

## Dry for northern North Island, wet for much of South Island

|                      |   |
|----------------------|---|
| <b>Rainfall</b>      | Rainfall was well below normal (<50% of normal) for much of Northland, Auckland, Coromandel Peninsula, and Bay of Plenty. Below normal rainfall (50-79% of normal) was observed in much of Waikato, East Cape, Gisborne and coastal parts of northern Taranaki. Above normal (120-149% of normal) or well above normal (>149% of normal) rainfall was observed in much of the South Island and the southern North Island including Southland, western and central Otago, north Canterbury, the northern West Coast, Wellington, Wairarapa, the Kapiti Coast and Manawatu-Whanganui. Rainfall was typically below normal for easternmost parts of the South Island from Christchurch to Dunedin. |
| <b>Temperature</b>   | Temperatures were near average ( $\pm 0.50^{\circ}\text{C}$ of average) for most of the country. Temperatures were above average ( $0.51^{\circ}\text{C}$ to $1.2^{\circ}\text{C}$ above average) in eastern parts of Otago, Canterbury, Hawke's Bay and Gisborne, as well as northern parts of Tasman and Marlborough.   |
| <b>Soil Moisture</b> | As of 1 October, soil moisture was lower than normal for eastern parts of Otago and Canterbury from Dunedin to Christchurch, as well as parts of Northland, Auckland, coastal Bay of Plenty and East Cape. Soil moisture was considerably lower than normal in North Otago and South Canterbury – these areas were categorised as “Dry” or “Very Dry” according to NIWA’s New Zealand Drought Index. Soil moisture was higher than normal in parts of western Otago and eastern Marlborough. Soil moisture was typically near normal for remaining areas of New Zealand.  |

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### Overview

September 2020 was characterised by higher than normal mean sea level pressure over the northern North Island and the Tasman Sea, with lower than normal pressures to the southeast of New Zealand. This pressure set up resulted in a westerly airflow anomaly across the country (i.e. more westerly winds than normal). The prevalence of high pressure over the northern North Island suppressed rainfall, resulting in a very dry month for that area of the country. September rainfall was well below normal (<50% of normal) for much of Northland, Auckland, Coromandel Peninsula and Bay of Plenty. Rainfall was below normal (50-79% of normal) for much of Waikato, coastal parts of northern Taranaki, East Cape and Gisborne. It was also a dry month along parts of the east coast of the South Island, which were sheltered from the prevailing westerly winds by the inland mountain ranges. Rainfall was well below normal in Dunedin, and below normal (50-79% of normal) for other easternmost areas of Otago and Canterbury as far north as Christchurch. In contrast, it was a wet September for

southwestern parts of the North and South Islands, and much of the inland and northern portions of the South Island. Rainfall was above normal (120-149% of normal) or well above normal (>149% of normal) for Southland, western and central Otago, north Canterbury, the northern West Coast, Wellington, Wairarapa, the Kapiti Coast and Manawatu-Whanganui. Remaining parts of New Zealand typically experienced near normal (80-119% of normal) rainfall totals for the month.

September temperatures were near average (-0.50 to +0.50°C of average) for most of the country. The exception was eastern parts of Otago, Canterbury, Hawke's Bay and Gisborne where temperatures were above average (0.51°C to 1.20°C above average). These areas were located to the lee of the inland mountain ranges given the prevailing westerly winds, and the mild temperatures were likely a result of the Foehn effect (when air warms and dries as once it passes over elevated terrain).

September temperatures were also above average for northern parts of Tasman and Marlborough. It was an especially warm month in Banks Peninsula, Motueka and Wairoa where September temperatures were well above average (>1.20°C above average). Overall, the nationwide average temperature in September 2020 was 11.0°C. This was 0.5°C above the 1981-2010 September average, making it New Zealand's seventeenth-warmest September since NIWA's seven station temperature series began in 1909. It has now been 44 consecutive months since New Zealand's nationwide average temperature was below average.

#### Further Highlights:

- The highest temperature was 25.5°C, observed at Hanmer Forest on 23 September.
- The lowest temperature was -7.5°C, observed at Middlemarch on 2 September.
- The highest 1-day rainfall was 239 mm, recorded at Milford Sound on 13 September.
- The highest wind gust was 187 km/h, observed at Cape Turnagain on 14 September.
- Of the six main centres in September 2020, Auckland was the warmest, Dunedin was the driest, Christchurch was the sunniest and coldest, Wellington was the wettest and Hamilton was the least sunny.
- Of the available, regularly reporting sunshine observation sites, the sunniest four regions in 2020 so far are Bay of Plenty (1972 hours), Wider Nelson (1958 hours), Marlborough (1939 hours) and Taranaki (1905 hours).

