

A mild and wet September

Temperature	Temperatures were near average ($\pm 0.50^{\circ}\text{C}$ of average) for most of the country. Small areas of above average temperatures (0.51°C to 1.20°C above average) were observed in the Coromandel, eastern coastal Auckland, and the Canterbury Plains. Discontinuous pockets of below average temperatures (0.51°C to 1.20°C below average) occurred in parts of Waikato, Bay of Plenty, Nelson, Otago and Southland.
Rainfall	Rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) about the Bay of Islands, southern Waikato, northern Taranaki, the Kāpiti Coast, and much of the Canterbury Plains. Above normal (120-149% of normal) or well above normal rainfall (>149% of normal) was observed across most of Northland, Auckland, northern Waikato, Bay of Plenty, eastern and southern Hawke's Bay, parts of Taranaki, Manawatū-Whanganui, Wellington, Tasman, Nelson, Marlborough, along the Southern Alps, and much of Otago and Southland. Near normal rainfall (80-119% of normal) was observed elsewhere.
Soil Moisture	At the end of the month, and for the time of year, soil moisture levels were lower than normal near the Bay of Islands, eastern parts of Hawke's Bay to the south of Napier, near Banks Peninsula, and a small area of eastern Otago. Soil moisture levels were higher than normal for eastern parts of North Canterbury and Marlborough, parts of Auckland, parts of Otago, eastern Hawke's Bay and eastern Gisborne. Soil moisture levels were typically near normal for most remaining parts of New Zealand.

Click on the link to jump to the information you require:

[Overview](#)

[Temperature](#)

[Rainfall](#)

[September 2021 climate in the six main centres](#)

[Highlights and extreme events](#)

Overview

September 2021 was characterised by higher than normal mean sea level pressure (MSLP) over the North Island and top of the South Island, with lower than normal MSLP over the south of the South Island, as seen in Figure 1. This resulted westerly flow anomaly across most of Aotearoa New Zealand.

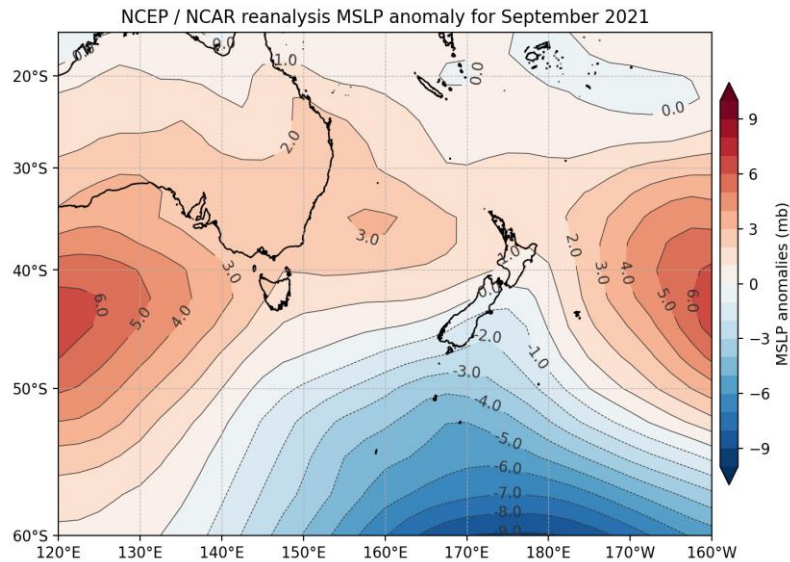


Figure 1: Mean sea level pressure (MSLP) anomaly over New Zealand during September 2021.

These westerlies brought several strong frontal systems, resulting in periods of wet and windy weather. One such front brought gusts in excess of 140 km/h to parts of the South Island and North Island during mid-September (see the [highlights and extreme events](#) section for more details). However, these unsettled periods were interspaced by dry and calm weather. Such changeable weather is typical of spring.

A lack of strong global climate drivers during September resulted in a patchwork of rainfall and temperature patterns across the country. Conditions in the equatorial Pacific were neutral, although NIWA remained at La Niña Watch as ocean temperatures in the equatorial Pacific continued to cool.

During September, the Southern Annular Mode (SAM) was positive. The SAM is a proxy for the location of a belt of westerly winds that encircle the South Ocean and occasionally protrude into the mid-latitudes. Usually, a positive SAM can indicate calmer and drier conditions for New Zealand. However, New Zealand experienced relatively wet and windy conditions during September. This is because the region of anomalously high pressure was located away from New Zealand during September, and frontal systems favoured a track that brought them over New Zealand at times.

