Days with extreme temperatures

This report presents indicators of extreme temperature (hot days and cold days) in Aotearoa New Zealand. It comments on the current overlap in where temperature extremes occur and the geographical distribution of populations that are more vulnerable to heat.

Key facts

- Following the midpoint of the Climate Normal Period (1991–2020), nearly every year has had more than the average number of hot days and fewer than average cold days.
- New Zealand experienced an average of 23.9 hot days (where maximum temperatures exceeded 25°C) and 16.5 cold days (where minimum temperatures were below 0°C) in 2023.
- In 2023, hot days were most common in the east and west of the North Island and the eastern half of the South Island.
- In 2023, cold days were most common in much of the South Island, and the North Island's central plateau.
- Higher concentrations of vulnerable populations live in areas prone to hot days, particularly Māori, young children and people living in higher levels of deprivation.

New Zealand's climate is expected to keep warming

It is very likely that climate change will increase the number of hot days (where the maximum temperature exceeds 25°C), particularly in the north of the North Island. Additionally, there will be a decrease in the number of cold days (where minimum temperatures fall below 0°C), particularly in the South Island (Ministry for the Environment 2018; Royal Society Te Apārangi 2017).

Since 1909 **+1.13°C (±0.27)**	The annual average temperature in New Zealand has risen by 1.13°C since 1909 (Ministry for the Environment & Stats NZ 2020).
By 2040: **+0.7–1.0°C**	Climate scientists predict that relative to 1986–2005, New Zealand will continue to warm by 0.7–1.0°C by the year 2040 (Ministry for the Environment 2018).
By 2090: **+0.7–3.0°C**	Climate scientists predict that relative to 1986–2005, New Zealand will continue to warm by 0.7–3.0°C by the year 2090 (Ministry for the Environment 2018).

A hotter climate will have consequences for health

A hotter climate will alter biological processes in our environment that can affect our health. Increased temperatures can affect health in several ways.

- Research suggests that periods of higher temperatures are linked to an increase in salmonellosis and other gastrointestinal diseases (Lal et al. 2016).
- Increasing temperatures can change the geographical distribution of some mosquitoes, which may carry infectious diseases (Smith et al. 2014).
- Increasing temperatures bring a longer pollen season and increased fire risk, associated with increases in respiratory problems.
- Heat is linked to worsening heart problems and an increase in overall death rates (Hales et al. 2007; McMichael et al. 2003).

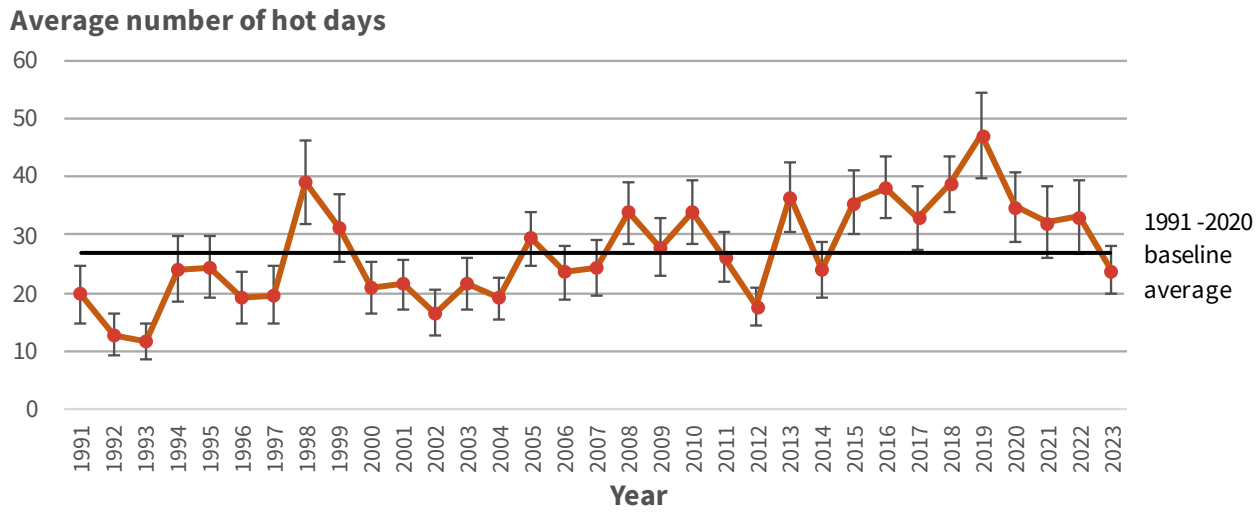
Since 1991, hot days have become more common and cold days rarer

During the Climate Normal Period (1991–2020), which sets a baseline for climate variables, the average number of hot days was 26.9. In 2023, the average was 23.9, the fewest (and first 'below average' year) in almost a decade (Figure 1). This does not mean that 2023 was cooler than previous years, as this is a measure of extremes, not average temperatures. The number of annual hot days has steadily increased since 1991, and most years since the mid-point of the Normal Period (2005) have had more than the baseline number of hot days. According to NIWA's annual climate summary:

"2023 was New Zealand's 2nd warmest year on record, based on NIWA's seven station series which began in 1909. Annual temperatures were above average (+0.51°C to +1.20°C above the annual average) or well above average (>1.20°C above the annual average) for much of Aotearoa New Zealand."

