Greater Wellington
Te Pane Matua Taiao

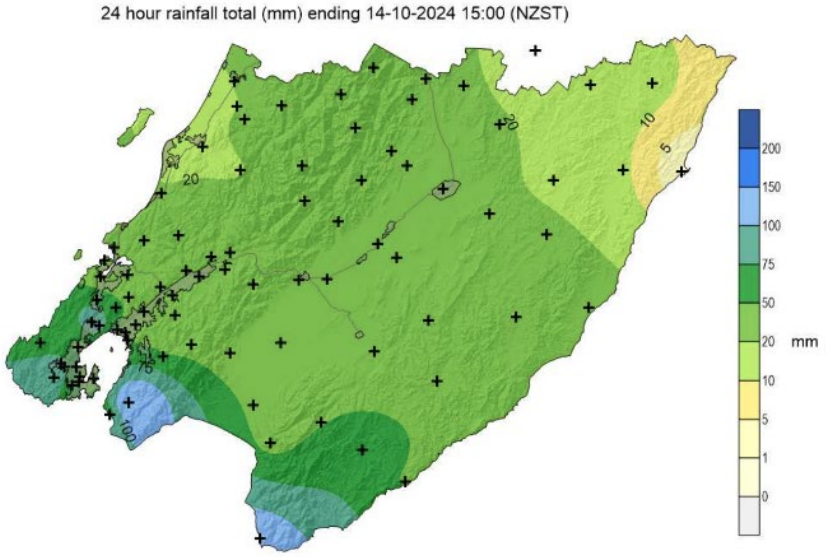
Climate drivers and seasonal outlook for the Wellington Region

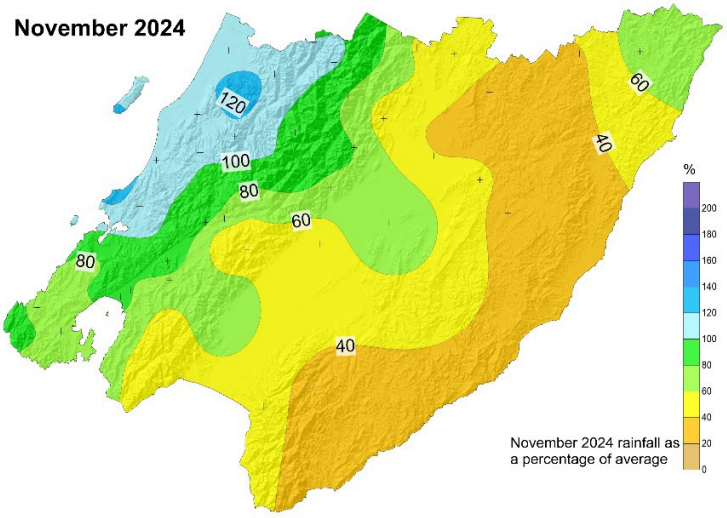
Spring 2024 summary

Summer 2024-2025 outlook

Release date: 19 December 2024

Knowledge and Insights





A very heavy rainfall day for the southern part of the region around mid-October (greater than 100 mm in 24 hours, upper panel) largely contrasted with a dry November (bottom map), where most of the rainfall was confined to the Kāpiti coast under a strong westerly flow. Source: GWRC.

Overview

Spring 2024

Spring 2024 was the warmest on record for Wellington and Paraparaumu, with data available since 1928 for Wellington and since 1953 for the Kāpiti Coast. Various warm nighttime records were also broken west of the ranges. Even though the mean seasonal wind was slightly below average, a persistent period of severe westerly flow produced an impressive 118km/h inland in Martinborough on 7 September, the second highest wind gust since records began in 2001. The total accumulated seasonal rainfall was near average around the capital, above average for the Kāpiti Coast and largely below average for most of the Wairarapa, with only about 50% of the normal spring rain falling in parts of the east coast. As a result, the eastern Wairarapa was classed as extremely dry by mid-December with potential to escalate further into the new year, before the synoptic flow reverses in response to the weak La Niña footprint.

