Greater Wellington
Te Pane Matua Taiao

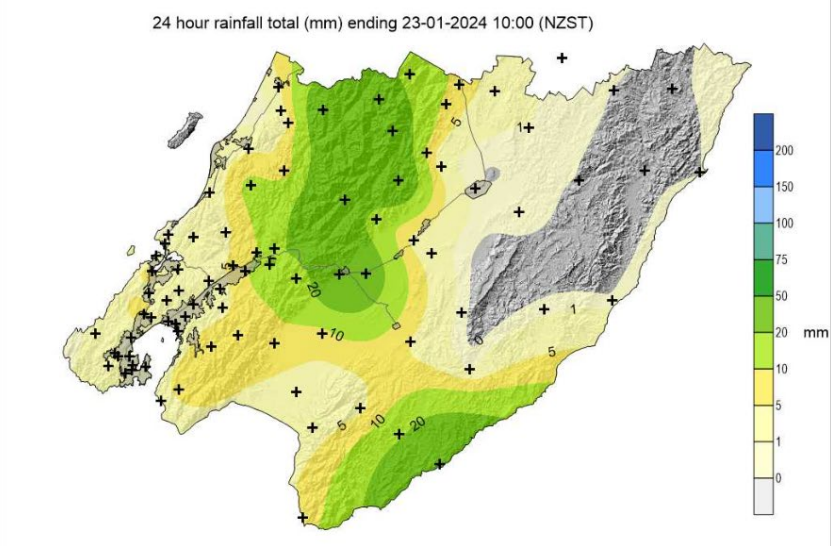
Climate drivers and seasonal outlook for the Wellington Region

Summer 2023-24 summary

Autumn 2024 outlook

Release date: 27 March 2024

Knowledge and Insights



Even though our summer was dry as predicted, the weather patterns were very unusual compared to normal El Niños of the past. In both January and February, severe thunderstorms formed over the Tararua Ranges and Wairarapa. These isolated thunderstorms helped keep river flows up a little higher than they might otherwise have been over summer. Pictured on the map above, we can see the 24-hour total rainfall ending at 10am on 23 January. The map shows totals between 20 and 50mm over the Tararua Ranges, and around Tora on the south-eastern Wairarapa coast mostly due to isolated thunderstorms. Some of the thunderstorms were accompanied by hail, small tornadoes, and severe wind gusts. Source: GWRC network.

Overview

Summer 2023-2024

Summer 2023-2024 was marked by progressive El Niño impacts with drier than normal conditions in our region. Even though the total seasonal rainfall was near normal over the western Tararua Ranges and Kāpiti Coast, most of the other areas received only about half of the normal rain. The driest spots in eastern Wairarapa received between 20-40% of the long-term seasonal average. Isolated thunderstorms were an unusual feature observed during this El Niño, fuelled by anomalously warm oceanic waters around New Zealand. These storms helped prevent the summer dryness from exacerbating low river flows throughout the season. Various long-term records were broken, including the lowest historical January rainfall accumulation for Masterton with only 4mm (recorded since 1926), and the highest January temperature for Wellington Airport, with 29.6 degrees on 22 January (recorded since 1962). Various nighttime high temperature records were also broken throughout the region. Both Wellington Airport and Masterton Te Ore Ore sites had the third driest summer on record (driest since 2001 for Wellington and similar to 2021 for Masterton), even though these were local anomalies as other near-by stations were not so dry. The El Niño-enhanced westerlies were felt mostly at the end of the season, with Wellington airport having the windiest February since 1992. However, for the total summer average, wind speeds were only slightly above average in the south of the region, and below average in the north of the region (see appendix 2).

Climate drivers

The El Niño is now dissipating. According to international climate models there is a 50-60% likelihood that a La Niña could form during winter. This poses an interesting transition in the atmospheric and oceanic circulation, which could still see the continuation of El Niño effects for a few months before transitioning again to a possible higher rainfall regime over winter and beyond.

Climate outlook for autumn 2024

With the demise of El Niño and potential return of La Niña later in the year, the atmosphere will now undergo a considerable ‘re-adjustment’. Most international climate models are currently diverging in how quickly this will play out. There is a moderate chance that the dry pattern associated with El Niño will continue to linger until May-June, albeit not too severe. Autumn temperatures should remain near to slightly above average, even though there is a good chance of early cold snaps and early frosts. There is a 40-50% chance that rainfall could remain below average in the eastern Wairarapa throughout autumn, returning to normal gradually over winter and beyond.

Contents

1. Climate drivers

1.1 El Niño – Southern Oscillation (ENSO)

The ensemble projections of the Australian climate model below show that the ENSO phenomenon is returning to neutral during autumn. According to other international models surveyed by NOAA in the United States, there is a near 60% likelihood that the climate system could start shifting back to La Niña during winter. However, as noted by the Bureau of Meteorology in Australia, it's still too early to make a firm prediction as ENSO forecast skills are low at this time of the year.

