

New Zealand – Unaffected by Global Warming

July 2011

NIWA's official New Zealand Temperature Record (NZTR) estimates a significant warming trend during the past century. We show that the data adjustments driving that trend are wrongly based and contrary to scientific authority. Contaminated raw data were combined with untested and inappropriate statistical methods, and the resulting trend is inconsistent with other records.

When internationally accepted techniques are applied, the NZTR reveals that no material warming has occurred in this country. New Zealand did not experience the 20th-century warming recorded elsewhere.

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1. BACKGROUND

1.1 Weather History

The New Zealand Government began gathering weather records shortly after the country became a self-governing colony in 1852. The earliest surviving record of an averaged “New Zealand temperature record” (NZTR) is an 1868 notice by the predecessor of the NZ Royal Society which records that the average of 10+ years at six representative weather stations was 13.1°C.

Other major compilations were published in 1920 and 1960.

In 2010, the National Institute for Water and Atmospheric Research (“NIWA”) assessed the current ‘normal’ (ie 1971-2000 ‘adjusted’ average) at 12.74°C.¹

New Zealand’s average recorded temperatures have remained very stable at 12.6°C ± 0.5°C over the past 150 years².

Year series ended	Number of years (avg)	Number of stations	Average temperature
1868	13	6	13.1°C
1920	35	9	12.2°C
1960	23	24	12.1°C
2000	30	7	12.7°C

Table 1: Summary of published NZTRs³

1.2 Controversy

James Hessell, formerly senior climatologist at the New Zealand Meteorological Service, produced the first modern peer-reviewed paper on the subject of New Zealand temperature records (Hessell, 1980)⁴. It identified which weather stations were “reliable” and found that those stations showed no warming trend during the half-century from 1930 to 1980.

An unpublished study, included as an annexe to a 1981 doctoral thesis⁴ submitted by M.J. Salinger to Victoria University of Wellington, took the view that a warming trend of

¹ NIWA “Review of 7SS”; www.niwa.co.nz/our-science/climate/news/all/nz-temp-record/seven-station-series-temperature-data.

² B.E. Brill “The NZ Temperature Record – A Brief History”; http://nzclimatescience.net/index.php?option=com_content&task=view&id=742&Itemid=32.

³ V. Gray NIWA 7-Station Review Fails to Show Significant Temperature Changes in NZ 2011 *Energy & Environment*, Volume 22 No 4. http://nzclimatescience.net/index.php?option=com_content&task=view&id=754&Itemid=1.

⁴ Salinger, M.J., 1981: Appendix C in: New Zealand Climate: The instrumental record. Thesis submitted at the Victoria University of Wellington, January 1981.

approximately 1°C/century might have occurred during 1853-1975. Historical data from seven selected stations were adjusted to create a ‘Seven-station Series’ (“the 7SS”)⁵.

Unfortunately, the statistical calculations of the adjustments have been lost.

In 1992, FORST⁶ issued a contract to the NZ Meteorological Service (“the MetService”), and later NIWA, for research on the New Zealand Temperature Record (“the NZTR”).

This yielded three outcomes:

1. A published document, *Fouhy et al (1992)*⁷, listing all recorded weather station site changes.
2. An unpublished document in which Salinger updated and revised the 7SS from the 1981 thesis. This was subsequently adopted by NIWA (per Salinger as Principal Scientist) as its official version of the NZ Temperature Record.
3. A peer-reviewed paper, *Rhoades & Salinger (1993)*⁸, providing a comprehensive discussion of the homogenisation of temperature records, including statistical techniques for identifying and justifying adjustments.

In November 2009, the New Zealand Climate Science Coalition (“NZCSC”) pointed out⁹ that the raw weather data relevant to the 7SS showed no material temperature change, demonstrating that the 7SS warming trend resulted solely from the then undisclosed NIWA/Salinger adjustments.

⁵ Auckland, Masterton, Wellington, Nelson, Hokitika, Lincoln, and Dunedin.

⁶ The Foundation for Research Science and Technology (a government science-funding agency).

⁷ Fouhy, E.; Coutts, L.; McGann, R.P.; Collen, B.; Salinger, M.J., 1992: South Pacific Historic Climatological Network Climate Station Histories. Part 2: New Zealand and Offshore Islands. NZ Meteorological Service, Wellington, ISBN 0-477-01583-2.

⁸ Rhoades, D.A., and Salinger, M.J., 1993: Adjustment of temperature and rainfall records for site changes. *International Journal of Climatology*, 13, 899—913.

⁹ “Are We Feeling Warmer Yet?” www.climateconversation.wordshine.co.nz/docs/awfw/are-we-feeling-warmer-yet.htm.

NZ Temperature trends

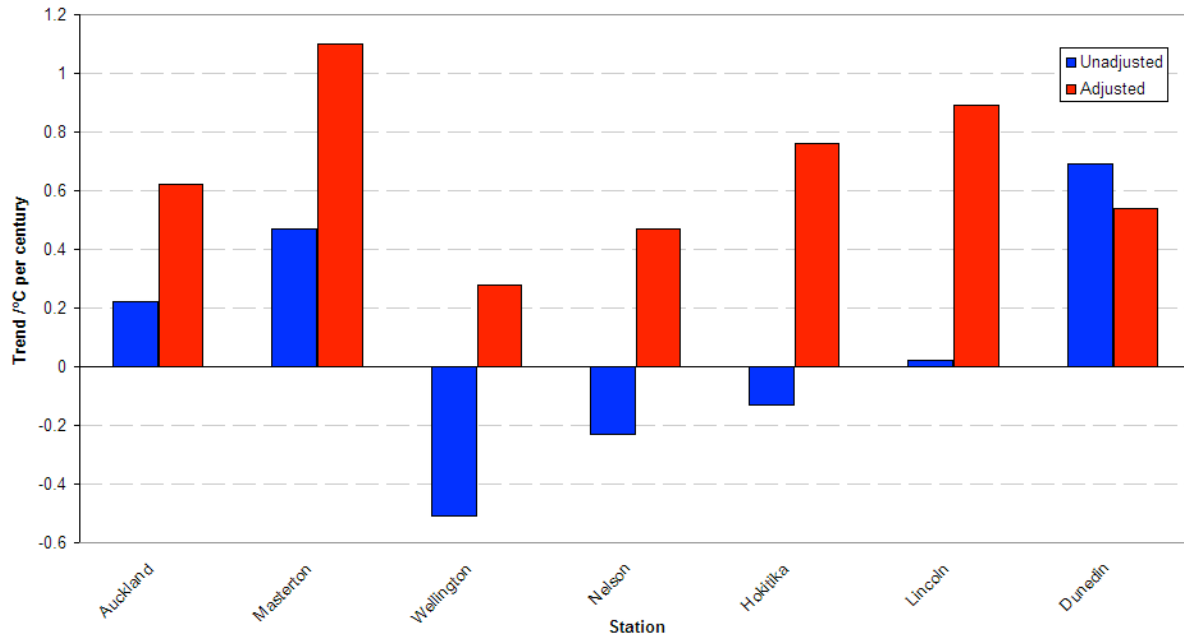


Figure 1: Comparison of temperatures before and after NIWA adjustments (by station)¹⁰

In response, NIWA/Salinger released¹¹ an “Eleven-station Series” (“the 11SS”)¹² of selected unadjusted stations – which also showed a warming trend.

NIWA eventually documented the adjustments used in the 7SS in February 2010¹³, along with an illustrative description¹⁴ of the adjustments made to the Hokitika record. Both papers were tabled in Parliament.

In August 2010, an NZCSC associate issued High Court proceedings for judicial review of both the 7SS and the 11SS, alleging illegality and bias. The grounds for this action are partially set out in an article on Quadrant Online¹⁵, with further details on the NZCSC website¹⁶.

¹⁰ “Are we feeling warmer yet?” (ibid) p5.

¹¹ Press Release 3 December 2009. www.scoop.co.nz/stories/SC0912/S00004.htm.

¹² Website: www.niwa.co.nz/news-and-publications/news/all/2009/nz-temp-record/temperature-trends-from-raw-data.

¹³ www.niwa.co.nz/our-science/climate/news/all/nz-temp-record/seven-station-series-temperature-data. In response to an Official Information Act request in 2009, NIWA had been unable to produce any documents whatever related to the 7SS. Salinger seems to have acted alone.

¹⁴ www.niwa.co.nz/_data/assets/pdf_file/0018/101835/Hokitika-Adjustments.pdf.