Climate drivers

The overall climate drivers are slowly starting to point towards a weak La Niña signature, with marine heatwaves already forming locally around Australia and New Zealand in December. This pattern tends to work in synergy with La Niñas and could be a prelude to a circulation shift to humid northeasterly flows in the new year, especially as the warm season advances. An analysis of past historical La Niñas in our region shows that it is not uncommon for summers to start very dry, and then shift to a wet pattern as the seasonal progresses.

Climate outlook for summer 2024-2025

Most international climate models are predicting a significantly hotter than average warm season, with New Zealand already surrounded by near record warm oceanic waters at the start of the season. It is expected that the synoptic flow will shift towards predominantly humid north-easterlies as summer advances, and the influences of a La Niña signature start to be felt. We are expecting the Wairarapa to be initially very dry, but likely shifting to a wetter north-easterly flow as the season progresses. For the west of the range, rainfall is expected to be about average. There is a high likelihood of extreme weather events and thunderstorms developing as the season progresses, with an increased chance of tropical influences such as atmospheric rivers or ex-tropical cyclones, impacting our region towards late summer and autumn.

Contents

1. Climate drivers

1.1 El Niño – Southern Oscillation (ENSO)

The ensemble projections of the Australian climate model below show that borderline La Niña conditions are expected to continue through summer. At this stage, there is no clear indication that the event will officially meet the thresholds, even though most international climate models suggest that the atmospheric circulation will shift to a La Niña flow at some point as the warm season progresses.

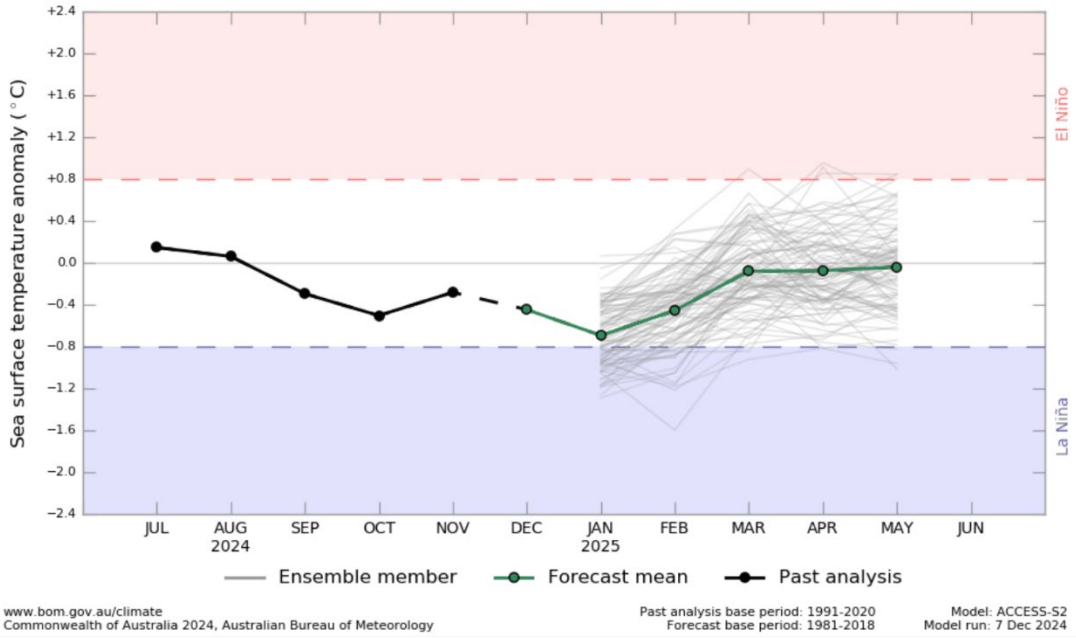


Figure 1.1: Average modelled projections (in green) show that the ENSO phenomenon is expected to briefly turn borderline La Niña before going back to neutral in autumn. Source: Australian Bureau of Meteorology.

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 8 December 2024.

