

# The Climate Update

A monthly summary of New Zealand's climate from the National Climate Centre for Monitoring and Prediction

## December: warm, grey, and unsettled

A 'conveyor belt' of warm, moist sub-tropical air triggered a wet, cloudy month ... *page 2*

## More rain ahead for the north

Moist conditions are likely to persist in parts of the North Island ... *page 3*

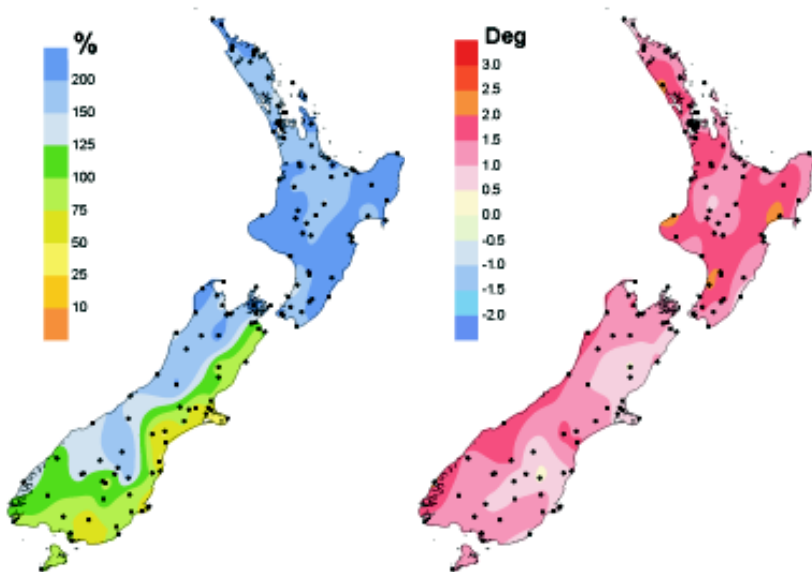
## 2001 in retrospect

A year in which climate records were topped ... *page 4*



## Rainfall

## Mean air temperature



Percentage of average rainfall (left) and difference from the average air temperature in degrees Celsius (right). Dots indicate recording sites.

### December rainfalls set some new records

More than 150% of normal rainfall was recorded for December in the North Island and northwest of the South Island. New rainfall records for the month were set in parts of the far north (Kerikeri 240%), Hawke's Bay (Whakatu 467%), Wairarapa (East Taratahi 253%), central North Island (Turangi 246%), and Nelson (Lake Rotoiti 222%). A few localities in north Taranaki and eastern Bay of Plenty received over three times more rain than usual.

These high rainfalls contrasted with the drier than normal conditions in parts of Canterbury and Southland, where just 75% or less of average rainfall was recorded.

### High temperatures

Air temperatures were about a degree higher than normal for the month, due particularly to unusually warm nights. Some locations in both the North and South Islands recorded overnight temperatures of 2 to 3 °C above average.

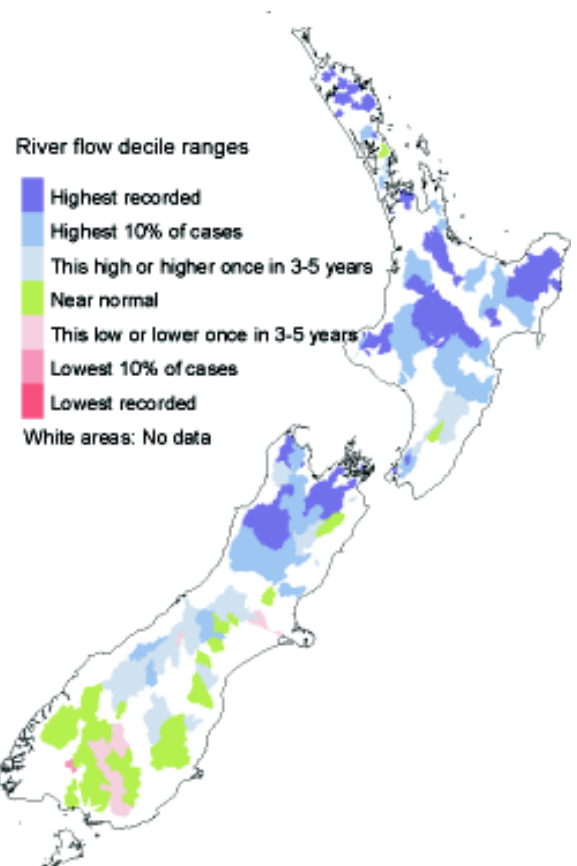
### Cloudy

It was the least sunny December on record for some places, with 60 to 70% of normal hours of bright sunshine in many northern and western regions of both islands.