¹⁵ Brill: “Crisis in New Zealand Climatology” www.quadrant.org.au/blogs/doomed-planet/2010/05/crisis-in-new-zealand-climatology.

¹⁶ http://nzclimatescience.net/index.php?option=com_content&task=blogsection&id=14&Itemid=47.

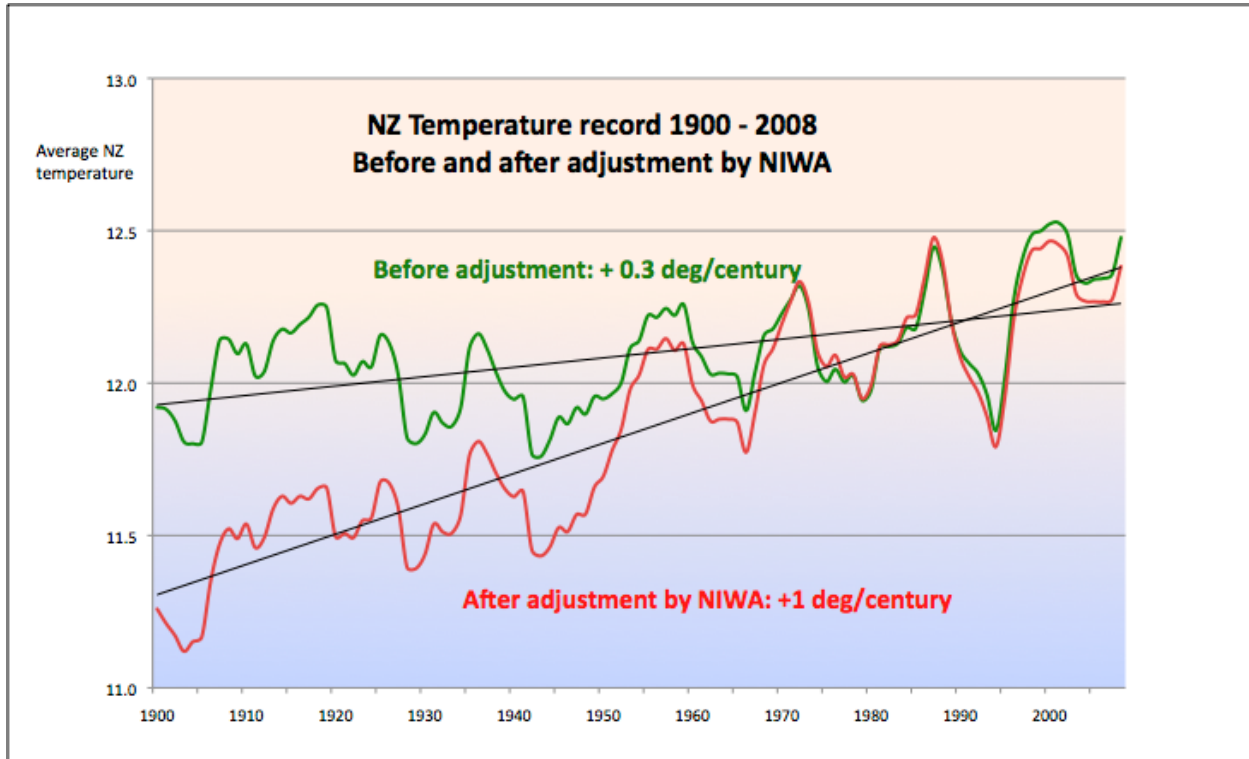


Figure 2: NZTR before and after NIWA adjustments¹⁷

In December 2010, NIWA published a detailed report¹⁸ ("the Review") which revised the 7SS de novo and abandoned the temperature data prior to 2009. The Review included a new spreadsheet and graph ("the NZT7") showing a warming trend of 0.91°C/century for the period 1909-2009 (which is identical to the warming shown in the 7SS for that period).

¹⁷ B. Leyland (2010) http://nzclimatescience.net/index.php?option=com_content&task=view&id=653&Itemid=47.

¹⁸ Review (supra).

2. WEATHER vs CLIMATE

Weather stations historically set out to record temperatures in whole degrees, with the general aim of achieving consistent accuracy within $\pm 2^{\circ}\text{C}$. This level of accuracy is acceptable for weather purposes.

Thermometer(s) measure the daily maximum and minimum surface air temperatures at only one specific point in space¹⁹, but sustained trends in those measures are assumed to reflect changes in “local” weather conditions²⁰.

Recently, climate scientists turned back to those historical weather records to construct decades-long time-series – in the hope of discerning temperature trends measured in tenths (and even hundredths) of a degree.

This ambition highlighted the limitations of the 150-year-old system: most weather stations have been relocated more than once; they have been affected by growth of vegetation and urbanisation; instruments and/or screens have changed; and inconsistent methods or times of reading and recording have applied.

All of these non-weather factors contaminate the historical data. A key challenge for the climate archivist is to identify, quantify and adjust for the contaminants, where possible.

In recent times, an international peer-reviewed scientific literature has developed on statistical techniques for adjusting and “homogenising” raw temperature data.

NIWA contends it has strictly observed the principles laid down in the literature, while the NZCSC challenges this claim. This dispute lies at the heart of the pending court proceedings.

Non-meteorological influences on weather data fall into two distinct categories, depending on whether the effects are long-lasting and progressive or consist of single step-changes.

¹⁹ See James Hansen: http://data.giss.nasa.gov/gistemp/abs_temp.html.

²⁰ Aguilar, E., Auer, I., Brunet, M., Peterson, T. C. and Wieringa, J. (2003). WCDMP No. 53, WMD/TD No. 1186: *Guidelines on climate metadata and homogenization*. World Meteorological Organization. At p5 under “Local Environment” – “Data are influenced by factors that act at several scales. Mesoscale (1 km to 30 km) climate is influenced by proximity and size of large water surfaces, urbanized areas and mountain ranges; at toposcale (“local” scale, 300 m. to 2 km) the observations are influenced by terrain slope, forests, crops and other roughness, and by nearby obstacles such as trees or houses (at airports: airplanes); at microscale (less than 300 m) the minimum temperature is affected in “frost hollows”, the surface energy exchange is influenced by wetness and thermal conductivity of the earth, and reliable radiation measurements depend on an obstacle-free horizon.”

3. PROGRESSIVE CONTAMINATION – UHI/SHELTER

3.1. Non-Linear Effects

A slow, progressive non-climatic influence is difficult to detect and often impossible to correct. The most prevalent problems in this category are:

Shelter. Exposures to wind and/or sun change over time with the growth of trees or other vegetation in proximity to a thermometer. The effects are non-linear, and it is often impossible to subsequently assess the extent of the non-climatic warming or cooling impact on the recorded data for any particular time period²¹.

UHI. Urbanisation produces area-warming from concrete, roofing, shelter, air-conditioning, vehicles, etc., rather than from changes in local climatic conditions²². The effects on temperature data are unpredictable over time, and may occur in bursts. UHI effects have been measured in Australian populations of less than 1,000²³.

3.2 The Hessel Paper

J.W.D. Hessel, the most-published senior meteorologist at the Met Service, undertook a detailed survey of data contamination and, in his 1980 paper, divided New Zealand weather stations into Reliable and Unreliable categories. Amongst the latter were four from the 7SS – Auckland, Wellington, Dunedin and Hokitika.

Applying a number of statistical tests over a 40-year period, Hessel recorded that the stations whose data he identified as Unreliable had warmed at about five times the rate of the Reliable stations. This result tested as ‘highly significant’²⁴. He also found that New Zealand urban stations were significantly warmer than their nearest rural counterparts.

The author calculated that many stations (including Auckland and Wellington, in particular) were affected by both UHI and Shelter effects during the period 1930-80.

²¹ Treadgold - www.climateconversation.wordshine.co.nz/2011/04/nzt7-uses-defective-raw-data/.

²² http://en.wikipedia.org/wiki/Urban_heat_island.

²³ Torok, S.J., Morris, C.J.G., Skinner, C. and Plummer, N. 2001. “Urban heat island features of southeast Australian towns.” Australian Meteorological Magazine 50: 1-13.

²⁴ Hessel (supra) p6.