The overall pattern shows an emerging La Niña signature, with a cold tongue now extending well into the central Equatorial Pacific. Meanwhile, the oceans are progressively warming around New Zealand with marine heatwave conditions already established as of mid-December. The local marine heatwaves tend to enhance the odds of an eventual north-easterly pattern. If this happens as predicted, it will be a large contrast to the beginning of summer, which was mostly dominated by a strong westerly flow with very dry conditions in the Wairarapa.

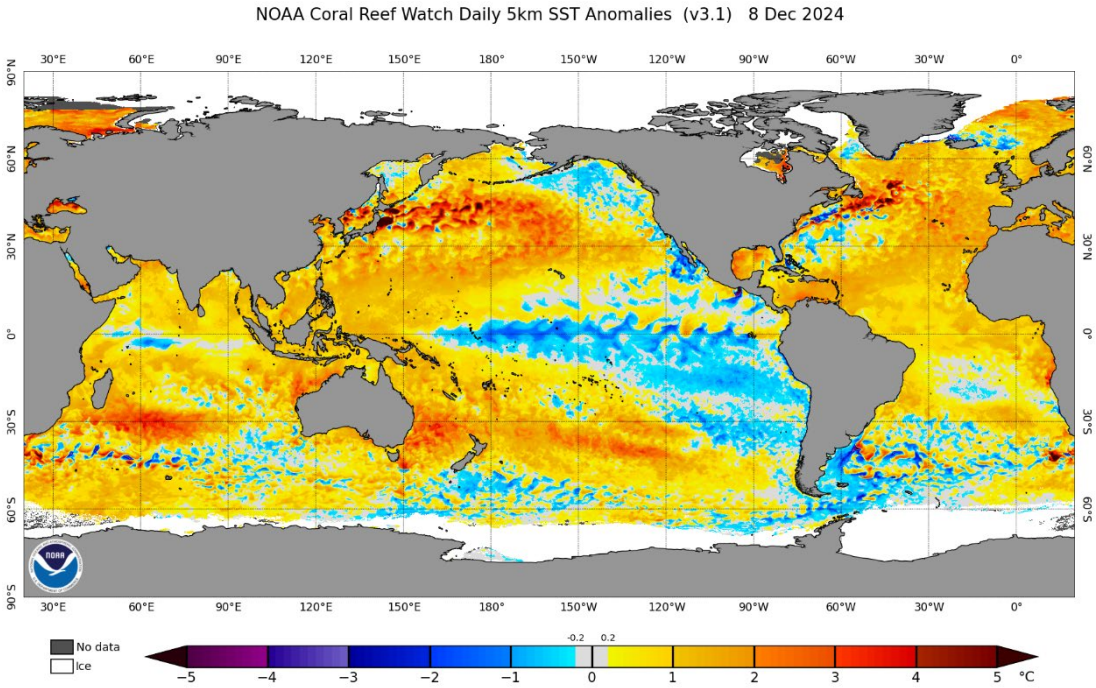


Figure 1.2: Sea Surface Temperature (SST) anomalies as of 8 December 2024. Sea ice coverage is shown in white. The Equatorial Pacific (ENSO) shows an emerging La Niña, leading to warmer water temperature anomalies with marine heatwaves around New Zealand. Sea Ice Extent (in white) reached very low levels very similar to last year. 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 oscillating wildly for most of the second half of the year, without a clear preferred pattern of action. Figure 1.3 shows that the spring average sea level pressure pattern anomaly was characterised by persistent high pressure north and east of New Zealand. For the most part, this pattern helped keep the polar air away from the country, with enhanced north-westerly flow.

