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NIWA
Taihoro Nukurangi

The Climate Update

August 2002: Mild; low rainfall in some areas

It was drier than normal in Marlborough, mid Canterbury, and Bay of Plenty for the second consecutive month ... *page 2*

Spring outlook

Warmer than normal in the North Island and north of the South ... *page 3*

Weather hazards

Estimating changing frequencies ... *page 4*

New Zealand climate in August 2002

Rainfall and air temperature

Mild conditions widespread

Despite a cold, wintry outburst during the last week, August was warmer than usual, especially in the South Island. The national average mean temperature of 9.2 °C was 0.5 °C above normal.

Temperatures were near average in north Westland, the central North Island, parts of Northland, and scattered areas of Central Otago and inland Southland.

Drier than normal conditions for the second consecutive month in some places

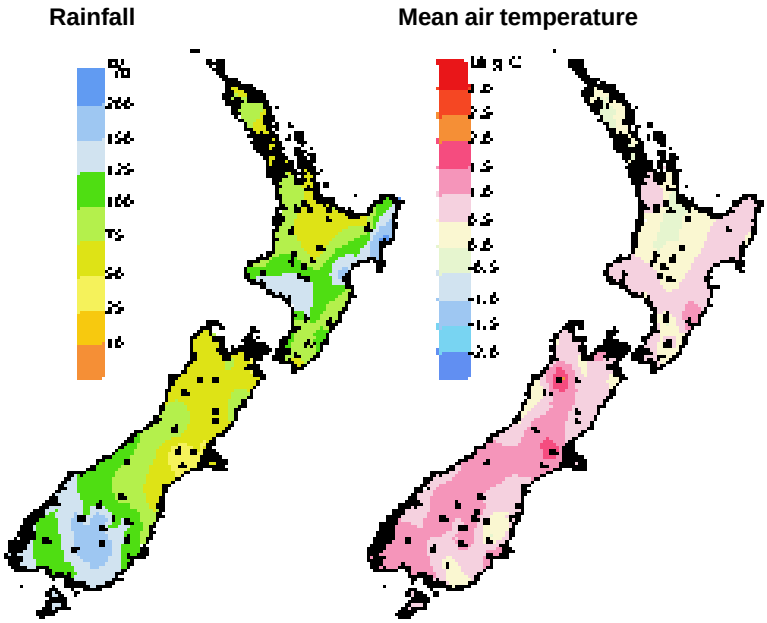
July and August were both drier than normal in the northeast of the South Island and in Canterbury, with rainfall about 50% of average or less, and in Bay of Plenty, which had less than 75% of normal rain.

However, there was above average rainfall in Southland, Fiordland, Southern Lakes, and parts of Central Otago. Rainfall was also above average in the southwest and the northeast of the North Island. Heavy, intense rainfall around and to the north of Gisborne caused surface flooding and some severe damage to hill country properties on 6 June.

Sunny spots

Sunshine totals were near average in many areas, but Gisborne, Hawke's Bay, and Wellington were sunnier than normal. Lower than normal sunshine totals were recorded in Wanganui, coastal Southland, and Central Otago.

August's climate pattern was dominated by more frequent than normal southwesterlies over mainland New Zealand, with below average pressures about and east of the Chatham Islands.

