did and to make adjustments that are disproportionate to step-changes in the data.

Read on …

Carnarvon is one of 25 ACORN-SAT sites in Western Australia used by the BoM and CSIRO to monitor warming of Australia's climate (Figure 16). It is also the western-most site in the ACORN-SAT network

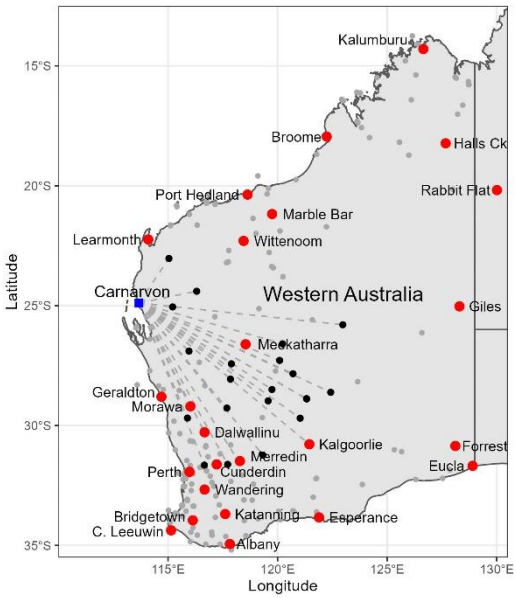

Figure 16. Carnarvon (blue square) is one of 25 ACORN-SAT sites (red circles) in Western Australia. BoM weather stations having more than 10-years of temperature data are indicated as grey circles, while dashed lines point to the total of 25 sites used to homogenise Tmax and Tmin data, highlighted in black.

Under the guidance of Dr Neville Nicholls, who from 1986 to 1990 was a member of the Australian Committee for the World Climate Research Programme, and in 1991/92 was Lead Author of the Section C, Supplement to the IPCC First Scientific Assessment Report[1], homogenisation has been used since before 1990 by BoM scientists, most recently Blair Trewin, to adjust for the impact of site and instrument changes so trends in homogenised data supposedly reflect the climate. While the most recent homogenised dataset is ACORN-SAT v.2.3, the question of whether homogenised data truly reflect climatic trend and change has not been independently assessed.

The overarching problem is that data were not collected in the first place to estimate trend and change, but to describe the weather, make short-term predictions for use by ships, aircraft and local communities, and gather statistics for use in planning and risk assessment, for example in planning public works such as culverts and dams and in agriculture. Data for Carnarvon also contribute to daily weather maps including those shown on television news services.

As no sites have stayed the same, the need to adjust for site and instrument changes is unarguable. However, arbitrary selection of changepoints and disproportionate adjustments applied using opaque or complex methods may result in pre-determined fake trends. For instance:

- By adjusting site changes that made no difference, while ignoring those that did.
- By selecting up to 10 comparator datasets from the pool of potential neighbours on the basis of first-difference linear correlation with target site data, *without ensuring individual datasets are homogeneous*.
- By using reference series comprised of data that likely embed parallel faults, to make adjustments during the homogenisation process.

Referring to a 'composite move' (to the Aeradio office) Torok and Nicholls (1996)[2], who developed the original homogenised high-quality *HQ₁* dataset, adjusted Carnarvon Tmax prior to 1948 down

[1] https://www.eoas.info/biogs/P003289b.htm

[2] Torok, S.J. and Nicholls, N. (1996). A historical annual temperature dataset for Australia. Aust. Met. Mag., 45, 251-260.

by 0.5°C (Figure 17). However, as previously noted there was no discernible step-change in rainfall-adjusted data (Figure 9) related to the move. Furthermore, they ignored the up-step in Tmax when observations moved *around 1974* to the unwatered site at the met-office. Adjusting for a change in 1948 that made no difference and ignoring the one in 1974 that did, resulted in a Tmax trend of 0.17°C/decade in homogenised HQ_1 data. However, because the trend reflected site changes it could not be claimed to reflect the true climate. (Except for 1950, rainfall between 1947 and 1953 was generally above average, consequently Tmax was transiently cooler.)