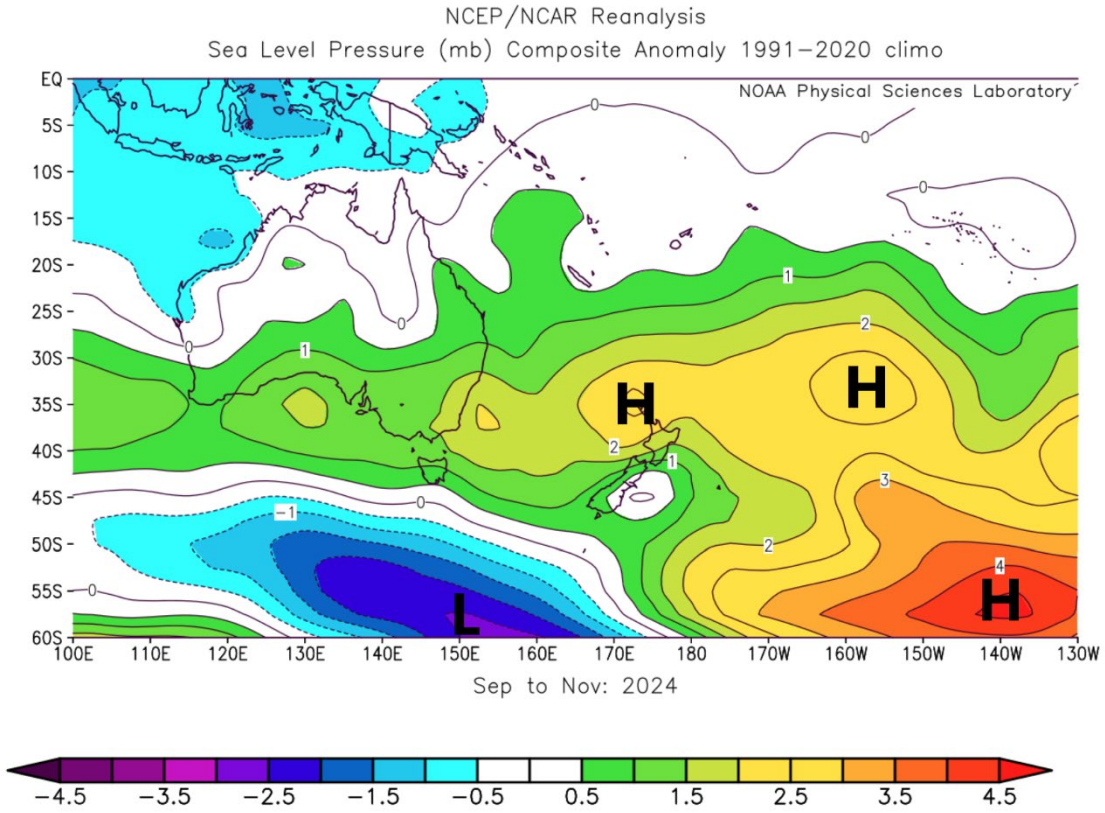


Figure 1.3: Mean sea level pressure anomaly map (hPa) for spring 2024. The 'H' indicates the centre of the anomalous high pressures affecting the atmospheric flow around and east of New Zealand. This pattern helped create enhanced north-westerly flow, with wet conditions west of the ranges and dry in the Wairarapa. 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 yet.

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.

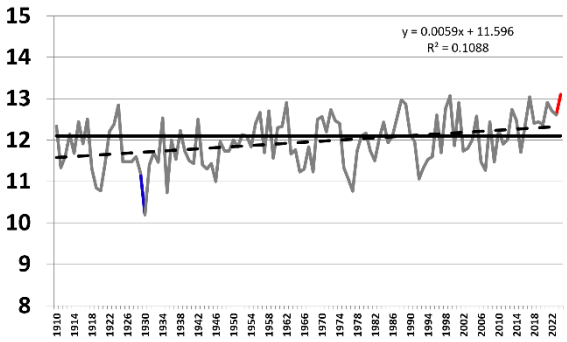
An analysis of linear trends associated with climate change is plotted onto the graph only when the trends are statistically different from zero at the 99% confidence level.

