Title	Global and New Zealand temperatures, five year running average (1911–2010)
Type	Dataset
Subject	climate change
Source	National Institute for Water and Atmospheric Research
Description	Temperature change is influenced by changes in atmospheric composition that result from greenhouse gas emissions. It is also linked to atmospheric circulation changes (eg the El Niño southern oscillation). It can have a significant effect on agriculture, energy demand, and recreation. The primary aim of the datasets is to provide a tool to show average New Zealand and global temperatures compared to a reference temperature in order to compare this with expected global climate change in response to mechanisms such as atmospheric carbon dioxide, volcanic aerosols, and solar irradiance changes. Further information can be found in: Tait, A, Macara, G, & Paul, V. (2014) Preparation of climate datasets for the 2015 Environmental Synthesis Report: Temperature, Rainfall, Wind, Sunshine and Soil Moisture. Prepared for Ministry for the Environment. Available at https://data.mfe.govt.nz/x/Fwn9AL on the Ministry for the Environment dataservice (https://data.mfe.govt.nz/). Trend results can be found in the excel file "National temperature trend statistics" at https://data.mfe.govt.nz/x/vVuob5. This dataset relates to the "National temperature time series" measure on the Environmental Indicators, Te taiao Aotearoa website.
Rights	Creative commons 3.0 (automatic)
Publisher	New Zealand's Environment Reporting Series: The Ministry for the Environment and Statistics New Zealand
Coverage	1911–2010. National temperature (7 station) series composite values.
Identifier	https://data.mfe.govt.nz/x/vmYt38
Language	New Zealand English
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Environmental reporting topic	National and regional temperature
Environmental reporting category	National indicator
Methodology (collection & analyses)	New Zealand Temperature: NIWA's 'seven-station' temperature series uses temperature measurements from seven 'climate stations'. The sites offer a representative geographical spread with reliable records dating back to the early 1900s. For each site, NIWA has merged temperature records from local

	sites to form a long time series. The data are adjusted for climatic differences between sites and changes in exposure or instrumentation at the same site. This prevents the introduction of significant biases with time. Reasons for climatic differences between sites include altitude (a higher site is generally colder than a lower site) and exposure to the elements (a more wind-swept site is generally colder than a more protected site). This methodology has been reviewed nationally and internationally. Information about the data and adjustments made to the underlying data to compile the series: http://www.niwa.co.nz/our-science/climate/information-and-resources/nz-temp-record/seven-station-series-temperature-data/adjustments. Global mean annual air temperature: NIWA has completed an analysis of global mean annual air temperature variations and trends over the last century and compared this with similar data derived from New Zealand climate stations. Regular global surface temperature analysis is carried out by the three groups listed below. Global mean annual air temperature data (based on land stations only) for the period 1909-2013 were downloaded from: • Climatic Research Unit, University of East Anglia, UK (http://www.cru.uea.ac.uk/cru/data/temperature/#datdow). • NASA Goddard Institute for Space Studies, USA (http://data.giss.nasa.gov/gistemp/). • NOAA National Climatic Data Center, USA (https://www.ncdc.noaa.gov/monitoring-references/faq/anomalies.php). These data were all converted to global mean annual air temperature anomalies, based on the period 1981-2010. This is the same base period now used for the New Zealand seven station temperature series (7SS). This period is used in order to comply with a recommended World Meteorological Organization (WMO) Policy, which suggests using the latest decade for the 30-year average. The primary aim of the datasets is to provide a tool to show average global temperatures compared to a reference value in order to compare this with expected global climate change in response to mechanisms such as atmospheric carbon dioxide, volcanic aerosols, and solar irradiance changes. They have been in produced since the 1980s and 90s with subsequent revisions and data improvement. They improve on previous studies most of which did not have full global coverage. (Jones et al 1982, IPCC, 2007) These datasets are based on much the same input observations (based on a global network of nearly 5000 stations) so can't be viewed as strictly independent. However they provide useful checks as they each use different methods of handling data problems such as incomplete spatial and temporal

	coverage or other non-climatic influences on the measurement station environment. (Hansen, 2010). For a full description of their sources and methods see the links above.These data have all been converted to global mean annual temperature anomalies, based on the same period we use for the New Zealand data (1981–2010).
Limitations to data & analysis	The variations in time of New Zealand temperature are consistent with completely independent measurements of regional sea temperatures. There is also a strong correlation between variations in New Zealand temperature and prevailing wind flow, which relates closely to the abrupt warming in the mid 20th century, and the slower rate of warming since about 1960. The spatial pattern in the warming is consistent with changes in sea surface temperature around New Zealand, with greatest warming in the north of the country (Auckland) and least warming (but still significant) in the southeast (Dunedin). For further information on comparison measurements see: http://www.niwa.co.nz/sites/niwa.co.nz/files/import/attachments/Report-on-the-Review-of-NIWAas-Seven-Station-Temperature-Series_v3.pdf.
Changes to time series	The accuracy of the data source is of high quality. The climatologies are specific to the 'Reference' stations at each location, which are: Auckland Aero (Auckland, agent 1962), East Taratahi AWS (Masterton, agent 2612), Kelburn (Wellington, agent 3385), Hokitika Aero (Hokitika, agent 3909), Nelson Aero (Nelson, agent 4241), Lincoln Broadfield EWS (Lincoln, agent 17603), and Musselburgh EWS (Dunedin, agent 15752). Dunedin, Lincoln, Nelson and Wellington are available for 1909–2013. Auckland is available from 1910, Masterton from 1912 and Hokitika from 1913. Data is available for Temp and Anomaly. Temp = Annual average mean temperature (deg C) and Anomaly = Temp(year) minus the 1981–2010 average. The 7-Station Composite Anomaly = Average of anomalies at individual sites where there is data for that year (<7 sites before 1913). The 7-Station Composite Temperature = 7-Station Anomaly + Average of 7-Station 1981–2010 climatologies (eg for 1909 when there are 4 sites, the 7-Station Composite Temp is not the average of the Wellington, Nelson, Lincoln and Dunedin values).