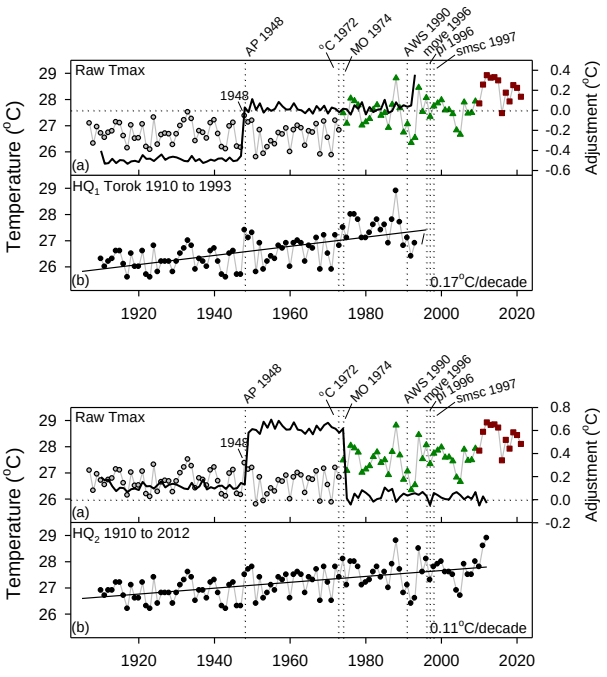

Figure 17. Despite there being no trend in rainfall-adjusted Tmax data before the move in 1974, Torok and Nicholls (1996) adjusted Carnarvon Tmax (right axis, thick line in (a)) down -0.49°C before 1948, which resulted in a homogenised Tmax trend of 0.17°C/decade. Rainfall in 1947 was the 18th highest in 125 years (1910-1920), 1949 ranked 17th, 1951 ranked 46th, 1952 ranked 31st and 1953 ranked 6th.

By adjusting data from 1949 to 1974 up by an average of 0.62°C, final round of HQ homogenisation (Della-Marta et al., 2004[1] (HQ_2)) reversed Torok and Nicholls adjustments, resulting in a homogenised Tmax trend of 0.11°C/decade (Figure 17).8

Figure 18. While ignoring the step-change in 2010, adjustments applied during the Aeradio era by HQ_2 resulted in a Tmax trend of 0.11°C/decade to 2012.

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While annual means determine overall trends, ACORN-SAT homogenisation allegedly results in datasets that are more homogeneous for extremes as well as for means[2,3]. However, post office data were imprecise, sites were watered up to *around 1974*, a cluster of changes occurred between 1990 and 1997 including that the site was moved out of the way of a new bitumen-sealed access road *possibly in 1996-1997*, rainfall was low from 2011 (Figure 6), and as shown in Figure 15, the local environment was disturbed considerably by buildings and earthworks prior to the office closing in 2016.

Effects of such changes on extremes would accumulate in the tails of daily data distributions, and as explained previously, they would be detectable as relative shifts in numbers of daily observations ≤5th and ≥95th day-of-year dataset percentiles. While changes in the Hi_N/Lo_N ratio (Figure 11), and frequencies of daily data within classes (Figure 13), implicates site changes as the overarching factor affecting extremes, ACORN-SAT does not undertake such analysis routinely on a dataset-by-dataset basis.

The crucial question is: *how would Trewin and others including peer reviewers, ascertain which frequency range to adjust, and by how much, if quality assurance including inhomogeneity analysis of frequency data and Hi_N/Lo_N ratios of the target dataset was not undertaken in advance*?

[1] Della-Marta, P., Collins, D. and Braganza, K. (2004). Updating Australia's high quality annual temperature dataset. *Aust. Met. Mag.* 53, 15-19 https://www.cmar.csiro.au/e-print/internal/braganza_x2004a.pdf

[2] Trewin, B.C. 2001. *Extreme temperature events in Australia.* Ph.D. thesis, School of Earth Sciences, University of Melbourne.

[3] Trewin, Blair (2012). Techniques involved in developing the Australian Climate Observations Reference Network – Surface Air Temperature (ACORN-SAT) dataset. CAWCR Technical Report No. 049.

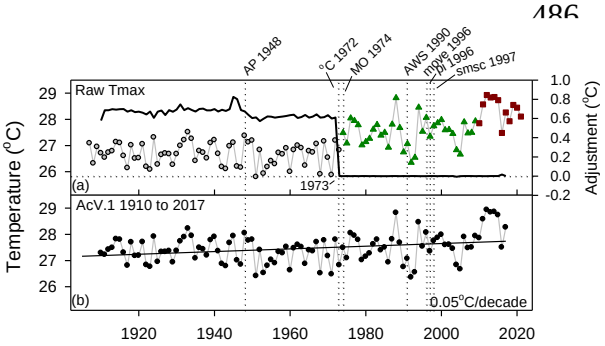
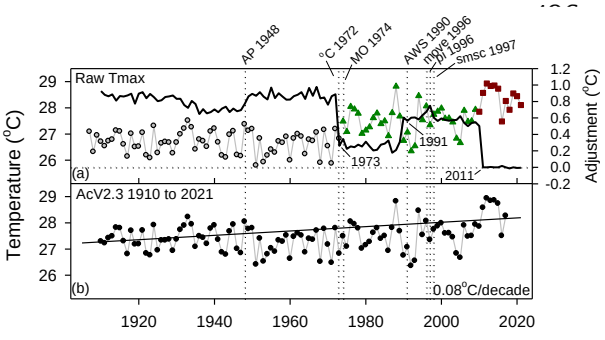


Figure 18 shows adjustments made by ACORN-SAT v.1 and their effect on Tmax trend to 2017.