Overall, most of New Zealand experienced a mild month, with near average ($\pm 0.50^\circ\text{C}$ of average) for most of the country. Small areas of above average temperatures (0.51°C to 1.20°C above average) were observed in the Coromandel, eastern coastal Auckland, and the Canterbury Plains. Discontinuous pockets of below average temperatures (0.51°C to 1.20°C below average) occurred in parts of Waikato, Bay of Plenty, Nelson, Otago and Southland. Overall, the nationwide average temperature in September 2021 was 10.7°C . This was 0.2°C above the 1981-2010 September average.

Generally, above normal rainfall was more common than below normal rainfall in September. Above normal (120-149% of normal) or well above normal rainfall (> 149% of normal) was observed across most of Northland, Auckland, northern Waikato, Bay of Plenty, eastern and southern Hawke's Bay, parts of Taranaki, Manawatū-Whanganui, Wellington, Tasman, Nelson, Marlborough, along the Southern Alps, and much of Otago and Southland. Rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) about the Bay of Islands, southern Waikato, northern Taranaki,

the Kāpiti Coast, and much of the Canterbury Plains. Near normal rainfall (80-119% of normal) was observed elsewhere.

Further Highlights:

- The highest September temperature was 24.0°C, observed at Christchurch (Riccarton) on 21 September.
- The lowest September temperature was -6.3°C, observed at Middlemarch on 1 September.
- The highest 1-day rainfall was 170 mm, recorded at Mount Cook Village on 12 September.
- The highest wind gust was 222 km/h, observed at Cape Turnagain on 10 September.
- Of the six main centres in September 2021, Auckland was the warmest, Christchurch was the sunniest, driest and coldest, and Hamilton was the wettest and least sunny.
- Of the available, regularly reporting sunshine observation sites, the sunniest four regions in 2021 so far are Taranaki (1884 hours), Hawke's Bay (1867 hours), Marlborough (1855 hours), and Wider Nelson (1853 hours).

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Temperature: An unremarkable September with temperatures near average

Temperatures were generally near average for New Zealand during September. There were only six locations that reported near-record temperatures during September.

Of note was Tākaka, which reported an exceptionally large diurnal range during September. This resulted in its 3rd-highest mean maximum temperatures, but also its 2nd-lowest mean minimum temperatures for September.

Record¹ or near-record mean air temperatures for September were recorded at:

Location	Mean air temp. (°C)	Departure from normal (°C)	Year records began	Comments
High records or near-records				
None observed				
Low records or near-records				
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
High records or near-records				
Dannevirke	16.1	1.6	1951	2nd-highest
Tākaka	17.1	1.3	1978	3rd-highest
Windsor	15.9	1.4	2000	4th-highest
Low records or near-records				
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
High records or near-records				
None observed				
Low records or near-records				
Tākaka	3.3	-1.5	1978	2nd-lowest
Middlemarch	1.0	-1.3	2000	3rd-lowest
Dunedin Airport	1.8	-1.2	1962	4th-lowest

¹ The rankings (1st, 2nd, 3rd.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.

Rainfall: Wet periods, with intense rainfall

Several frontal systems throughout the month delivery heavy rainfall, particularly to western areas. For the South Island, there was a clear west-east divide in rainfall distribution as many fronts approached from the west, dropped their rain over the Southern Alps, while drier and warmer air descended to the east.

In the North Island, periods of south-easterly winds brought sporadic, heavy rain to parts of the Wairarapa District as well as Hawke’s Bay and Gisborne. This led to near average or above average rainfall for this area. However, Napier, Whakatu, Hastings and Cape Turnagain all had 21 or more dry days² during September, highlighting the swings that are typical of spring in New Zealand.

These periods of heavy rain also lead to the recharge of some river systems. During September, the Orere River, located in Auckland’s Hunua Ranges, had its highest mean flow since December 2018.

Record or near-record September rainfall totals were recorded at:

Location	Rainfall total (mm)	Percentage of normal	Year records began	Comments
High records or near-records				
Whanganui	178	225	1890	2nd-highest
Manapouri (West Arm Jetty)	625	202	1971	4th-highest
Tiwai Point	161	187	1970	4th-highest
Low records or near-records				
None Observed				

² A dry day is defined as a day where less than 1 mm of rainfall is recorded in the 24 hours to 9 am (local time).

September climate in the six main centres

September temperatures were above average for Dunedin, while temperatures were near average for remaining main centres. It was a particularly wet month in Hamilton, with 176% of normal September rainfall. Of the six main centres in September 2021, Auckland was the warmest, Christchurch was the sunniest, driest and coldest, Hamilton was the wettest and the least sunny.