- (NIWA, 2024)

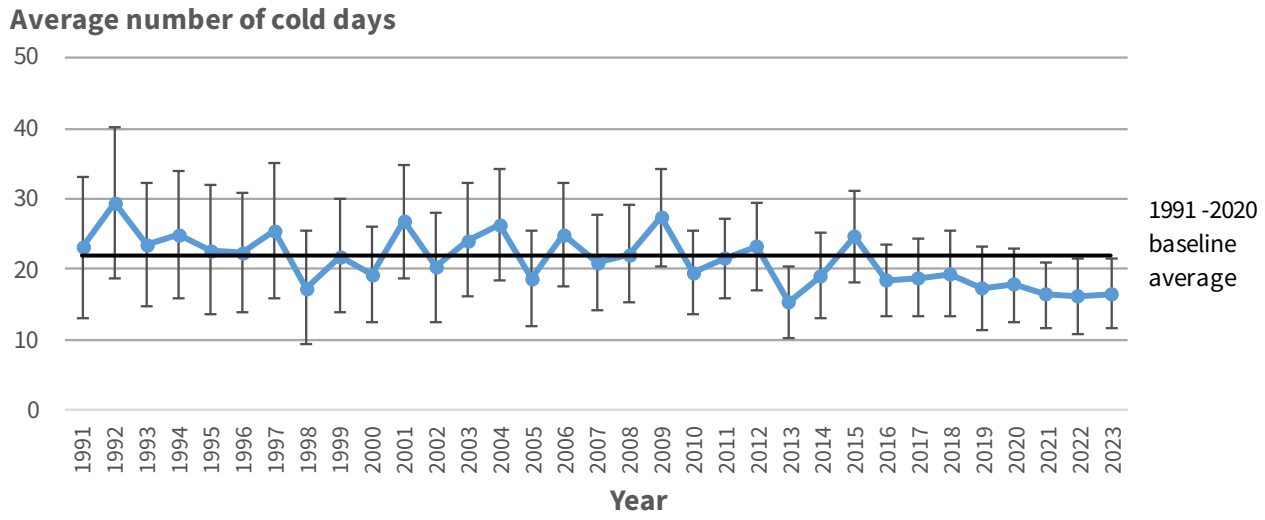
Figure 1: Average number of days with maximum temperatures above 25°C, 1991–2023



Note: 95% confidence intervals have been presented as vertical bars. The baseline refers to the most recent Climate Normal Period, 1991–2020 (NIWA 2024). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared. The New Zealand average is calculated based on the data taken from each climate station with valid data for a given year.
Source: National Climate Database (CliFlo), NIWA

During the Climate Normal Period (1991–2020), the average number of cold days was 21.8. In 2023, there were 16.5 cold days on average, the third-fewest on record. The number of cold days each year has been in steady decline for some time, even during the Normal Period, and only five years since the middle of the normal period (2005) have had more than the baseline number of cold days.

Figure 2: Average number of days with minimum temperatures below 0°C, 1991–2023



Note: 95% confidence intervals have been presented as vertical bars. The baseline refers to the most recent Climate Normal Period, 1991–2020 (NIWA 2024). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared. The New Zealand average is calculated based on the data taken from each climate station with valid data for a given year.
Source: National Climate Database (CliFlo), NIWA

Hot days were more common in the north and east

In 2023, hot days were most common in the east and west of the North Island and the eastern half of the South Island. The Territorial Authorities (TAs) with the most hot days (Figure 3) were:

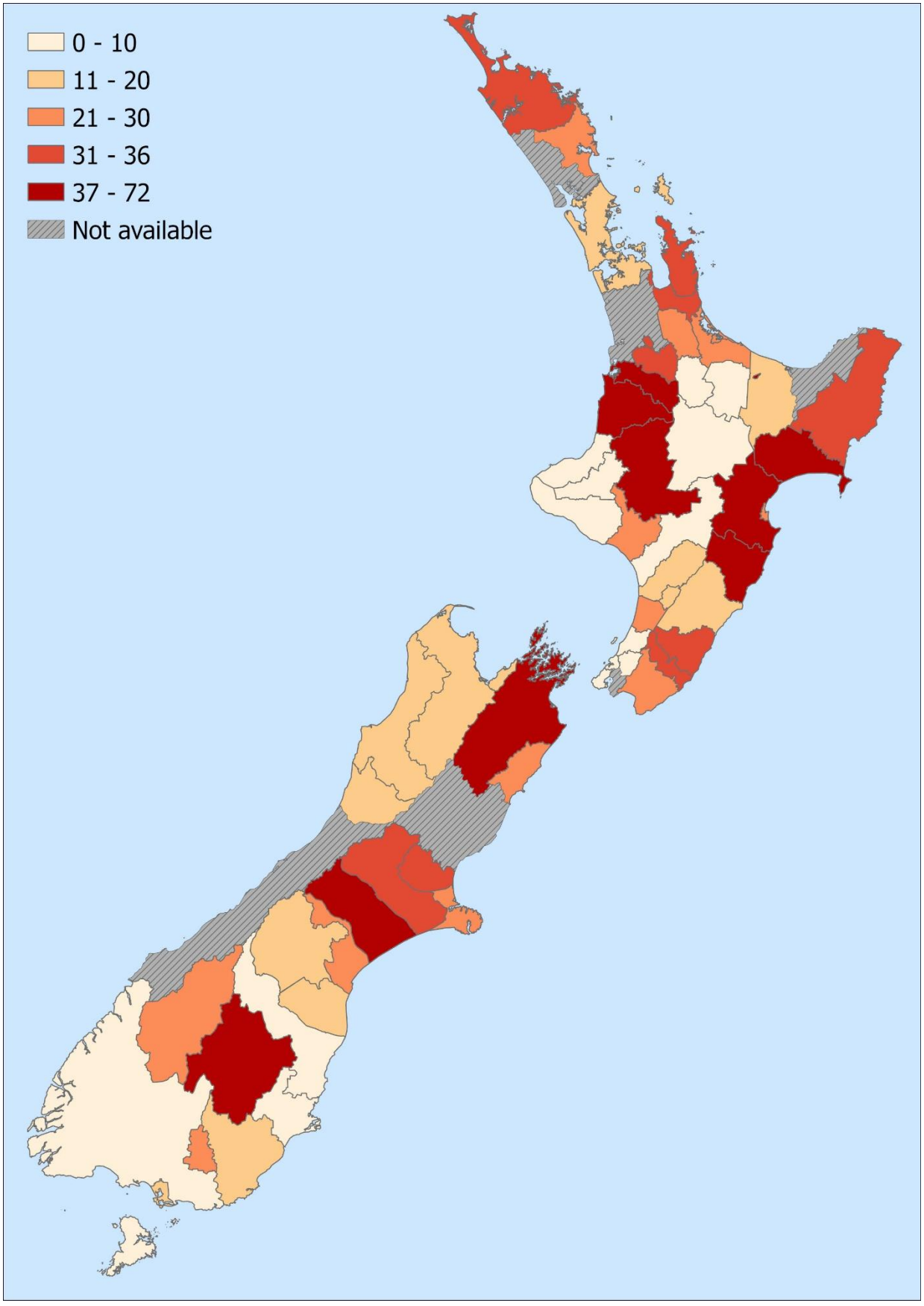
- Kawerau (Bay of Plenty) – 72 days
- Wairoa (Hawke's Bay) – 66 days
- Central Otago (Southland) – 64 days

Cold days were most common in the south

In 2023, cold days (minimum temperatures were below 0°C) were most common in much of the South Island, and the North Island's central plateau. The TAs with the most cold days (Figure 4) were all in the lower South Island:

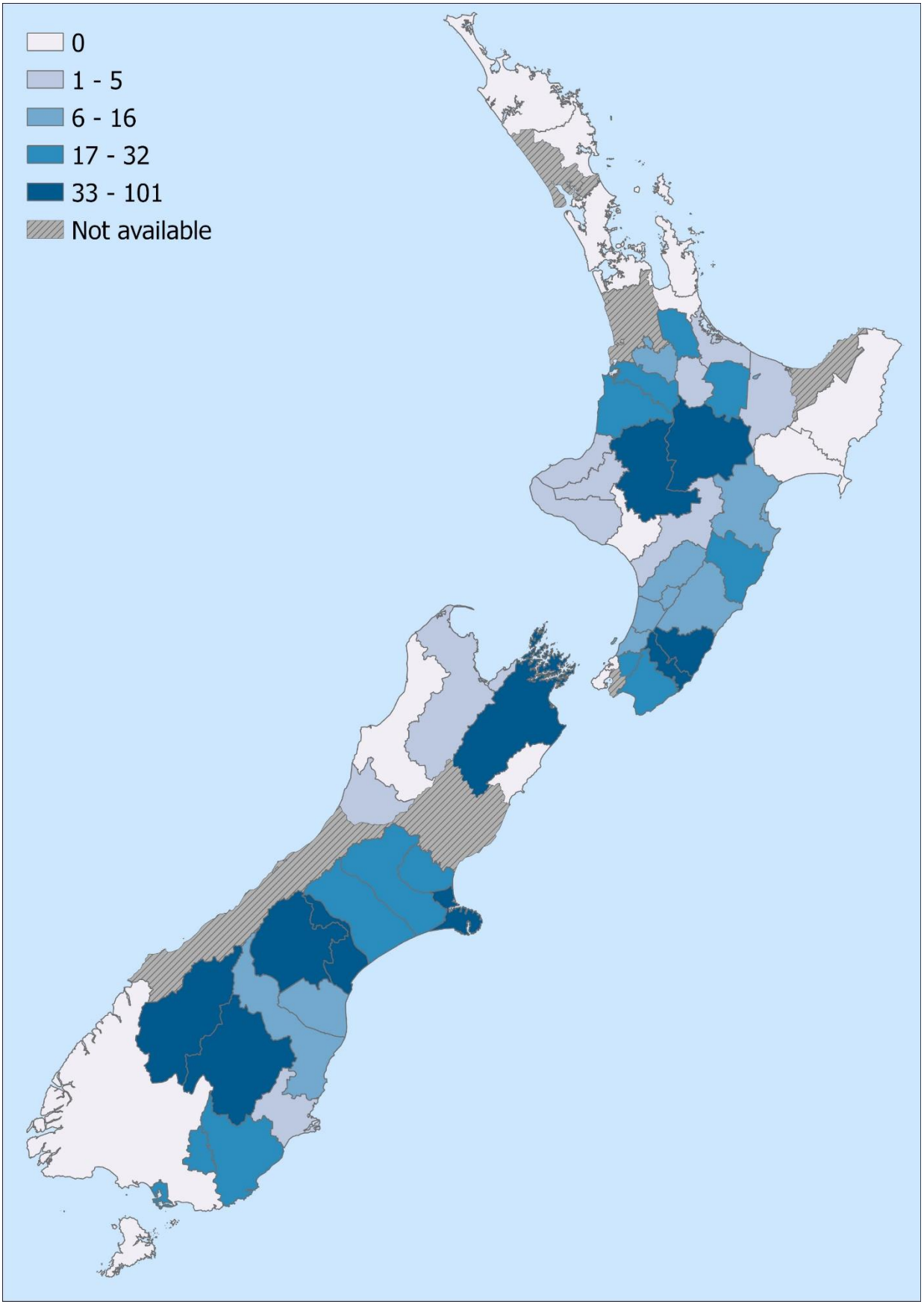
- MacKenzie (South Canterbury) – 101 days
- Central Otago (Southland) – 76 days
- Queenstown-Lakes (Otago) – 54 days

Figure 3: Average number of days with maximum temperatures above 25°C, 2023



Source: National Climate Database (CliFlo), NIWA

Figure 4: Average number of days with minimum temperatures below 0°C, 2023



Source: National Climate Database (CliFlo), NIWA

Many in New Zealand are vulnerable to high temperatures

Populations more vulnerable to temperature-related health effects are:

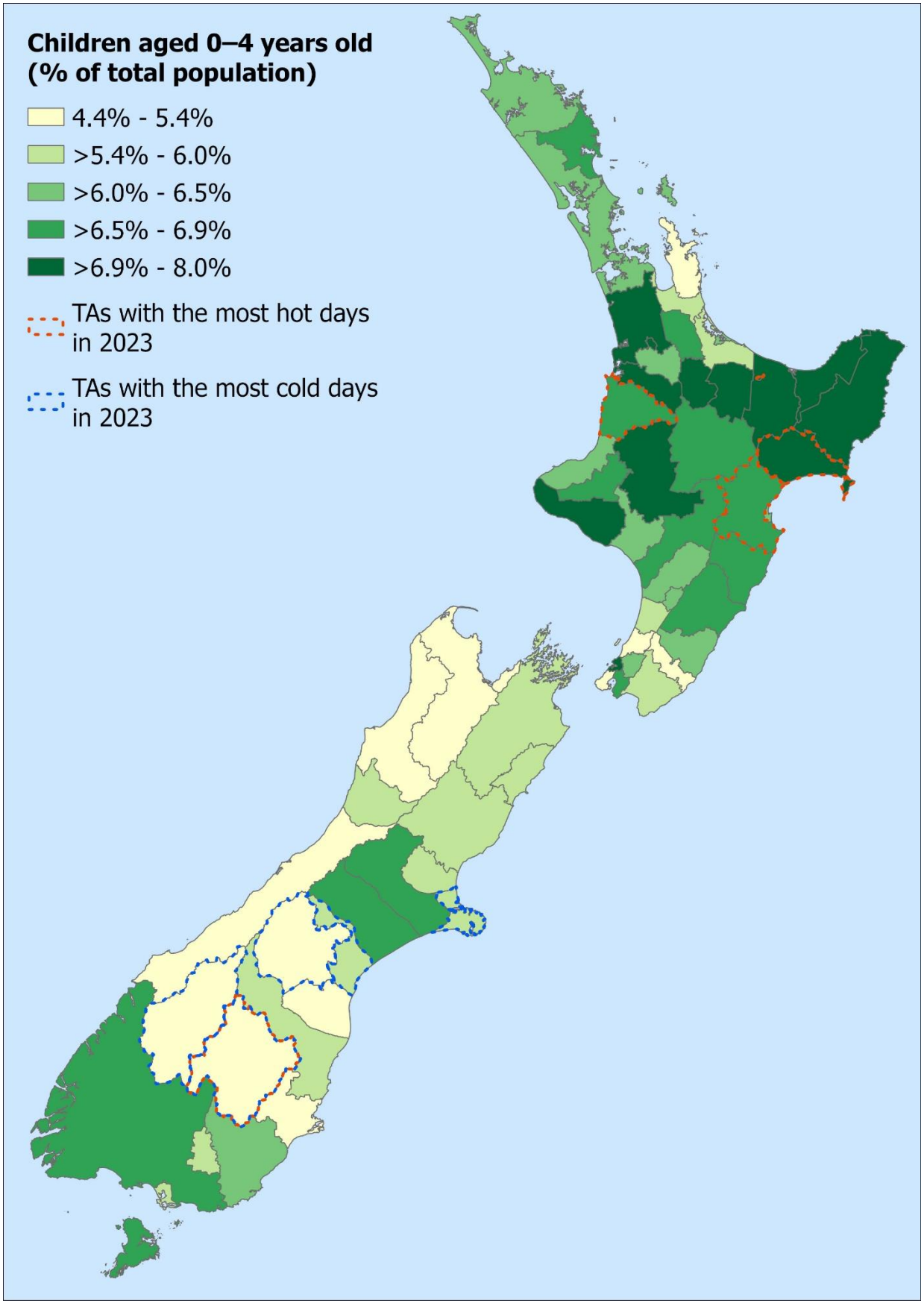
- Young children aged 0–4 years, through having fewer sweat glands than adults and being more quickly dehydrated from 'tummy bugs') (Smith et al. 2014, Gamble et al. 2016).
- Older people 85 years and over, through taking medications that cause water loss and being more quickly dehydrated from' tummy bugs') (Smith et al. 2014).
- Māori communities, who often have high employment rates in outdoor occupations and primary industries (Te Puni Kōkiri, 2007).
- People employed in primary industries. Working in primary industries (and other outdoor occupations) increases a person's exposure to the potential health effects of elevated temperatures (e.g. hyperthermia or occupational heat stress) (Royal Society Te Apārangi, 2017).
- Those on low incomes (for instance, if someone lacks money for transport, it can be hard to get to a swimming pool or beach to cool down) (Smith et al. 2014).
- Those with chronic disease or disability (e.g. cardiovascular diseases or mental illness).

