Greater Wellington
Te Pane Matua Taiao

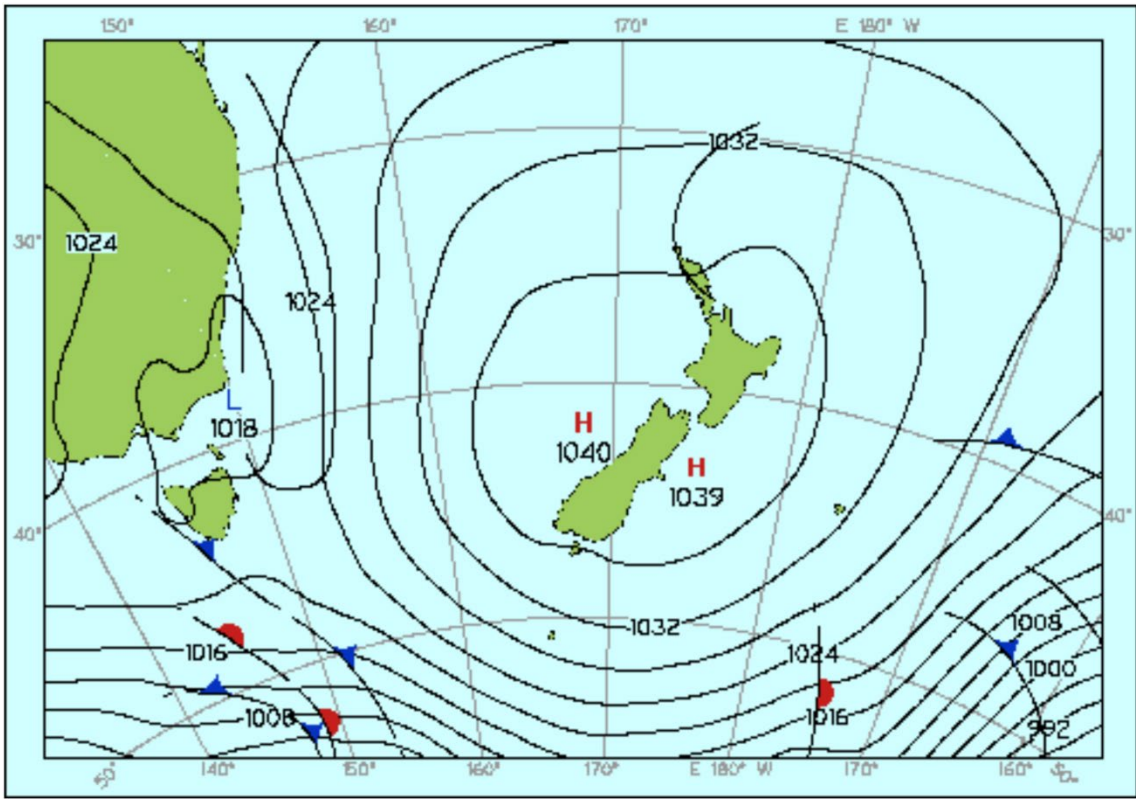
Climate drivers and seasonal outlook for the Wellington Region

Winter 2024 summary

Spring 2024 outlook

Release date: 23 September 2024

Knowledge and Insights



A very strong high-pressure cell enveloped the entire country on 9 July, bringing severe winter frosts in many areas. In the Wairarapa, the morning of 10 July was the coldest of the year, with -4.4 ^{o}C recorded in Masterton. The map shows the mean sea level pressure at 12pm on 9 July 2024. Most of the country was also cloud free at the time. Source: MetService.

Overview

Winter 2024

Winter 2024 was significantly warmer than the long-term average, with the Kāpiti Coast measuring the second warmest winter on record for measurements since 1953. Thanks to a large blocking high pressure area east of New Zealand, the synoptic flow was predominantly from the north. While this anomalous set up prevented major polar incursions from Antarctica, the lack of winds associated with this winter's flow led to significant frosts. The total accumulated seasonal rainfall was above average for the Kāpiti Coast and parts of the Wairarapa, which helped ameliorate the dryness remaining from the El Niño summer. Even so, the Wairarapa will need a consistent spring recharge to prevent the dryness reoccurring. August had a major recovery over the Tararua Range with more than double the long-term rainfall and floods on the Kāpiti Coast, where the monthly totals were the second highest on record (measurements since 1945).