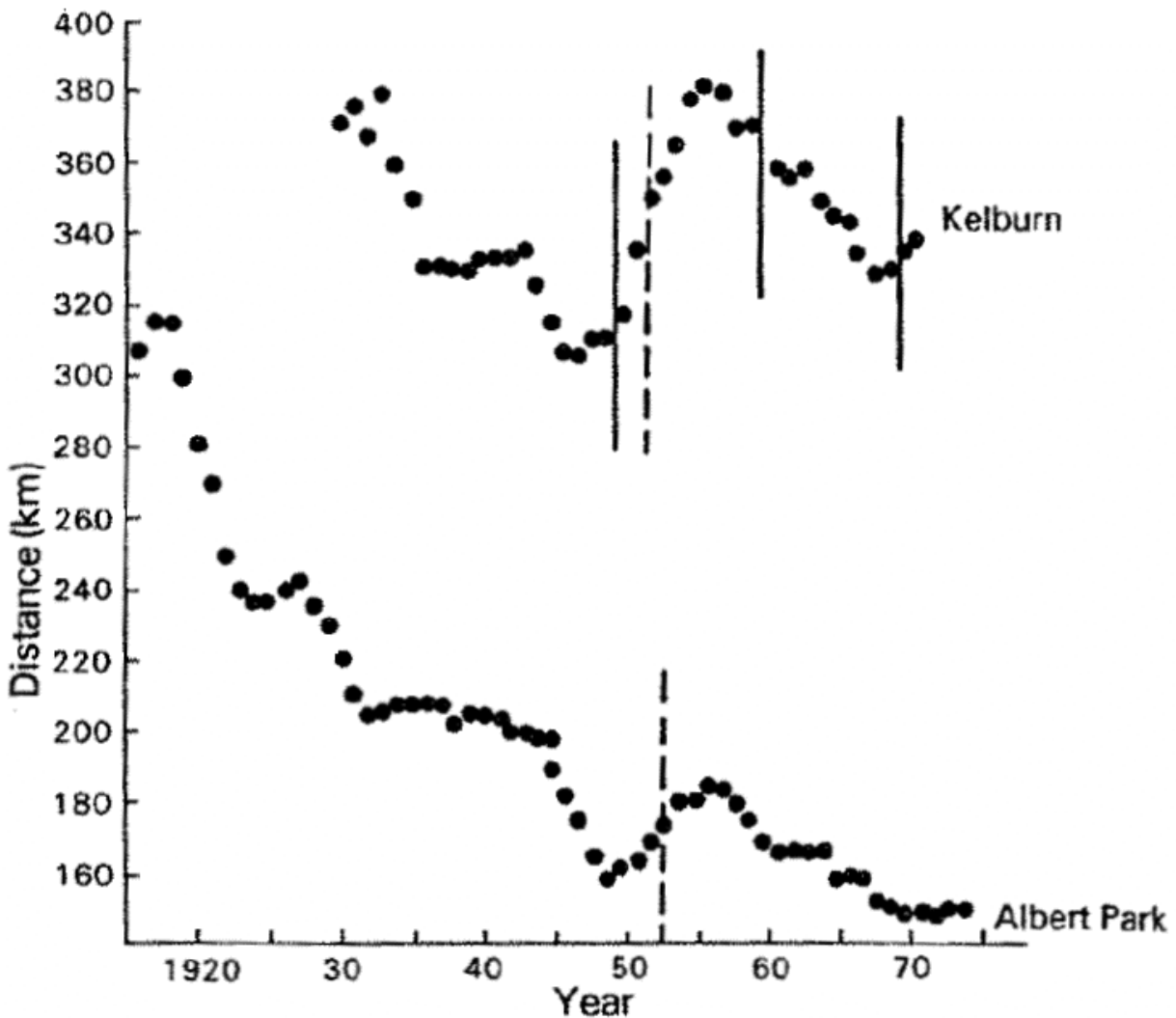


Figure 3: Hessell – Wind strength measures for Auckland/Wellington, indicating serious Shelter issues²⁵

3.3 Adjustment Prospects

Simply avoiding the use of contaminated stations is standard practice for most national and international climate agencies. The standing policy of NIWA’s counterpart, the Australian Bureau of Meteorology (“the BoM”), is to omit all city stations from the “high-quality” series it uses for climate research.²⁶

Hessell states firmly²⁷: “Quantitative assessments of sheltering and Urban Heat Island Effects cannot be satisfactorily resolved unless either or both can be shown to be negligible.”

²⁵ A possible explanation for NIWA’s failure to use Hessell’s wind flow evidence appears in Fn28 p35, stating that “the NIWA climate database does not currently have digitised monthly wind-run data prior to 1946.” But NIWA expressly acknowledges that such data is useful in assessing Shelter problems.

²⁶ Treadgold - www.climateconversation.wordshine.co.nz/2011/04/nzt7-uses-defective-raw-data/.

²⁷ Hessell p3.

Rhoades & Salinger²⁸ recommends that “it is best to choose stations which have not been affected by shading or urbanisation.”

In the USA, the National Oceanic and Atmospheric Administration (NOAA) has made attempts to compare urban stations with averages of a number of surrounding rural stations. In New Zealand, especially prior to 1945, there are insufficient rural datasets available to provide a basis for adjustments to the 7SS.

No adjustments for UHI/Shelter problems have been attempted by NIWA in either the original 7SS or the NZT7.

3.4 Auckland and Wellington

In its 2010 Review, NIWA classifies the Auckland warming trend as “significantly influenced” by Shelter/UHI (estimated at 0.38°C) but elects not to make any adjustment.

In an effort to partially quantify Albert Park’s problems, NIWA chose a comparison with rural Te Aroha²⁹. Adopting this precedent³⁰ for the 60 years of known Albert Park contamination, and using a similar method for the Mangere stations, **NZCSC finds that NIWA’s Review has over-stated the Auckland warming trend by as much as 1.05°C/century.**³¹

NIWA makes no attempt to test UHI effects at the three Manukau City stations which replaced Albert Park after 1976. The population here exploded by 1200%, from under 16,000 in 1951 to almost 200,000 30 years later. When the Coalition compares Auckland Aero with two other airport sites near Auckland, it appears the former has experienced UHI effects in excess of 0.9°C³².

Although Wellington metadata references Shelter problems³³ (and the original 7SS made a 1950 adjustment in consequence) the Review fails to recognise the UHI/Shelter problems documented in the Hessel paper³⁴. This contrasts sharply with NIWA’s treatment of Lincoln before 1944³⁵, where statistical PMT tests are used to identify non-metadata Shelter problems (although, curiously, NIWA treats them as step-changes).

Using Appleby as a ‘rural’ comparator, NZCSC finds that NIWA’s Review has over-stated the Wellington warming trend by 0.27°C/century³⁶.

A ‘first difference’ statistical analysis³⁷ of the raw data shows the 7-station record to be 0.7° higher than a 5-station series which omits Auckland and Wellington.

²⁸ Rhoades p899.

²⁹ Review p37 Appendix 5. A comparison with Waipoua Forest is also mentioned, but fast-growing pine plantations suffer from “Forest Heat Island” effects – as NIWA acknowledges at p36 Fn 29.

³⁰ NZCSC: Statistical Audit of the NIWA 7-Station Review: Supplementary Information p62.

³¹ This calculation takes no account of the fact that Te Aroha is not rural, but a small town which was almost certainly affected by UHI during the relevant period. Its 2006 population was 3,678.

³² NZCSC: Statistical Audit of the NIWA 7-Station Review: Supplementary Information p60.

³³ Review p64.

³⁴ Although NIWA expressly addresses a screen change issue noted by Hessel in the same paper.

³⁵ Review p139.

³⁶ NZCSC: Report on the NIWA 7-Station Review: Supplementary Information p69.

³⁷ NZCSC paper: “Some Characteristics of the NZTR” (2011) www.climate-science.org.nz/.

Even after the NZCSC’s suggested corrections, the warming trends of Auckland and Wellington are more than double the average of the other five (corrected) stations. This result reinforces the view that these two contaminated locations should be excluded from the series³⁸.

3.5 Other Urban Areas

The BoM found in 2001³⁹ that the maximum urban-rural temperature differences of cities tend to scale linearly with the logarithms of their populations. In Australia, Europe and North America, the mean urban-rural difference was found to be approximately 2.2 ± 0.2 °C when the urban population was in the vicinity of 1,000 people.

The remaining five locations of the 7SS have populations as follows:

Location	Population	Year
Masterton	20,698	2010
Nelson	42,891	2010
Hokitika	3,401	2006
Lincoln	2,235 + 4000 students.	2006
Dunedin	118,683	2006

It is almost certain that the historical data from all five stations have been tainted to some extent by urbanisation during the 20th century. Indeed that was a specific finding of the Hessel paper. Although the exact extent remains undiagnosed to date, it is clear that the raw data materially overstates the actual warming that has occurred.

