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NIWA
Taihoro Nukurangi

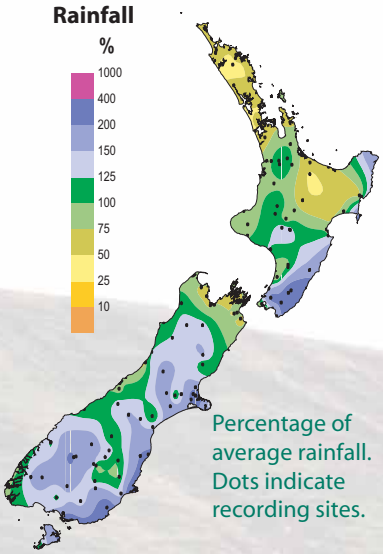
The Climate Update

A monthly newsletter from the National Climate Centre

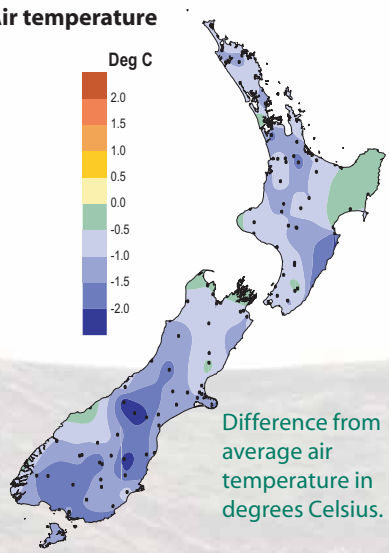
August temperatures lowest for over 10 years.
Very wet in Wairarapa, Canterbury, Otago, and coastal Southland. High river flows in the central and southern North Island, Buller, and coastal Southland.

Outlook for September to November – below normal rain likely in the north and east of the North Island.
Air temperatures average or above.

New Zealand climate in August 2004



Percentage of average rainfall. Dots indicate recording sites.



Difference from average air temperature in degrees Celsius.

Coldest August since 1992

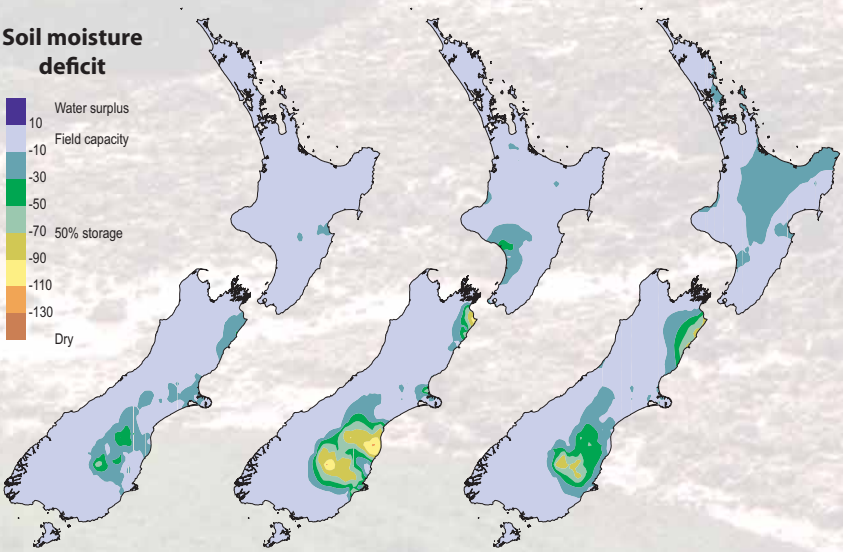
The average New Zealand temperature was 7.9 °C, the lowest August average temperature for more than 10 years. Much of the country was more than 0.5 °C cooler than average, and temperatures in parts of coastal Wairarapa and the South Island were more than 1.5 °C below average.

The low temperatures were associated with wet conditions in some areas. About 200% of normal rainfall fell in parts of Wairarapa, Canterbury, Otago, and coastal Southland. In contrast, rainfall was less than 50% of normal in inland Bay of Plenty and in parts of Northland.

For more information on the climate in August, visit the climate summaries page at www.niwa.co.nz/ncc/cs/mclimsum_04_08

South Island dry spots

Soil moisture levels along the Marlborough-Kaikoura coast and in parts of inland Otago were lower than average at the end of August. Bay of Plenty and central North Island soils were also a little drier than normal. Soils elsewhere were near field capacity.