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## **Rainfall: Near-record dry for parts of the northern North Island**

It was a particularly dry month for much of Northland, Auckland and the Bay of Plenty where several locations observed near-record low September rainfall totals. Rainfall was much lower than normal in Northland, which continues the exceptionally variable pattern of monthly rainfall totals observed in the region this year. In Kerikeri, monthly rainfall has been near normal (within 20% of normal) for just two of the nine months so far this year. However, rainfall deficits from the four drier than normal months (January, February, April and September) have been offset by the three wetter than usual

months (May, July and August), such that Kerikeri’s year-to-date rainfall total (1,321 mm) is only 3% lower than normal.

New Zealand’s wettest location relative to normal was Lauder, where 52 mm of rainfall was recorded (224% of normal). It was also very wet month in Milford Sound, which recorded 1000 mm of rainfall (181% of normal). Although both locations observed a similar rainfall anomaly (i.e., difference from normal), the absolute difference in September rainfall at the two locations (948 mm) demonstrates the incredible precipitation gradients created by the Southern Alps. For context, the distance between Milford Sound and Lauder is approximately the same as the distance between Auckland and Tauranga.

**Record<sup>1</sup> or near-record September rainfall totals were recorded at:**

| Location                            | Rainfall total (mm) | Percentage of normal | Year records began | Comments    |
|-------------------------------------|---------------------|----------------------|--------------------|-------------|
| <b>High records or near-records</b> |                     |                      |                    |             |
| Manapouri (West Arm Jetty)          | 740                 | 239                  | 1971               | 2nd-highest |
| Manapouri                           | 210                 | 198                  | 1961               | 3rd-highest |
| Tiwai Point                         | 161                 | 187                  | 1970               | 3rd-highest |
| Dannevirke                          | 166                 | 186                  | 1951               | 4th-highest |
| <b>Low records or near-records</b>  |                     |                      |                    |             |
| Kaikohe                             | 42                  | 34                   | 1956               | 2nd-lowest  |
| Auckland (Whenuapai)                | 37                  | 36                   | 1943               | 2nd-lowest  |
| Auckland (Western Springs)          | 39                  | 37                   | 1948               | 2nd-lowest  |
| Te Puke                             | 48                  | 38                   | 1973               | 2nd-lowest  |
| Kerikeri                            | 46                  | 28                   | 1935               | 3rd-lowest  |
| Whangarei                           | 36                  | 27                   | 1937               | 3rd-lowest  |
| Leigh                               | 38                  | 40                   | 1966               | 3rd-lowest  |
| Auckland (North Shore)              | 47                  | 45                   | 1966               | 3rd-lowest  |
| Tauranga                            | 28                  | 33                   | 1898               | 3rd-lowest  |
| Auckland (Mangere)                  | 43                  | 45                   | 1959               | 3rd-lowest  |
| Whitianga                           | 65                  | 38                   | 1961               | 4th-lowest  |
| Whakatane                           | 33                  | 35                   | 1952               | 4th-lowest  |

**Temperature: Mostly near average, above average in eastern parts**

Le Bons Bay was New Zealand’s warmest location relative to average: the mean temperature (11.4°C) was 2.2°C higher than average. The country’s coldest location relative to average was Cromwell (8.1°C, 0.8°C lower than average). Many eastern locations observed a larger diurnal range than usual (i.e. higher daily maximum and lower daily minimum temperatures compared to average), indicating clear skies featured during the month. This was confirmed by sunshine data: Napier, Blenheim, Cheviot, Winchmore and Rangiora each observed their highest September sunshine totals on record.

<sup>1</sup> The rankings (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>.etc) in all Tables in this summary are relative to climate data from a *group* of nearby stations, some of which may no longer be operating. The current climate value is compared against all values from any member of the group, without any regard for homogeneity between one station’s record, and another. This approach is used due to the practical limitations of performing homogeneity checks in real-time.

**Record or near-record mean air temperatures for September were recorded at:**

| Location                            | Mean air temp. (°C) | Departure from normal (°C) | Year records began | Comments    |
|-------------------------------------|---------------------|----------------------------|--------------------|-------------|
| <b>High records or near-records</b> |                     |                            |                    |             |
| Farewell Spit                       | 13.6                | 1.8                        | 1971               | Highest     |
| Le Bons Bay                         | 11.4                | 2.2                        | 1984               | Highest     |
| Motueka                             | 11.8                | 1.5                        | 1956               | 2nd-highest |
| Wairoa                              | 13.4                | 1.5                        | 1964               | 3rd-highest |
| Cheviot                             | 10.2                | 0.7                        | 1982               | 3rd-highest |
| Akaroa                              | 11.7                | 1.3                        | 1978               | 3rd-highest |
| Gisborne                            | 13.6                | 1.7                        | 1905               | 4th-highest |
| <b>Low records or near-records</b>  |                     |                            |                    |             |
| None observed                       |                     |                            |                    |             |