Climate drivers

While ENSO has been neutral, the winter flow responded primarily to a positive SAM, with warm waters around New Zealand. This has led to suppressed westerly fronts until later in August, when a brief *Sudden Stratospheric Warming* event led to a negative SAM, and an influx of sub-polar air into the country. While this condition settles, a new La Niña is expected to develop during spring, potentially driving the formation of marine heatwaves with a more prominent north-easterly flow later in the year.

Climate outlook for spring 2024

Considering the very complex set up of the climate drivers, we will continue to experience a period with mixed signals driving our local climate anomalies. Spring temperatures should be warmer than average, with increasing likelihood of early heatwaves forming this year, possibly developing together with marine heatwaves. Total seasonal rainfall should be near or below average for the most part, except on the Kāpiti Coast where there is a stronger signal for positive anomalies. Dry conditions could re-develop over the Wairarapa, but the likelihood of easterly events and inland thunderstorms should increase later in the season as La Niña develops. While the main driver for warmer temperature anomalies is more certain, there is low confidence for the rainfall totals.

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 form during spring. At this stage, there is no indication that the event will be very strong. However, as global warming tends to amplify the La Niña signal around New Zealand, it is likely that our coming summer will be significantly impacted. This will be discussed in the final seasonal report of the year due in December, once we have more certainty on the likely developments.

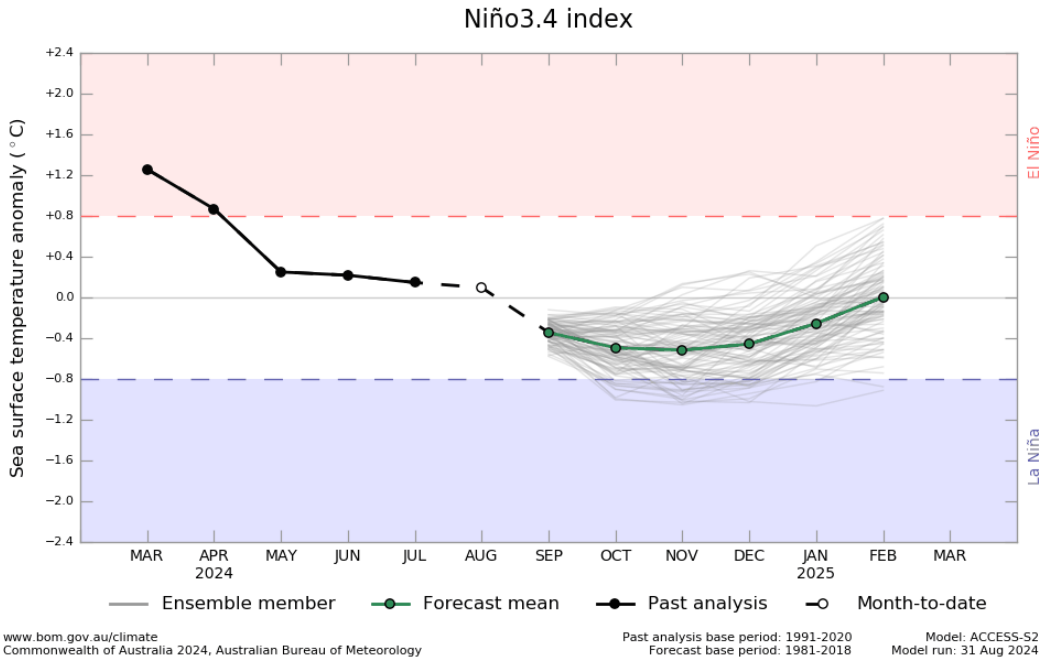


Figure 1.1: Average modelled projections (in green) show that the ENSO phenomenon is expected to turn towards La Niña during spring. Source: Australian Bureau of Meteorology.

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 4 September 2024.

The overall pattern shows an emerging La Niña, with a cold tongue now extending well into the central Equatorial Pacific. Meanwhile, the oceans are progressively warming north of New Zealand (relative to normal), which could be a prelude to marine heatwaves later in the year. The SIE (in white) remains significantly below average.