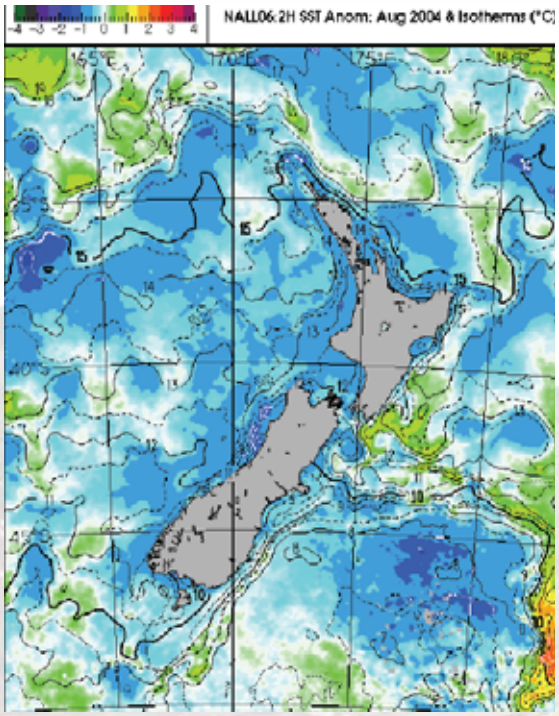
Historical average deficit on 31 August

Deficit on 31 August 2003

Deficit on 31 August 2004

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

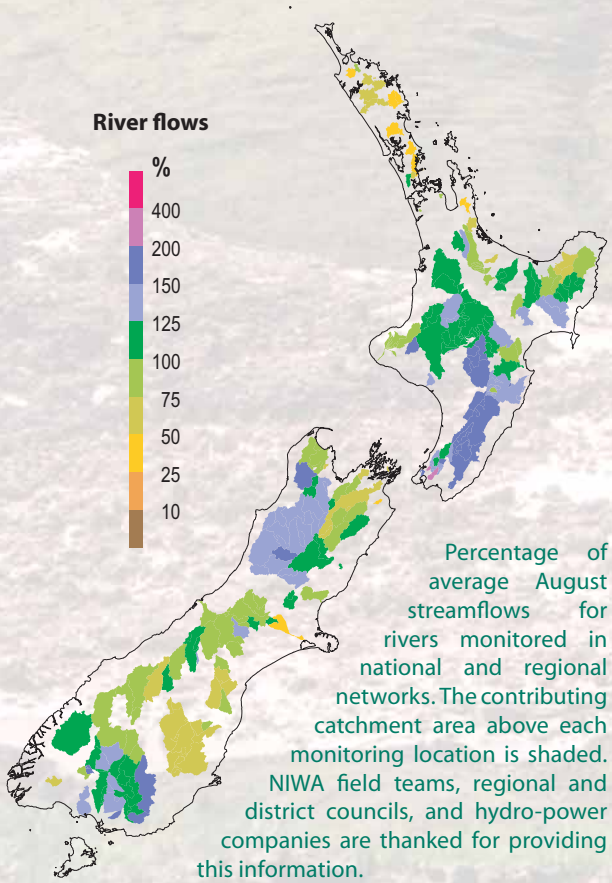
Sea surface temperatures



Difference from the mean 1993–2002 surface water temperatures in the seas around New Zealand. Surface temperatures were mostly below average in August compared with this base period.

High river flows follow heavy rain

Stream and river flows were above normal in the central and southern North Island, Buller, and coastal Southland. Flows were below normal in Northland and Auckland, and normal elsewhere.



Percentage of average August streamflows 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.

Checkpoint

June to August 2004

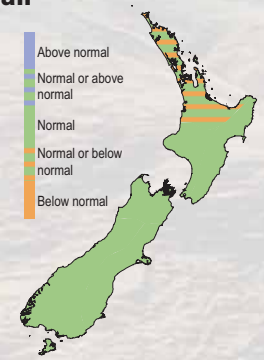
Many districts recorded average rainfall, as predicted, and it was drier than normal in Northland and Auckland. Parts of the east and south of the North Island, and the northwest and south of the South Island, were wetter than expected.

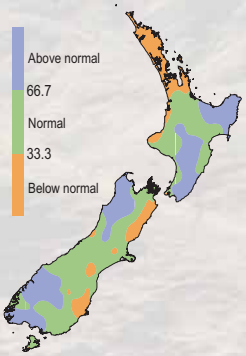
Air temperatures were average, as predicted, in many areas, and average or below average, as predicted, in the southern South Island. It was cooler than predicted in the northwest of the South Island and in the Auckland region. North Canterbury temperatures were above average.

River flows were expected to be generally normal. Below normal flows occurred in Northland and Auckland, but above normal in the central and southern North Island, Buller, and coastal Southland. Flows were near normal in the remainder of the South Island.

