New Zealand 7-station Temperature Series

Dr Jim Salinger
Outline

∎ Origins - the 7-stations

∎ Homogenization

∎ Updates

∎ Sceptics

∎ Concluding Remarks
Origins

- Inspired by Central England Temperatures;
- Long station records prior to 1900s;
- Records from one ‘town’ combined;
- Captured features of NZ climate - east/west and north/south differences.
Homogenization

- Records from several sites;
- Sir James Hector created a climate network of 12 in late 1860s with Stevenson screens;
- Because of a recession, the network reduced to 4 in the 1880s;
- Homogenized (1970s) by consideration of metadata, neighbour station comparisons, record overlaps, changes in instrumentation and changes in environs;
- Homogenisation in the 1990s by a statistical technique developed with David Rhoades;
- The series has been updated by Mullan et al. (2010, 2017).
Dunedin

- Effectively 6 different locations - 4 sites there is overlap;
- Musselburgh from 1947.

- Princes St
- Observatory
# Dunedin

<table>
<thead>
<tr>
<th>Site Label</th>
<th>Site Name (Agent Number)</th>
<th>Location (Full Period of Record)</th>
<th>Height (m a.s.l.)</th>
<th>Previous Period</th>
<th>Prev. Temp. Adjust. (°C)</th>
<th>Revised Period</th>
<th>Revised Temp Adjust. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>Leith Valley (5380)</td>
<td>Northeast facing slope of Leith Valley, Dunedin. (May 1886 to Jan 1913)</td>
<td>108</td>
<td>May 1886 to Jan 1913</td>
<td>+0.3</td>
<td>Jan 1900 to Dec 1912³</td>
<td>+0.25</td>
</tr>
<tr>
<td>Site 2</td>
<td>Botanical Gardens (5375)</td>
<td>Near curator’s house in Botanical Gardens, Dunedin. (Jan 1913 to Nov 1942)</td>
<td>73</td>
<td>Feb 1913 to Sep 1940</td>
<td>−0.1</td>
<td>Jan 1913 to Nov 1942</td>
<td>−0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oct 1940 to Nov 1942</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Beta Street (5379)</td>
<td>Water reservoir, Belleknowes, Dunedin (Sep 1940 to Dec 1947)</td>
<td>210</td>
<td>Dec 1942 to May 1947</td>
<td>+0.6</td>
<td>Dec 1942 to May 1947</td>
<td>+0.59</td>
</tr>
<tr>
<td>Site 4</td>
<td>Musselburgh (5402)</td>
<td>South of Musselburgh Pumping Station, Dunedin (Jan 1947 to Oct 1960)</td>
<td>2</td>
<td>Jun 1947 to Oct 1960</td>
<td>−0.2</td>
<td>Jun 1947 to Oct 1960</td>
<td>−0.14</td>
</tr>
<tr>
<td>Site 5</td>
<td>Musselburgh (5402)</td>
<td>Northwest of Musselburgh Pumping Station, Dunedin (Oct 1960 to Aug 1997)</td>
<td>4</td>
<td>Nov 1960 to Aug 1997</td>
<td>0.0</td>
<td>Nov 1960 to Aug 1997</td>
<td>−0.07</td>
</tr>
<tr>
<td>Site 6</td>
<td>Musselburgh EWS¹ (15752)</td>
<td>Musselburgh, same enclosure as Site 5, automated (Sep 1997 to present)</td>
<td>4</td>
<td>Sep 1997 to present</td>
<td>0</td>
<td>Sep 1997 to present</td>
<td>0.00</td>
</tr>
</tbody>
</table>

After Mullan et al. (2010)
First attempts

Salinger, 1979
Alleged Flaws in Data

Climate sceptics claim leaked emails are evidence of collusion among scientists.

Hundreds of emails and documents exchanged between world's leading climate scientists stolen by hackers and leaked online. Climate change sceptics who have studied the emails allege they provide "smoking gun" evidence that some of the climatologists colluded in manipulating data to support the widely held view that climate change is real, and is being largely caused by the actions of mankind.

The Guardian 20 November 2010

New Zealand climate scientist falls victim to hackers

A New Zealand scientist has been caught up in an international hacking stunt in which thousands of climate change emails have been leaked on the internet.

In one July email, Dr Salinger reacts to the de Freitas & Carter paper: "Is there an opportunity to write a letter to JGR pointing out the junk science in this paper? "If it is not rebutted, then all sceptics will use this to justify their position."

New Zealand Herald 24 November 2010
Pristine Sites

Pristine Site Temperatures 1931-2008

A set of 11 stations spanning the country where there have been no significant site moves for many decades.
Sceptics

According to the New Zealand Climate Science Coalition
Sceptics

Annual Temperature Series
1) “Wellington”

Annual Temperature Series
4) As (3) but …
- Airport adjusted to Kelburn (from overlap difference, 0.79°C)
- Same adjustment applied to Thorndon, as for Airport
Mean annual temperature for New Zealand, calculated from NIWA's 'seven-station' series. The data are adjusted to take account of factors such as different measurement sites (Mullan et al.2010). The blue and red bars show the difference from the 1981-2010 average. The black line is the linear trend over 1909 to 2016 (0.95 ± 0.26°C/100 years).
Concluding Remarks

- 7-station temperature series was originated to describe trends and variability back to the 19th century;
- Homogenisation techniques were used to concatenate together long records from 7 towns;
- First published in 1979, it was updated in 1992;
- Later updates occurred in 2010 and 2016, after the records were reviewed following criticism of their veracity by sceptics;
- These revisions confirmed the original warming trend of 0.91°C/century from 1909-2009 (NIWA)!
- The method of homogenization makes little difference to the trend – whether it is those from Salinger (1981), Rhoades and Salinger (1993) or Mullan et al. (2010).