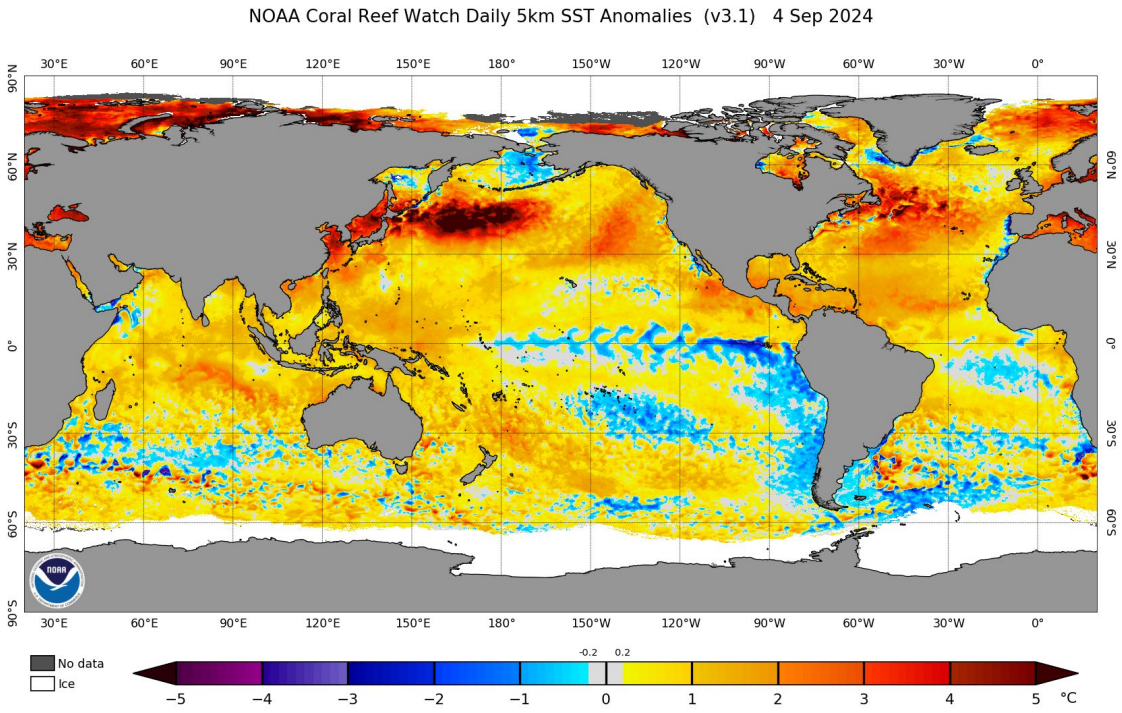


Figure 1.2: Sea Surface Temperature (SST) anomalies as of 4 September 2024. Sea ice coverage is shown in white. The Equatorial Pacific (ENSO) shows an emerging La Niña, leading to warmer water temperature anomalies around New Zealand. This combination could possibly lead to the return of marine heatwaves later this year. Once again, the Sea Ice Extent (in white) reached very low levels at the end of the season, like 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 around normal since the end of autumn, even though it went briefly very negative in the second part of August because of a mild *Sudden Stratospheric Warming* event. This event helped explain the displacement of the polar vortex of very cold air around Antarctica, with unsettled weather affecting both New Zealand and southern South America in August.

Figure 1.3 shows that the winter average sea level pressure pattern was characterised by an anomalous high pressure southeast of New Zealand. For the most part, this pattern helped keep the polar air away from the country, creating an anomalous northeasterly flow which at times resembled a La Niña pattern.