The climate change and variability summary for spring 2024 is as follows:

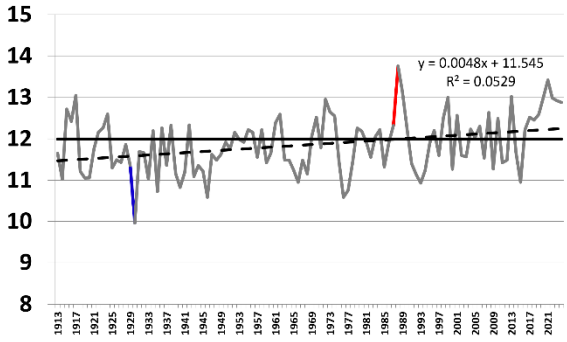
- Statistically significant trends are seen only for temperature and wind, meaning that spring is getting warmer and less windy due to ongoing climate change. The long-term historical warming trend is about 0.7 degrees per century for Wellington and 0.5 degrees per century for Masterton. It is also worth noting that spring is the season with the least amount of historical warming, compared to other seasons;
- Spring 2024 was the warmest on record in Wellington, and warmer than normal in the Wairarapa;
- Sunshine hours were near to above average for Wellington and more on the lower end for Wairarapa (where records are still too short for a 30-year climatology);
- Seasonal average wind speed was below average for both Wellington and Wairarapa;
- Total seasonal rainfall was near average for Wellington and below average for the Wairarapa;

- Total seasonal rain days were near average for Wellington and below average for the Wairarapa.

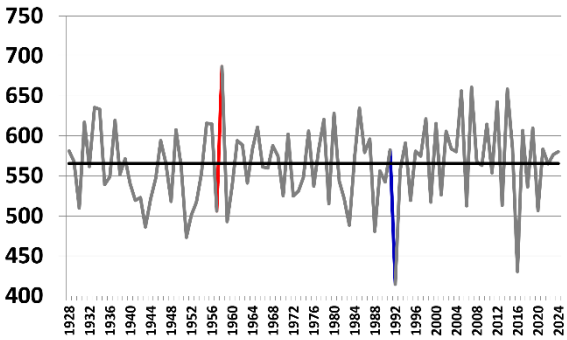
Spring Mean Temperature (deg C) - Kelburn (1910-2024)



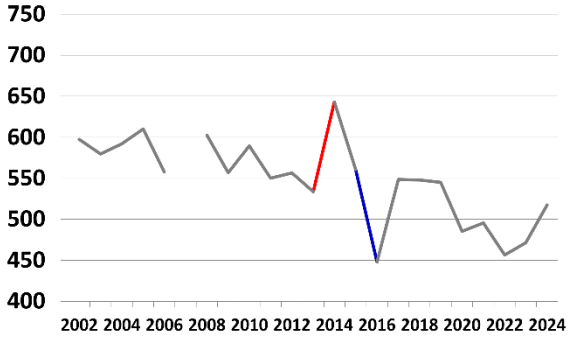
Spring Mean Temperature (deg C) - Masterton (1913-2024)



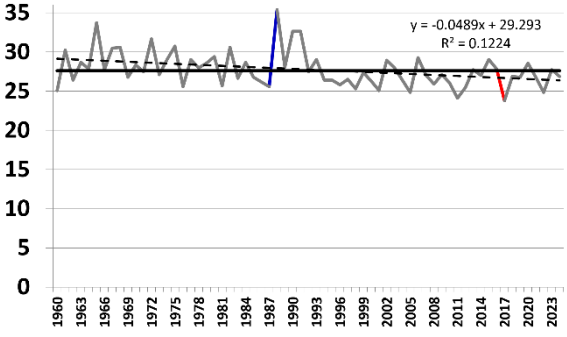
Spring Total Sunshine Hours - Kelburn (1928-2024)



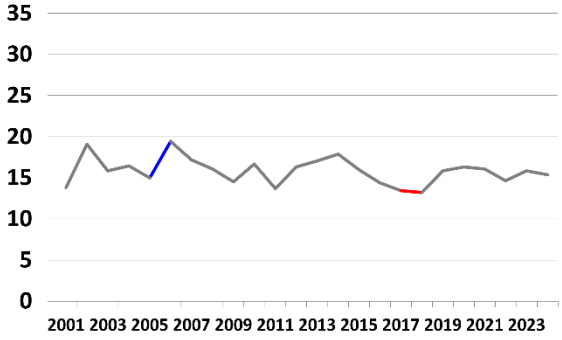
Spring Total Sunshine Hours - Martinborough (2002-2024)