### Conveyor belt

December was characterised by persistent low atmospheric pressures over the country, with moist northerly air flows much of the time – a conveyor belt of moisture from the sub-tropics that brought the heavy rain, frequent wet days, and warm, cloudy weather.

## December average river flows

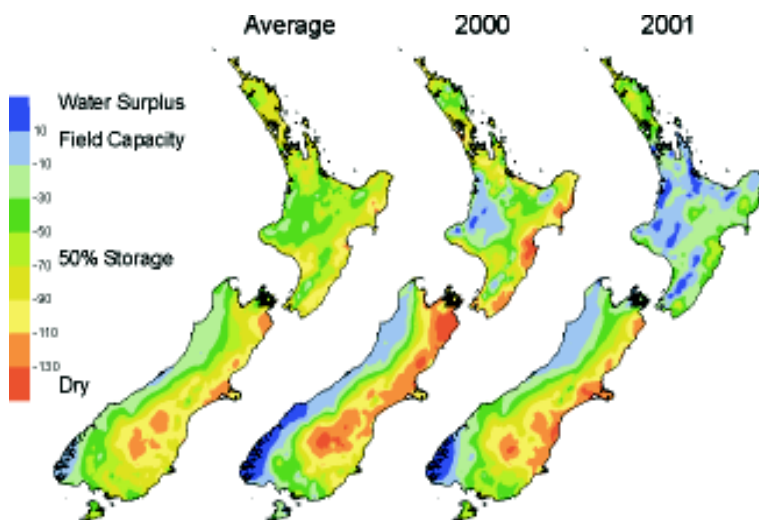


Streamflow decile ranges in December for rivers monitored in national and regional networks. The contributing catchment area above each monitoring location is shaded. NIWA field teams, regional and district councils, and hydro-power companies are thanked for providing this information.

### Highest recorded December mean flows in some catchments

December mean flows were at record high levels for much of the North Island and the northern third of the South Island. Above normal flows occurred in rivers draining the Southern Alps. Flows in foothill rivers in Canterbury and Otago were normal to above normal, and Southland rivers were normal to below normal.

## Soil moisture deficit on 31 December



### Saturated soils in the north

In the North Island and northwest of the South Island, soils which were wetter than average at the end of November remained near or above field capacity for much of December. Levels of available soil moisture were unusually high for the time of year.

In the South Island, some east coast areas were drier than normal at the end of the month, while soils along the west coast were generally wetter than average.

Soils in Southland and south Otago contained ideal moisture content for pasture growth for much of the month.

LEFT: Soil moisture deficit in the pasture root zone at the end of December (right) compared with the deficit at the same time last year (centre) and the long-term end of December average (left). The water balance is for an average soil type where the available water capacity is taken to be 150 mm.