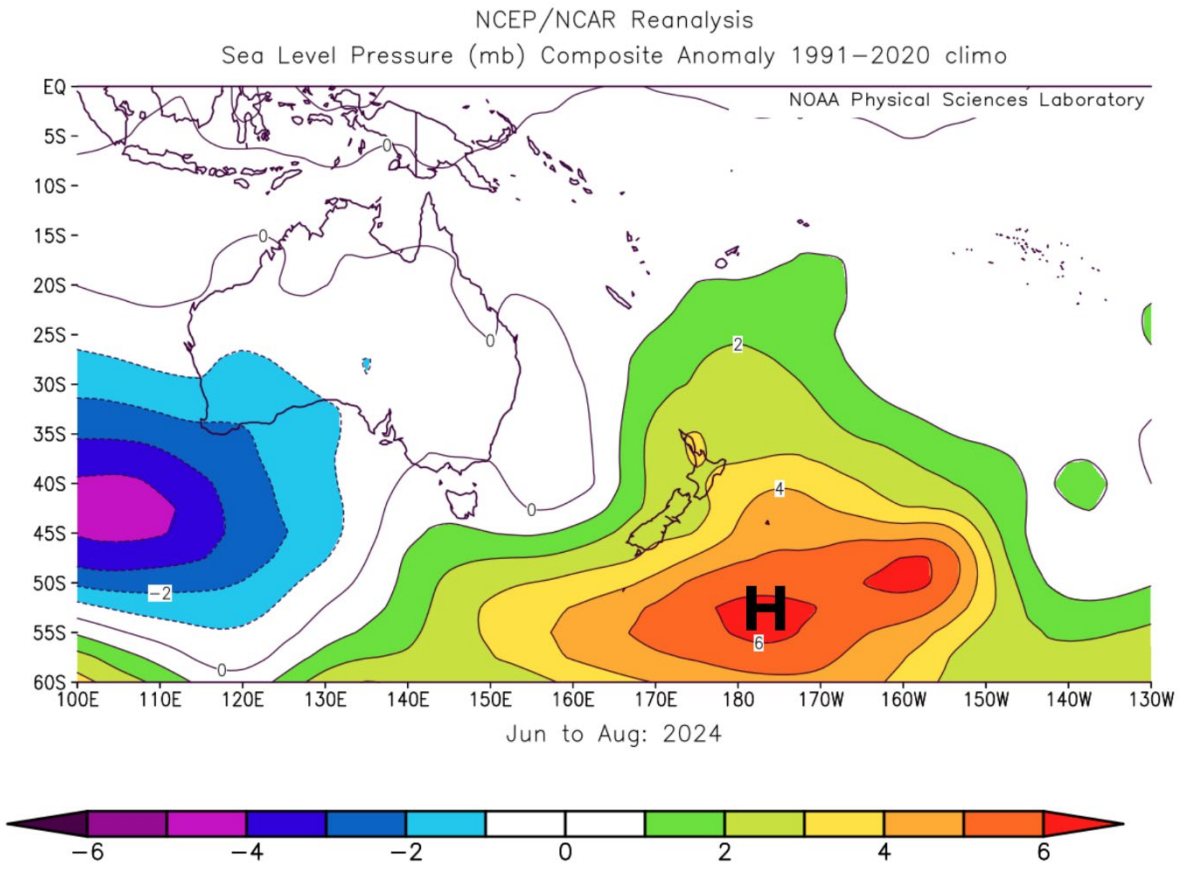


Figure 1.3: Mean sea level pressure anomaly map (hPa) for winter 2024. The 'H' indicates the centre of the anomalous high pressures affecting the atmospheric flow around New Zealand. This pattern helped create enhanced northeasterlies, keeping the typical winter polar air mostly away from New Zealand. 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.

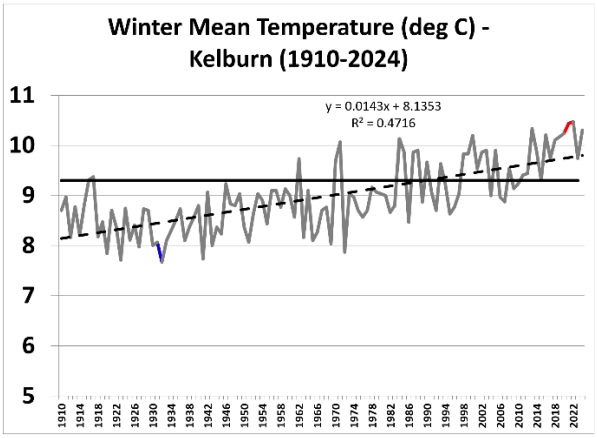
The key climate variables shown are mean temperature, total sunshine hours, mean wind, total rainfall and total number of rain days (above 0.1 mm). Temperature measurements go back to the 1910s, allowing for a meaningful analysis of climate change trends. Most other variables also have long periods of 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.