**Record or near-record mean maximum air temperatures for September were recorded at:**

| Location                            | Mean maximum air temp. (°C) | Departure from normal (°C) | Year records began | Comments    |
|-------------------------------------|-----------------------------|----------------------------|--------------------|-------------|
| <b>High records or near-records</b> |                             |                            |                    |             |
| Farewell Spit                       | 17.9                        | 2.5                        | 1971               | Highest     |
| Motueka                             | 18.2                        | 2.5                        | 1956               | Highest     |
| Le Bons Bay                         | 15.9                        | 3.5                        | 1984               | Highest     |
| Whangarei                           | 18.5                        | 1.0                        | 1967               | 2nd-highest |
| Waipawa                             | 17.1                        | 1.8                        | 1945               | 2nd-highest |
| Cheviot                             | 16.3                        | 1.2                        | 1982               | 2nd-highest |
| Whitianga                           | 18.0                        | 1.2                        | 1962               | 3rd-highest |
| Gisborne                            | 18.7                        | 1.7                        | 1905               | 3rd-highest |
| Wairoa                              | 19.1                        | 2.2                        | 1964               | 3rd-highest |
| Takaka                              | 17.1                        | 1.3                        | 1978               | 3rd-highest |
| Leigh                               | 18.2                        | 1.8                        | 1966               | 4th-highest |
| <b>Low records or near-records</b>  |                             |                            |                    |             |
| None observed                       |                             |                            |                    |             |

**Record or near-record mean minimum air temperatures for September were recorded at:**

| Location                            | Mean minimum air temp. (°C) | Departure from normal (°C) | Year records began | Comments    |
|-------------------------------------|-----------------------------|----------------------------|--------------------|-------------|
| <b>High records or near-records</b> |                             |                            |                    |             |
| Le Bons Bay                         | 7.0                         | 1.0                        | 1984               | 3rd-highest |
| Ngawi                               | 10.4                        | 0.8                        | 1972               | 4th-highest |
| Medbury                             | 4.4                         | 1.8                        | 1927               | 4th-highest |
| <b>Low records or near-records</b>  |                             |                            |                    |             |
| None observed                       |                             |                            |                    |             |

## September climate in the six main centres

Of the six main centres in September 2020, Auckland was the warmest, Dunedin was the driest, Christchurch was the sunniest and coldest, Wellington was the wettest and Hamilton was the least sunny. It was a particularly windy month in Wellington, where the mean wind speed (measured at Kelburn) was 24.8 km/h. This was Wellington's highest monthly mean wind speed since October 2009, when the mean wind speed was 25.2 km/h. It was Christchurch's sunniest September on record, exceeding its previous sunniest September by 39.7 hours. The Garden City observed more sunshine during September than it normally records in December (220 hours) and January (238 hours), a remarkable feat given the difference in daylight hours between September and December/January. Dunedin observed a bitterly cold day on 29 September with weather conditions akin to a ski field: from 9 a.m. to 2 p.m. the mean temperature was just 0.9°C, with wind gusts reaching 73.8 km/h and frequent snow showers passing through the city.

### September 2020 main centre climate statistics:

| Temperature               |                  |                            |   |
|---------------------------|------------------|----------------------------|---|
| Location                  | Mean temp. (°C)  | Departure from normal (°C) | Comments                                |
| Auckland <sup>a</sup>     | 13.1             | +0.1                       | Near average                            |
| Tauranga <sup>b</sup>     | 12.9             | +0.5                       | Near average                            |
| Hamilton <sup>c</sup>     | 11.4             | +0.1                       | Near average                            |
| Wellington <sup>d</sup>   | 10.9             | +0.1                       | Near average                            |
| Christchurch <sup>e</sup> | 9.9              | +0.5                       | Near average                            |
| Dunedin <sup>f</sup>      | 10.2             | +0.7                       | Above average                           |
| Rainfall                  |                  |                            |   |
| Location                  | Rainfall (mm)    | % of normal                | Comments                                |
| Auckland <sup>a</sup>     | 43               | 45                         | Well below normal. 3rd-lowest on record |
| Tauranga <sup>b</sup>     | 28               | 33                         | Well below normal. 3rd-lowest on record |
| Hamilton <sup>c</sup>     | 72               | 71                         | Below normal                            |
| Wellington <sup>d</sup>   | 196              | 200                        | Well above normal                       |
| Christchurch <sup>e</sup> | 35               | 86                         | Near normal                             |
| Dunedin <sup>f</sup>      | 23               | 48                         | Well below normal                       |
| Sunshine                  |                  |                            |   |
| Location                  | Sunshine (hours) |                            |   |
| Auckland <sup>a</sup>     | 186              |                            |   |
| Tauranga <sup>b</sup>     | 217              |                            |   |
| Hamilton <sup>g</sup>     | 167              |                            |   |
| Wellington <sup>d</sup>   | 196              |                            |   |
| Christchurch <sup>e</sup> | 260              |                            |   |
| Dunedin <sup>f</sup>      | 185              |                            |   |