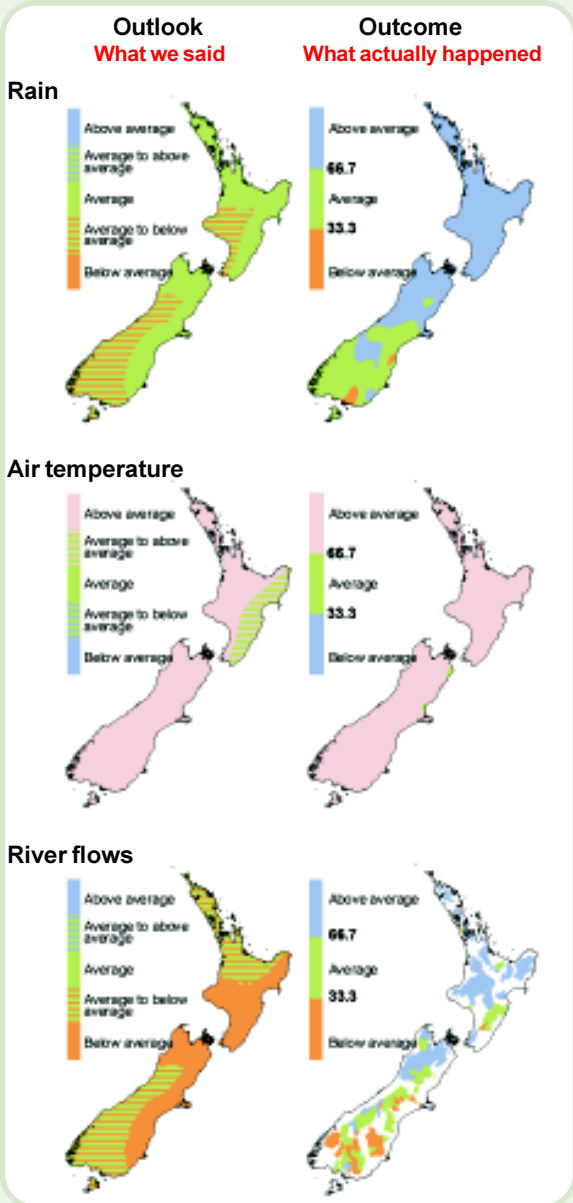
# Checkpoint

## October to December 2001

Near average rainfall was predicted for much of New Zealand, with average to below average totals in the south and west of both islands. Parts of the southern half of the South Island received average or below average rain in line with predictions, while elsewhere rainfall exceeded expectations.

**Air temperatures** were above average over most of the country as was forecast in the Outlook, but were higher than predicted in the east of the North Island.

Average to below average **river flows** were forecast for many regions. Flows were above average in the North Island and Nelson and Marlborough, average in Canterbury and Westland, and tending to below average in Otago and Southland.



The three outcome maps (right column) give the tercile rankings of the rainfall totals, mean temperatures, and river flows that eventuated for October to December 2001. Terciles were obtained by dividing ranked October to December data from the past 30 years into three groups of equal frequency (lower, middle, and upper one-third values) and assigning the data for the present year to the appropriate group. As an approximate guide, middle tercile rainfalls often range from 80 to 115% of the historical average. Middle tercile air temperatures typically occur in the range of the average plus or minus 0.5 °C.