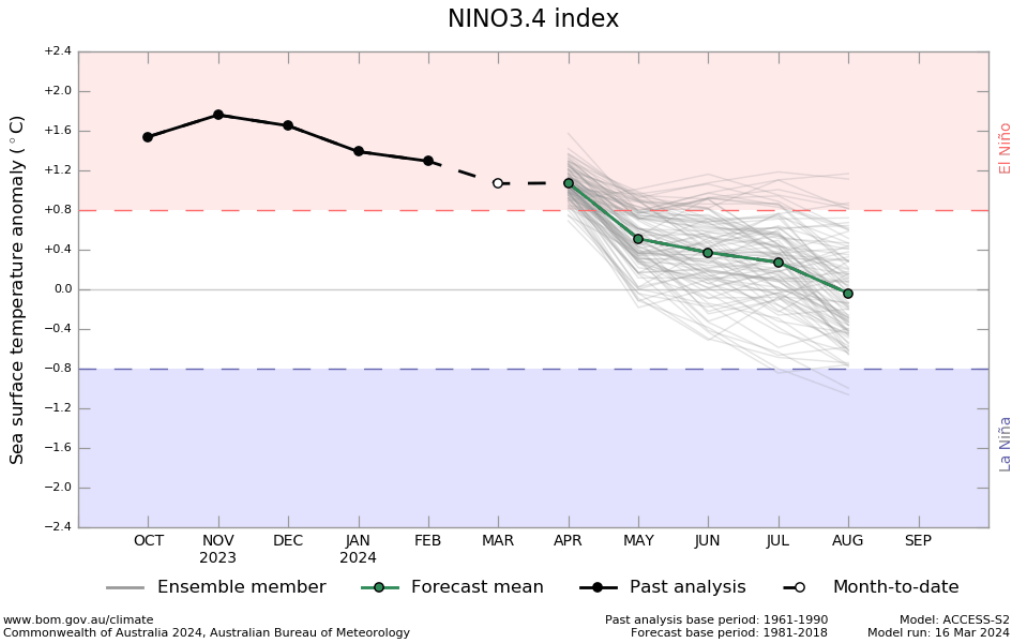


Figure 1.1: Average modelled projections (in green) show that the ENSO phenomenon is expected to become neutral during autumn. Source: Australian Bureau of Meteorology.

1.2 Sea Surface Temperature (SST) anomalies

The SST anomalies and the total Sea Ice Extent (SIE, in white) are shown in Figure 1.2, as of 18 March 2024.

The overall pattern shows a dying El Niño in the Equatorial Pacific, with a cold tongue now forming on the Peruvian coast. Meanwhile, the waters remain warmer than average around New Zealand but colder to the south. The SIE (in white) remains well below average, with a nearly 40% reduction of Antarctic sea ice compared to the long-term climatology. This reduction in ice coverage is similar to what was observed last year. As we can see below, there are areas around Antarctica with near total loss of sea ice.

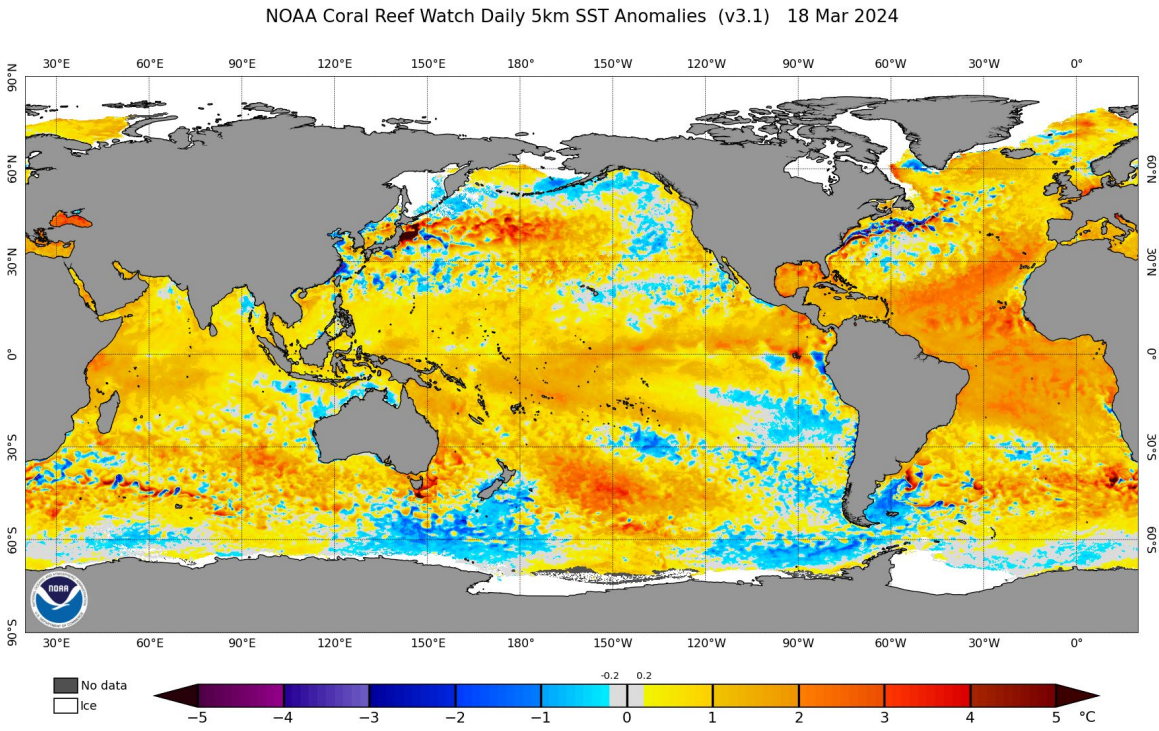


Figure 1.2: Sea Surface Temperature (SST) anomalies as of 18 March 2024. Sea ice coverage is shown in white. Water temperatures south of New Zealand are now colder than average, but warmer than average waters remain elsewhere. The Equatorial Pacific (ENSO) shows a dissipating El Niño. The Sea Ice Extent (in white) reached very low levels once again at the end of summer. Source: NOAA.