³⁸ The Review discusses the possible trend effect of omitting Auckland from the 7SS (p6), but does not take the matter further.

³⁹ Torok et al (2001) - see Fn 18. One of the authors, Dr Neil Plummer, is the signatory to the BoM’s Letter of Support, included at p15 of the Review.

4. STEP CHANGES – NEIGHBOUR COMPARISONS

4.1 Overlaps

The preferred method for homogenising temperatures before and after a site change is to run the two situations in parallel for a suitably lengthy period so as to identify the average basic temperature differential.

Regrettably, this practice has been unusual in New Zealand until modern times⁴⁰. Of the 31 adjustments applied in the Review, only 8 were resolved by overlaps whilst the remaining 23 rely upon before-and-after comparisons with neighbouring stations.

4.2 Neighbouring Stations

Rhoades & Salinger draws a clear distinction between stations with neighbours and those which are “isolated”⁴¹. While adjustments may be made by comparison of the records of neighbouring stations, which are defined as “subject to similar local weather patterns,” this technique is not available for isolated stations.

This distinction raises an immediate problem. Many of the adjustments used in the 7SS relate to the period prior to World War 2, when weather stations were few and most of the seven stations were isolated. Nevertheless, NIWA has used inter-comparisons between the seven stations for most of their adjustments⁴², even while acknowledging that all seven experienced different “local weather patterns.”

The extreme case is when temperature data from both Dunedin and Dargaville are used to supply missing data for Albert Park in Auckland. Dargaville abuts the Tasman Sea and is some 1140 kilometres from Dunedin, which fronts the Pacific Ocean on the opposite coast. They are separated by Cook Strait, several mountain ranges and ten degrees of latitude. Clearly, they have never been “subject to similar local weather patterns.”

The need to confine comparisons to “nearby” stations is emphasised in all of the relevant literature cited by NIWA in the Review⁴³, and there is no precedent or authority for the ‘correlation-only’ method NIWA has applied.

The Review itself acknowledges that comparisons should “ideally” be confined to stations which experience the same broad climatic conditions⁴⁴.

⁴⁰ Prior to 1975, only one NIWA adjustment relies on an overlap – Hokitika 1944. This is controversial as it is not clear from the records which temperatures related to which site.

⁴¹ Supra fn 8 at p908.

⁴² Brill: www.climateconversation.wordshine.co.nz/2011/02/niwas-maverick-methodology.

⁴³ e.g., Aguilar et al., *ibid* p34: “The most common approach for building a reference time series is to calculate for each year a weighted average of data from neighbouring stations or sections of neighbouring station time series that metadata indicate are homogeneous. Some measure of similarity (usually correlation coefficient) is employed to select the most adequate neighbours and weight them according to their statistical resemblance to the candidate.”

⁴⁴ Review Fn17 p21.

It should be mentioned that NIWA has declared its intention to publish an ‘adjustments paper’ in a scientific journal during the 2010/11 fiscal year (i.e., by 30/06/2011)⁴⁵, but has not yet disclosed the nature of its research.

Authority	Comparators	Neighbours
Rhoades & Salinger	Yes	Essential
Peterson, Easterling et al.	Yes	Essential
Aguilar et al.	Yes	Preferred
Torok et al.	yes	Essential
Hessell	No	N/A

Table 2: Where the scientific literature discusses the use of comparator stations, authors generally state the pre-requisite that ‘neighbours’ must be available.

4.3 Climate Zones

Emphasising the complexity and variability of New Zealand’s climate, which “divides the country into dramatically different climate regions”⁴⁶, NIWA’s website identifies eight broad climate zones:

⁴⁵ PQ 301 (2011) and 306 (2011).

⁴⁶ www.niwa.co.nz/education-and-training/schools/resources/climate/overview.

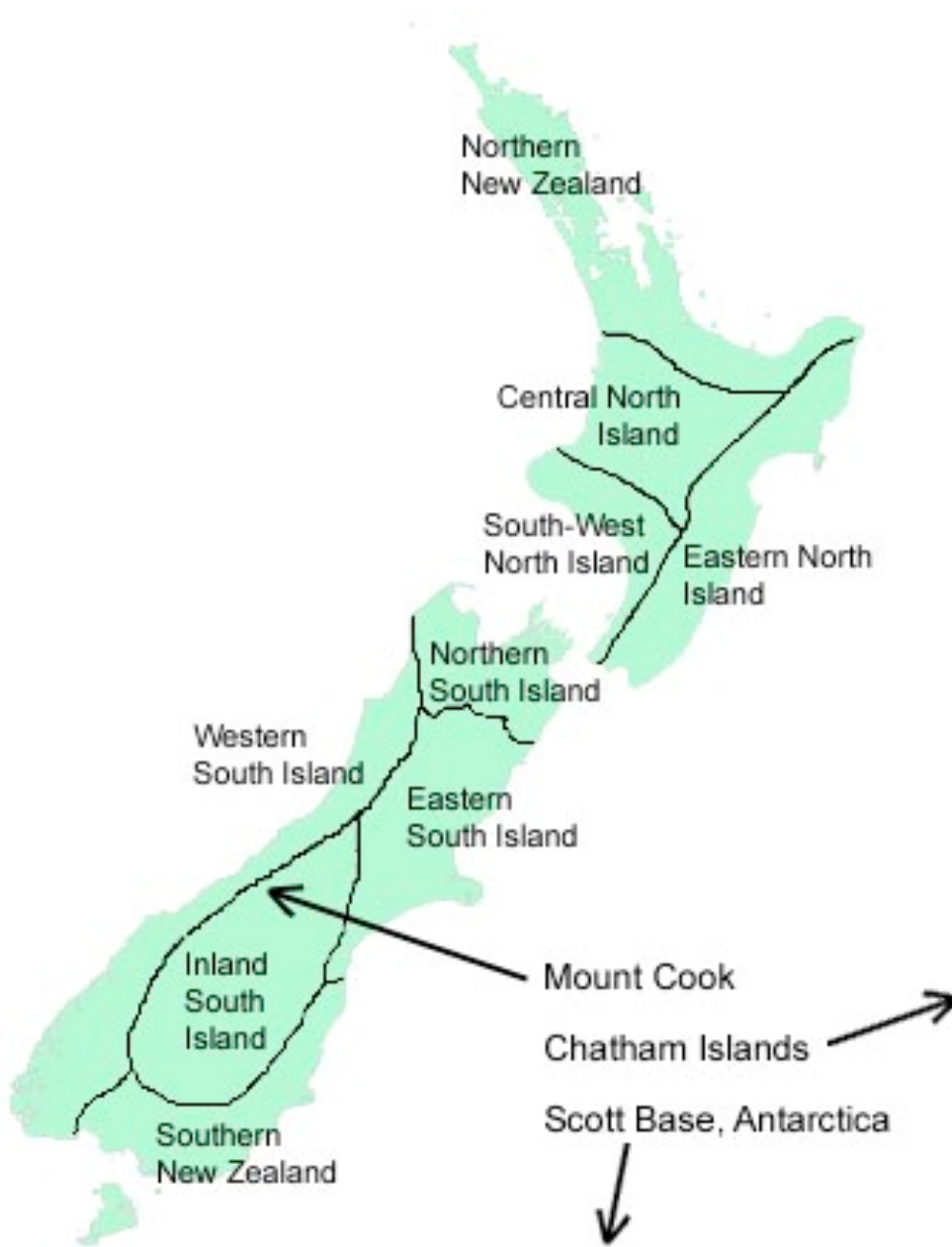


Figure 4: NIWA’s depiction of New Zealand’s eight climate zones

Each of the stations comprising the 7SS is located in a different climate zone. All are isolated, and none share the same local temperature patterns. This diversity is the very reason why the average temperatures of these seven comprise a useful proxy for the country-wide average.

Without justification, the Review uses temperature data from all seven stations interchangeably. NIWA ignores its own zones and tests only for ‘first difference correlation.’ Data trends identified at any one station are treated as sufficient evidence that identical trends must have occurred at the remaining six stations.

5. STATISTICAL METHOD

5.1 Rhoades & Salinger

Rhoades & Salinger (“*Rhoades*”) is the seminal paper on the statistical analysis and homogenisation of New Zealand temperature records. It is the only peer-reviewed paper describing adjustment techniques to offset known non-climatic step changes, in the New Zealand context. It applies broadly-accepted statistical methods to the narrow field of climate records.