# Outlook

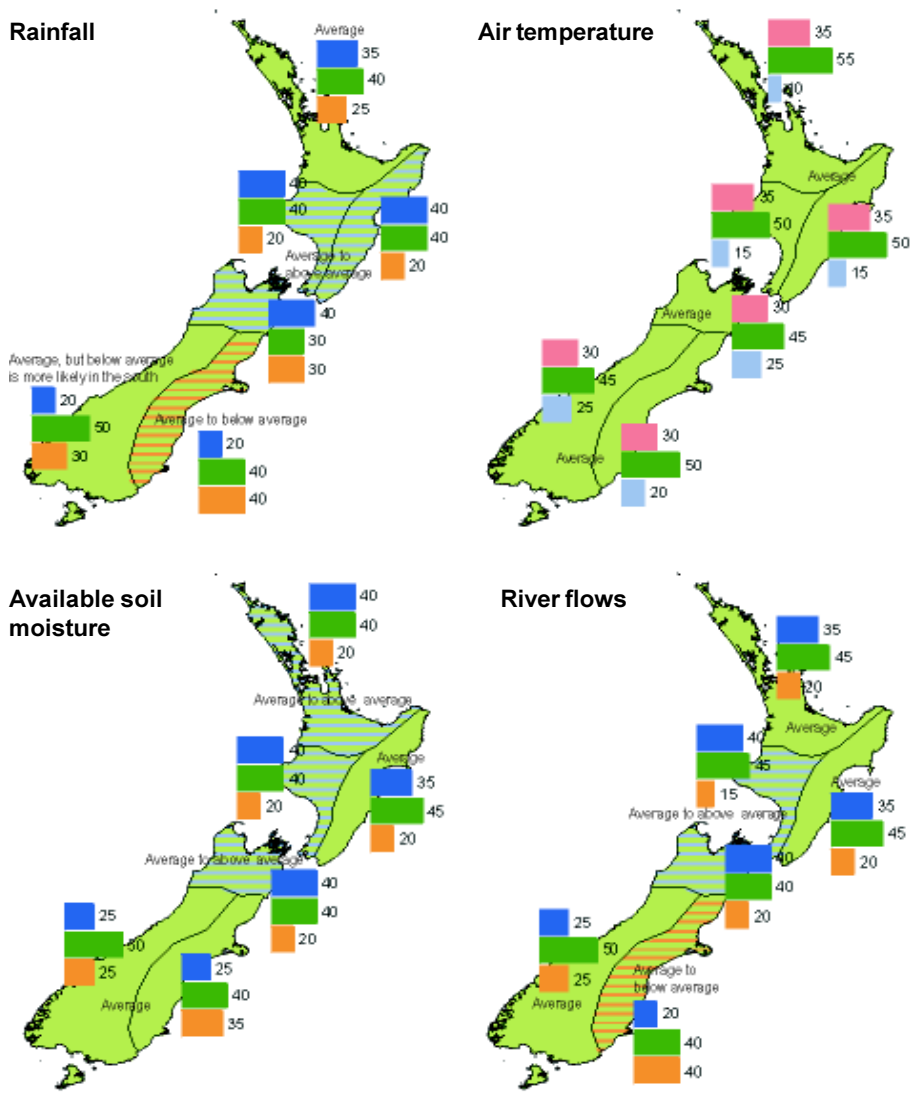
## January to March 2002

The El Niño-Southern Oscillation is in near neutral phase at present. Some climate models suggest El Niño-like conditions will develop in the equatorial Pacific over the next three to six months. However, past experience shows the predictability of El Niño development in the period leading up to autumn is low. Sea-surface temperatures near New Zealand should remain above average through the summer, especially east of the country, which will make lower than normal air temperatures over the country unlikely (see outlook map probabilities below).

Large-scale atmospheric pressure patterns are likely to favour a more frequent than usual development of low pressure systems in the Tasman Sea, resulting in more northerlies than usual over New Zealand.

Rainfall totals over the three months as a whole are expected to trend towards above average in both western and eastern regions of the North Island, and to below average in the east of the South Island. Average rainfall is likely in other regions.

The chances of an ex-tropical cyclone affecting New Zealand over the next three months are average to below average for this time of year. (On average, about one ex-tropical cyclone affects northern New Zealand in the January to March period.)



### KEY to maps (Example interpretation)

**A.** Climate models give no strong signals about how the climate will evolve, so we assume that there is an equal chance (33%) of the climate occurring in the range of the upper, middle, or lower third (tercile) of all previously observed conditions.

**B.** There is a relatively strong indication by the models (60% chance of occurrence) that conditions will be below average, but, given the variable nature of climate, the chance of average or above-average conditions is also shown (30% and 10% respectively).

	No strong climate signal	Strong expectation of below average
Above average	33	10
Average	33	30
Below average	33	60

## 'Normal' climate sidelined by extreme conditions

National Climate Centre

The climate of 2001 was highly variable and its extremes topped some long standing records of adverse conditions. Drought and flood-causing rainfall, relatively warm months and a mid-winter freeze, extreme frosts, and hail stones the size of golf balls were elements of an unusual year.

### Major shift in circulation

The year featured a major shift in circulation from the predominance of higher than usual atmospheric pressures over the South Island for the first nine months of the year to periods of persistent, unusually low pressure over the Tasman Sea for the subsequent three months. For central regions of New Zealand, particularly Wellington and Marlborough, this brought a dramatic change from drought to rainfalls well in excess of seasonal averages.

The adjacent maps illustrate the transition from at least 30 year low rainfalls for January to September, to totals for October to December that exceeded 1 in 10 year highs. Lake Rotoiti in the north of the South Island, in the 30 year dry zone for the first part of the year, recorded its highest December rainfall (324 mm) since records began in 1933.

During seven of the first nine months of the year, as the drought progressed, many localities around the country had record low rainfalls for the month.

River flows filled hydro-electric lakes in November and December, which was a welcome change after low lake inflows for much of the year.

### Annual temperature just above average

The 2001 national average temperature, calculated from 7 long term representative climate sites across the country, was 12.8 °C which was just 0.3 °C above the 1961–90 normal. Air temperatures were much higher than average in May, August, September, October and December, and January and July were both cooler than normal.

Air temperatures were 4.0 °C above average during the first two weeks of May, but, illustrative of the contrasting weather that characterised 2001 at times, the month ended with some severe screen frosts (e.g., Christchurch Airport, -5.3 °C) and some early winter snowfall.