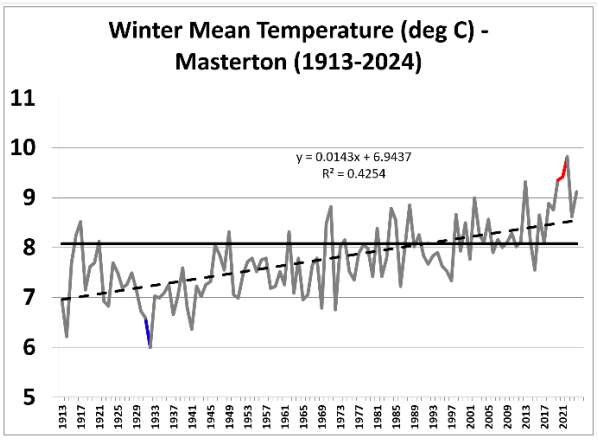
The red and blue bars show the extreme years of the entire measurement period. Red indicates seasons that were warmer, drier, sunnier and less windy than average (i.e., extreme hot/dry), and blue indicates seasons that were colder, wetter, cloudier and windier than average (i.e., extreme cold/wet). The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

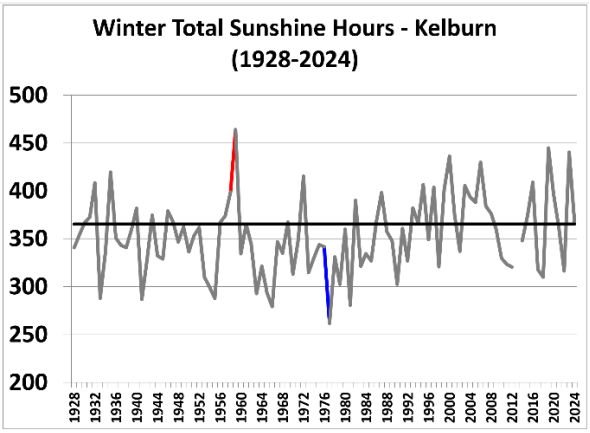
An analysis of linear trends associated with climate change is plotted onto the graph only when the trends are statistically different from zero at the 99% confidence level.

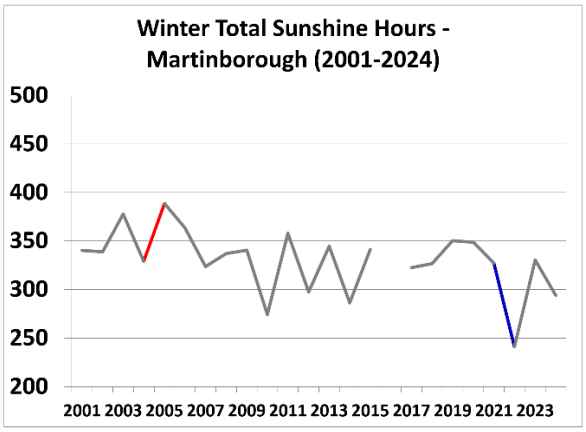
The climate change and variability summary for winter 2024 is as follows:

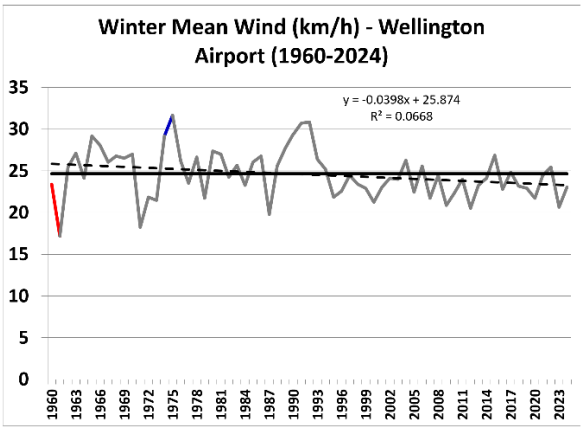
- Statistically significant trends are seen only for temperature and wind, meaning that winter is getting warmer and less windy due to ongoing climate change. The long-term warming trend is about 1.4 degrees per century for both Wellington and Masterton;
- Winter 2024 temperatures were significantly warmer than normal for both Wellington and Wairarapa;
- Sunshine hours were about 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 above average for the Wairarapa;
- Total seasonal rain days were near average for both Wellington and Wairarapa.