Peterson et al. (1998)⁴⁸, which is an omnibus paper drawing together techniques from around the world, quotes the *Rhoades* methodology as New Zealand’s contribution.

NIWA cites *Rhoades* as its primary authority for both the original 7SS and the Review⁴⁹.

5.2 Audit based on *Rhoades*

Putting aside its objections to NIWA’s use of contaminated data and isolated stations, NZCSC audited the Review to check its compliance with the statistical techniques described in detail in *Rhoades*. The resulting paper⁵⁰ establishes that NIWA has departed from its chosen template in highly significant ways.

The *Rhoades* techniques for comparison of data between two or more neighbouring stations require the use of:

- Monthly data
- Symmetric intervals centred on the site change
- A 1-2 year period before and after the shift
- Weighted averages based on levels of statistical correlation

In compiling the NZT7, NIWA ignores all four of these requirements.

Making the same adjustments and using the same comparator stations as NIWA, NZCSC has found that strict application of the *Rhoades* procedures **leads to a maximum warming trend of $0.34 \pm 0.29^{\circ}\text{C}/\text{century}$** as follows:

⁴⁸ Peterson, T.C.; Easterling, D.R.; Karl, T.R.; Groisman, P.; Nicholls, N.; Plummer, N.; Torok, S.; Auer, I.; Boehm, R.; Gullett, D.; Vincent, L.; Heino, R.; Tuomenvirta, H.; Mestre, O.; Szentimrey, T.; Salinger, J.; Forland, E.J.; Hanssen-Bauer, I.; Alexandersson, H.; Jones, P.; Parker, D. (1998). Homogeneity adjustments of *in situ* atmospheric climate data: a review. *International Journal of Climatology*, **18**, 1493- 1517.

⁴⁹ Treadgold: www.climateconversation.wordshine.co.nz/2011/04/niwa-bible.

⁵⁰ NZCSC: “Statistical Audit of the NIWA 7-Station Review” (NZCSC website).

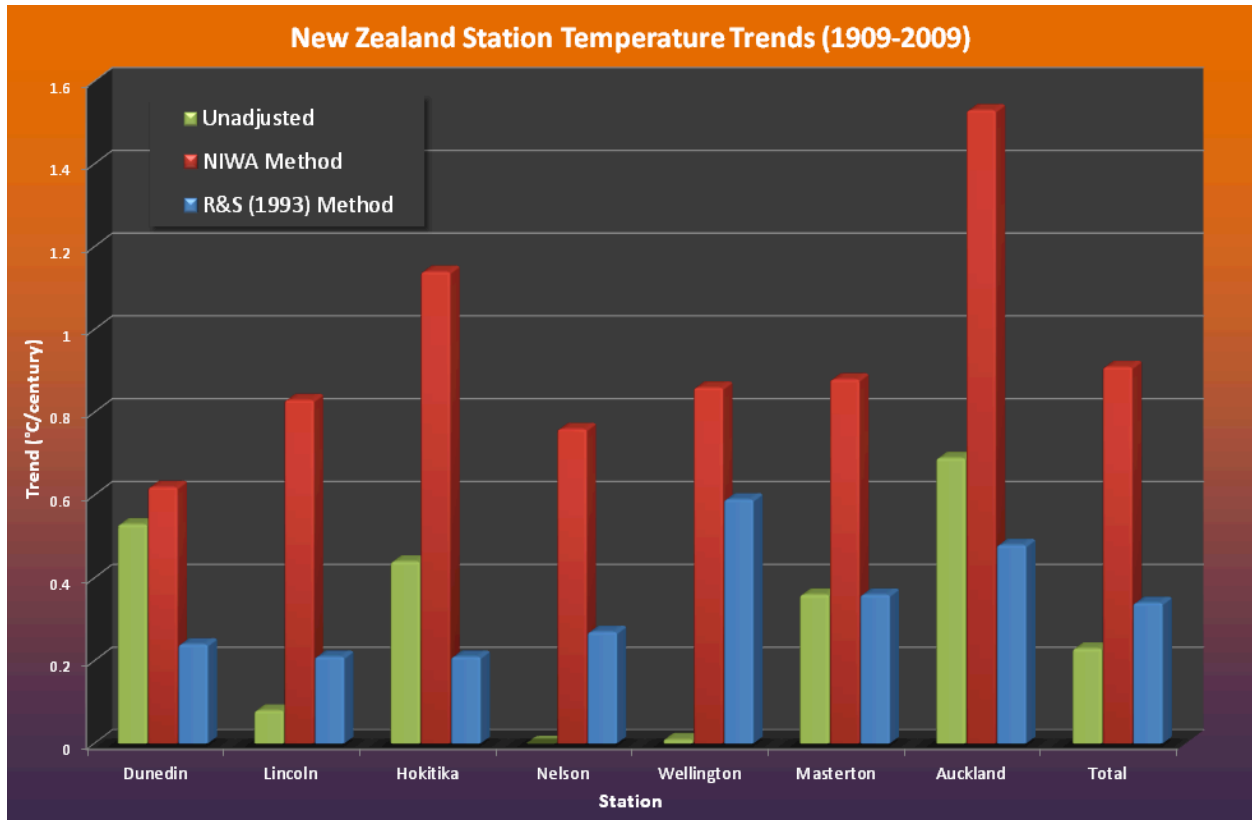


Table 3: Summary of trends by station

When the two contaminated stations are omitted (as recommended by *Rhoades*) the warming trend for the resulting “Five-station Series” is a trifling **0.24°C**. But this low figure is indistinguishable from the noise in the series (ie it is statistically insignificant) so the figure is effectively **zero**.

The methodology of this important paper has been independently peer-reviewed by three consulting statisticians and three climate scientists.

5.3 Uncertainties

A key component of any statistical analysis is the measurement of confidence levels and the rejection of proposals which do not prove to be statistically significant⁵¹. As *Rhoades* points out⁵², this approach balances the risks of the type I and type II errors (i.e., adjusting when no shift occurred and failing to adjust for a real shift).

Rhoades is quite clear that adjustments should not be accepted in cases where results are not significant at the standard 95% confidence level.

⁵¹ Aguilar et al. at p38: “The final step in homogenisation assessment should be evaluation of the results. This is unavoidable and time-consuming, no matter what approach has been used. It is very important to understand what adjustment factors are applied to improve the reliability of the time series and to make measurements comparable over all their extent.”

⁵² Ibid p905.

NIWA accepts this discipline, and the Review states⁵³ that “further research is under way to quantify how the accumulating adjustments influence the uncertainties in the trend estimates.” However, that research has not yet been published.

The Review further notes that the 95% confidence intervals on the measurement of the NZT7 trend line itself is approximately $\pm 0.3^{\circ}\text{C}/\text{century}$ (excluding the uncertainty of the adjustments creating that trend).

The $0.24^{\circ}\text{C}/\text{century}$ warming trend found in the NZCSC audit for the five ‘uncontaminated’ stations (being within the margins of error of the measurement of the trend line) is not statistically significant. Note also that no provision has yet been made for the unquantified UHI at the five stations.

Accordingly, **New Zealand’s measurable warming trend throughout the past century is at or close to zero degrees.**

5.4 Lack of Randomness

Non-systemic site changes, widely separated in time and space, ought to give rise to a wholly random set of adjustments differing in both sign and amplitude. The BoM has noted that, over the course of decades, random corrections of historical data are expected to yield positive and negative adjustments equally, which should tend to balance out and have little effect on trends⁵⁴.

A similar expectation is recognised in Peterson et al. (1998)⁵⁵.

This random element is not apparent in the adjustments of either the original 7SS or the NZT7. The NZCSC calculates that, in both cases, over 80% of NIWA’s adjustments are helpful to NIWA’s starting hypothesis that significant warming has occurred (Table 4).

Such a departure from normal distributions is not impossible in any given series. However, it is certainly very unlikely, in the absence of bias or persistent error. So, this result in itself raises questions regarding NIWA’s method and/or objectivity.

Figure 5 shows that the NIWA adjustments also display an unusual linearity over time, between 1909 and 1975 (the period covered by the Salinger thesis). The older the data, the greater the adjustment, with a resultant upwards linear trend of approximately $0.9^{\circ}\text{C}/\text{century}$.

⁵³ Ibid p5.

⁵⁴ Brill: www.climateconversation.wordshine.co.nz/2011/01/nothing-random-about-niwa.

⁵⁵ Ibid p1513: “Easterling and Peterson (1995a,b) found that on very large spatial scales (half a continent to global), positive and negative homogeneity adjustments in individual station’s maximum and minimum temperature time series largely balance out so when averaged into a single time series, the adjusted and unadjusted trends were similar.”