July had the lowest mean air temperature for over 30 years. Hanmer Forest recorded 11

consecutive days when the air temperature at ground level dropped to lower than -10.0 °C. Water supplies froze in many South Island areas, and several small inland lakes and streams froze over for the first time in many years. In the North Island, the Ruapehu ski field reported its deepest snowfall in 20 years.

### Floods and high rainfall

While central and southern New Zealand experienced months of relatively dry weather, the north of the country experienced frequent episodes of high rainfall, often with associated flooding. Rainfalls exceeding 100 mm in 24 hours were a common feature of the more severe events. Some eastern Bay of Plenty and Coromandel locations received record rainfall totals in each of February, April, and May. Leigh (north of Auckland) received 109 mm of rain in just one hour on 30 May, the highest recorded one hour rainfall at a New Zealand lowland site.

Outside the northern region, the most significant recorded heavy rainfall event of the year occurred in the Wellington and Hutt Valley area on 22 November. Most of the 50 to 100 mm of rain fell within 6 hours.

### Gale force winds

The highest gust speeds that were measured, at about 190 km/h or more, occurred in Cook Strait. Winds gusting to 170 km/hr caused damage in Otago Harbour in January. Wind gusts of about 140 km/h were sufficiently strong to cause damage to buildings and power lines in Wellington during January, Kaikoura in March, Tauranga in May, and across Auckland and Bay of Plenty during October.

### Hail

The worst recorded hail storms of the year were in Masterton and Alexandra during January. In both places hail stones the size of golf balls caused severe damage to fruit crops.

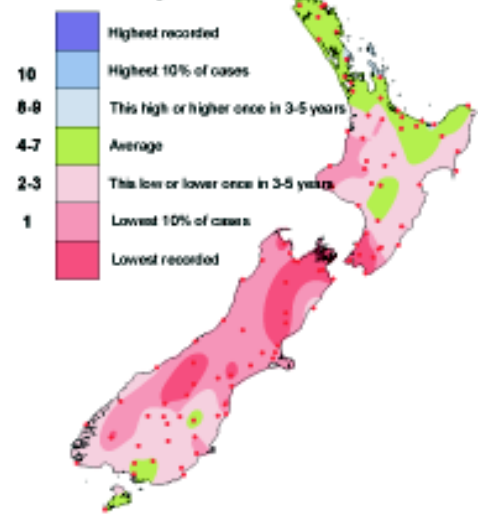
Hail lay 4 cm deep in parts of Rangiora following a convectional storm during the afternoon of 28 December.

A more detailed summary of the climate of 2001 can be found at [www.niwa.co.nz/climsum\\_2001.html](http://www.niwa.co.nz/climsum_2001.html)

### Before the wet...

The year 2001 to 30 September was the driest January to September period of the past 30 years in many places (highlighted by the darkest shade of pink in the map below).

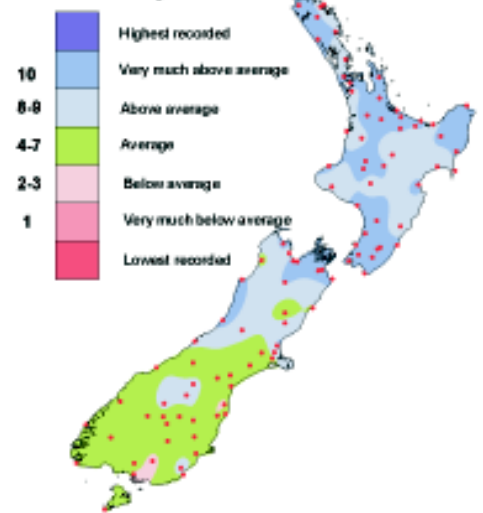
Rainfall decile ranges



### ...and after

October to December rainfalls exceeded 1 in 10 year highs in central New Zealand and northern North Island regions.

Rainfall decile ranges



2001 rainfall totals for January to September (upper map) and October to December (lower map) recorded at the sites indicated, shown according to their positions in respective rankings of all January to September or October to December rainfall totals for the past 30 years.

## The Climate Update

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### Cover picture:

Hutt River in tranquil mode. Apart from a few exceptions, the average annual flows in New Zealand rivers during 2001 were well below normal.

Photograph: Alan Porteous