Areas prone to hot days coincide with concentrations of vulnerable people

Combining temperature and population data shows that Northland, the east coast of the North Island, and parts of the Bay of Plenty are likely to be regions where people will be particularly affected by the direct health effects of temperature increases. For example, many Māori live in the north and east of New Zealand, where hot days are projected to increase (Ministry for the Environment 2018).

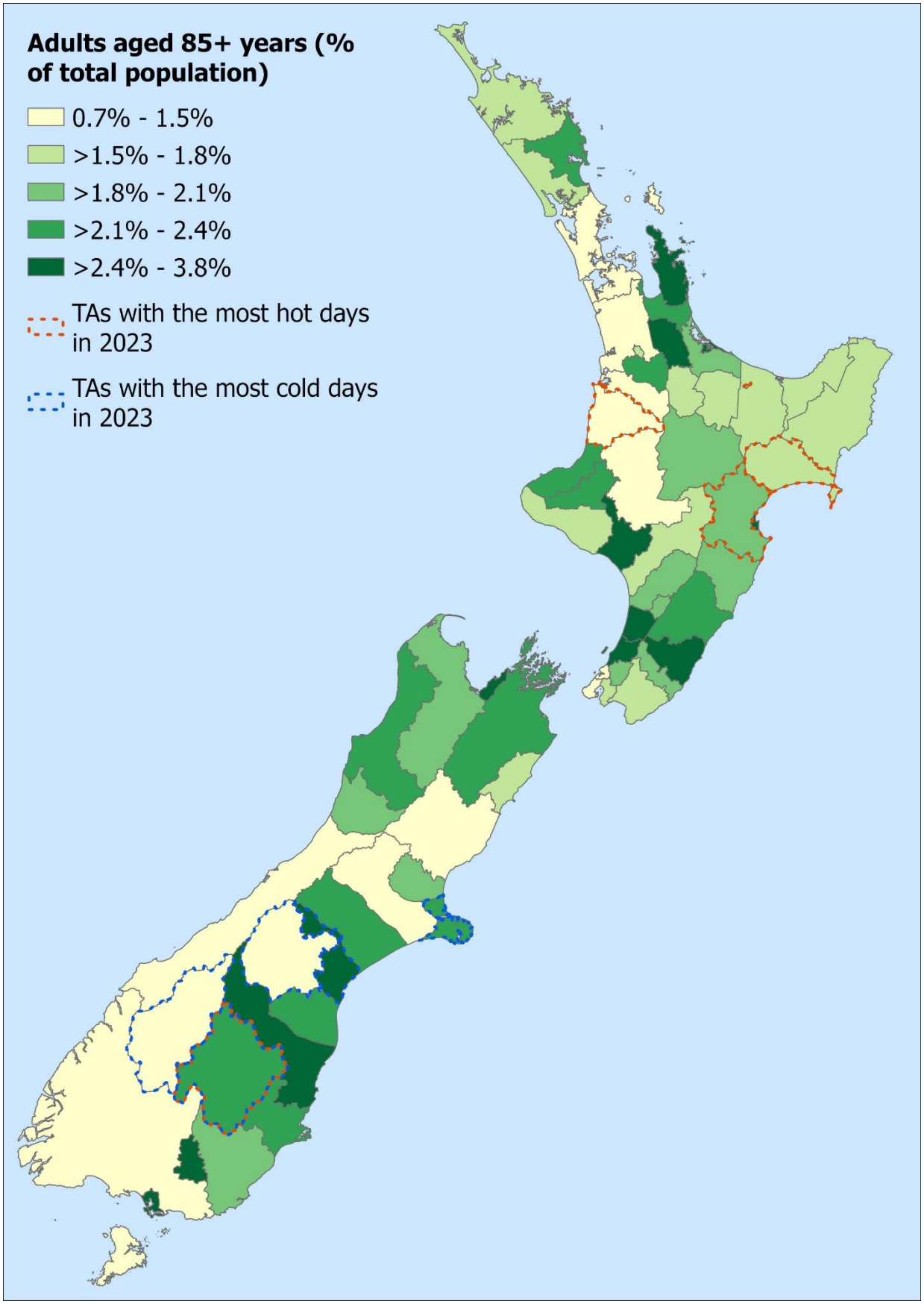
Figures 5a – 5e below show the TAs with the most hot and cold days in 2023, in relation to the distribution of these vulnerable populations using numbers from the 2018 Census.