1.3 Southern Annular Mode (SAM)

The SAM is the natural pressure oscillation between mid-latitudes and the Antarctic region. Normally, positive SAM is associated with high pressures around the North Island keeping the weather stable and dry/cloud-free (especially in summer), whereas the opposite is expected when the SAM is negative.

The SAM has been predominantly positive over summer, which has contributed to the build-up of progressively drier conditions throughout our region. Figure 1.3 shows that the summer sea level pressure pattern was characterised by an anomalous high pressure to the northwest of New Zealand. Albeit weak, this pattern combined with lower pressure to the south and led to enhanced westerly flow particularly over the South Island. Compared to last year's summer, this was an almost complete inversion of the pressure anomaly pattern, with much less tropical influences compared to what we had observed early in 2023.

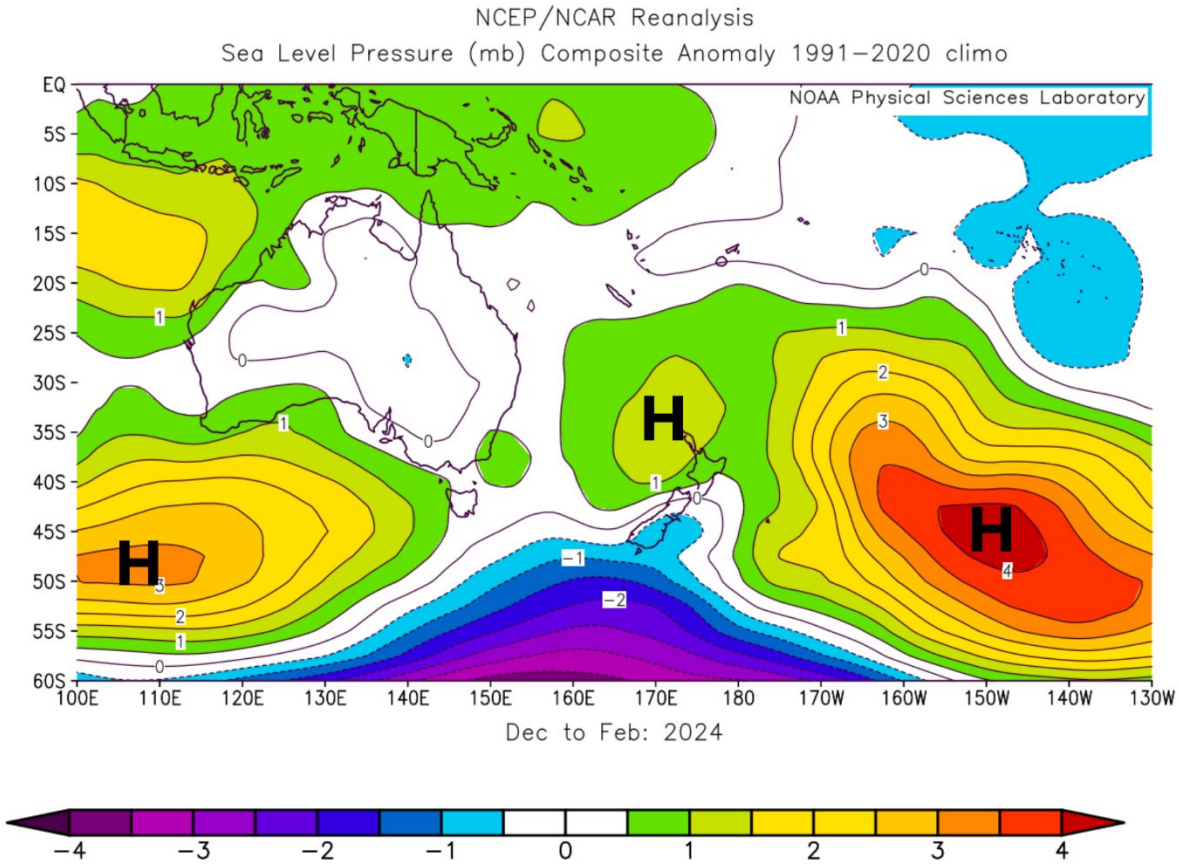


Figure 1.3: Mean sea level pressure anomaly map (hPa) for summer 2023-2024. The 'H' indicates the centre of the anomalous high pressures affecting the atmospheric flow around New Zealand. The smaller high to the northwest of New Zealand formed as a response to the El Niño summer. This pattern combined with lower pressure to the south to enhance the westerly flow mostly over the South Island. Source: NCEP Reanalysis.

2. Seasonal variability and outlook

2.1 Trend analysis

The graphs below (Figure 2.1) show summaries of seasonal climate change and variability for Wellington and the Wairarapa using reference climate stations, chosen based on length of data record and availability.

The key climate variables shown are mean temperature, total sunshine hours, mean wind, total rainfall and total number of rain days (above 0.1 mm). Temperature measurements go back to the 1910s, allowing for a meaningful analysis of climate change trends. Most other variables also have long periods of measurement greater than 50 years, except sunshine hours and wind for the Wairarapa; these are only available for less than two decades, which is a very short period climatologically and does not allow for an analysis of trends.