Figure 19. ACORN-SAT v.1 ignored adjustments made previously by Torok and Nicholls and Della-Marta et al. (Figure 17, Figure 18) and only corrected for the move to the MO *around 1974*. Post 1974-data were not adjusted for the step-change in 2010, which together with the previous average adjustment of +0.62°C resulted in a Tmax trend of 0.05°C/decade to 2017.



ACORN-SAT v.2[1] was said to be a major upgrade. While there have been two prior rounds, adjustments and resulting trend is shown for the most recent (AcV2.3 to 2021) in Figure 20.

Figure 20. ACORN-SAT v.2.3 adjusted Tmax to 1931 by an average of +0.86°C; from 1932 to 1947 by +0.71°C; from 1948 to 1972, +0.87°C; 1973 to 1989 +0.26°C; 1990 to 2010, +0.59°C, and zero after 2011, which resulted in a homogenised Tmax trend of 0.08°C/decade to 2021.

The difference in adjustments between ACORN-SAT v.1 (AcV.1) and AcV2.3 is stark, unexplained and not supported by ancillary analyses. While the primary aim of ACORN-SAT is that homogenised datasets would be more homogeneous for extremes as well as for means, *post* hoc analysis is not routinely undertaken as a quality assurance measure. Therefore, on a site-by-site basis, Trewin presents no evidence that the goals of ACORN-SAT have been realised.

4.1 *Post hoc* evaluation of ACORN-SAT

Like any other study, *post hoc* evaluation of the outcome is essential for assuring that objectives were realised, namely for ACORN-SAT that *homogenised datasets would be more homogeneous for extremes as well as for means*.

Read on …

4.1.1 Homogeneity of means

Step-changes are not trends, particularly if they are statistically highly significant and relate to known changepoints in the data. A test that differentiates step-changes from trend *per se* is whether data each side of a step-change are trending at a similar rate (but off-set by the step), or if they show no trend attributable to another factor, which makes the step the determinant factor. Note that homogenisation may move the timewise location of a step while preserving (or not) its magnitude.

Step-change analysis of the same ACORN-SAT data shown in Figure 19(b) and Figure 20(b) is shown in Figure 21. Although eye-catching, the trend is illusionary. AcV.1 and AcV3.1 embed inhomogeneities: AcV.1 in 1951, 1994 and 2011 (Figure 21(a)), and AcV3.1 in 1994 (Figure 21(b)). In both cases, data consist of untrending segments joined by step-changes, which invalidates the trend model (i.e., a second unaccounted-for signal is embedded in the data). Accounting for the

[1] Trewin, Blair (2018). *The Australian Climate Observations Reference Network – Surface Air Temperature (ACORN-SAT) version 2*. Bureau Research Report No. 032. (http://www.bom.gov.au/climate/change/acorn-sat/documents/BRR-032.pdfRR-032 (bom.gov.au))

steps removes the trend but leaves behind a residual rainfall signal, which because ACORN-SAT is based on raw data, is confounded with the trend shown earlier. For example, although barely significant, a cluster of high rainfall years from 1947 to 1953 cooled Tmax, while a cluster of low rainfall years from 1986 to 1990 caused Tmax to increase particularly in 1988. Similarly, as noted previously, confounded with on-going site changes, due to a low rainfall episode Tmax was clustered-high from 2011. As the effects of rainfall are transitory and therefore an expression of the *weather* not the *climate*, even if not significant overall, as shown in Figure 9, the weather effect should be accounted for as part of the analytical protocol.

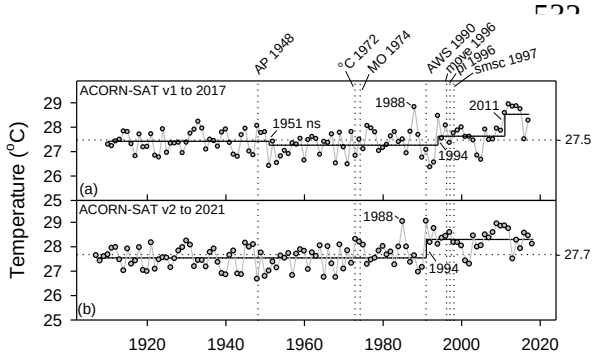


Figure 21. Inhomogeneities in the same ACORN-SAT data shown with a trend-line in Figure 19 and Figure 20 ((a) and (b)). Note that homogenisation, including by Torok and Nicholls (1996) and Della-Marta *et al.* (2004) does not remove the effect of rainfall prior to identifying changepoints and calculating adjustments.

