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ehinz
Environmental Health Intelligence New Zealand
Rapu Mātauranga Hauora mo te Taiao – Aotearoa

Climate change

Patrick Hipgrave
Intelligence Analyst

Extreme rainfall and drought

This factsheet presents indicators of days with extreme rainfall and dry days. It comments on the current overlap in where these days occur and the geographical distribution of populations more vulnerable to extreme rainfall and drought.

Extreme rainfall days were most common during 2022 in the same parts of the North Island that were worst affected by Cyclone Gabrielle the following year.

New Zealand experienced an average of 23 days with extreme rainfall in 2022. Extreme rainfall days were most common in the central North Island and the Bay of Plenty

On average, between 2020–2022, days of soil moisture deficit were common across the South Island, especially in Marlborough, the Canterbury Plains and Central Otago.

The areas of the South Island with frequent dry days correlate to areas of high agricultural activity, particularly the Marlborough region, Canterbury Plains and Central Otago.

Climate change will increase extremes of drought and rainfall

Detecting changes in rainfall patterns in New Zealand is difficult due to the high variability in rainfall from year to year and from region to region. The variability is caused by changing weather patterns and natural climate variations such as El Niño (Ministry for the Environment and Stats NZ 2020).

Climate change is projected to cause the annual amount of rainfall and the number of days with extreme rainfalls to increase in the west and south of both islands, areas which have not historically been as affected by extreme weather. An 'extreme rainfall day' is one where the amount of rainfall is greater than the 95th percentile during the Climate Normal Period (1981–2010).

The number of dry days (those in soil moisture deficit) is projected to increase in the North Island and inland areas of the South Island (Ministry for the Environment 2018). A day in soil moisture deficit (a 'dry day') is one where the moisture content of soil is less than half the soil's capacity to hold water.

+20% **Extreme rainfall days**	Extreme rainfall days are expected to increase by more than 20% in the south and west of the South Island by 2090 (Ministry for the Environment 2018).
+5% **Dry days**	Dry days are expected to increase by about 5% by 2090 across New Zealand (up to 10 more days per year) (Ministry for the Environment 2018).

Extreme rainfall and drought have several effects on health

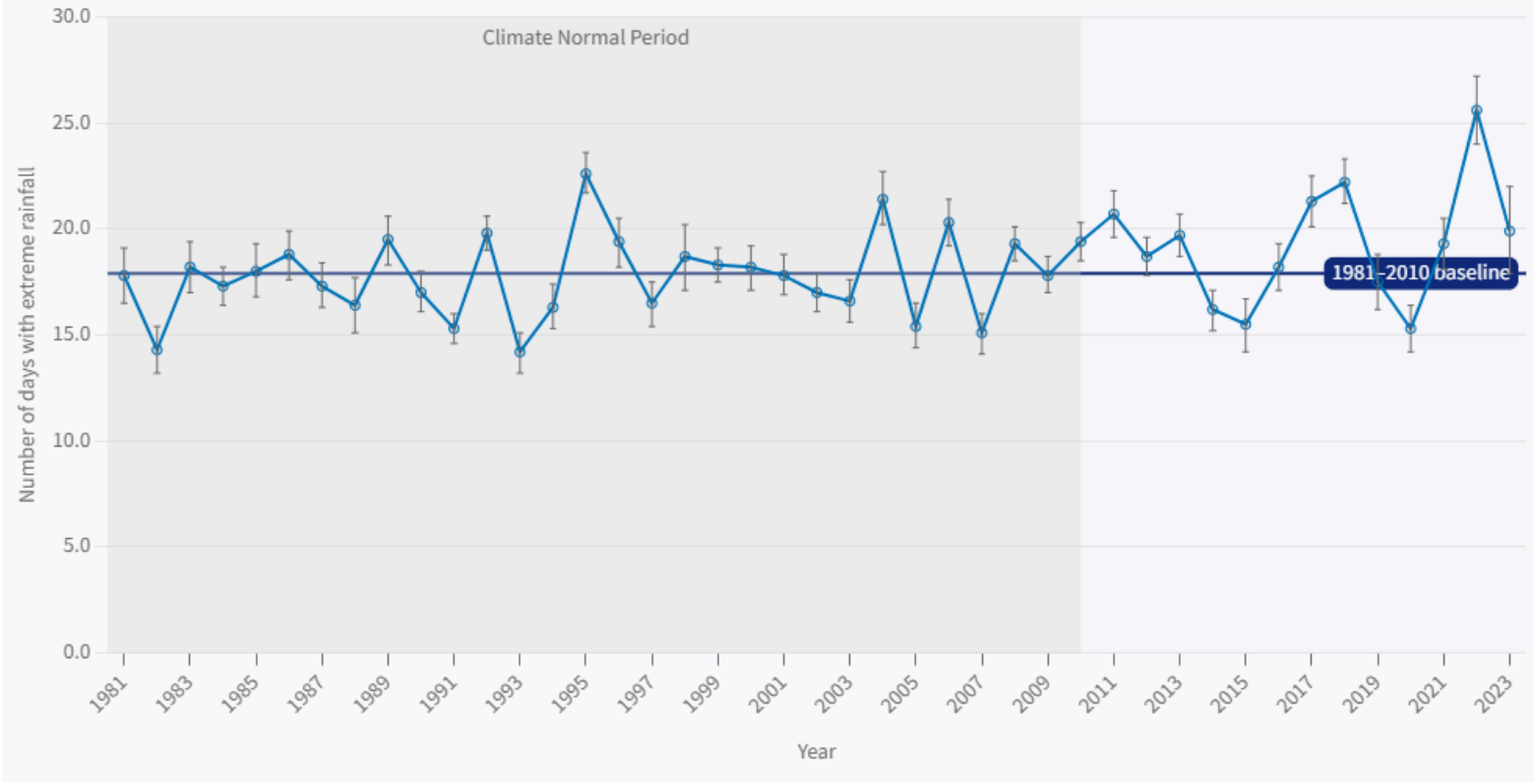
Variations in rainfall patterns can affect health in several ways:

- Drinking water: Prolonged drought can reduce the quality and the amount of drinking water available. Flooding caused by extreme rain can also affect the quality of drinking water. New Zealand's populations that rely on rainwater tanks for their drinking water supply can be particularly affected by periods of drought (McMichael, 2013). See the 'Drinking water' domain for more information.
- Gastrointestinal infections: Heavy rainfall washes giardia and cryptosporidium cysts into waterways, where they can contaminate drinking water sources (Britton et al. 2010). Likewise, studies show a positive association with heavy rainfall increasing the risk of campylobacteriosis outbreaks, such as in Havelock North in 2016 (Gilpin et al 2020). See the 'Health effects of climate change' domain for more information
- Leptospirosis: Floods displace rodents from their usual habitats,and they may congregate around houses where food is easily available. Rats are known to carry a variant of the leptospirosis bacteria, which may survive in flood water or soil for several days before infecting a human host (Vallee et al 2023).
- Food: Drought can reduce crop production, meaning less (and possibly more expensive) food is available. Food from freshwater sources will also be diminished. Extreme rainfall can also damage crops or prevent harvests (McMichael, 2013).
- Mental health: Drought can significantly affect mental health, particularly for those in rural areas who rely on rain for their livelihoods. Similarly, extreme rainfall can lead to flooding or landslides, causing damage to infrastructure and property - and placing severe mental stress on those affected. (McMichael, 2013).

Extreme rainfall is becoming more common

During the Climate Normal Period (1981–2010), which sets a baseline for climate variables like temperature and rainfall, the average number of extreme rainfall days per year was 17.9 (about 5% of days). In 2022, the average was 22.8 (about 6% of days), the most since 1995. In over 40 years of data, only five years have averaged more than 20 extreme rainfall days; three of these were in the last five years of records (Figure 1). Half of the 12 years following the end of the normal period have had significantly more than the average number of extreme rainfall days, only three had fewer.