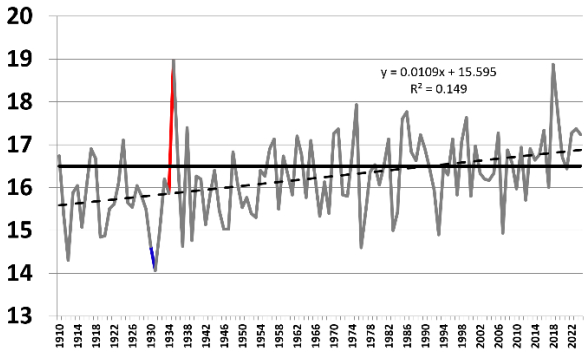
The red and blue bars show the extreme years of the entire measurement period. Red indicates seasons that were warmer, drier, sunnier and less windy than average (i.e., extreme hot/dry), and blue indicates seasons that were colder, wetter, cloudier and windier than average (i.e., extreme cold/wet). The reference climatological average (1981-2010) is shown by a horizontal bar where available.

An analysis of linear trends associated with climate change is plotted onto the graph only when the trends are statistically different from zero at the 99% confidence level.

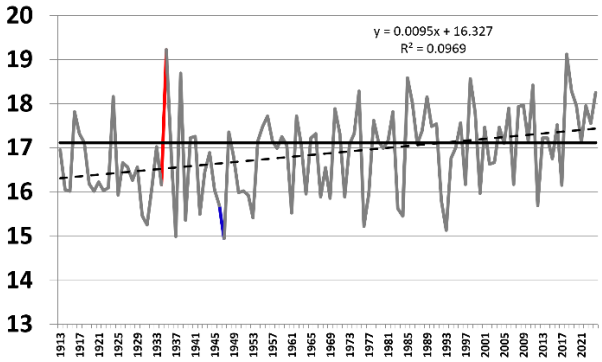
The climate change and variability summary for summer 2023-2024 is as follows:

- Statistically significant trends are seen only for temperature and wind, meaning that summer is getting warmer and less windy due to ongoing climate change. The long-term warming trend is about 1.0 and 1.1 degree per century for Masterton and Wellington respectively;
- Summer 2023-2024 temperatures were warmer than normal for both Wellington and the Wairarapa, with greater anomalies for the Wairarapa;
- Sunshine hours were near average for both Wellington and Wairarapa;
- Seasonal average wind speed was near average for both Wellington and Wairarapa;
- Seasonal rainfall was well below average in Wellington and the Wairarapa (third lowest on record for Wellington airport);
- Total rain days were near average for Wellington, and below average for the Wairarapa.

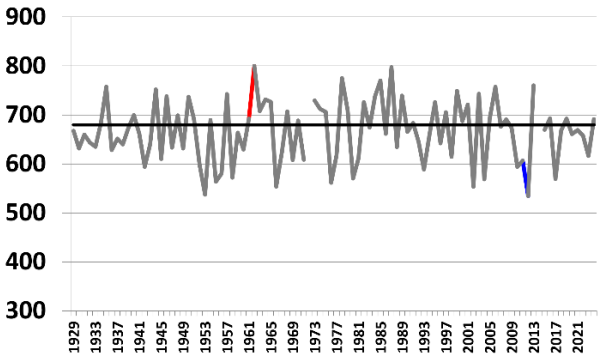
Summer Mean Temperature (deg C) - Kelburn (1910-2024)



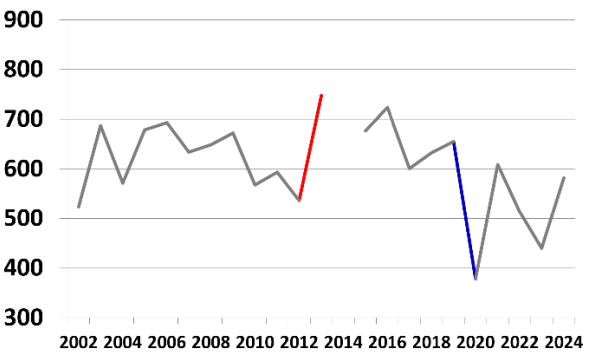
Summer Mean Temperature (deg C) - Masterton (1913-2024)



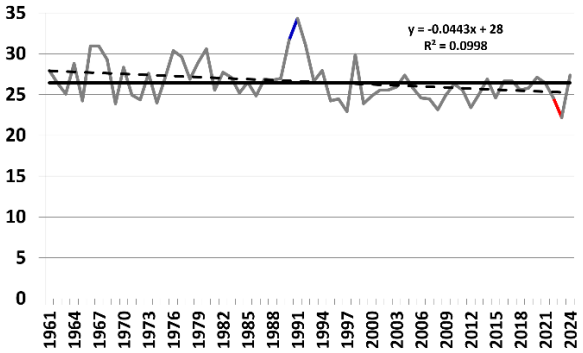
Summer Total Sunshine Hours - Kelburn (1929-2024)



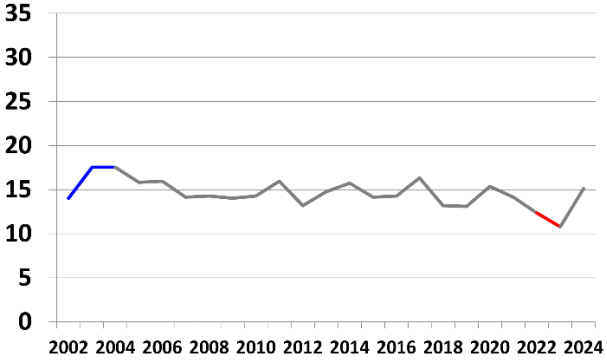
Summer Total Sunshine Hours - Martinborough (2002-2024)