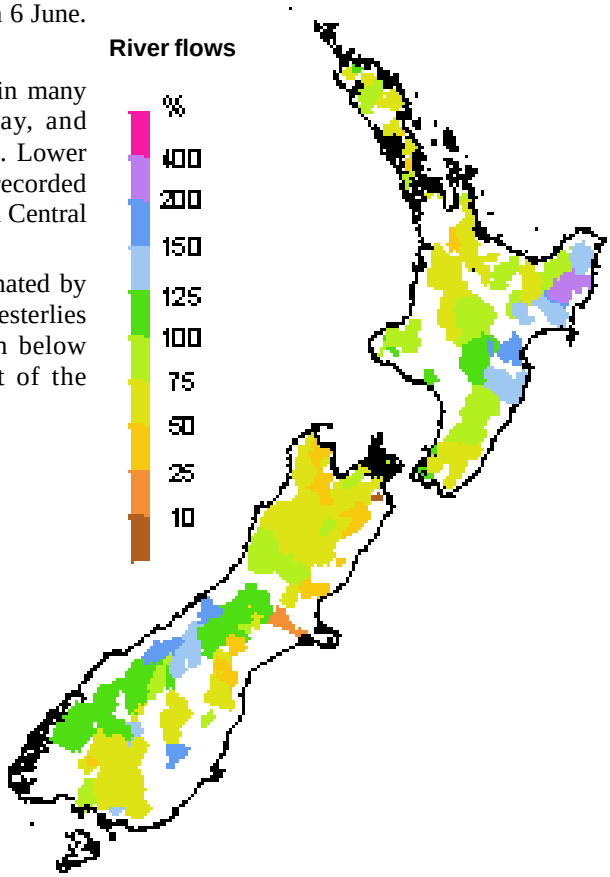


ABOVE: Percentage of average rainfall (left) and difference from the average air temperature in degrees Celsius (right). Dots indicate recording sites.

River and streamflows

August streamflows varied

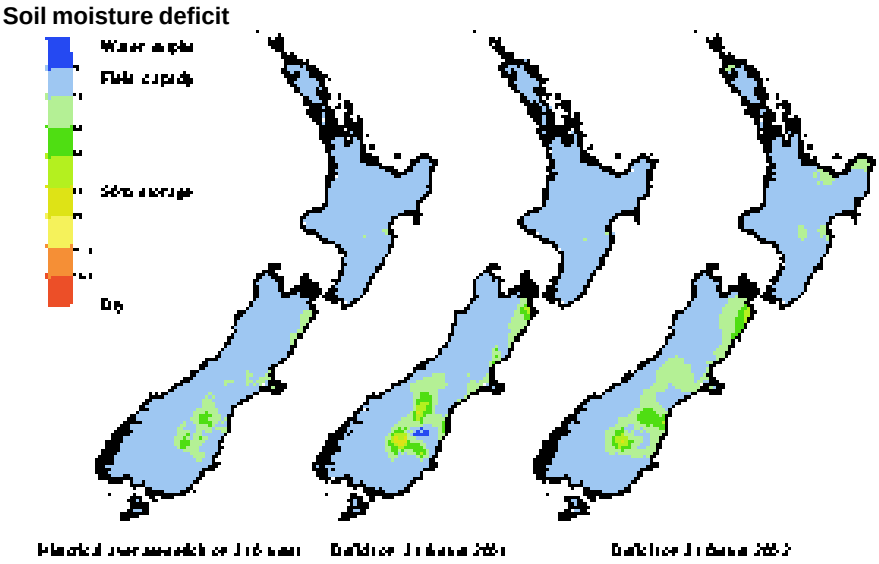
August flows were below normal for most of the country, but above normal around Gisborne and Hawke's Bay, and in parts of inland Otago and the South Island hydro lakes.



ABOVE: 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.

Soil moisture

Pockets of drier than normal soils were evident at the end of August in Bay of Plenty, Hawke's Bay, Marlborough, Canterbury, and in inland and coastal Otago. Rainfall was below average for both July and August in northern and central areas of the South Island, resulting in lower than normal subsoil moisture content in Marlborough and mid and south Canterbury.



RIGHT: 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.

Checkpoint

June to August 2002

Rainfall was generally as expected over the South Island as well as the central North Island, but wetter than forecast in the east and parts of the north of the North Island.

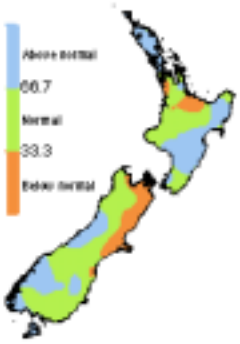
Air temperatures were normal or above normal, as was predicted, for all districts except the east of the North Island, where normal temperatures were predicted but the winter temperature outcome was above normal.