4.1.2 ACORN-Sat extremes

Figures 22 shows counts of daily ACORN-SAT data ≤5th and ≥ 95th dataset day-of-year percentiles and step-changes in the mean of their log_{10}-transformed (Hi_N/Lo_N) ratio were not homogeneous but embedded a persistent step-charge parallel to those in Figure 21, in 1994 and 2011 in the case of AcV1, and 1994 in AcV2.3.

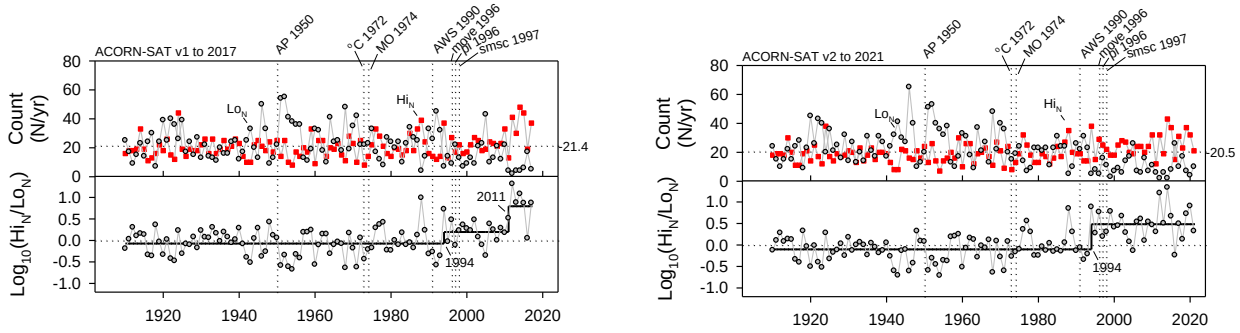


Figure 22. Step changes in log_{10}-transformed Hi_N/Lo_N ratio means show extremes of ACORN-SAT v.1 and v.2 daily data distributions were not homogeneous. While homogenised data before 1994 were random and un-trending step-charges were embedded in v.1 extremes in 1994 and 2011, and in v.2 in 1994.

5. Discussion

5.1 Site control

Good site control is fundamental to any experiment investigating long-term trend and change. However, the site at the post office was shaded, watered and generally poor, the Aeradio site was also watered, while the site at the meteorological office was subject to multiple changes after 1990.

Read on …

Control of extraneous variation and data hygiene (precise observing, recording, reporting-on and archiving of data) are vital to the outcome of any experiment, especially those focussing on long-term trend and change.

However, according to Torok (1996) there were data entry problems at the post office, the screen was very poor and the site was only fair, possibly because he suspected (or it was noted on file) that surroundings were shaded and watered (Figure 23). As the Aeradio site at the aerodrome was also watered (Figure 3), data up to *around 1975* were not much use for determining climatic trend or change.

Figure 23. A snapshot from of a May 1949 aerial photograph (25,000' (7.6 km)), scanned at NLA at a resolution of 1200 DPI to a pdf, reoriented, rescaled and overlaid on a July 2013 Google Earth Pro satellite image (100% opacity) shows the rear yard of the post office facing Robinson Street was shaded and watered. A path leads from the rear of the post office to the Stevenson screen below the position marked 'x'. Unwatered areas appear in light shades and trees are defined by their shadows. While watering cooled Tmax it may also partially explain the lack of a relationship between Tmax and rainfall.

At the current MO site an AWS installed in 1990 became the primary instrument on 1 November 1996, which is about the time the site was moved out of the way of the new bitumen-sealed access road in 1996/97; the 230-litre screen was replaced by a more sensitive 60-litre one on 11 September 1997, the radar was replaced in 2009 and a new met-office was built in 2010. Confounded with all the changes including works associated with the non-directional beacon, the transmitter hut and the wind-profiler array, areas around the enclosure were denuded of vegetation and topsoil after 2010 (Figure 1. Under such conditions and with the protracted turndown in rainfall after July 2011 (Figure 6), there is zero likelihood that daily Tmax, or trends in Tmax could reflect the wider climate.

5.2 Homogenisation

While the obvious response to significant shifts in dataset means is to directly add or subtract the magnitude of the step, ACORN-SAT adjusts past data relative to current data, while also maintaining the warming trajectory predicted by models. However, it is a conundrum that ACORN-SAT creates fake trends and that robust analysis of raw data shows models predicting global warming are wrong.