Summer Mean Wind (km/h) - Wellington Airport (1961-2024)



Summer Mean Wind (km/h) - Martinborough (2002-2024)



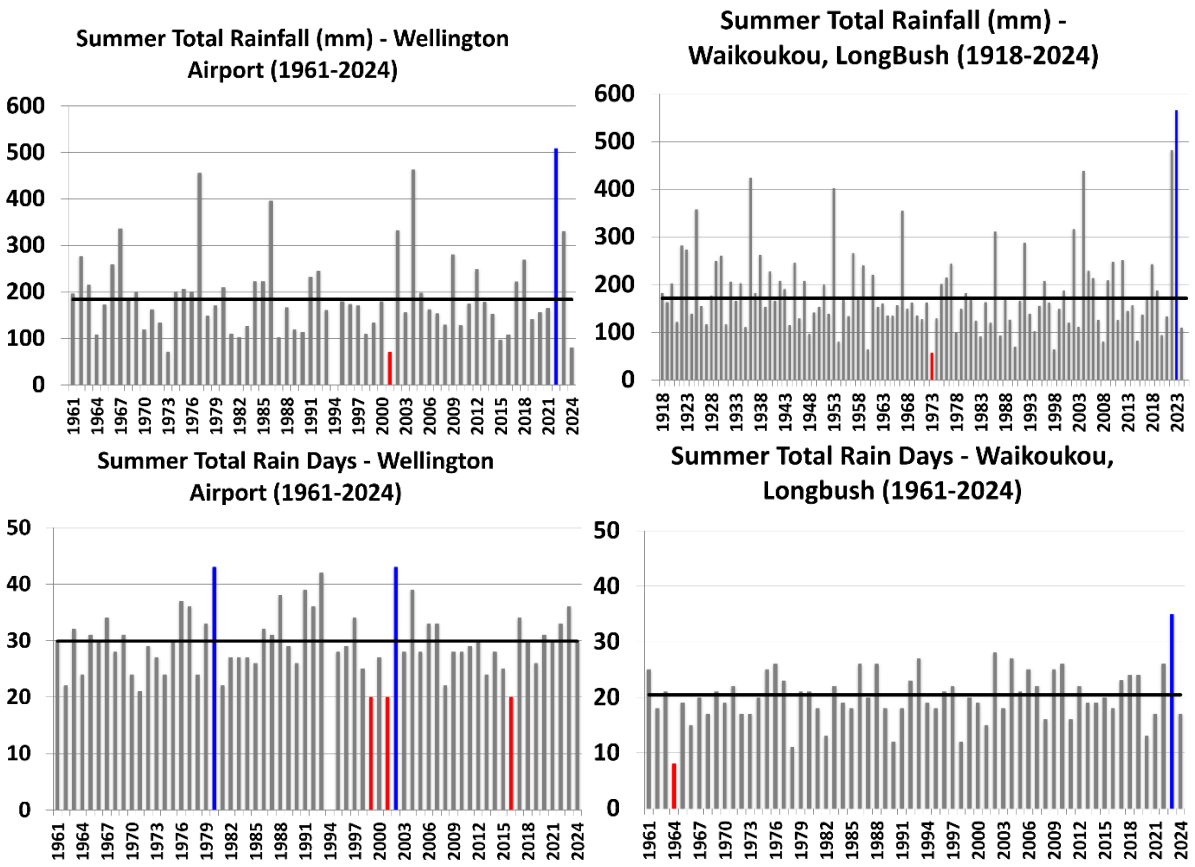
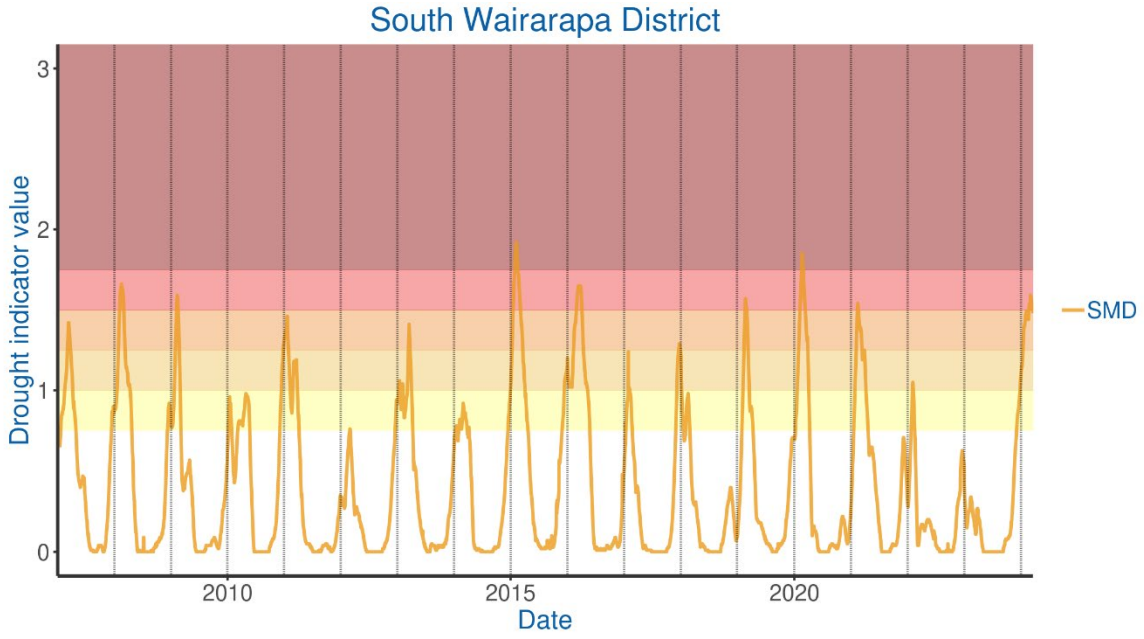
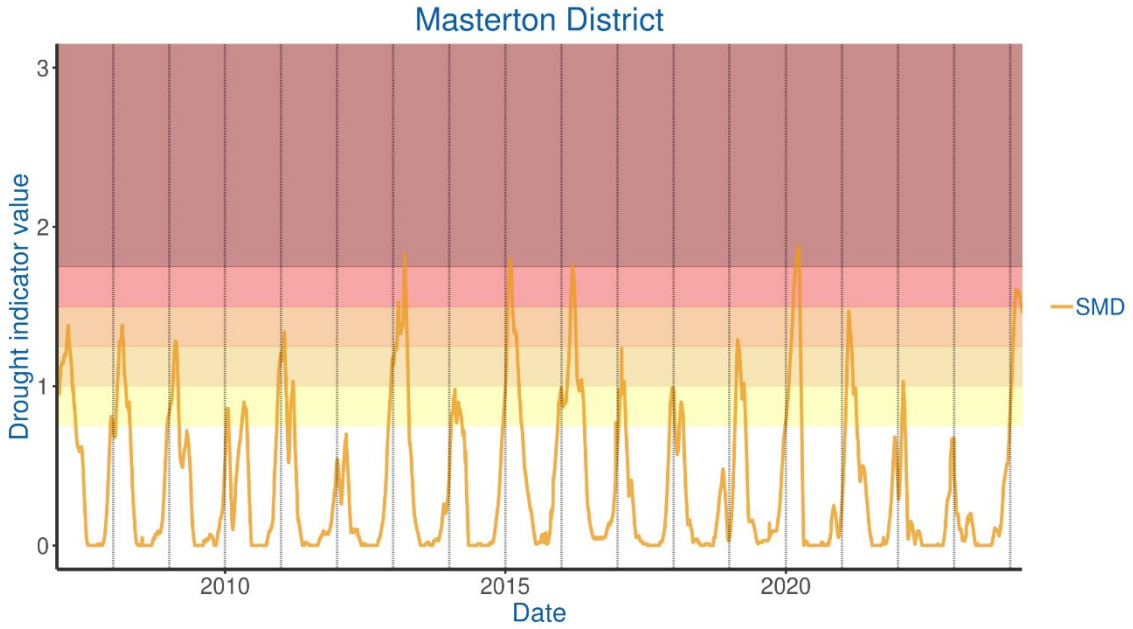