Figure 5a: Children aged 0–4 years old, by TA, 2018 (% of total population)



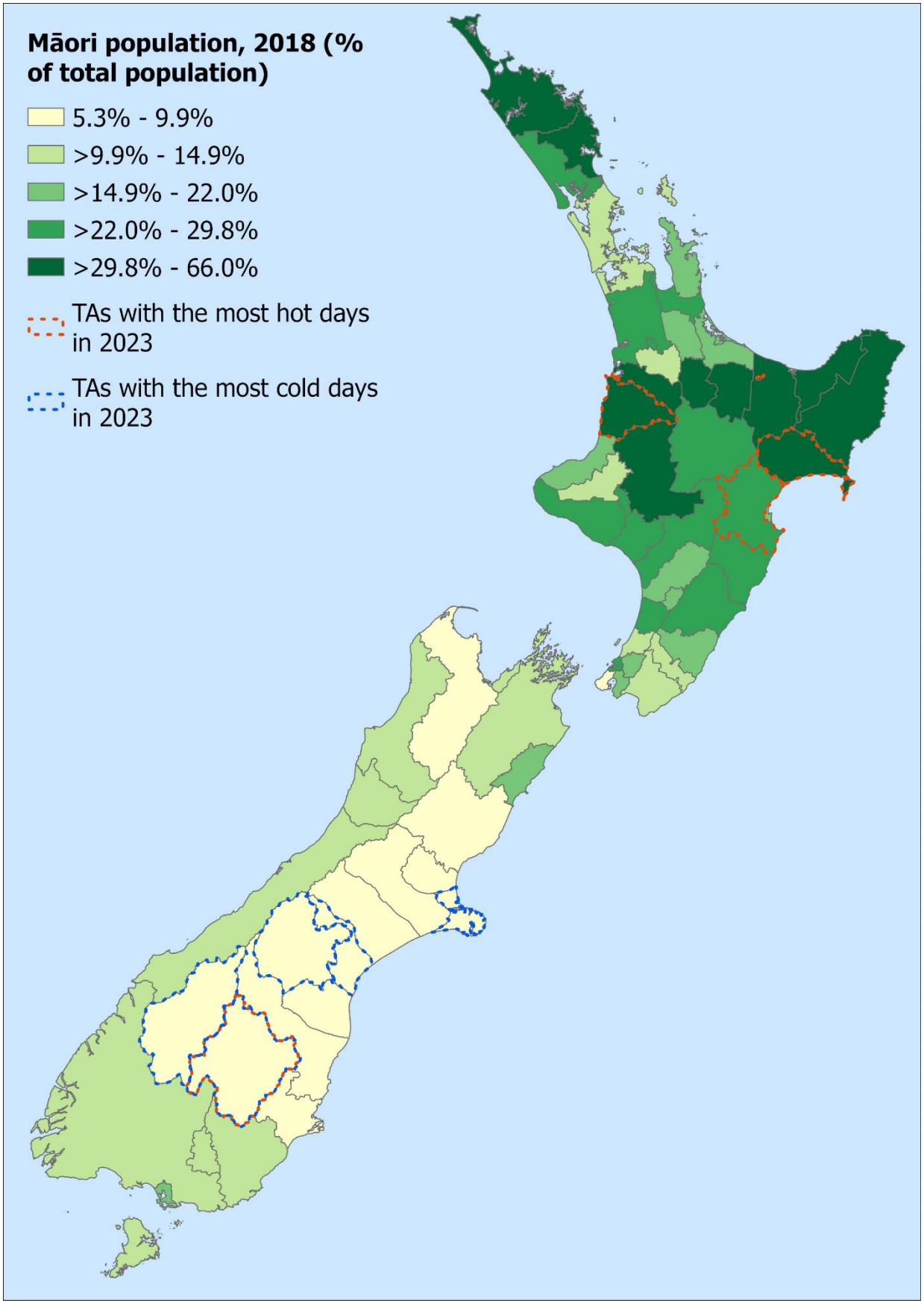
Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings

Figure 5b: Older adults aged 85+ years, by TA, 2018 (% of total population)



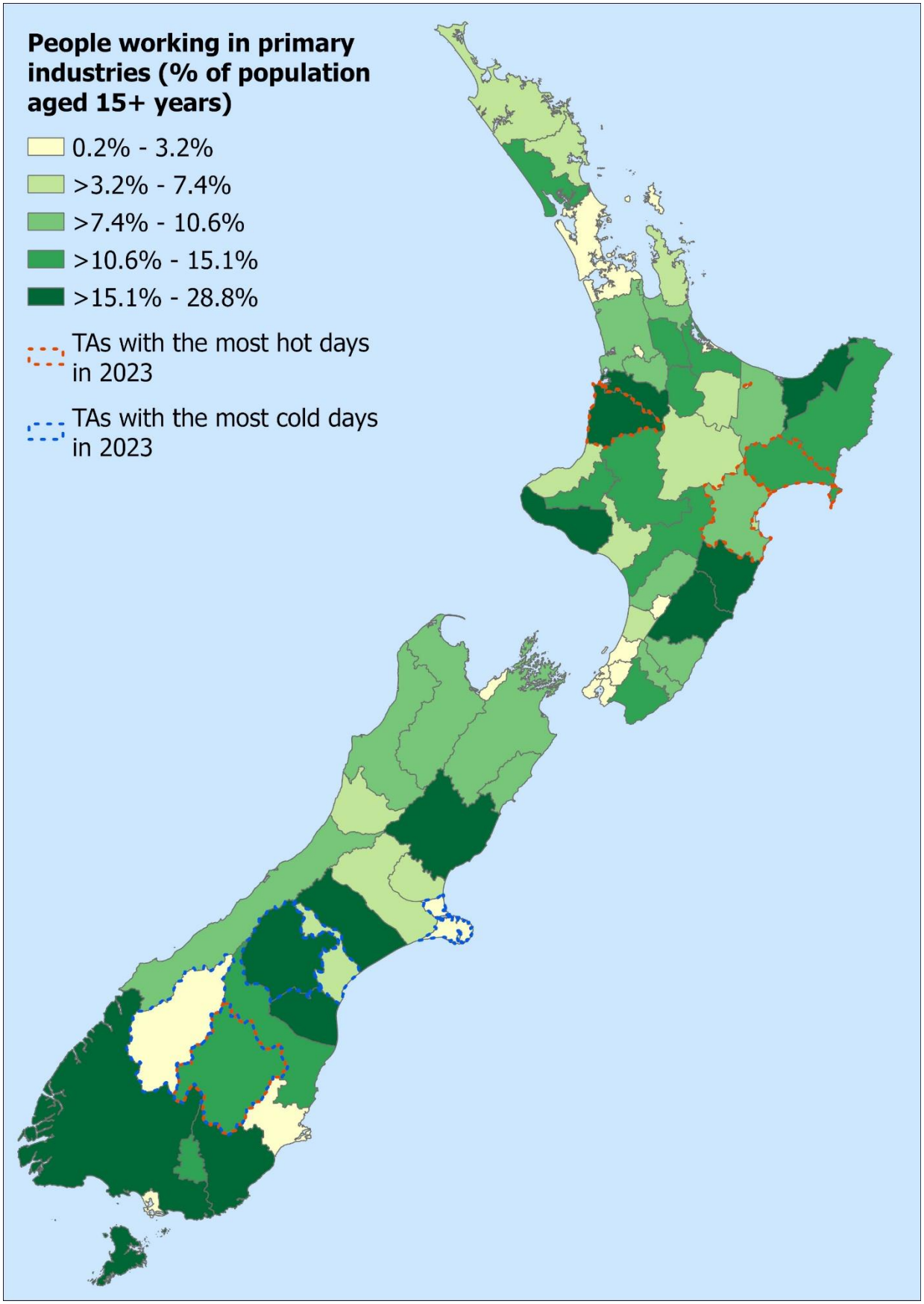
Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings

Figure 5c: Māori population, by TA, 2018 (% of total population)