Read on …

The appropriate response to significant long-term shifts in dataset means is to directly add or subtract the magnitude of the step (-0.814^{o}C in Carnarvon Tmax in 1974, and -0.855^{o}C in 2011 (Figure 9)). STARS provide tables of residuals, but because processes used by homogenisation are not direct, ACORN-SAT and its predecessors lack any form of error control or quality assurance *that relates to their objective*. Even though data before 1974 was affected by watering, maintaining relativity requires that current (post-2011) data be adjusted down by a cumulative average of 1.67^{o}C (0.143$^{o}C_{SE}$), not for past data to be adjusted up which erodes their historic context. Metadata for the 112 ACORN-SAT sites should also provide precise coordinates of where the sites were, relevant notes from Simon Torok's PhD thesis, and whether sites were watered. ACORN-SAT should also quantitively assess whether raw data are fit for the purpose of estimating trend and change, which is an aspect of quality control that is entirely missing in both Simon Torok's 1996 and Blair Trewin's 2001 PhD theses.

As site changes and relocations have caused daily Tmax to increase across the network the simple subterfuge of not adjusting current data for the effect of site and instrument changes has been used relentlessly by the BoM, CSIRO, scorcher.org.au (run by Sarah Perkins-Kirkpatrick at the ARC Centre of Excellence for Climate System Science at the University of NSW), the Australian Academy of Science, WWF, the Climate Council, state and local governments and politicians to make ambient claims about the climate that are fundamentally untrue.

For instance, while ignoring that data before *around 1974* were cooled by watering (Figures 3 and 23), and that disturbances in the vicinity of the weather station (Figure 15) caused average Tmax (and Tmax extremes) to step-up in 2010/11 (Figures 9, 11 and 13), *heatwave expert* Perkins-Kirkpatrick (Figure 24) and her *Scorcher team* reckoned that the hottest temperature recorded in Carnarvon since 1910 was 47.8°C on 6 March 2007. However, 47.8°C was also reported on 23 January 1953; also, as 47.7°C reported on 20 January 2015 was within the uncertainty band of comparing individual observations (±0.6°C), it could not be claimed to be different. Thus, there were three record-holders, not one.

To show the effect of homogenisation on Scorcher's *daily hottest temperature in Carnarvon*, Table 1 lists the five highest-ranked raw daily temperatures, and those for four of the various rounds of homogenisation for which daily data are available (only post-1948 daily airport data are available for HQ_2).

Figure 24. Adding an emotive personal touch, *heatwave expert* Sarah Perkins-Kirkpatrick (photo from http://scorcher.org.au/team) intoned to www.news.com.au on 20 November 2021, that as a mother, a person, and a human being, which is arguably true, she "*made the extreme decision to move her family to Canberra, where the climate is much cooler, for her daughters, aged 2 and 4*", which, considering Canberra's long cold winters and hot summers is not entirely true. (https://www.news.com.au/technology/environment/climate-change/family-moves-to-another-city-to-escape-atrocious-temperatures-due-to-climate-change/news-story/c9a4122d83bdaca3e15aed53d25cc599).

Table 1. The five highest-ranked raw daily Tmax values, and those for various rounds of homogenisation for which daily data are available. (Daily HQ_2 data were only available from 10 January 1945.)

	Raw to 2021		HQ_2 to 2012		AcV.1 to 2014		AcV.2.1 to 2017		AcV.2.3 to 2021	
Rank	Date	Tmax (°C)	Date	Tmax (°C)	Date	Tmax (°C)	Date	Tmax (°C)	Date	Tmax (°C)
1	6/03/2007	47.8	23/01/1953	48.8	23/01/1953	48.5	23/01/1953	48.5	23/01/1953	51.0
2	20/01/2015	47.8	17/12/1946	48.1	6/03/2007	47.8	6/03/2007	47.8	14/01/1952	49.8
3	23/01/1953	47.7	6/03/2007	47.8	14/01/1952	47.3	20/01/2015	47.8	4/01/1969	49.2
4	21/01/1986	47.0	14/01/1952	47.6	21/01/1986	47.0	14/01/1952	47.3	21/01/1986	49.1
5	9/02/1984	46.9	28/12/1945	47.0	9/02/1984	46.9	21/01/1986	47.0	16/01/1952	49.0

Possibly unbeknown to Perkins-Kirkpatrick and her *Scorcher team*, in order to moderate the trend in merged Carnarvon Tmax of 0.143°C/decade *relative to recent data* (Figure 8(a)), Tmax observed at the Aeradio site on 23 January 1953 was increased from 47.7°C to an unlikely 51.0°C by AcV2.3, which is 3.3°C higher than the value actually reported. Ranked 4th in raw data, Tmax for 21 January 1986 (47.0°C), was increased 2.1°C between AcV2.1 and AcV2.3 to 49.1°C. Scorcher's *daily hottest temperature* of 47.8°C on 6 March 2007, was ranked 3rd by HQ_2, 2nd by AcV.1 and AcV.2.1; however, despite being adjusted-up by 1.0°C (to 48.8°C) it was down-ranked to 7th-place by AcV2.3, below that of the top-five shown in Table 1.