NEW ZEALAND – UNAFFECTED BY GLOBAL WARMING

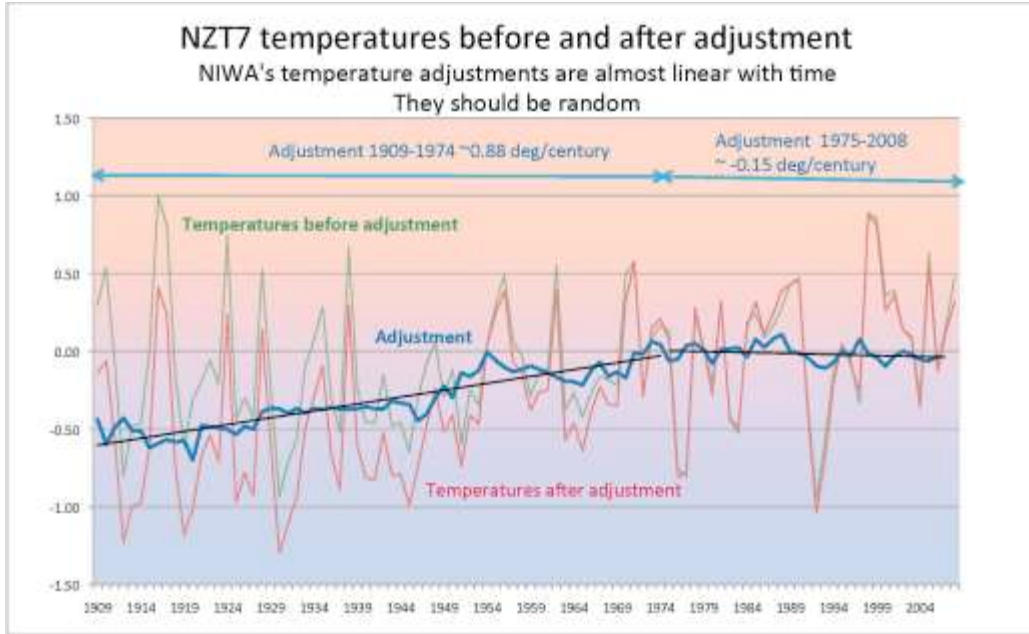


Figure 5: The adjustments prior to 1975 are not only uniformly negative but also virtually linear with time.

Downward adjustments prior to 1975 are favourable to a warming trend, whilst upward adjustments have an opposite effect. Post-1975, the situation is reversed and downward adjustments are unfavourable to the trend. This table shows the percentages that actually occurred in the original 7SS and the NZT7:

Trend-favourable	7SS		NZT7	
	Number	Percent	Number	Percent
Number of adjustments	21	73%	27	80%
Years affected	360	70%	467	90%
Total impact*		88		82

* *Adjustment size × years*

Table 4: Number and percentage of NIWA adjustments favouring a warming trend (i.e., upward slope).

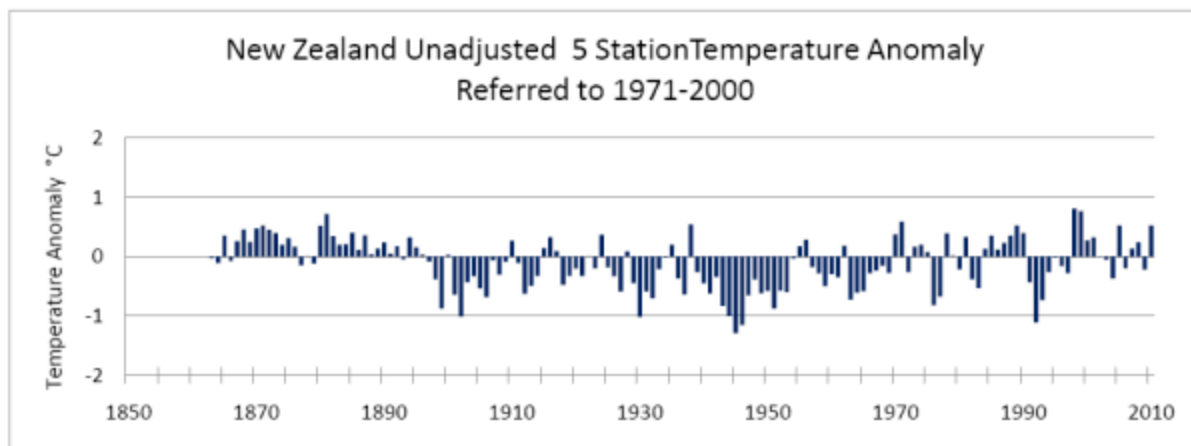
6. THE ORIGINAL DATA

6.1 Similar to Adjusted Data

As adjustments for step-changes tend to balance out over time and space, they generally leave unaffected the long-term trends and other macro-characteristics of the historical weather data at national level. Most useful climate history is gleaned from analysis of that original data⁵⁶.

In New Zealand’s case, the NZCSC audit of NIWA’s Review⁵⁷ shows that correctly-applied adjustments do balance out, leaving a warming trend almost identical to that of the raw data (i.e., close to zero).

If the heavily-contaminated Auckland and Wellington stations are omitted, the original annual data for the five long-record stations show real stability:



6.2 No Human Signal

NIWA’s advice to the Government (based on IPCC reports) is that the 20th-century global warming trend of 0.7°C exceeds the bounds of ‘natural variability’ and that most of the excess is probably caused by the increase in human-caused emissions of CO₂ and other greenhouse gases. Since about 1750, the atmospheric concentration of CO₂ has increased from 280ppm to almost 400ppm, with about half of this increase occurring in the last 30 years.

The New Zealand historical data offers no support at all for this thesis:

- New Zealand has seen no significant warming trend during the past 30 years; and, in particular, a slight cooling trend since the beginning of this century.
- There has been no acceleration in warming trends during the past 60 years, despite increasing global GHGs.

⁵⁶ NIWA even claims that the 7SS and its adjustments are “unofficial”, and intended only for internal research purposes. The official Climate Database does not use the adjustments.

⁵⁷ Para 5.2 (supra).

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- The 0.2°C/decade trend predicted by IPCC climate models has not occurred, either globally or in New Zealand.
- Decades with the most warming are (1) 1930s (2) 1950s, while the greatest cooling occurred in (1) 1940s, (2) 1970s and (3) 2000s.
- The 5-station 30-year trends show a substantial deceleration between the peak period in 1949-78 and 1979-2008.

All New Zealand temperature trends have been modest, short-lived and unpredictable. They change constantly in both sign and amplitude, displaying no discernible pattern. Clearly, they are not responding to any linear or progressive external forcing (Table 5).

6.3 Decadal warming trends

NIWA has relied upon 2000-10 being “the warmest decade on record”. But climate change concerns relate to temperature **changes** (i.e., warming), not to absolute temperature **levels** (i.e., warmth).

Table 5 shows New Zealand’s historical average temperatures since the instrumental record began, divided by decade. The first group is coloured according to mean warmth, with the warmest in red and the coolest in blue. The second group is coloured according to warming trend.

Note that there has been no really significant trend since the 1950s, and that there has been a cooling trend since the turn of the century.

Decade	Mean	Std Dev	Decade	Trend °C/cent
1859-1868	12.0	0.24	1859-1868	8.8
1869-1878	12.2	0.22	1869-1878	-5.4
1879-1888	12.2	0.24	1879-1888	-1.7
1889-1898	11.9	0.20	1889-1898	-3.9
1899-1908	11.4	0.33	1899-1908	3.5
1909-1918	11.8	0.31	1909-1918	-0.1
1919-1928	11.7	0.27	1919-1928	0.6
1929-1938	11.6	0.46	1929-1938	9.4
1939-1948	11.2	0.36	1939-1948	-4.9
1949-1958	11.6	0.38	1949-1958	8.7
1959-1968	11.5	0.26	1959-1968	1.0
1969-1978	11.9	0.47	1969-1978	-4.5
1979-1988	11.9	0.32	1979-1988	4.8
1989-1998	11.8	0.58	1989-1998	1.8
1999-2008	12.0	0.34	1999-2008	-4.1

Table 5: Decadal trends 1859-2009. The historical data discloses no linear or other consistency. The most recent decade had a cooling trend.

6.4 Withers et al. (2009)

The most recent peer-reviewed paper on the New Zealand temperature record⁵⁸ noted that “if global warming is accelerating one might expect temperatures for most stations to be accelerating and perhaps variability to be increasing.”