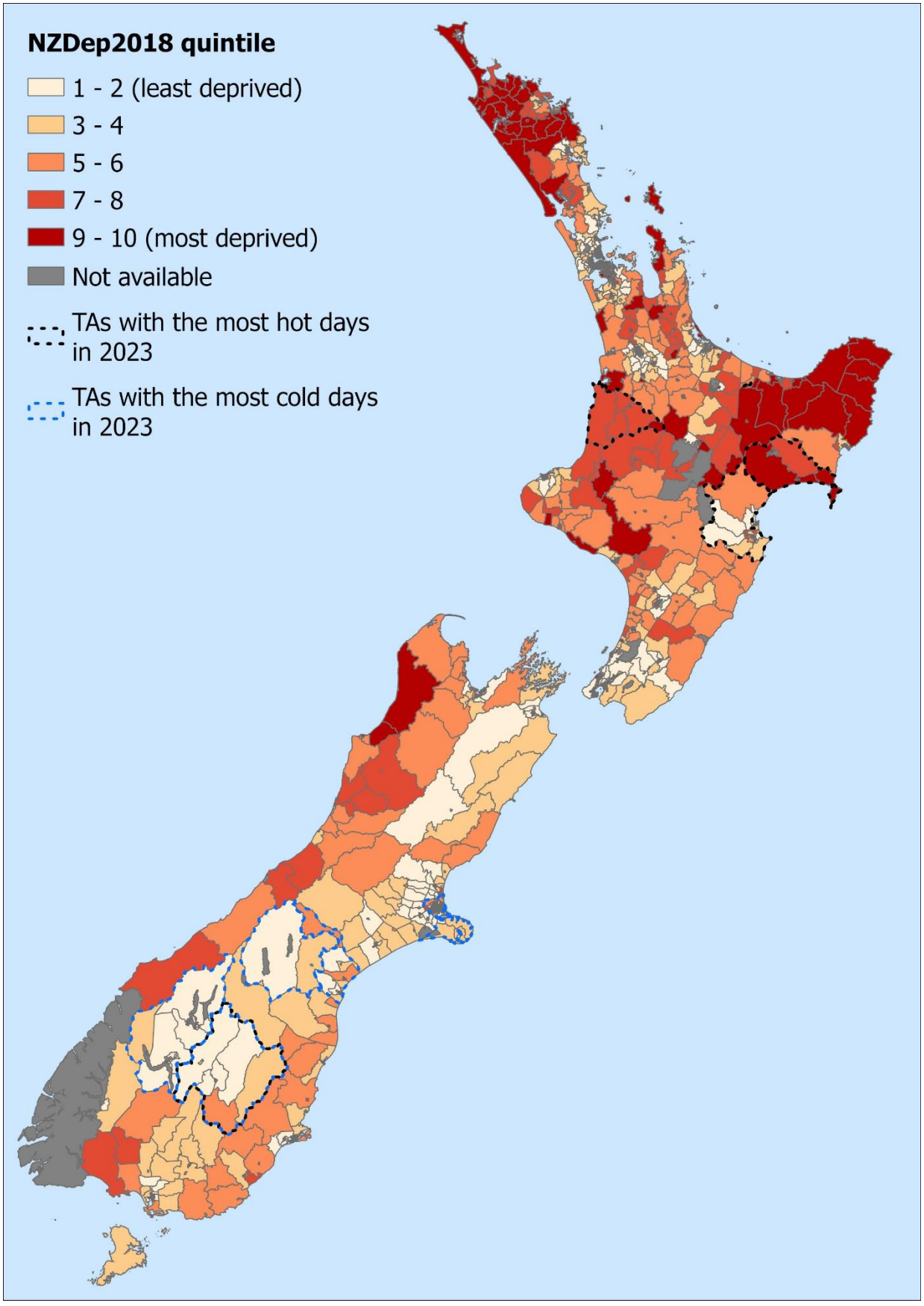
Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings

Figure 5d: People working in primary industries, by TA, 2018 (% of population aged 15+ years)



Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings

Figure 5e: Socioeconomic deprivation index (NZDep2018 decile), by Statistical Area 2 (SA2)



Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings

Data for this indicator

This indicator analyses climate station records of the daily maximum and minimum temperatures around New Zealand, sourced from the National Climate Database (CliFlo), a web service provided by the National Institute of Water and Atmospheric Research (NIWA). One climate station was selected per Territorial Authority, based on their proximity to each TA's population-weighted centroid (based on 2018 Census data).

The number of hot days (days with a maximum air temperature above 25°C) and the number of cold days (days with a minimum temperature below 0°) was counted for each year by TA. Only years with data for 90% of all days or more were counted. Data was compared to the most recent Climate Normal Period, 1991–2020, where the 30-year average acts as a benchmark against which more recent observations can be compared.

All 95% confidence intervals have been presented as vertical bars on graphs. For additional information, see the Metadata sheet.

Note on climate normals – this report uses the *most recent* Climate Nornal Period of 1991–2020 as defined by NIWA (2024). Previous editions of this report refer to an earlier normal period of 1981–2010, therefore, any baseline climate figures referred to in this document will not match those referred to in previous editions. Moving to the new normal period is in line with the World Meteorological Office's advice that standard reference periods should be updated every decade to reflect changes in the climate best.

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