As a scientist also, Dr Perkins-Kirkpatrick might at least be curious that between AcV2.1 and AcV2.3, 48.5°C became 51.0°C; 47.3°C became 49.8°C; 47.0°C became 49.1°C; while newcomers 49.2°C (4 January 1969) and 49°C (16 January 1952) pushed *Scorcher's* raw data record to 7th place. [4 January 1969 (45.9°C) ranked 14th in raw data; while 16 January 1952 (45.7°C) ranked 18th.] It is also notable that despite the numerous changes at the MO site (Figures 4 and 15) and their impact on raw data (Figure 9) and extremes (Figures 11 and 13), and her belief and that of her *Scorcher team* that the frequency of upper-range extremes has increased due to CO_2, despite the arid, hot environment of Carnarvon experiencing low rainfall from 2011, no recent Tmax data were ranked in the top-five by AcV2.3.

Clearly a work of fiction, in order to maintain the warming trajectory predicted by models like those that scare Perkins-Kilpatrick, the *Scorcher team*, and colleagues including Andrew King at the University of Melbourne and Nerilie Abram at ANU[1], homogenisation usually adjusts past data down relative to current data. However, due to watering before 1974 as naïve Tmax trend was too steep Trewin adjusted past data up, which in the process created absurd values.

It is useful for folks to remember that despite the hype, the atmosphere is still 99.96% CO_2-free, and that no warming is occurring in the climate at Carnarvon, Meekatharra, Marble Bar, Parafield, Canberra, Amberley, Rutherglen, western Sydney or other places including at weather stations along the Great Barrier Reef, that cannot be explained by station moves, installation of AWS, replacing former 230-litre Stevenson screens with 60-litre ones (and in some places like Yeppoon, plastic screens), and site disturbances including destruction of local vegetation.

BoM and CSIRO scientists and university professors are clearly in the business of promoting warming at any cost to their reputation, and for his role, Trewin appears to be racing the clock to ensure Tmax regularly breaches the 50°C threshold that models predict *under Paris limits to warming*[2,3]. The problem is, careful Bomwatch research and analysis shows the models do not portray the trajectory of Australian temperature datasets.

So instead of battling commentators at the *Adelaide Advertiser*[4], or as a mother, person, and human being, convincing children that they are headed to the cooker and the world will end during their lifetimes[5], Perkins-Kirkpatrick could objectively analyse datasets that underpin her irrational global warming fears using BomWatch protocols. She could start with the freely available statistical packages detailed in the Parafield case study and datasets linked to each report, then openly discuss the outcomes here at www.bomwatch.com.

Cli-fi, climate-porn and horror stories of the kind promoted by Perkins-Kirkpatrick and her compatriots (https://theconversation.com/ can-cli-fi-actually-make-a-difference-a-climate-scientists-perspective-83033) is causing enormous damage to science generally, across the economy and combined with all the other pressures of growing-up, great harm to children and young adults[6]. Promoting possibly irreversible psychological abuse of children, through media and schools, based

[1] https://theconversation.com/theres-no-end-to-the-damage-humans-can-wreak-on-the-climate-this-is-how-bad-its-likely-to-get-166031

[2] https://doi.org/10.1002/2017GL074612

[3] https://pursuit.unimelb.edu.au/articles/how-fast-the-planet-warms-will-be-crucial-for-liveability

[4] https://www.adelaidenow.com.au/ technology/environment/a-climate-scientist-takes-on-the-comments-section/video/32f9b8cc441bd87b83711c6a7e126e3f)

[5] https://thesector.com.au/2021/11/05/wondering-how-to-talk-to-children-about-climate-change-experts-share-their-thoughts/

[6] https://www.theguardian.com/environment/2006/aug/03/greenpolitics.pressandpublishing

on fake-facts, without the permission or knowledge of parents is hardly fitting for a mother, person, human being or scientist of the stature that she promotes.

(As there is no climate crisis, Dr Perkins-Kirkpatrick's daughters might better enjoy re-runs of *Frozen* than *cli-fi* horror-clips invented by spin-doctors at the Monash University, Climate Change Communication Research Hub, who use "*best practice approaches to communicating climate change*" to vulnerable children and mothers (https://www.monash.edu/mcccrh/home/ articles/the-climate-crisis-a-different-lens-documentary-series)).