Figure 1 Average number of days with extreme rainfall, 1981–2022

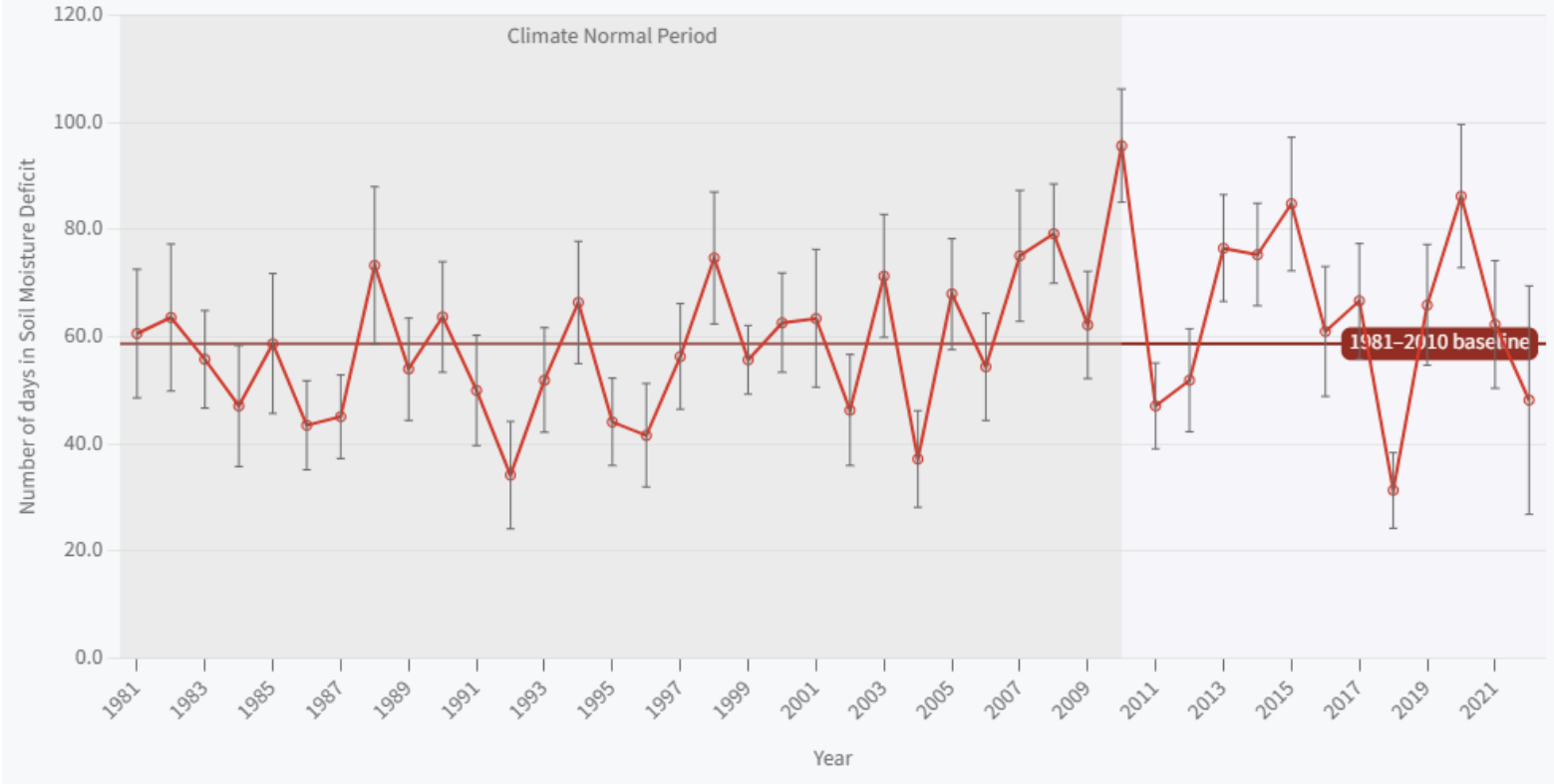


Note: 95% confidence intervals have been presented as error bars. The baseline refers to the most recent Climate Normal Period, 1981–2010 (WMO 2017). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared. The New Zealand average is calculated based on the data taken from each climate station with valid data for a given year.

Source: National Climate Database (CliFlo), NIWA

The average number of dry days in New Zealand varies yearly (Figure 2). During the Climate Normal Period, New Zealand experienced an average of 58.7 dry days yearly. One of the years with the fewest dry days was 2018, whereas 2010 was one of the years with the most. Using three-year moving averages to account for the varying availability of TA data (Figure 3), 2020–2022 was not significantly drier than the average for the Climate Normal Period.