Figure 2.1: Climate change and variability graphs for summer in Wellington and the Wairarapa. The thick horizontal line shows the 1981-2010 average (where available), and the dashed line shows the linear trend. Trends are plotted only when statistically significant at 99% confidence level. For all graphs, the bright red and blue bars show the extreme min and max values for each time series (red for warm, dry, sunny and calm and blue for cool, wet, cloudy and windy). The key variables shown are mean temperature, total number of sunshine hours, mean wind speed, total rainfall and total number of rain days (>0.1mm for Wellington and > 1mm for Waikoukou). Missing bars means that no reliable mean seasonal data was available for that particular year.

As an additional trend analysis, Figure 2.2 shows that late summer soil moisture deficit conditions in the Wairarapa were on the dry side but not too extreme, similar to what was observed in 2020 and 2021.


South Wairarapa District
Drought indicator value
3
2
1
0
2010
2015
2020
Date
SMD


Masterton District
Drought indicator value
3
2
1
0
2010
2015
2020
Date
SMD

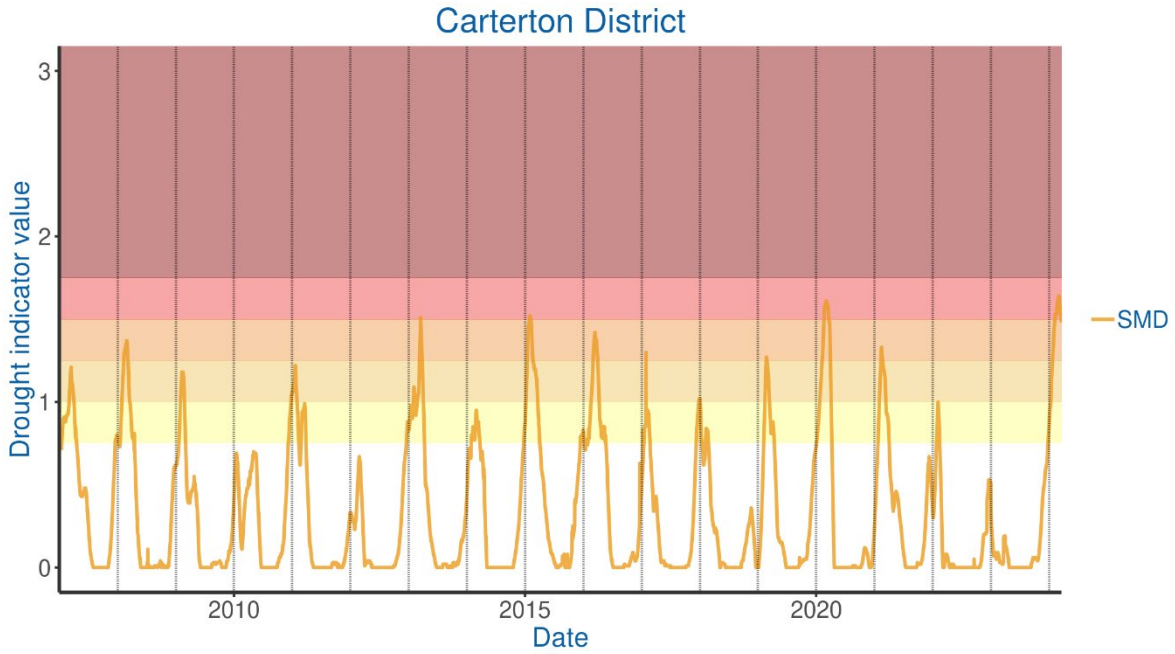


Figure 2.2: Evolution of soil moisture deficit (SMD) for South Wairarapa, Masterton and Carterton districts over the last 20 years. The curves show that soil conditions at the end of summer 2024 were similar to the deficit levels observed during 2020 and 2021, and in general less extreme than 2020. Source: NIWA drought index (https://niwa.co.nz/climate/information-and-resources/drought-monitor)

2.2 Seasonal Outlook

- El Niño to dissipate, but dry pattern east of the main ranges lingering possibly until May-June, with a progressive return of normal rainfall after that;
- Sea Surface Temperatures remain warmer than average north of New Zealand, but cooler than average to the South. This could favour more vigorous westerlies and earlier cold spells this season;
- Seasonal rainfall normal or above average in the west, but remaining below average in the Wairarapa and possibly Wellington south of the Hutt Valley;
- Temperatures average to slightly above, but early cold spells and inland frosts likely.

Whaitua*	Variables	Climate outlook for autumn 2024*
Wellington Harbour & Hutt Valley	**Temperature:**	Average to above. Early cold spells and inland frosts likely.
	Rainfall:	Average to below, but higher falls on the ranges.
Te Awarua-o-Porirua	**Temperature:**	Average to above. Early cold spells and inland frosts likely.
	Rainfall:	Average to below.
Kāpiti Coast	**Temperature:**	Average to above. Early cold spells and inland frosts likely.
	Rainfall:	Average to above.
Ruamāhanga	**Temperature:**	Average to above. Early cold spells and frosts likely.
	Rainfall:	Below average east of the ranges.
Wairarapa Coast	**Temperature:**	Average to above. Early cold spells likely.
	Rainfall:	Below average.

*Whaituas are the whole catchment areas (https://www.gw.govt.nz/environment/freshwater/protecting-the-waters-of-your-area/).

Refer also to the drought monitor for our catchments: https://www.gw.govt.nz/environment/environmental-data-hub/climate-monitoring/drought-check/

Appendix 1 – Seasonal temperature and wind anomalies for selected stations

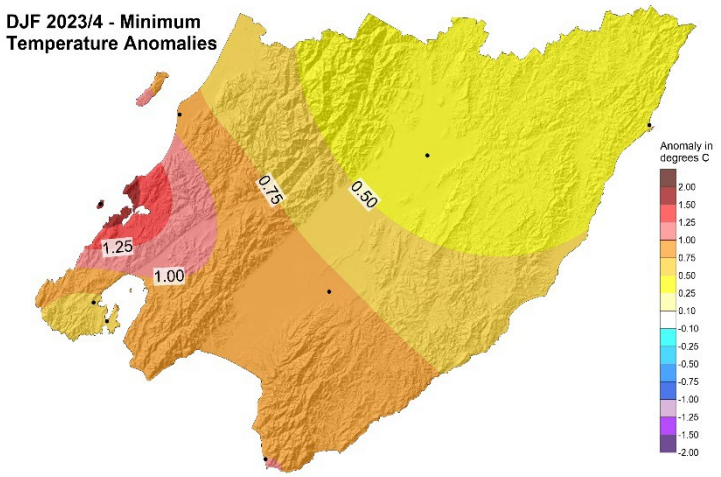
Dec-Jan-Feb 2023-24	Min T	Max T
Castlepoint	**0.5**	**1.2**
Kelburn	**0.7**	**0.6**
Masterton	**0.3**	**1.1**
Ngawi	**1.0**	**1.4**
Paraparaumu	**0.9**	**0.9**
Wellington Airport	**0.7**	**1.3**
Martinborough	**0.8**	**1.5**
Mana Island	**1.2**	**1.2**