Having examined 57 time series, the authors (including a NIWA scientist) found “a surprising diversity of behaviour,” including a high proportion of decreasing temperatures in cases of both linear and non-linear trends. Variability was found to be decreasing in about two-thirds of all cases.

⁵⁸ [C. S. Withers, D. P. Krouse, C. P. Pearson and S. Nadarajah](#) (2009) “Modelling Temperature Trends in New Zealand” Environmental Modeling and Assessment Vol 14 No 2, 231-249.

7. CORROBORATION

7.1 The 11-station Series

The purpose of this 2009 graph and spreadsheet was to corroborate the 7SS by using unadjusted data from a selected group of eleven stations⁵⁹ said to show a warming trend of 1.2°C/century during 1931-2008.

NIWA contends that these stations were chosen because they had “no significant site changes”. In fact, 10 of the 11 had documented site changes, some more than one.⁶⁰ At least two were category 4, regarded as unsuitable for climate studies.

As Minister Mapp told Parliament⁶¹, the graph is dominated by the entry and exit of stations and by missing data. These are the factors that drive the measured temperature trend.

The series simply ignores the standard requirement that annual averages should be calculated only when values are available for at least 80% of the years of record, with no more than three consecutive missing years⁶².

During the first ten years of this series, more than 70% of the data is missing. Most stations have gaps far larger than three consecutive years – e.g. Invercargill data is missing for 17 consecutive years, and Molesworth data for 15 years. Only one year has full data out of the first 24.

The graph now on the website is alleged to exclude years that lack even a single monthly datapoint⁶³. But the website spreadsheet follows a different rule: “If two or more months are missing in any year, then the annual average is missing also”.

However, the spreadsheet fails this criterion, in spectacular fashion.⁶⁴ During the ‘Normal’ period (1961-90) alone, some included years have as few as six datapoints and four stations

⁵⁹ Raoul Island, Tauranga Airport, Ruakura (Hamilton), Gisborne Airport, Chateau Tongariro, Palmerston North DSIR, Westport Airport, Molesworth, Queenstown, Invercargill Airport and Campbell Island.

⁶⁰ Eg Ruakura 29/6/28, 31/5/36, 17/10/39.

⁶¹ Parliamentary Question 08810 (2010) 24 May 2010: “The number varies with the opening and closing of stations and with missing data; 3 stations operated in 1931, 4 during the period 1932–1937, between 5 and 9 during the period 1938–1944; with the exception of 1964 (8 stations) there were between 9 and 11 stations operating in 1945 and all subsequent years.”

⁶² Section 4.8.4 on “Missing Data” in the “Third Edition of the Guide to Climatological Practices” published by the World Meteorological Organisation’s Commission for Climatology.

⁶³ <http://www.niwa.co.nz/our-science/climate/information-and-resources/nz-temp-record/temperature-trends-from-raw-data/technical-note-on-the-treatment-of-missing-data>

⁶⁴ Of the 77 years in the series, more than 60 years (78%) are non-compliant.

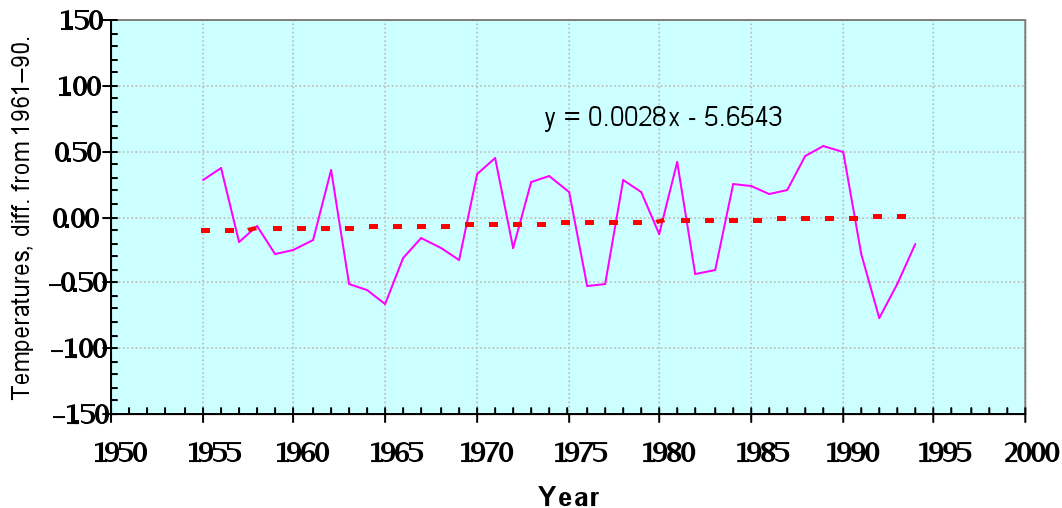
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have multiple years with two or more months missing⁶⁵. As the climatologies are defective, so are the calculated anomalies – and the series is therefore unusable.

The literature expressly addresses the 11SS situation – “an alternative option where there is an extended period of missing data but reasonably complete data after that time, is to calculate a period average using only data from the years following the break in the record.”⁶⁶

As soon as this guidance is applied, the alleged warming trend disappears. During the 40-year period (1955-95) when 11 stations **were** available 80% of the time, the warming trend turns out to be a mere 0.28°C/century.⁶⁷ The high warming trend invoked by NIWA was confined to the period of missing data – when the temperature increase was achieved by addition and subtraction of sites, rather than changing temperatures.

ESS 1955 – 1994 (40 years). Average at 11 sites, anomalies from 1961–90.
Trend 0.28°C/century



11SS over the 40-year period which complies with the WMO rules regarding missing data.

One of the worst aspects of the 11SS is that it was published to dispel prior allegations of chicanery. Its very purpose was damage control. The Minister (Hon Wayne Mapp) tabled it in Parliament as evidence that allegations of bias against NIWA were baseless.

It has been presented as a testament to NIWA’s honesty and professionalism.

Instead, it compounds the original offence⁶⁸. It is a flagrant example of how objective science can be crowded out by an advocacy stance.

⁶⁵ Tauranga (3), Molesworth (9), Ruapehu (14), Westport (4)

⁶⁶ Guide to Climatological Practices (supra): 4.8.4.

⁶⁷ Brill: Quadrant Online www.quadrant.org.au/blogs/doomed-planet/2010/06/nz-climate-crisis-gets-worse.

⁶⁸ Brill: Quadrant Online www.quadrant.org.au/blogs/doomed-planet/2010/06/nz-climate-crisis-gets-worse.

7.2 The BoM Review Report

The Review document contains a letter from a BoM executive stating that people within his organisation had carried out peer-reviews of six out of the seven station reports comprising the 7SS.

Unfortunately, the BoM reviews are unavailable, and both government agencies have rejected formal applications under Freedom of Information statutes in both New Zealand and Australia. Out of 161 relevant documents, no fewer than 159 have been suppressed. The rejections are currently under appeal in both countries, with those appeals being fiercely resisted by NIWA. What do they have to hide?

It is not clear whether the reports reviewed by the BoM were similar to those published in the Review. From a Schedule of Documents⁶⁹ produced by the BoM it seems highly likely that NIWA has **declined** to accommodate all the changes recommended by the BoM⁷⁰. When the BoM signed its letter dated 14 December 2010, it may not have been aware that NIWA intended to reject its advice in whole or in part.

Over many years, the BoM has taken strong public positions on several relevant issues – e.g., avoidance of the effects of UHI on non-rural sites; and the need for comparator stations to be ‘neighbours’; and the expectation that random adjustments to temperature data will balance out. Did they ask NIWA to adhere to those principles?

We don’t know. All elements of the BoM station reviews are so shrouded in secrecy as to prevent their relevance (if any) from being assessed.

The blanket suppression of data also raises the same suspicions and credibility issues as those which continuously dog the climate sciences in the UK and elsewhere.

⁶⁹ <http://www.warwickhughes.com/agri/WSH%20FOI%20Request%20schedule%20of%20docs.pdf>

⁷⁰ The Schedule shows that the BoM supplied “tracked changes” for all stations on 26/11/10 followed by a final report on 8/12/10. Rather than adopting those changes, NIWA replied with formal “responses to BoM review” (42 pages) on 23/12/10. All these papers are held to be strictly confidential.