<sup>a</sup> Mangere <sup>b</sup> Tauranga Airport <sup>c</sup> Hamilton Airport <sup>d</sup> Kelburn <sup>e</sup> Christchurch Airport <sup>f</sup> Musselburgh <sup>g</sup> Ruakura

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## Highlights and extreme events

### Temperatures

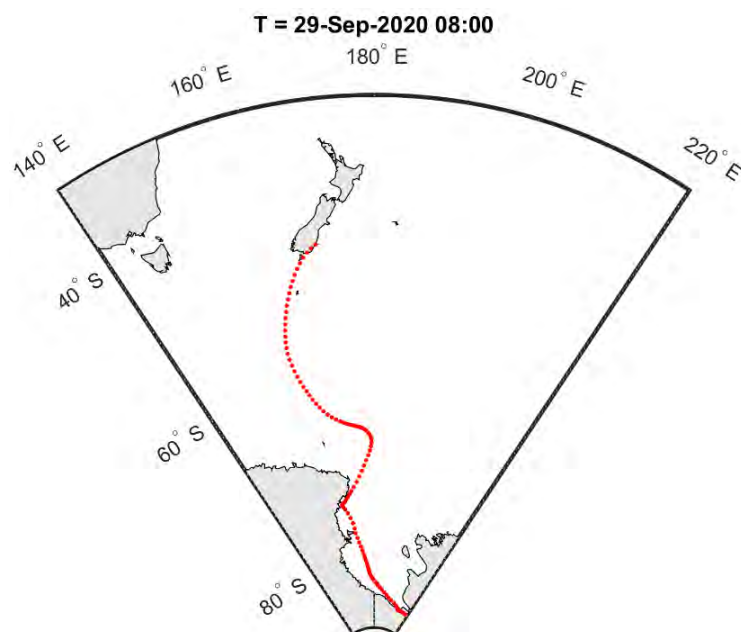
On 1 September, several South Island locations observed near-record low September daily maximum temperatures. The cold temperatures resulted from a southerly front that delivered snow to relatively low elevations.

On 12 September, clear skies and light winds following the passage of a cold front allowed a heavy frost to develop in many parts of the South Island. Christchurch Airport recorded a minimum temperature of  $-4.7^{\circ}\text{C}$ ; the city's second-lowest September temperature since records began in 1863.

From 23-27 September, a warm northerly airflow covered much of New Zealand, with numerous locations observing record or near-record high daily minimum and maximum temperatures.

From 28-30 September, a bitterly cold southerly outbreak brought unseasonably low temperatures to many parts of the South Island. The coldest air of the system passed over during 29 September, when several locations observed record or near-record low daily maximum temperatures for September.

The prevalence of negative air temperatures at many low elevation coastal locations on 29 September indicates that the free air freezing level was situated at around sea level (0 m elevation), which is particularly impressive given the time of year. The air was so cold as it was sourced from Antarctica, and travelled on a relatively direct path towards New Zealand (Figure 1). The southerly airflow was established by a very deep low pressure system in the Southern Ocean, with central air pressures as low as 938 hPa. This system met the criteria of a "bomb cyclone" as it strengthened at a pace of  $\geq 24$  hPa in 24 hours. The cold air temperatures combined with strong winds resulted in severe wind chill factors, which created stress for livestock, and meant it felt much colder than the measured air temperature. At Nugget Point between 9-10 a.m., the lowest temperature was  $-1.1^{\circ}\text{C}$  and the maximum wind gust was 137.1 km/h, resulting in a "feels like" temperature as low as  $-13.5^{\circ}\text{C}$ .



**Figure 1.** HYSPLIT trajectory output for 8 a.m. 29 September 2020 (NZDT) out to -120 hours. The red-dotted trace indicates the 5-day track of the airmass that started over Antarctica at 8 a.m. on 24 September 2020, and arrived over Dunedin at 8 a.m. on 29 September 2020. Data credit: NOAA Air Resources Laboratory. Image credit: Todd Redpath.