5.3 Implications

The climate at Carnarvon is uniquely different to places near the Tropic of Capricorn on Australia's east coast. Watering to keep local environments habitable, the long dry season, including through summer, and significant site disturbances after 1990, resulted in a breakdown of relationships between Tmax and rainfall. Due predominantly to site changes, trends in raw and homogenised Tmax bear no relationship to the true climate.

Read on …

Due to its location relative to the high-pressure ridge that separates equatorial from sub-polar regions of low pressure, and which oscillates from north in winter to south in summer, the climate at Carnarvon is uniquely different to stations at similar Latitudes on Australia's east coast. For example, while tropical cyclones originating in the Coral Sea in summer may affect much of Queensland and northern NSW, those originating in the Timor Sea rarely cross the WA coast south of the Pilbara. In winter after the high-pressure ridge shifts north, usually in April, low-pressure cells and associated frontal systems that originate in the Southern Ocean bring rain from May to July, which tails off to virtually nothing after August until the cycle starts again. Watering to keep local environments habitable, combined with a 7-month dry season, including through summer, and significant site disturbances after 1990, caused relationships between average Tmax and annual rainfall to break-down.

While, as a 'bolt-on' experiment that had its origins in the need for the World Meteorological Organisation, the Australian Greenhouse Office and the IPCC to show the Australian climate is warming, it is highly unlikely that Tmax at Carnarvon or any other Australian weather station would be fit for the purpose of measuring long-term trend or change. As data were not collected in the first place to support such an experiment, stitching disparate datasets together and embedding trends under the guise of data homogenisation lacks any statistical or scientific merit. For instance, it cannot be believed that according to AcV.2.3 the warmest homogenised daily temperature (51°C) is 3.3°C warmer than when it was measured behind the Aeradio office on 23 January 1953.

Adjusting the past relative to the present distorts understanding of past weather and enables the Bureau to use unadjusted temperatures measured by the rapid-sampling probes used by automatic weather stations housed in sensitive 60-litre Stevenson screens at uncontrolled sites to imply that weather records are seemingly being broken somewhere every day of the year.

Daily AWAP[1] temperature maps used by news services (often re-coloured for effect), *State of The climate* reports and in sworn evidence provided by Dr Karl Braganza to the Royal Commission into Natural Disaster Arrangements, are tainted by the failure to adjust current data *down* to account for site changes and disturbances such as earthworks, installation of wind-profiler arrays,

[1] The Australian Water Availability Project (AWAP) uses raw data from all weather stations reporting each day, to construct daily temperature maps and anomaly maps that appear on evening news bulletins and used in BoM and CSIRO reports. However, as AWAP products use data that are unadjusted for station moves and changes, they exaggerate warming.

buildings, roads, scalping topsoil and vegetation in the vicinity of where temperature is measured, and spraying out local groundcover using herbicides *in lieu* of regular mowing and maintenance.

However, despite protestations to the contrary (e.g., https://theconversation.com/no-the-bureau-of-meteorology-is-not-fiddling-its-weather-data-31009), results presented in this and other BomWatch reports show unequivocally that with oversight from Neville Nicholls, who having been affiliated with WMO and IPCC, and evidenced by his numerous publications is unquestioning in his support for the warming hypothesis, BoM scientists, most recently Blair Trewin, ***are*** fiddling Australia's temperature records to show warming in means and extremes that does not reflect the true state of the climate.

6. Conclusions

Naïve trend analysis using spreadsheet applications such as Excel cannot distinguish between 'real' Tmax and the parallel effect of watering and shade in the post office yard, extensive watering of the operational precinct at the aerodrome, the move *around 1974* to the dryland site near the radio-aids office, and compounded changes at that site culminating in 2010/11 with low rainfall, building the new office, installing the wind-profiler array and denuding the area in the vicinity of the met-enclosure.

Watering to keep local environments habitable, a 7-month dry season, including through summer, combined with site disturbances, caused relationships between average Tmax and rainfall to break-down. Nevertheless, despite lack of statistical significance it is important to remove whatever rainfall signal is embedded in Tmax data prior to analysing site-change effects, which homogenisation failed to do.

Corroborated by aerial photographs and satellite images, a highly significant step-change in 1974 of 0.81°C (0.094_{SE}), and in 2010, of 0.86°C (0.152) accounted for all the naïve 'trend' from 1907 to 2021 (a total of 1.67°C in 114 years = 0.146°C/decade, the same as estimated using Excel but due to internal rounding, slightly different to that estimated by *Rcmdr* (0.143°C/decade). As individual segments show no trend and overall trend calculated by Excel is spurious (Figure 8), it could not be claimed that the climate at Carnarvon has warmed.