River flows were normal in Waikato, Nelson, and coastal Otago and Southland, and below normal in Marlborough and Canterbury, as they were predicted to be. Flows were higher than predicted in other areas, and below normal in parts of Bay of Plenty.

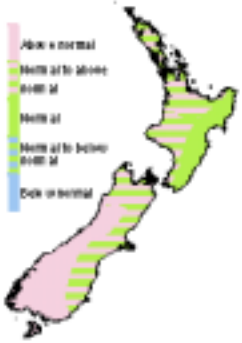
Rainfall

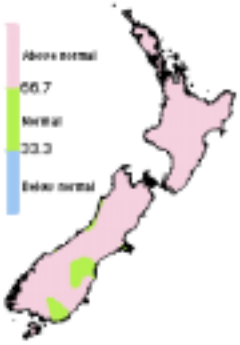
Outlook
What we said

Outcome
What actually happened

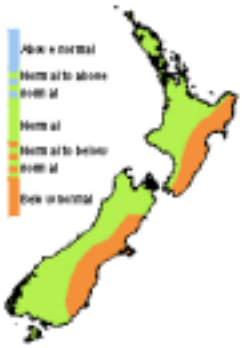


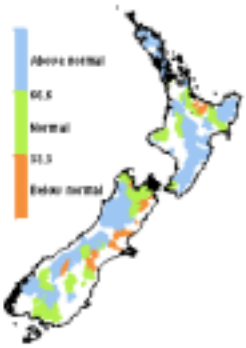
Mean air temperature





River and stream flows





The three outcome maps (right column) give the tercile rankings of the rainfall totals, mean temperatures, and river flows that eventuated for June to August 2002. Terciles were obtained by dividing ranked June to August 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 (33.3 to 66.7%) 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. Note that in the maps above, the upper, middle, and lower tercile ranges are described by the terms *Above normal*, *Normal*, and *Below normal,* respectively.

Outlook

September to November 2002

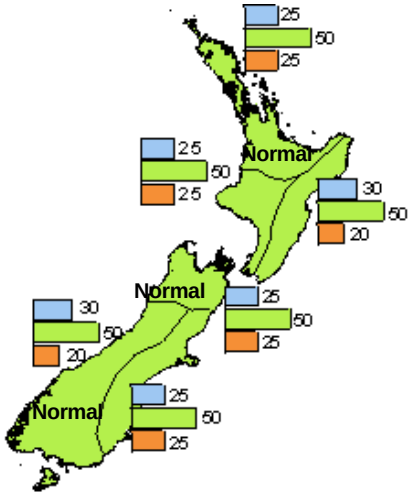
An El Niño event is under way in the tropical Pacific, but is likely to be much weaker than the 1997–98 episode. However, spring climate in New Zealand is expected to be influenced by the above average local sea surface temperatures and enhanced trough activity across southern New Zealand, rather than by typical El Niño conditions of cooler southwesterlies.

Most climate models predict that El Niño will continue through summer 2002–03, when drier conditions could develop in the north and east of the North Island, and the eastern South Island from north Canterbury through to Nelson.

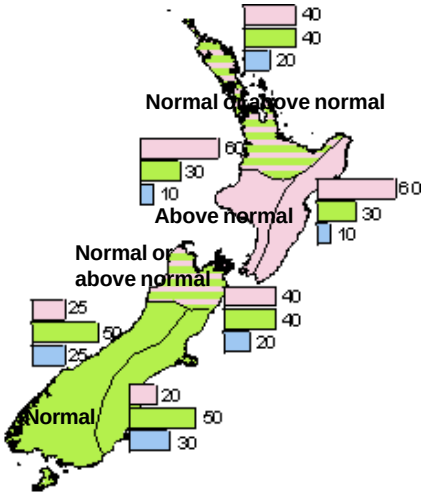
For September to November, temperatures are expected to be above average or average over the North Island and northern South Island, and near average over the rest of the South Island. Rainfall is expected to be near normal in all regions.

