

Information topic	Details
Indicator name	<b>Number of days below 0°C</b>
Domain and topic	Climate change: Extreme temperature
Indicator definition and units	Number of days with minimum air temperature below 0°C
Data source	<ul style="list-style-type: none"> <li>- CliFlo. NIWA's National Climate Database. URL: <a href="https://cliflo.niwa.co.nz/">https://cliflo.niwa.co.nz/</a></li> <li>- Data type: 201 Max_Min_Temp: Daily Maximum Temp (and implied minimum temperature)</li> </ul>
Numerator	Annual number of days with a minimum temperature below 0°C by Territorial Authority (TA)
Methodology	<p>Climate stations were selected based on their proximity to the population-weighted centroid for a TA as well as completeness of data for the period 1981-2019. One weather station per TA was selected.</p> <p>Using the population-weighted centroid coordinates for each TA, we looked at weather stations within a 25km radius. The weather station closest to the centroid was selected, provided it was currently operating and had a long record of data (ie, minimum of 10 years of data). Where there was insufficiently complete data or the station was closed, we then examined the next closest weather station, and so on until the 'best fit' was found. In six cases, a climate station is used for two TAs (Otorohanga/Waitomo, Tauranga/Western Bay of Plenty, South Taranaki/Stratford, Carterton/Masterton, Hamilton/Waipā). In three cases, the only suitable climate station was currently closed and an exception was made (Opotiki, Lower Hutt, Westland). In one case no suitable climate station was available (Kaipara). If a climate station's data had over 10% missing data for a calendar year, results for that year were excluded from analysis.</p> <p>The population-weighted centroid of a TA was calculated from 2018 Census data, using the geographic centroid of statistical area 1 (SA1, small Census area description) weighted by their usual resident population.</p> <p>The most recent Climate Normal for New Zealand was calculated as an average over the 30-year period 1981-2010 (all available data from all TAs was included). This average number acted as a benchmark against which current or recent observations were compared to (ie, anomalies).</p>
Time period and time scale	Annual; from 1981 onwards

Spatial Coverage	National; by TA
Measures of frequency	<ul style="list-style-type: none"> <li>- Average number of days per year below 0°C</li> <li>- Number of days per year below 0°C, by TA</li> <li>- 1981-2010 baseline average number of days below 0°C</li> </ul>
Limitations of indicator	<ul style="list-style-type: none"> <li>- Counting the number of days with a pre-determined minimum temperature has the effect of reducing a continuous variable (temperature) to a binary one (below 0°C). This gives a clear picture for an indicator purpose, but it also reduces the underlying data to use as an indicator only.</li> <li>- There will be geographic variation in temperature across a TA that is not represented in this indicator because we have used one weather station per TA.</li> <li>- The use of population centroids will increase the risk of an 'urban heat island effect' (Haines and Patz 2004) becoming a confounder. An urban heat island is a metropolitan area that is warmer than its surrounding rural areas because of human activities. If urbanisation is occurring at the same time as climate change then distinguishing between the two effects might be problematic.</li> </ul>
Limitations of data source	Some of the selected weather stations have missing data, usually due to starting collection after the year 1981.
Created by	Environmental Health Indicators Programme, Massey University
Related indicators	<ul style="list-style-type: none"> <li>- Number of days over 25°C</li> <li>- Number of days with soil moisture deficit</li> <li>- Annual amount of rainfall</li> <li>- Number of days with extreme rainfall</li> <li>- Notifications of salmonellosis</li> <li>- Notifications of cryptosporidiosis and giardiasis</li> </ul>
For more information	Ministry for the Environment & Stats NZ. 2020. New Zealand's Environmental Reporting Series: Our atmosphere and climate 2020. Wellington: Ministry for the Environment & Stats NZ.
References	Haines A, Patz JA. 2004. Health effects of climate change. <i>Journal of the American Medical Association</i> 291(1): 99-103. DOI: <a href="https://doi.org/10.1001/jama.291.1.99">10.1001/jama.291.1.99</a> (accessed February 2021).