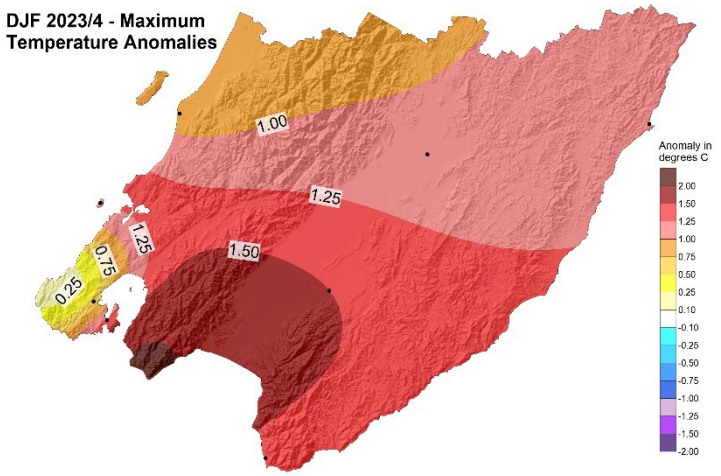
Table 1: Temperature anomalies (°C) for summer (DJF) 2023-2024 relative to the 1991-2020 climatology. Significant positive and negative anomalies (greater than 0.5°C magnitude) are highlighted in red (warmer than average) and blue (colder than average).

Dec-Jan-Feb 2023-24	Wind %
Castlepoint	**1.3**
Masterton	**-5.6**
Ngawi	**9.6**
Paraparaumu	**-3.6**
Wellington Airport	**3.5**
Martinborough	**4.5**
Baring Head	**3.1**

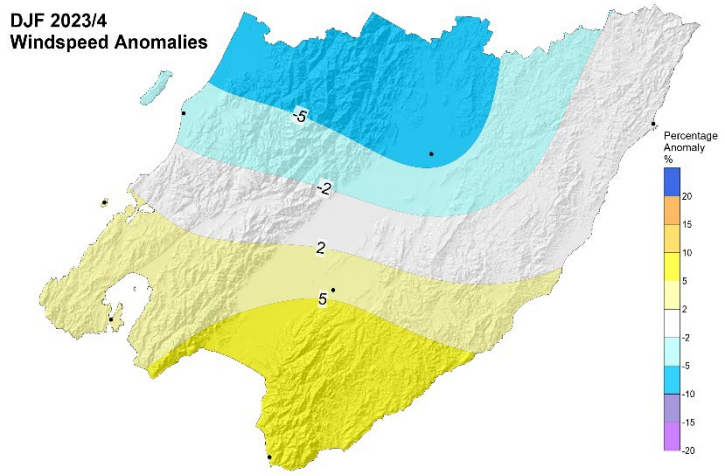
Table 2: Wind anomalies (%) for summer (DJF) 2023-2024 relative to the 1981-2010 climatology. Significant positive and negative anomalies (greater than 5%) are highlighted in red (calmer than average) and blue (windier than average).

Appendix 2 - Seasonal anomaly maps relative to the long-term average (1991-2020)

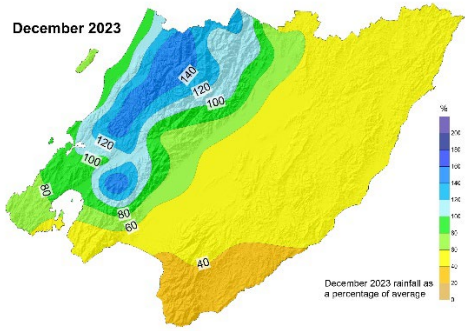


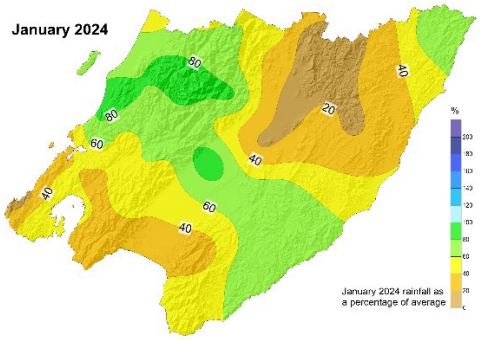


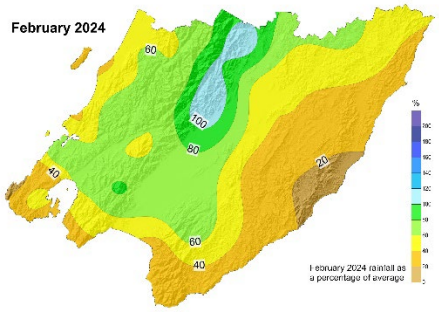
Min and Max Temperature anomalies (°C)

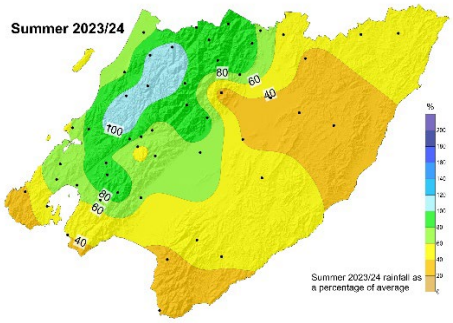


Wind anomalies (%)









Rainfall anomalies (%)

GWRC's climate science tools

- **Seasonal climate hub**
  https://www.gw.govt.nz/environment/environmental-data-hub/climate-monitoring/

- **Daily climate maps**
  https://graphs.gw.govt.nz/envmon/daily-climate-maps?view=rainfall-table

- **Drought Monitor**
  https://www.gw.govt.nz/environment/environmental-data-hub/climate-monitoring/drought-check/

- **Climate change impacts (reports and mapping tools)**
  https://www.gw.govt.nz/environment/climate-change/impacts-on-our-region/