Precision of daily observations improved after of post office data merged with aerodrome data in 1948, after metrication in 1972, commencement of AWS data in about 1990 and when the AWS became the primary instrument in 1996, but precision had no bearing on the frequency of upper-range extremes and the frequency of daily Tmax within classes.

The ratio of counts of daily values ≥95th and ≤5th dataset day-of-year percentiles [$\log_{10}(Hi_N/LoN)$] stepped-down slightly in 1950, indicating upper-range extremes were less frequent at the aerodrome, and stepped-up markedly when observations transferred to the dryland site near the radio-aids building, and again in 2016 due to low rainfall and accumulated site changes. As they reflected combined weather and site-related effects, changes in extremes do not reflect lasting changes in the climate.

Homogenisation fails to undertake basic quality assurance and frequency analysis, so cannot objectively adjust for the effect of extraneous factors such as watering, site changes etc., neither can the process correct daily data distributions and extremes if changes within distributions (frequencies within Tmax classes, or percentile ranges) are unknown. Consequently, ACORN-SAT v.1 and v.3.1 data were not homogeneous either with respect to extremes or annual means. Thus, the process fails its primary objective, which is to adjust for site and instrument changes so extremes and means are homogeneous.

The models loudly proclaimed by Dr Sarah Perkins-Kirkpatrick and compatriots including David Karoly, Andrew King, Nerilie Abram and others as foretelling the future, and on which public policy is based are wrong. Furthermore, grooming and manipulating innocent minds with climate-porn is loathsome, offensive and lacks any sense of decency. Deliberately embarking on projects with spin-doctors at the Monash University, Climate Change Communication Research Hub likely to cause long-term harm to vulnerable victims is a form of abuse to which no self-respecting scientist, *mother, person* or *human being* should be associated. It is simply the wrong path.

While changing data to agree with hypotheses has no place in science, the most obvious homogenisation subterfuge is the adjustment of changes that made no difference to the data, while ignoring those that did. Second, using neighbouring datasets to form reference series without ensuring they are homogeneous. The use of correlated data that likely embed parallel faults to disproportionally correct faults in ACORN-SAT data and thereby embed trends in homogenised data has no statistical or scientific merit. Consequently, the ACORN-SAT project is misleading and irredeemably deeply flawed and should be abandoned.

Disclaimer

Rules relating to scientific conduct by members of the Australian Meteorological and Oceanographic Society of which the Author is a member and of which Blair Trewin was President, specifically state that "*Members involved in scientific activities should base those activities on sound scientific principles*" and that "*Plagiarism, fabrication or falsification of data, and other misleading behaviour are all unacceptable*" (https://www.amos.org.au/about/rules-and-regulations/amos-code-of-conduct-2/).

Unethical scientific practices including the homogenisation of data to create false narratives undermines trust and is not in the public interest. While the persons mentioned or critiqued may be upstanding citizens, which is not in question, the problem lies with their approach to data, use of poor data or their portrayal of data in their cited and referenceable publications as representing facts that are unsubstantiated, statistically questionable or not true. The debate is therefore a scientific one, not a personal one.

Acknowledgements

Impetus for this research arose from the creepiness, that spearheaded by WWF, and teachers they should be able to trust, school children from primary school to Year 12; students at university, and the public at large have been groomed relentlessly by BoM, CSIRO, the Australian Museum, IPCC, the Climate Council and high-ranking professors to believe that the world is facing a tipping-point due to global warming caused by CO_2 for which there is no evidence.

Dr Neville Nicholls, who commenced as a cadet meteorologist with the Bureau of Meteorology in 1970[1] and later in 1986 was a member of the World Climate Research Programme when Dr John Zillman was Australia's permanent WMO representative and later President, oversaw BoM scientist Simon Torok's PhD and co-supervised Blair Trewin's PhD, which underpinned much of the Bureau's subsequent homogenisation effort. A contributor to the World Economic Forum[2], Nicholls is currently Emeritus Professor at Monash University and he is acknowledged for stirring my interest in the dark-art of using data homogenisation to create bogus climatic trends and changes. The damage wrought by elite scientists including Dr Sarah Perkins-Kirkpatrick, to the

[1] https://www.eoas.info/biogs/P003289b.htm
[2] https://www.weforum.org/agenda/authors/neville-nicholls

integrity of science in Australia, the national economy and the wellbeing and employment prospects of future generations in the name of climate change is deplorable.

Development of decimal fraction frequencies as a precision metric resulted from discussions with Chris Gillham (https://www.waclimate.net/). Others who contributed ideas and discussion over many years included Geoffrey Sherrington, Ken Stewart (https://kenskingdom.wordpress.com/) and Tom Berger (http://www.elastictruth.com/). David Mason-Jones is gratefully acknowledged for providing invaluable editorial assistance.

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