Spring Mean Wind (km/h) - Wellington Airport (1960-2024)



Spring Mean Wind (km/h) - Martinborough (2001-2024)



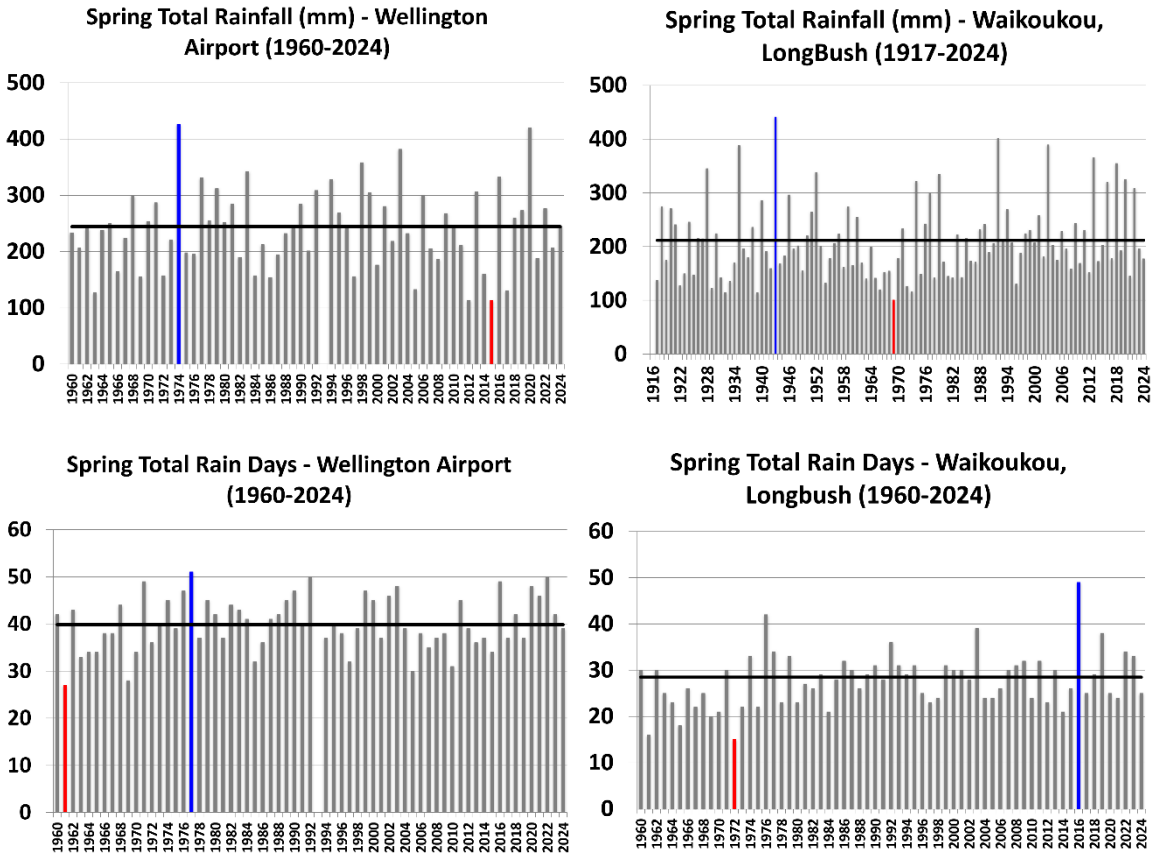


Figure 2.1: Climate change and variability graphs for spring in Wellington and the Wairarapa. The thick horizontal line shows the 1981-2010 average (where available), and the dashed line shows the linear trend. Trends are plotted only when statistically significant at 99% confidence level. For all graphs, 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.