September 2021 main centre climate statistics:

Temperature			
Location	Mean temp. (°C)	Departure from normal (°C)	Comments
Auckland ^a	13.2	+0.2	Near average
Tauranga ^b	12.7	+0.3	Near average
Hamilton ^c	11.1	-0.2	Near average
Wellington ^d	10.8	+0.0	Near average
Christchurch ^e	9.3	-0.1	Near average
Dunedin ^f	10.1	+0.6	Above average
Rainfall			
Location	Rainfall (mm)	% of normal	Comments
Auckland ^a	124	121	Above normal
Tauranga ^b	110	130	Above normal
Hamilton ^c	178	176	Well above normal
Wellington ^d	127	130	Above normal
Christchurch ^e	39	96	Near normal
Dunedin ^f	46	96	Near normal
Sunshine			
Location	Sunshine (hours)		
Auckland ^a	167		
Tauranga ^b	163		
Hamilton ^g	146		
Wellington ^d	170		
Christchurch ^e	224		
Dunedin ^f	212		

^a Māngere ^b Tauranga Airport ^c Hamilton Airport ^d Kelburn ^e Christchurch Airport ^f Musselburgh ^g Ruakura

Highlights and extreme events

Temperatures

The highest September temperature was 24.0°C, observed at Christchurch (Riccarton) on 21 September.

The lowest September temperature was -6.3°C, observed at Middlemarch on 1 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
High records or near-records				
Warkworth	23.5	16th	1966	Highest
Dannevirke	23.0	22nd	1951	Highest
Brothers Island	19.8	24th	1997	2nd-highest
Franz Josef Village	21.2	23rd	1953	Equal 2nd-highest
Whitianga	22.2	26th	1962	4th-highest
Low records or near-records				
Porirua	9.9	16th	1972	Equal 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
High records or near-records				
None Observed				
Low records or near-records				
Paraparaumu	-2.5	1st	1953	4th-lowest
Whanganui	-0.2	1st	1937	4th-lowest

Rain and slips

The highest 1-day rainfall was 170 mm, recorded at Mount Cook Village on 12 September.

A front brought areas of heavy rain to the western North Island on 14 September. A slip near Harrison Hill Rd caused the Pahiatua Track to close. Pockets of flooding was reported along the Kāpiti Coast and into Whanganui, including on areas of the State Highway 1 and State Highway 3.

A sub-tropical low brought areas of heavy rain to the North Island on 16-17 September. Parts of Napier recorded over 50 mm of rainfall, the heaviest rainfall there since November 2020. Kelburn (Wellington) recorded over 40 mm of rainfall, which resulted in localised areas of flooding over the roads.

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
Palmerston North	69	13th	1928	Highest
Whanganui	73	13th	1937	Highest

Motueka	112	22nd	1956	Highest
Wairoa	80	16th	1967	2nd-highest
Tiwai Point	35	9th	1970	2nd-highest
Mokohinau	44	15th	1994	3rd-highest
Auckland (Māngere)	51	22nd	1959	3rd-highest
Hamilton (Ruakura)	52	22nd	1907	4th-highest
Mahia	52	16th	1990	4th-highest
South West Cape	36	20th	1991	4th-highest

Wind

The highest wind gust was 222 km/h, observed at Cape Turnagain on 10 September.

The first in a series of strong cold fronts hit the South Island on 10 September, causing widespread gusts over 100 km/h, including 150 km/h gust at Waipara West and Upper Rakaia, 130 km/h at Lake Tekapo, 115 km/h at Cass, 113 km at Methven. The Canterbury and Otago regions were among the worst affected areas, as small buildings were damaged, roads were blocked by fallen trees, and almost 7000 homes were left without power. These winds also fanned several fires across the Canterbury and Otago regions.

Three days later on 13 September, another powerful cold front hit the South Island, causing gusts over 138 km/h at Upper Rakaia West, 116 km/h at Winchmore, 112 km/h at Waipara West and 104 km/h at Methven. The winds caused several fires to start burning out of control in Canterbury and Otago, as well as down tree and caused localised power outages. A flight from Wellington to Queenstown had to turn around due to the strong winds.

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
Castlepoint	178	10th	1972	Highest
Hanmer Forest	107	10th	1995	Highest
Winchmore	117	13th	1970	Highest
Secretary Island	133	8th	1994	2nd-highest
Middlemarch	120	12th	2000	2nd-highest
Clyde	98	9th	1983	2nd-highest
Taupō	82	17th	1982	Equal 2nd-highest
Upper Hutt (Trentham)	87	9th	1999	Equal 2nd-highest
Palmerston North	91	16th	1991	3rd-highest
Lincoln	91	10th	1999	3rd-highest
Timaru	107	10th	1972	3rd-highest
Mokohinau	119	8th	1994	Equal 3rd-highest
Tara Hills	100	9th	1985	Equal 3rd-highest
South West Cape	172	4th	1991	Equal 3rd-highest
Oamaru	104	10th	1984	3rd-highest
Kaikohe	91	10th	1986	4th-highest
Rangiora	89	25th	1999	4th-highest
Manapouri	80	12th	1991	4th-highest
Gore	115	9th	1987	4th-highest