8. CONCLUSIONS RE NIWA REVIEW

8.1 Nine problems with 7SS

The problems identified in respect of the Review, and its revised 7SS, include:

- It runs counter to all the historical records regarding “NZ average temperatures,” including those compiled in 1867, 1920 and 1964. The archive shows that current temperatures are slightly cooler than those of 150 years ago.
- Its trend outcome is heavily influenced by data from Auckland and Wellington stations which are declared in the peer-reviewed literature to be contaminated and to show false warming; and it fails to adjust for UHI at any of the six non-rural stations.
- It uses adjustments derived from comparisons between “isolated stations” in direct defiance of the scientific authorities.
- It radically departs from the statistical techniques laid down by its chosen precedent, Rhoades & Salinger. Diligently applied, those techniques demonstrate that New Zealand has experienced no material warming trend during the past century.
- It does not disclose the uncertainties (margins of error) associated with any of its adjustments; and statistically insignificant changes are applied.
- Its high warming trend is created by implausible accumulating adjustments, which lack the random spread and self-balancing effects described in the literature.
- Its sole corroboration, the 11SS, is driven by missing data and is demonstrably flawed ; it serves no purpose other than to damage NIWA’s credibility.
- Recommendations from the BoM station reports were apparently ignored. The pervasive secrecy surrounding all of the BoM review documents casts doubt on the process.
- Most of the warming in both of NIWA’s graphs occur during the first half of the century. This pattern is at odds with NIWA’s official advice that warming was driven by global CO₂ emissions – which are concentrated in the last 40 years.

These multiple defects render the 7SS (and the NZT7 graph) unusable as the source of the NZTR.

8.2 Three generations of 7SS

The statistical calculations for the Salinger 7SS of 1981 have been lost and there seems to be no record of Salinger’s updating methodology in 1992. Although the Review insists (at least seven times) that the 1992 effort applied the *Rhoades* statistical techniques, this is clearly not the case.

The 1992 7SS contained 34 adjustments⁷¹, of which 5 post-dated the Salinger thesis. The remaining 29 simply reproduced the 1981 thesis figures – which pre-dated *Rhoades* by some 12 years.

⁷¹ NIWA Schedule of Adjustments, tabled in Parliament 18 February 2010.

The 2010 revised 7SS is compiled very differently. Of the 30 adjustments in the 2010 Review, all (except one) differ from their 1992 counterparts. As a result, the NZT7 produces different mean temperatures from the old 7SS in every year throughout the century except 1921 and 2003 – a 98% dissimilarity rate⁷². The Review uses different reference stations, different climate normals, different selection methods⁷³, different raw data⁷⁴ and metadata⁷⁵, different years, etc. The result is that four stations show higher warming trends, two are lower, and only one remains the same⁷⁶.

But the trend remains the same. The 1992 and 2010 versions of the 7SS both find an identical average warming trend of 0.91°C/century. The correlation between the two is a near-perfect 0.996⁷⁷, and they are statistically indistinguishable at a 95% confidence level. As with the original, over 80% of the adjustments are favourable to a warming trend.

8.3 Conforming lines of evidence – or bias?

These identical outcomes are way beyond coincidence.

The accumulating (rather than self-balancing) and linear effects of the 7SS original adjustments were extraordinary enough. The probability of an entirely different set of adjustments duplicating those effects is close to zero.

Identical trends might be explicable if each station adjustment in both series managed to achieve 100% accuracy in capturing the temperatures that actually occurred. But that cannot be the case, because six of the seven station temperature trends in the 1992 series are materially different in the 2010 version.

The only tenable explanation is that the subjective decisions shaping the NZT7 trend were driven by the desire to corroborate the original 7SS – i.e. they were biased.

Additional indications of bias arise from other ‘problems’ mentioned above in 8.1. Why does the Review fail to explain, or even discuss, the risks of contaminated data, the failure to follow cited authorities, or the use of unprecedented methods? In particular, why does NIWA continue to rely upon the deeply flawed 11SS⁷⁸?

Unconscious ‘confirmation bias’ is a well-known phenomenon in all the sciences. Intentional bias is not unknown, especially in scientific disciplines which have become highly politicised. Either variety is inexcusable in a government agency responsible for scientific advice underpinning major policy decisions.

⁷² Treadgold: www.climateconversation.wordshine.co.nz/2011/03/when-does-an-adjustment-become-a-replacement.

⁷³ e.g., the NZT7 does not use comparison stations during periods which included site changes (fn17, p34) and relies on statistical correlation for selection.

⁷⁴ e.g., Hokitika 1945.

⁷⁵ e.g., Lincoln pre-1927.

⁷⁶ Review (supra) Table 1, p5.

⁷⁷ Minister Wayne Mapp – PQ 3357(2011).

⁷⁸ We are conscious of the advice, attributed to Napoleon Bonaparte: “Never ascribe to malice that which can be adequately explained by incompetence.” But the instances of NIWA bias are too manifold and diverse to be so explained.

9. CONSEQUENCES

9.1 NZ unaffected by global warming

It is widely accepted that New Zealand is partly insulated from any global warming by our surrounding oceans, but the extent and duration of that insulation is unknown⁷⁹. NIWA has stated that it expects New Zealand will experience a “discount” of about 33% from any future worldwide warming trends.

The NZCSC finding that New Zealand has suffered no material warming during the past century shows a 100% “discount” from the 0.7°C trend experienced globally. Absent any evidence of change, the null hypothesis is that New Zealand’s established immunity will continue into the future.

One consequence of this changed expectation is that “the effects of climate change” should be excised from planning documents administered by all levels of government. There have been no such effects to date, and recent history is the best available guide to what will happen in future.

Another major saving can be made in scientific research grants. Taxpayers have outlaid over \$180 million on climate research over the past decade, including large sums to study the effects on local flora and fauna of the warming that was presumed to have already occurred. The warming has not occurred and there is nothing to study.

9.2 NIWA credibility

The official science advice which underpins far-reaching governmental policies MUST be derived from hard-nosed and objective analyses of the available data. Government scientists who have pre-conceived views, (or who are susceptible to pressure by activists, politicians or overseas brethren), become advocates and partisans for the cause rather than protectors of the public interest.

The New Zealand situation is especially vulnerable in that science advice is wholly uncontestable and Government climate decisions are based on the single stream of advice that flows through NIWA. In theory, second opinions could be gleaned from the Royal Society of New Zealand or the PMCSA – but both of these depend almost exclusively upon NIWA for their climate science advice.

Our experience with the NZTR ineluctably raises the question of NIWA’s credibility in wider fields of climate advice. If bias and preconception drove this small group of scientists to exaggerate the temperature record, might these same drivers taint the broad climate advice they offer daily to central, regional and local government and to the Courts?

⁷⁹ PQ 18890 (2009) Hon Nick Smith: “What Dr Wratt has consistently said is that because New Zealand is surrounded by oceans, all the modelling indicates that the temperature impacts of climate change are most likely to be less for New Zealand than for other parts of the globe.”

9.3 Re-think of climate policy

While New Zealand might well choose to continue supporting international efforts to solve a perceived international issue, it is now clear that **there is no domestic climate issue**. It is not in this country's interests to continue incurring substantial costs in 'world-leading' policies such as the ETS.

The New Zealand temperature record discloses no "human signal", and our climate has remained comfortably within the bounds of 'natural variation' since records began.

During the 30% increase in global CO₂ emissions over the past 20 years, our temperatures have barely budged. Indeed, there has been a slight cooling during the past decade. Nothing in this country's home-grown experience supports the hypothesis that catastrophic anthropogenic global warming (CAGW) is looming in future.

If the Government doesn't know what happened to New Zealand's temperatures over the past century, why should we trust them to spend billions of dollars attempting to change or control New Zealand temperatures over the next century?

Appendix – Individual Contributors

It has never been the policy of the New Zealand Climate Science Coalition to publicise the names of its authors and reviewers. The basis of this policy is three-fold:

1. Any scientific argument must rest on its quality alone – its reasoning, coherence, supporting data, etc. Arguments from authority, or any other forms of ‘beauty contest’, have no place in determining the weight to be accorded to any disputed hypothesis.
2. Many of our members and advisers, in their private professional lives, may hold views which are contrary to their employers’ vested positions on aspects of climate science. It is not our purpose to provoke embarrassment or confrontation.
3. Climate science has become highly politicised, and individuals perceived as “deniers” are frequently subjected to virulent ad hominem attacks. We prefer to focus the debate on the merits of the case.

The Coalition itself takes responsibility for the content of its publications and for ensuring that authors and reviewers are appropriately qualified for their respective tasks.

B.E. Brill
Chairman
NZ Climate Science Coalition

July 2011