2.2 Seasonal Outlook

- Weak La Niña signature, with increasing chance of marine heatwaves and humid north-easterly flow as summer advances, extending into autumn
- Significantly warmer than the historical average
- Higher likelihood of thunderstorms and ex-tropical cyclone impacting later in the season
- Seasonal rainfall: initially very dry in the east Wairarapa but changing towards a wet easterly flow as the season advances. Likelihood of heavy rainfall events increases towards mid-to-late-summer, and early autumn

Whaitua*	Variables	Climate outlook for summer 2024-2025*
Wellington Harbour & Hutt Valley	**Temperature:**	Significantly warmer than average.
	Rainfall:	About average, with irregular distribution. High chance of extreme rainfall events late in the season
Te Awarua-o-Porirua	**Temperature:**	Significantly warmer than average.
	Rainfall:	About average, with irregular distribution. High chance of extreme rainfall events late in the season
Kāpiti Coast	**Temperature:**	Significantly warmer than average.
	Rainfall:	About average, with irregular distribution. High chance of extreme rainfall events late in the season
Ruamāhanga	**Temperature:**	Significantly warmer than average.
	Rainfall:	Well below average initially but changing to wet as the season advances. Easterly events and subtropical influences increase late summer to autumn.
Wairarapa Coast	**Temperature:**	Significantly warmer than average.
	Rainfall:	Well below average but wetter as the season advances. Easterly events and subtropical influences increase late summer to autumn.

*Whaitua 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

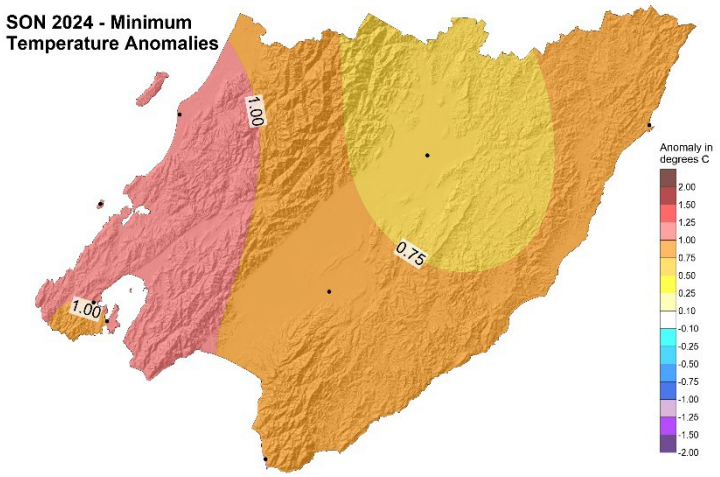
Table 1: Temperature anomalies (°C) for spring (SON) 2024 relative to the 1991-2020 climatology. Significant positive and negative anomalies (greater than 0.5°C magnitude) are highlighted in red (warmer than average) or blue (colder than average).

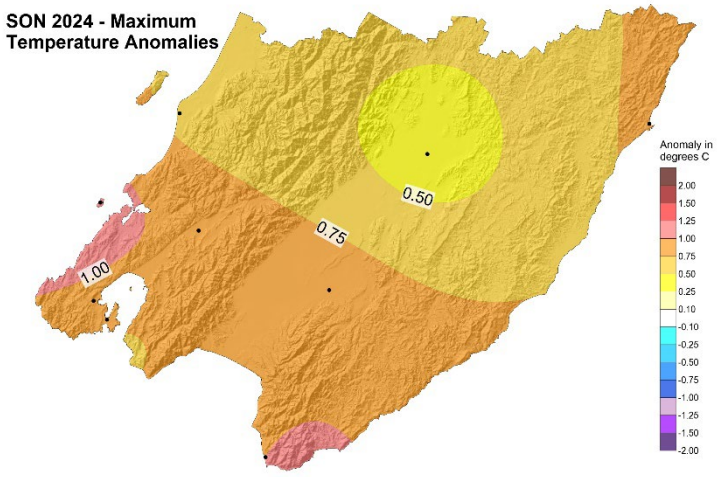
Sep-Oct-Nov 2024	Min T	Max T
Castlepoint	0.9	0.8
Kelburn	1.0	1.9
Masterton	0.6	0.4
Ngawi	1.0	1.0
Paraparaumu	1.2	0.7
Wellington Airport	1.0	0.8
Martinborough	0.9	0.9
Mana Island	1.1	1.1

Table 2: Wind anomalies (%) for spring (SON) 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).