On a given day (24-hour period) at New Zealand locations, the lowest daily temperatures observed typically occur overnight under clear skies and light winds. Remarkably, this wasn't the case for several low elevation locations on 29 September, where lowest daily temperatures were observed near the middle of the day. Locations where this occurred included Dunedin (Musselburgh; -0.2°C between 10-11 a.m.), Balclutha (-0.7°C between 12-1 p.m.) and Tiwai Point (-1.5°C between 10-11 a.m.). Perhaps most notably, Nugget Point recorded its lowest ever September temperature of -1.4°C between 11 a.m. and midday.

Several Canterbury locations observed near-record low minimum temperatures on 30 September during the early morning hours. Christchurch recorded a minimum temperature of -4.8°C, the equal-lowest September temperature ever observed in the city. A temperature of -4.8°C was also recorded at Christchurch Gardens in September 1919. As noted previously, temperature records at Christchurch began in 1863.

The highest temperature was 25.5°C, observed at Hanmer Forest on 23 September. The lowest temperature was -7.5°C, observed at Middlemarch on 2 September.

**Record or near-record daily maximum air temperatures for September were recorded at:**

| Location                            | Extreme maximum (°C) | Date of extreme temperature | Year records began | Comments          |
|-------------------------------------|----------------------|-----------------------------|--------------------|-------------------|
| <b>High records or near-records</b> |                      |                             |                    |                   |
| Cheviot                             | 25.2                 | 23rd                        | 1982               | Highest           |
| Le Bons Bay                         | 24.1                 | 17th                        | 1984               | Highest           |
| Dargaville                          | 23.8                 | 26th                        | 1943               | 2nd-highest       |
| Whangaparaoa                        | 21.5                 | 23rd                        | 1982               | 2nd-highest       |
| Whangarei                           | 23.5                 | 26th                        | 1967               | 3rd-highest       |
| Akaroa                              | 25.2                 | 23rd                        | 1978               | 3rd-highest       |
| Hamilton (Ruakura)                  | 22.3                 | 26th                        | 1906               | Equal 3rd-highest |
| Whakatu                             | 25.3                 | 22nd                        | 1965               | 4th-highest       |
| Farewell Spit                       | 19.9                 | 24th                        | 1971               | 4th-highest       |
| <b>Low records or near-records</b>  |                      |                             |                    |                   |
| Secretary Island                    | 6.0                  | 28th                        | 1989               | Lowest            |
| Puysegur Point                      | 6.2                  | 28th                        | 1978               | Lowest            |
| Dunedin (Airport)                   | 5.2                  | 29th                        | 1972               | Lowest            |
| Manapouri (West Arm Jetty)          | 1.9                  | 28th                        | 1972               | Lowest            |
| Alexandra                           | 4.6                  | 29th                        | 1930               | Lowest            |
| Clyde                               | 5.7                  | 29th                        | 1978               | Equal lowest      |
| Mt Cook (Airport)                   | 0.4                  | 1st                         | 1929               | 2nd-lowest        |
| Rangiora                            | 6.2                  | 1st                         | 1972               | 2nd-lowest        |
| Oamaru                              | 6.8                  | 29th                        | 1972               | 2nd-lowest        |
| Balclutha                           | 4.6                  | 29th                        | 1972               | 2nd-lowest        |
| Nugget Point                        | 3.2                  | 29th                        | 1972               | 2nd-lowest        |
| Westport                            | 9.4                  | 29th                        | 1966               | Equal 2nd-lowest  |
| Waiau                               | 5.6                  | 1st                         | 1974               | Equal 2nd-lowest  |
| Roxburgh                            | 5.3                  | 28th                        | 1950               | Equal 2nd-lowest  |
| Cheviot                             | 6.4                  | 1st                         | 1982               | 3rd-lowest        |



|              |     |      |      |                  |
|--------------|-----|------|------|------------------|
| Waipara West | 6.1 | 1st  | 1973 | 3rd-lowest       |
| Five Rivers  | 3.8 | 29th | 1982 | 3rd-lowest       |
| Gore         | 2.8 | 29th | 1907 | 3rd-lowest       |
| Tiwai Point  | 6.3 | 28th | 1972 | Equal 3rd-lowest |
| Culverden    | 4.8 | 1st  | 1930 | 4th-lowest       |
| Te Anau      | 4.5 | 28th | 1973 | 4th-lowest       |
| Lumsden      | 4.5 | 29th | 1982 | 4th-lowest       |
| Cromwell     | 5.7 | 1st  | 1949 | 4th-lowest       |