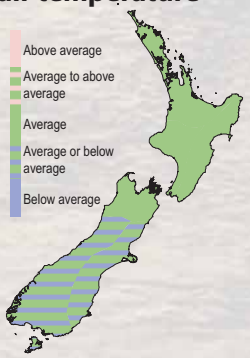
Outlook What we said | **Outcome** What actually happened

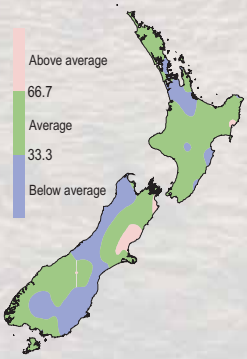
Rainfall



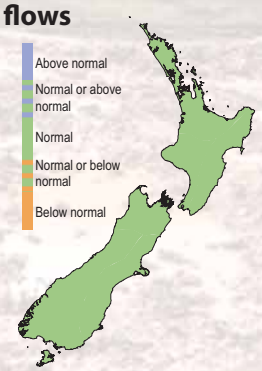


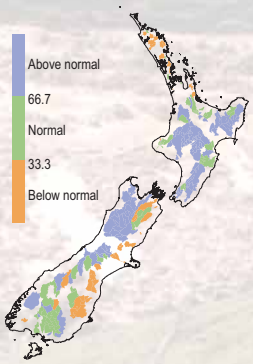
Mean air temperature





River flows





The three outcome maps (right column) give the tercile rankings of the rainfall totals, mean air temperatures, and river flows that eventuated from June to August, in comparison with the forecast conditions (left column).

As an approximate guide, middle tercile rainfalls typically range from 80 to 115% of the historical normal, and middle tercile temperatures range about the average by plus or minus 0.5 °C.

Outlook

September to November 2004

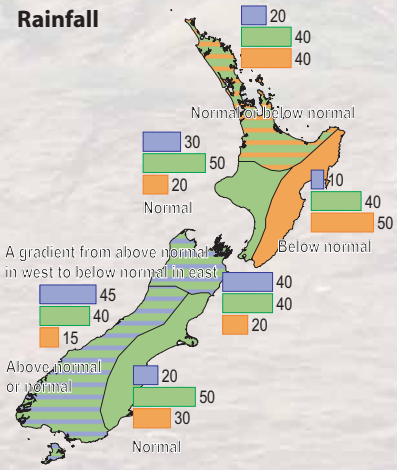
Lower than normal mean sea-level pressures in the south Tasman Sea are expected during spring, with more west to southwest wind flow than usual over New Zealand. Surface temperatures of seas close to the country are expected to be near average.

Temperatures are expected to be near average in most regions, but above average in the eastern North Island and northern South Island. Normal or below normal rainfall is expected in the north and east of the North Island, with normal or above normal rain in the west and south of the South Island. Near normal rainfalls are expected elsewhere.

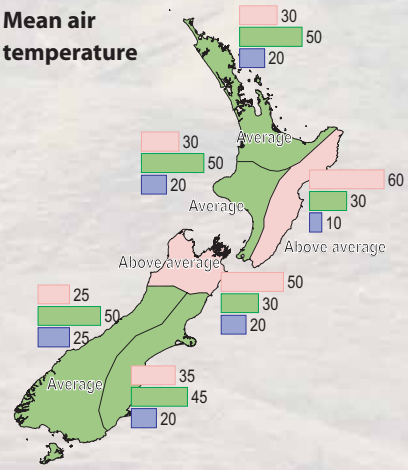
Normal or below normal soil moisture levels and streamflows are expected in the north and east of the North Island and the east of the South Island. Normal or above normal conditions are expected in the west and south of the South Island. Normal soil moisture and stream flows are expected elsewhere.

The tropical Pacific is on the verge of El Niño conditions. It is very likely that a weak El Niño will develop during spring, and ease back to neutral conditions during summer.

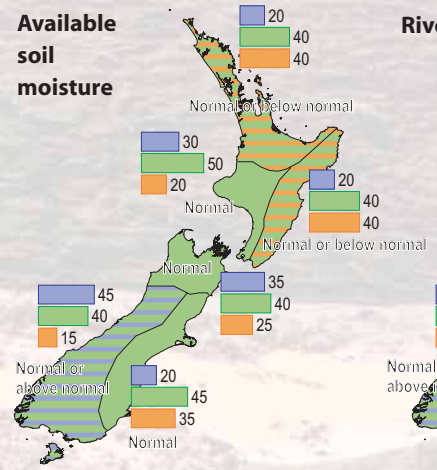
Rainfall



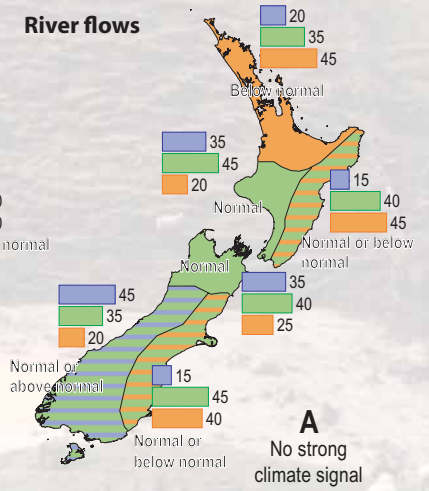
Mean air temperature



Available soil moisture

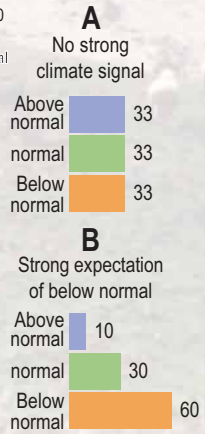


River flows



Key to maps (example interpretation)

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



Backgrounder

Are heavy rainfalls becoming more frequent?