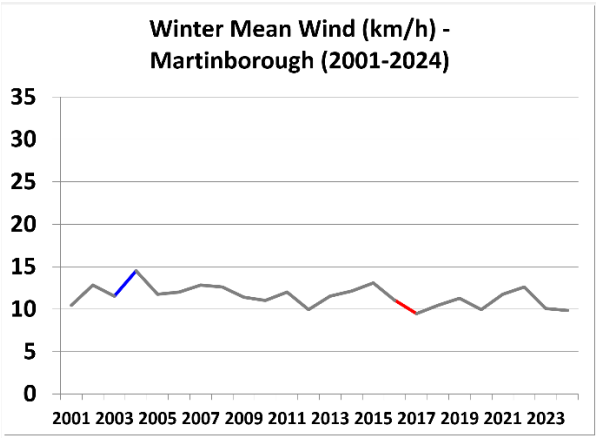

Winter Mean Temperature (deg C) - Kelburn (1910-2024)
y = 0.0143x + 8.1353
R² = 0.4716


Winter Mean Temperature (deg C) - Masterton (1913-2024)
y = 0.0143x + 6.9437
R² = 0.4254


Winter Total Sunshine Hours - Kelburn (1928-2024)


Winter Total Sunshine Hours - Martinborough (2001-2024)


Winter Mean Wind (km/h) - Wellington Airport (1960-2024)
y = -0.0398x + 25.874
R² = 0.0668


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

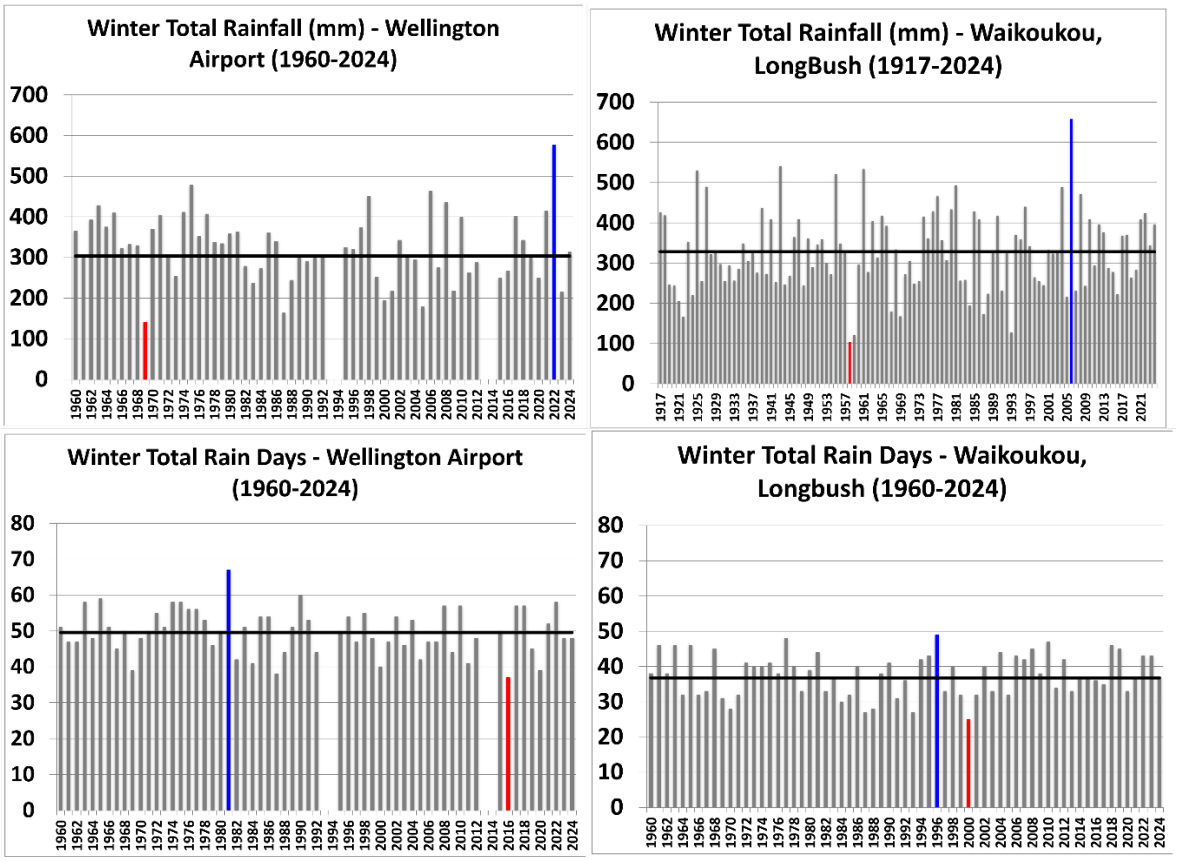


Figure 2.1: Climate change and variability graphs for winter in Wellington and the Wairarapa. The thick horizontal line shows the 1981-2010 average (where available), and the dashed line shows the linear trend. Trends are plotted only when statistically significant at 99% confidence level. For all graphs,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