Soil moisture levels and river flows are expected to be normal everywhere, apart from normal or below normal river flows for the northern South Island.

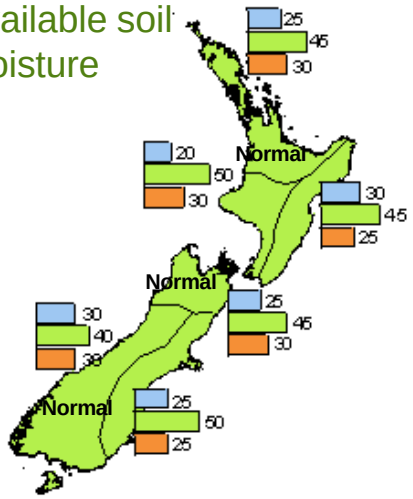
Rainfall



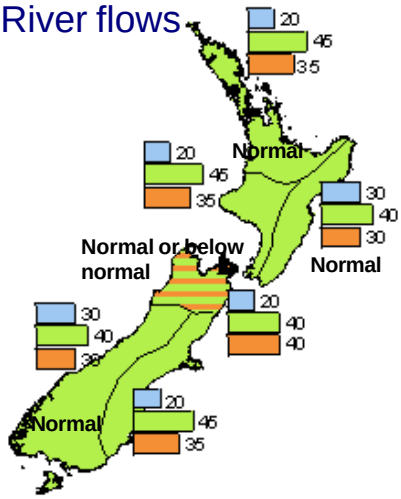
Mean air temperature



Available soil moisture



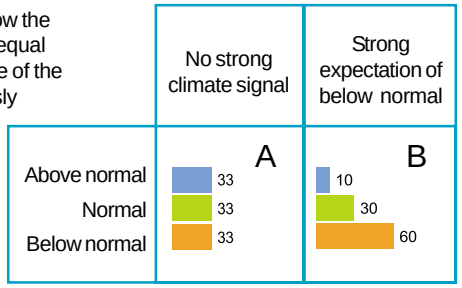
River flows



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 normal, but, given the variable nature of climate, the chance of normal or above-normal conditions is also shown (30% and 10% respectively).



Backgrounder

Estimating changing frequencies of extreme events

Winter this year was characterised by some relatively rare events, including extremes of temperature, at least three disruptive snowfalls, five damaging storms, and seven heavy rainfall/flooding events. Weather sensitive industries are concerned to know if extreme event frequencies are changing against the background of climate change, and whether these frequency changes can be estimated.

Wild winter weather

The infamous "weather bomb" in June, which brought over 200 mm of rain in less than 2 days and cut power to 20 000 homes in Waikato, the powerlines collapsing under snow around Ashburton, and the 12 metre waves battering Banks Peninsula were all rare events this winter that might have prompted the question "Is this a sign of things to come?"

Reports of recent severe floods in Europe, Korea, and China add to evidence of what might appear to be a global trend of increasing frequency of extreme events.

How can we determine whether such events are likely to occur more often (or for that matter, less often) in the future?

Changing return intervals

One of the problems with extreme events is that the intervals between them are almost never the same. It is quite possible, for example, to have two 50-year floods in, say, a five year period, and then to have no floods of that size for another 50 years. In this way, extreme events can occur in *clusters*. This makes prediction of the frequency of extreme events over shorter periods, say a decade or so, very difficult.

Options for determining future risk

So what then are the options for determining whether the frequency of extreme weather events is changing?

In practice, we have to look at a range of options for analysis. Each option provides part of the information we need for determining future risk. Here are some examples.

1. Data trends

The instrumental record, that is, the daily observations of the weather going back over 100 years in New Zealand, is an important resource in determining past climate trends. These data can tell us if drought is becoming more frequent, for example, or if the depth of heavy rainfall events is increasing. If we extrapolate historical data trends into the future, it gives us scenarios of what might happen.