Record or near-record daily minimum air temperatures for September were recorded at:

| Location                            | Extreme minimum (°C) | Date of extreme temperature | Year records began | Comments          |
|-------------------------------------|----------------------|-----------------------------|--------------------|-------------------|
| <b>High records or near-records</b> |                      |                             |                    |                   |
| Hastings                            | 16.0                 | 27th                        | 1972               | Highest           |
| Waiouru                             | 10.7                 | 24th                        | 1972               | Highest           |
| Le Bons Bay                         | 15.4                 | 23rd                        | 1984               | Highest           |
| Cape Reinga                         | 14.8                 | 27th                        | 1971               | Equal highest     |
| Kaitaia                             | 16.1                 | 27th                        | 1948               | 2nd-highest       |
| Whangarei                           | 16.8                 | 27th                        | 1967               | 2nd-highest       |
| Paeroa                              | 16.0                 | 27th                        | 1971               | 2nd-highest       |
| Napier                              | 16.8                 | 24th                        | 1940               | 2nd-highest       |
| Wairoa                              | 16.4                 | 27th                        | 1972               | 2nd-highest       |
| Porirua                             | 13.3                 | 24th                        | 1972               | 2nd-highest       |
| Hawera                              | 13.9                 | 27th                        | 1977               | 2nd-highest       |
| Motueka                             | 13.3                 | 27th                        | 1972               | 2nd-highest       |
| Lincoln                             | 14.2                 | 23rd                        | 1881               | 2nd-highest       |
| Tauranga                            | 15.8                 | 27th                        | 1941               | Equal 2nd-highest |
| Dargaville                          | 15.3                 | 27th                        | 1951               | 3rd-highest       |
| Port Taharoa                        | 14.8                 | 27th                        | 1974               | 3rd-highest       |
| Medbury                             | 14.5                 | 23rd                        | 1927               | 3rd-highest       |
| Waipawa                             | 12.7                 | 27th                        | 1945               | Equal 3rd-highest |
| Ohakune                             | 11.4                 | 27th                        | 1972               | Equal 3rd-highest |
| Hanmer Forest                       | 12.8                 | 23rd                        | 1972               | Equal 3rd-highest |
| Kaikohe                             | 15.1                 | 27th                        | 1973               | 4th-highest       |
| Warkworth                           | 15.5                 | 27th                        | 1966               | 4th-highest       |
| Te Puke                             | 14.8                 | 27th                        | 1973               | 4th-highest       |
| Ngawi                               | 15.2                 | 24th                        | 1972               | 4th-highest       |
| Whakatu                             | 15.1                 | 27th                        | 1972               | 4th-highest       |
| <b>Low records or near-records</b>  |                      |                             |                    |                   |
| Le Bons Bay                         | -0.9                 | 18th                        | 1984               | Lowest            |
| Nugget Point                        | -1.4                 | 30th                        | 1970               | Lowest            |
| Puysegur Point                      | 1.1                  | 29th                        | 1978               | Equal lowest      |
| Christchurch                        | -4.8                 | 30th                        | 1863               | Equal lowest      |
| Ohakune                             | -5.2                 | 4th                         | 1962               | 2nd-lowest        |
| Motu                                | -5.0                 | 13th                        | 1990               | Equal 2nd-lowest  |



|                   |      |      |      |                  |
|-------------------|------|------|------|------------------|
| Tiwai Point       | -1.5 | 30th | 1970 | Equal 2nd-lowest |
| Mt Cook (Airport) | -7.0 | 3rd  | 1929 | 3rd-lowest       |
| Te Kuiti          | -2.0 | 4th  | 1959 | Equal 3rd-lowest |
| Secretary Island  | 1.3  | 29th | 1985 | 4th-lowest       |
| Winchmore         | -4.7 | 30th | 1928 | 4th-lowest       |
| Lumsden           | -4.3 | 2nd  | 1982 | 4th-lowest       |
| Appleby           | -2.9 | 12th | 1932 | Equal 4th-lowest |
| Cheviot           | -3.6 | 30th | 1982 | Equal 4th-lowest |
| Rangiora          | -3.6 | 12th | 1965 | Equal 4th-lowest |

### Rain and slips

On 6 September, heavy rain caused a slip on SH6 through the lower Buller Gorge (between Westport and Inangahua), forcing the road to close temporarily.

On 18 September, several hours of heavy rain fell in the Wellington region. *Metlink* reported flooding in the Taita subway (Hutt Valley). Fire and Emergency crews reported responding to several call outs due to flooding.

On 26-27 September, heavy rain struck the Wellington region. Several roads were closed temporarily due to flooding and slips, including Grays Road between Plimmerton and Pauatahanui, Glenmore Street in Kelburn, Wainuiomata Hill, and Block Road adjacent to Hutt River. This was one of four heavy rainfall events observed in Wellington during the month. Overall, both climate stations at Kelburn and the Airport observed 200% of normal September rainfall.

The highest 1-day rainfall was 239 mm, recorded at Milford Sound on 13 September.