- Emerging La Niña, with increasing chance of marine heatwaves and humid north-easterly flow towards the end of the year.
- Warmer than long-term average.
- Vigorous spring westerlies first but progressing to a more north-easterly La Niña flow.
- Seasonal rainfall normal to above in the west, and likely below average initially in the Wairarapa. Likelihood of easterly rainfall events increases later in the season

Whaitua*	Variables	Climate outlook for spring 2024*
Wellington Harbour & Hutt Valley	**Temperature:**	Warmer than average.
	Rainfall:	Near average, with irregular distribution. High chance of extreme rainfall events
Te Awarua-o-Porirua	**Temperature:**	Warmer than average.
	Rainfall:	Near average, with irregular distribution. High chance of extreme rainfall events
Kāpiti Coast	**Temperature:**	Warmer than average.
	Rainfall:	Near or above average. High chance of extreme rainfall events
Ruamāhanga	**Temperature:**	Warmer than average.
	Rainfall:	Near or below average, with irregular distribution. Chance of easterly events increasing later in the year
Wairarapa Coast	**Temperature:**	Warmer than average.
	Rainfall:	Near or below average, with irregular distribution. Chance of easterly events increasing later in the year

*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

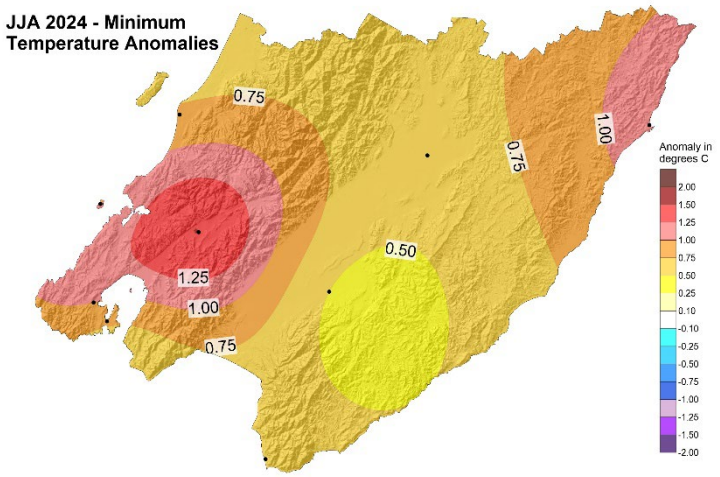
Jun-Jul-Aug 2024	Min T	Max T
Castlepoint	1.1	1.2
Kelburn	1.0	0.6
Masterton	0.6	0.6
Ngawi	0.6	1.0
Paraparaumu	0.8	0.8
Wellington Airport	0.8	0.7
Martinborough	0.5	1.3
Mana Island	1.0	1.0

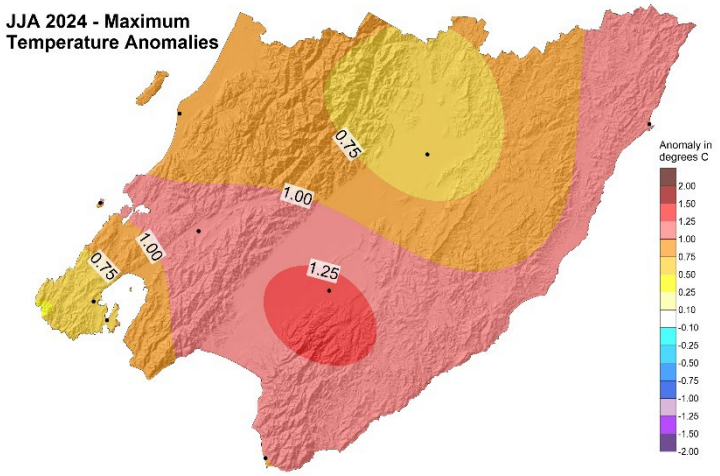
Table 1: Temperature anomalies (°C) for winter (JJA) 2024 relative to the 1991-2020 climatology. Significant positive and negative anomalies (greater than 0.5°C magnitude) are highlighted in red (warmer than average) and blue (colder than average).