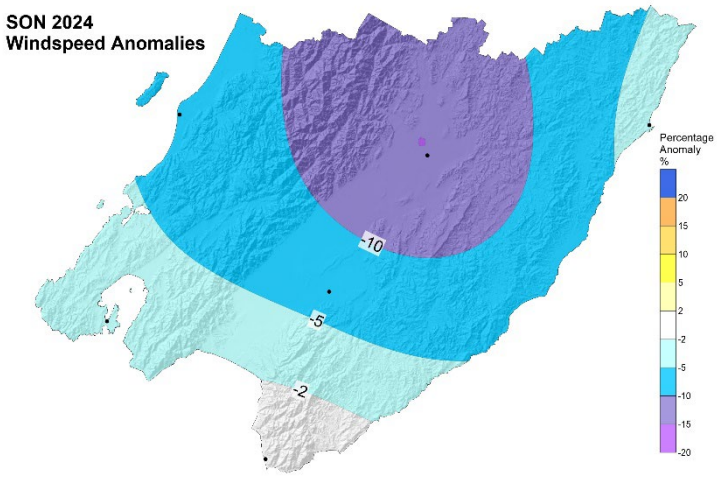
Sep-Oct-Nov 2024	Wind %
Castlepoint	-3.4
Masterton	-13.9
Ngawi	0.5
Paraparaumu	-6.1
Wellington Airport	-3.4
Martinborough	-6.7

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

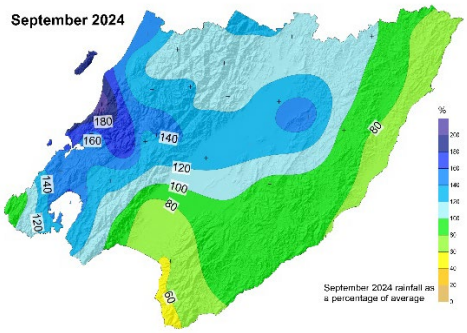


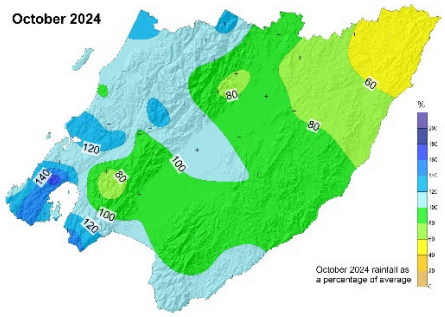


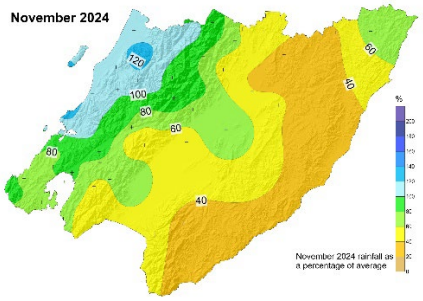
Min and Max Temperature anomalies (°C)

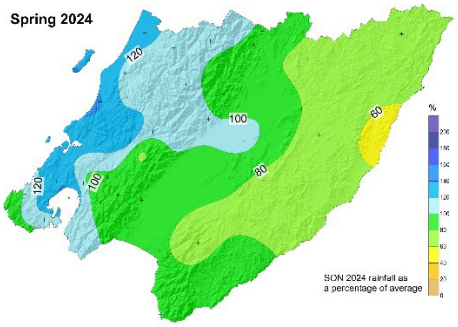


Wind anomalies (%)









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/