### Record or near-record September extreme 1-day rainfall totals were recorded at:

| Location                   | Extreme 1-day rainfall (mm) | Date of extreme rainfall | Year records began | Comments    |
|----------------------------|-----------------------------|--------------------------|--------------------|-------------|
| Stratford                  | 89                          | 26th                     | 1960               | 3rd-highest |
| Manapouri (West Arm Jetty) | 129                         | 13th                     | 1971               | 3rd-highest |
| South West Cape            | 36                          | 12th                     | 1991               | 3rd-highest |
| Upper Hutt (Trentham)      | 56                          | 26th                     | 1939               | 4th-highest |
| Milford Sound              | 239                         | 13th                     | 1929               | 4th-highest |

### Wind

On 9 September, strong winds hampered efforts to control a fire near Macraes (approximately 50 km north of Dunedin). The fire started had started as a controlled burn-off, but winds caused it to flare up and burn beyond its designated area.

On 18 September, strong winds occurred in Auckland. A shipping container truck travelling south on the Harbour Bridge was blown sideways causing structural damage to the bridge. By the end of September, lane closures remained in place to allow repair work.

On 23 September, strong northerly winds in Wellington caused the *East by West* ferry service to reduce sailings.

From 27-28 September, winds brought down trees in the Wellington region. Widespread power outages were reported in Wainuomata, Eastborne, Plimmerton Pukerua Bay, Judgeford, Tawa, Elsdon, Grenada North, Takapu Valley and Pauatahanui with approximately 2000 residents affected. Paraparaumu also experienced strong winds, with fences, trees, a shipping container and a shed blown over in and near Mazengarb Reserve and Kapiti Sports Turf and Pavilion.

On 29 September, more than 700 properties across the wider Whanganui region were without power after strong winds brought down trees onto powerlines. The Auckland Harbour Bridge was closed due to strong wind gusts. Four cars and a street light in Hamilton were crushed by a falling tree. Farther south, a fallen tree caused traffic delays in Little River (between Christchurch and Akaroa).

The highest wind gust was 187 km/h, observed at Cape Turnagain on 14 September.

**Record or near-record September extreme wind gusts were recorded at:**

| Location               | Extreme wind gust (km/h) | Date of extreme gust | Year records began | Comments          |
|------------------------|--------------------------|----------------------|--------------------|-------------------|
| Upper Hutt (Trentham)  | 98                       | 28th                 | 1999               | Highest           |
| Hawera                 | 104                      | 29th                 | 1986               | Highest           |
| Westport               | 120                      | 15th                 | 1973               | Highest           |
| Secretary Island       | 156                      | 26th                 | 1994               | Highest           |
| Palmerston North       | 96                       | 15th                 | 1991               | Equal highest     |
| Motu                   | 107                      | 27th                 | 1991               | 2nd-highest       |
| Levin                  | 95                       | 28th                 | 1971               | 2nd-highest       |
| Brothers Island        | 139                      | 28th                 | 1997               | 3rd-highest       |
| Farewell Spit          | 98                       | 28th                 | 1973               | Equal 3rd-highest |
| Reefton                | 57                       | 28th                 | 1999               | Equal 3rd-highest |
| Hanmer Forest          | 98                       | 17th                 | 1995               | 4th-highest       |
| Clyde                  | 74                       | 16th                 | 1983               | 4th-highest       |
| Turangi                | 89                       | 15th                 | 1973               | Equal 4th-highest |
| Mt Kaukau (Wellington) | 145                      | 27th                 | 1969               | Equal 4th-highest |

**Snow and ice**

On 1 September, snow fell to relatively low elevations throughout the South Island. Snow flurries were reported in parts of Ashburton and Timaru, with snow accumulations to the valley floor reported in several inland Southland, Otago and Canterbury locations including Kingston, Arrowtown, the Maniototo, Lake Tekapo and Castle Hill Village. The cold front delivered a welcome dump of fresh snow to ski areas which had suffered from a relative lack of snow during winter. Coronet Peak (near Queenstown) reported 25-40 cm of fresh snow, while farther north Craigieburn (Canterbury, north of Castle Hill Village) reported 42 cm of fresh snow. The snowfall provided relief to firefighters battling a large scrub fire near SH80 between Twizel and Mount Cook Village.

From 28-29 September, snow settled to sea level in Otago, Southland and Stewart Island (Figure 2). It was the most widespread low-elevation snowfall of the year to-date, with polar air drawn from Antarctica by a deep low pressure system in the Southern Ocean. There were widespread road closures in Southland and Otago, and snow also caused the closure of SH6 between Fox Glacier and Franz Josef Glacier. Approximately 50 cars and trucks were stranded on SH1 north of Balclutha due to

blizzard conditions, with police and council contractors called in to move the vehicles safely. Flights at Invercargill, Dunedin and Queenstown Airports were disrupted by snow on their runways and poor visibility. *The Remarkables* ski area reported up to 60 cm of fresh snow, and the snow density was relatively low due to very cold air temperatures associated with the snowfall. Snow also fell to low elevations in Nelson and Tasman, with several road closures including SH63 from Kawatiri to St Arnaud and Canaan Road (Takaka Hill).