Jun-Jul-Aug 2024	Wind %
Castlepoint	-5.3
Masterton	-15.3
Ngawi	-7.1
Paraparaumu	-10.4
Wellington Airport	-6.6
Martinborough	-17.3
Baring Head	-8.6

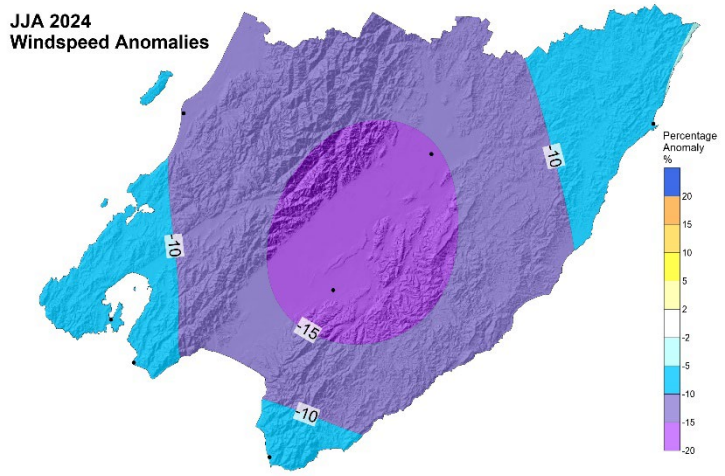
Table 2: Wind anomalies (%) for winter (JJA) 2024 relative to the 1981-2010 climatology. Significant positive and negative anomalies (greater than 5%) are highlighted in red (calmer than average) and blue (windier than average).

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

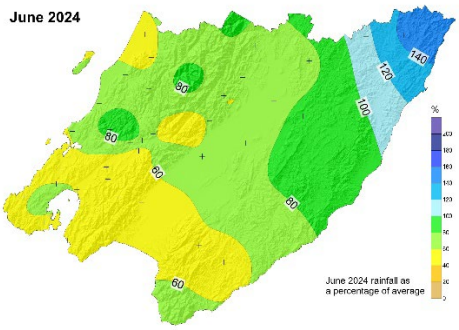


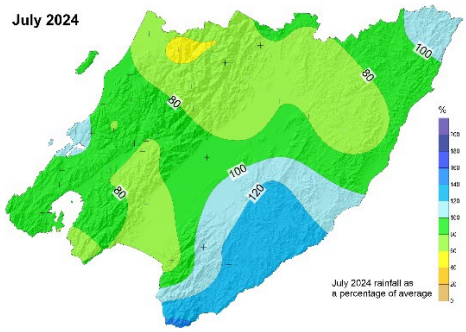


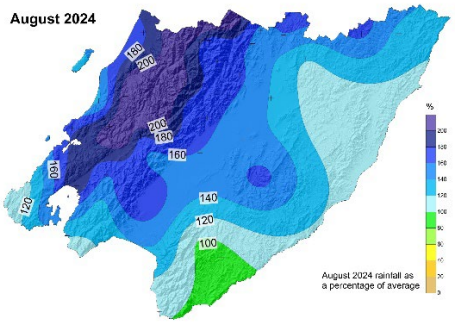
Min and Max Temperature anomalies (°C)

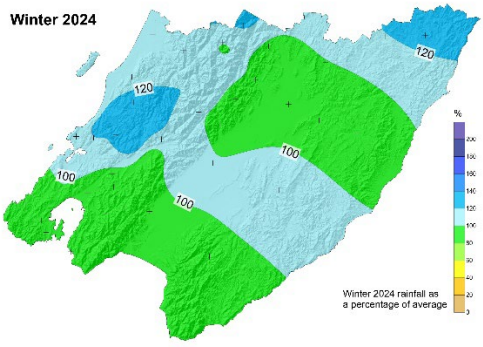


Wind anomalies (%)









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/