Dannevirke	95	10th	1961	Equal 4th-highest
Bromley	82	13th	1972	Equal 4th-highest

Lightning, hail, and tornadoes

The front that brought powerful wind gusts to the South Island on 13 September also triggered several thunderstorms in the South Island. Lightning from these storms reportedly started a number of fires. Over 34,000 lightning strikes were observed over or near New Zealand during this period.

Unstable cold air due to a cold front brought pockets of hail showers to Wellington on 28 September. Hail stones were reportedly 1 cm in diameter.

Snow and ice

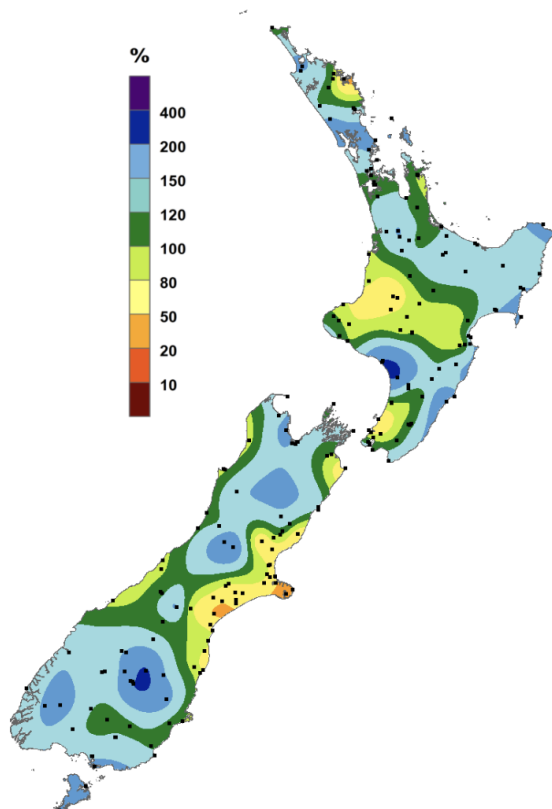
On 26 September, a front brought late season heavy snow to the Southern Alps and parts of the North Island ranges. Snow made driving conditions hazardous in Arthur's Pass and Lindis Pass. Snow fell to around 500 metres above sea level in parts of the South Island, and about 900 metres above sea level in parts of the North Island. On 28 September, a snow depth of 94 cm was recorded at NIWA's Mt Potts weather station (2,128 m above sea level), with nearby snow drifts exceeding 200 cm (Figure 2).



Figure 2: Mt Potts weather station on 28 September, which measured a snow depth of 94 cm.

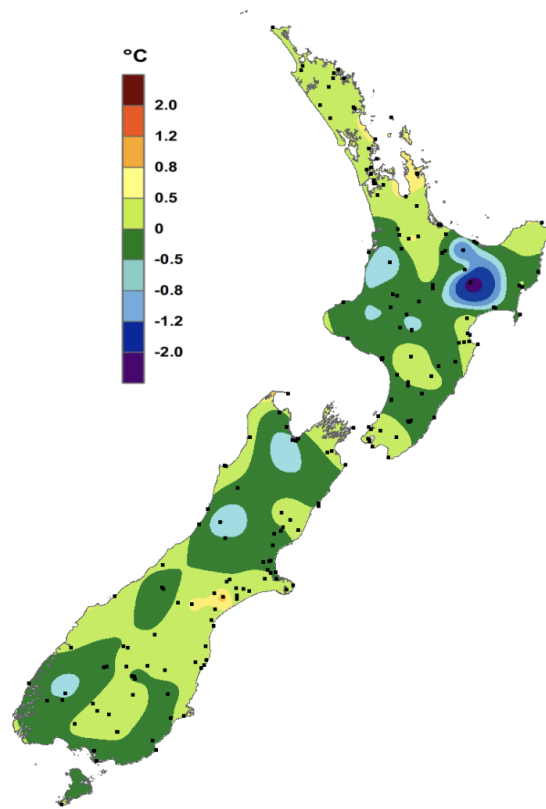
For further information, please contact:

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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 in degrees Celsius. Note, the very lowest temperature anomalies ($>1.2^{\circ}\text{C}$ below average) illustrated south of Whakatāne are a result of data quality issues at a single station, and as such are not an accurate representation of monthly temperature for this area.

<https://www.niwa.co.nz/our-science/climate>

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