2. Global scale climate cycles

Most of us are familiar with the El Niño–Southern Oscillation climate cycle, and the more slowly oscillating Interdecadal Pacific Oscillation, both of which affect atmospheric circulation over New Zealand and cause climate variability.

3. Climate scenarios

Climate scientists in many countries are working with Global Circulation Models that emulate how global climate patterns evolve and what happens when there are both natural and human induced changes, such as reduced forest cover, or higher green house gas concentrations.

4. Weather generators

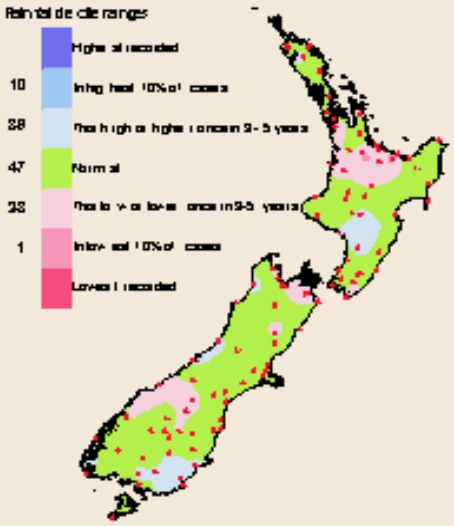
Weather generators are computer models that statistically represent day-to-day weather patterns and events. Once the models are good enough to simulate present weather, they can be adjusted based on how the climate is expected to change over the next few decades, using stronger westerlies or higher temperatures for example. The output might show changes in climate – does it rain more or less often? Is there any change in the depth of rainfall events and their intensities?

Natural hazards

Some regional authorities in New Zealand are compiling information on natural hazards, including extreme weather. The above methods are being used to help create this information, which provides a basis for future hazard awareness and planning. NIWA and GNS (Institute of Geological and Nuclear Sciences) are addressing natural hazard concerns by launching a Natural Hazards Centre. There will be more information on this in subsequent issues of this publication.

2002 rainfall to date

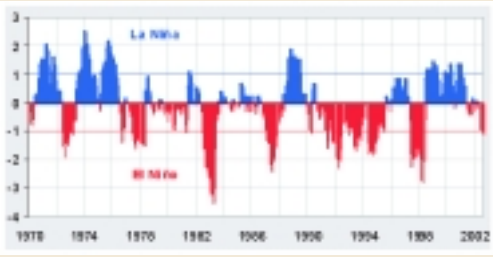
Large areas of New Zealand have received near normal rainfall. Parts of Waikato, Bay of Plenty, and the northeast and southwest of the South Island have been drier than average.



ABOVE: Total rainfalls for 1 January to 31 August 2002, shown according to decile rankings of all rainfalls for this period from 1972. Dots indicate observation sites used in the analysis.

Update on the SOI

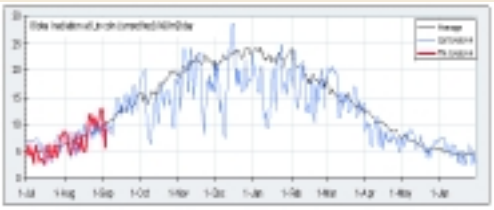
The mean Southern Oscillation Index (SOI) for August was –1.8, with the three month average now at –1.1. The present moderate El Niño is expected to be weaker than the 1997–98 event. Further general information on El Niño is available on the World Meteorological Organization web site www.wmo.ch



ABOVE: The Southern Oscillation Index (SOI), a measure of changes in the atmospheric pressures across the Pacific, smoothed over three months. La Niña or El Niño typically have an observable effect on the New Zealand climate when there is a large departure of the SOI from zero.

Online climate graphics

Climate maps and line plots of climate site observations are updated each week on the Climate Now website. See www.niwa.co.nz/ncc/climatenow



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Cover picture:
Debutante tulips mark the arrival of spring in the Wellington Botanic Gardens. *Photograph:Alan Blacklock*