At least 13 high rainfall events have occurred in New Zealand over the past 12 months, in some cases resulting in severe floods. The worst affected areas were Paekakariki in October 2003, south Taranaki-Manawatu and Picton in February 2004, and Eastern Bay of Plenty in July 2004.

Are events like this becoming more frequent?

A useful statistical approach to this question is to look for any change in frequency of a given type of rainfall event, for example, the highest 1-day rainfall each year from each climate station over the whole country. From the historical climate record we can consider the 1-day rainfalls that have a 1% chance of being exceeded each year – the so called '100-year event'. At sites with a century or more of records, such an event will have been measured; at shorter duration sites, we model the distribution of extreme rainfalls to evaluate the likely 100-year falls.

If we consider all the observations we have of 100-year, 1-day rainfalls since 1920, we find that there has been at least one 100-year event in New Zealand in most years, and occasionally as many as five or six. Only about 10% of years since 1920 had no such event.

This is illustrated in the figure below. Six 100-year events occurred in both 1924 and 1991, and three events have occurred so far in 2004. The long-term average is a little more than two events per year.

At face value, these data suggest there has been little long-term change in the frequency of extreme 1-day rainfalls.

Other measures of extreme events

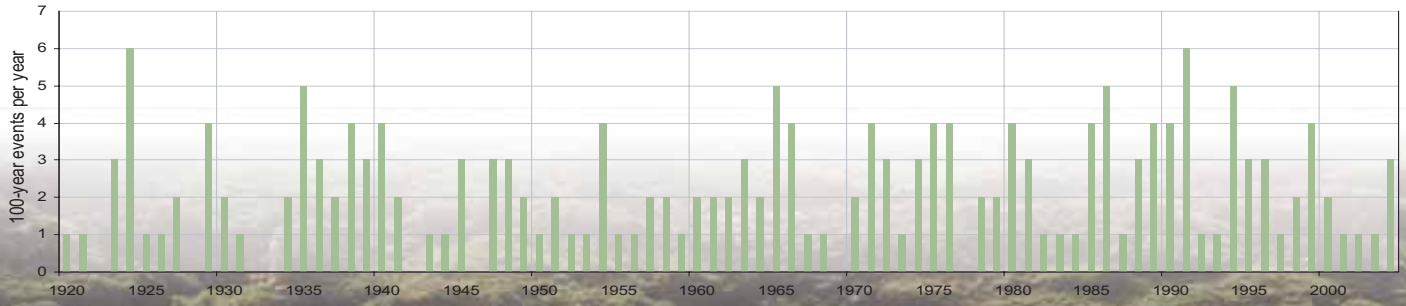
This analysis of 1-day rainfalls provides only one measure of possible changes in the risk of events like this occurring somewhere in New Zealand. We also need to consider events when there have been several days or weeks of rain, and whether there is any trend in the spatial extent of the areas affected by floods. February's floods, for example, were the most widespread that we know of since at least the 1920s.

We also need to take into account the total volume of rain over regions of the country, and the number and location of rainfall recording stations. There were more stations in the 1980s than in the 1920s, for example, and we have to make sure this does not bias our analysis. We may need to consider evidence of storms that have occurred in places where there were no stations to record them.

In addition, we need to know about the nature of each storm that brings damage. In February, there was a lot of rain prior to the height of the storm, so the ground was already saturated when the most intense period of rainfall occurred.

The impact of individual storms, even when they are meteorologically 'typical' in their development and intensity, can be highly variable. So, determining heavy rainfall frequency trends requires consideration of many aspects of storm behaviour. NIWA is continuing to investigate these issues.

The number of New Zealand 1-day (9am-9am) 100-year rainfall events from 1920 to 2004. Note that the same event might be recorded at more than one station.



Wairarapa land slip. Soils already saturated prior to the heavy August rains presented a significantly higher risk of erosion.

Cover photo: *Alan Blacklock*

The Climate Update is a monthly newsletter from NIWA's National Climate Centre, and is published by NIWA, Private Bag 14901, Wellington. It is also available on the web. Comments and ideas are welcome. Please contact Alan Porteous, Editor
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