**Figure 2.** Snow on the beach at Waldronville (near Dunedin) on 29 September 2020. Credit: Todd Redpath

### **Lightning and hail**

On 6 September, a late-afternoon southerly change generated several thunderstorms over parts of Canterbury, especially towards the eastern foothills. Heavy hail was reported in the town of Oxford, which blanketed the ground white. Fire and Emergency responded to several calls in Oxford where household roofs were leaking. At least 900 lightning strikes were recorded over the area between Methven and Amberley.

On 15 September, thunderstorms delivered at least 2000 lightning strikes over the South Island, especially about the West Coast.

On 27 September, an *Air New Zealand* flight travelling from Invercargill to Auckland was struck by lightning shortly after take-off.

In the early hours of 28 September, thunderstorms struck parts of Taranaki with heavy hail reported near Rahotu.

### **Cloud and fog**

On 21 September, early morning fog in Timaru caused flight delays at the local airport.

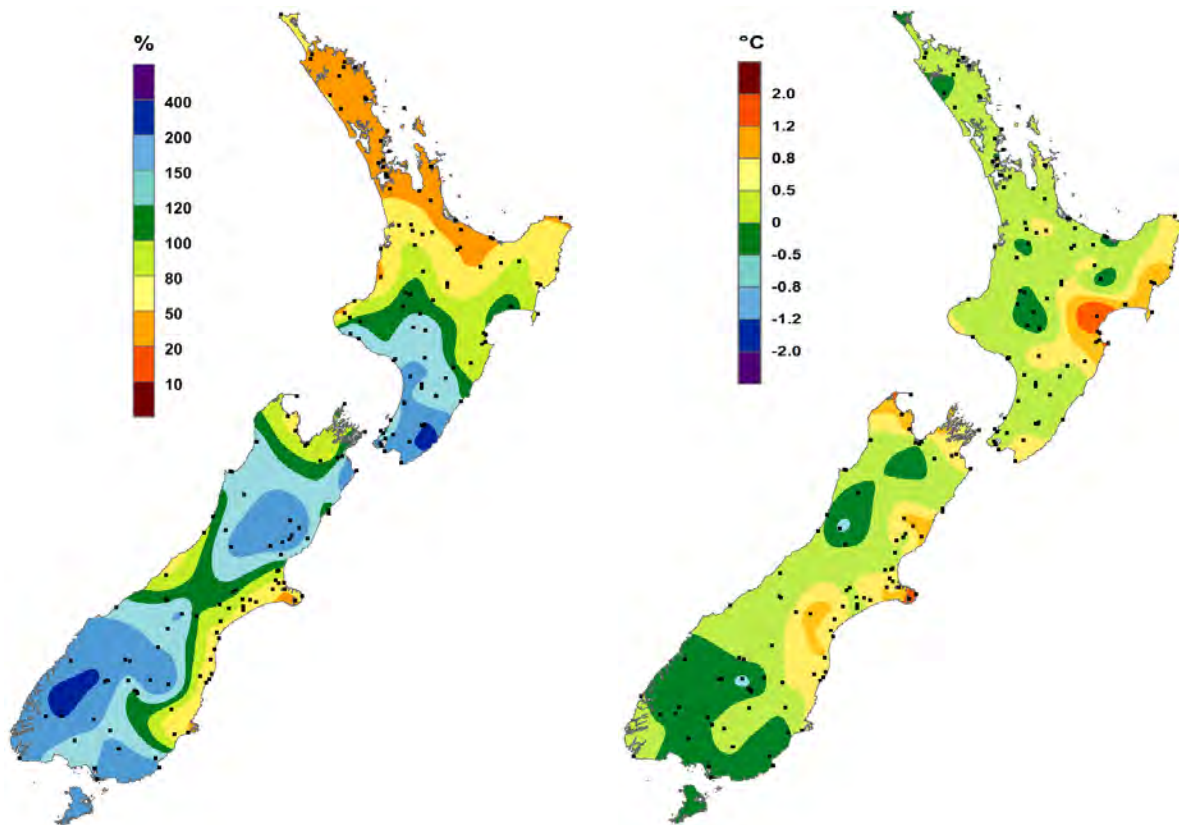
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**September rainfall**

Expressed as a percentage of the 1981-2010 normal.

**September temperature**

Expressed as a departure from the 1981-2010 average.

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