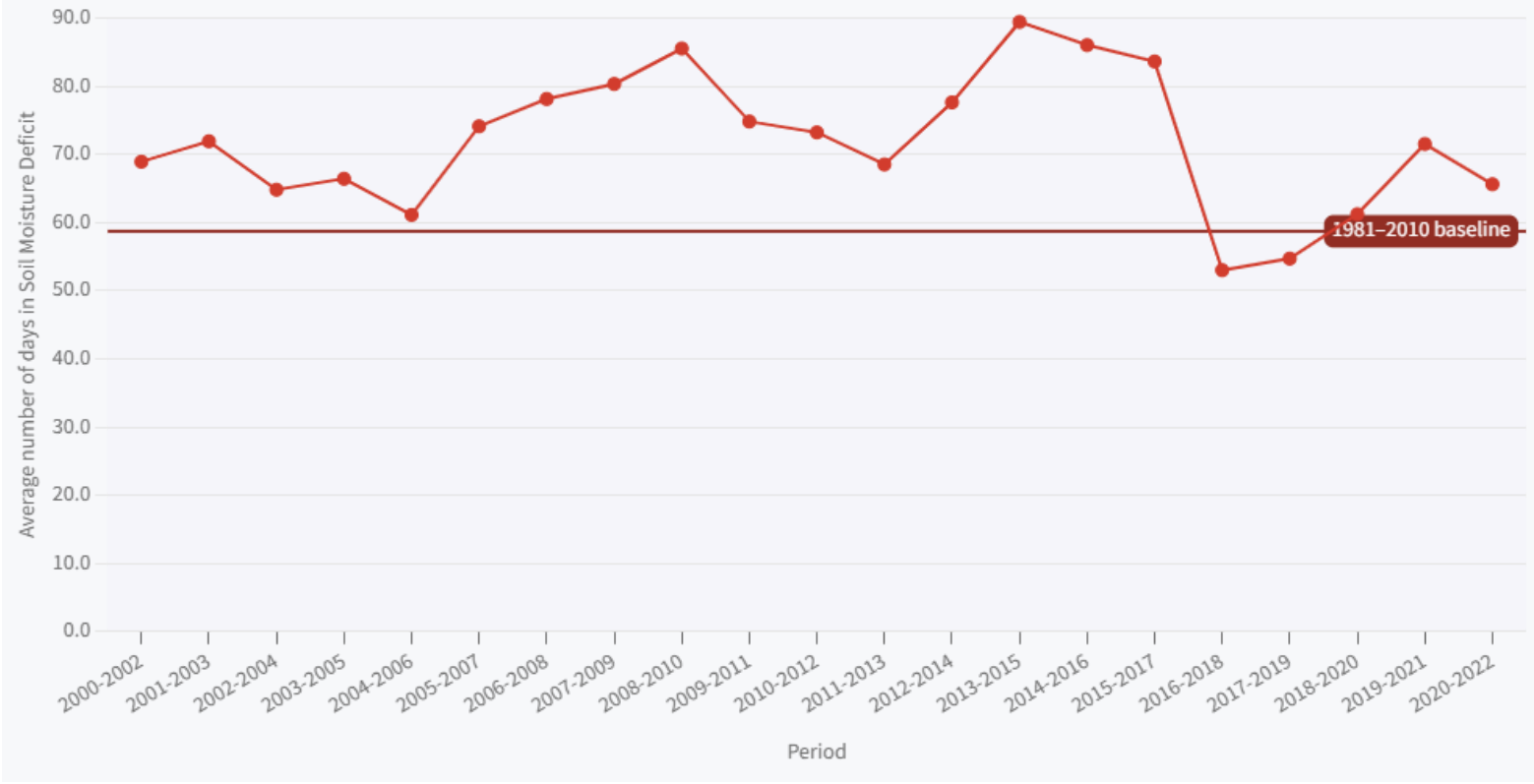
Figure 2 Average number of days in Soil Moisture Deficit, 1981–2022



Note: 95% confidence intervals have been presented as error bars. The baseline refers to the most recent Climate Normal Period, 1981–2010 (WMO 2017). 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

Figure 3 Average number of days in Soil Moisture Deficit, 2000–2022 (3-year moving average)



Note: The baseline refers to the most recent Climate Normal Period, 1981–2010 (WMO 2017). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared. The New Zealand three-year average is calculated based on three-year averages for individual stations with valid data.

Source: National Climate Database (CliFlo), NIWA

Regional variation in climate

Comparing rainfall, drought and population data shows that the health effects associated with extreme rainfall are most likely to occur in the central and eastern North Island. These areas have higher concentrations of Māori, young children and people living in higher levels of deprivation. To learn more about this, continue on to the Territorial Authority section of this factsheet, using the link below.

Continue to read this factsheet at the Territorial Authority (TA) level

Dashboard - Climate change

Data for this indicator

This indicator analyses climate station records of daily rainfall and soil moisture content 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 (2018 Census data).

Number of days with extreme rainfall

The amount of rainfall was calculated for each year by TA. Only years with more than 90% of valid data were counted. The 95th percentile for 1981–2010 was calculated for each TA, and the number of days above this percentile was counted as extreme rainfall days.

Number of days with soil moisture deficit (SMD)

The number of days with soil moisture deficit was counted for each year by TA. Only years with more than 90% of valid data were counted.

Data for both indicators was compared to the most recent Climate Normal Period, 1981–2010, where the 30-year average acts as a benchmark against which more recent observations can be compared.

For descriptive information about the data, see the **Metadata Sheet.**

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Previous factsheet(s):

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Author

To get in touch with the author ehinz@massey.ac.nz

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