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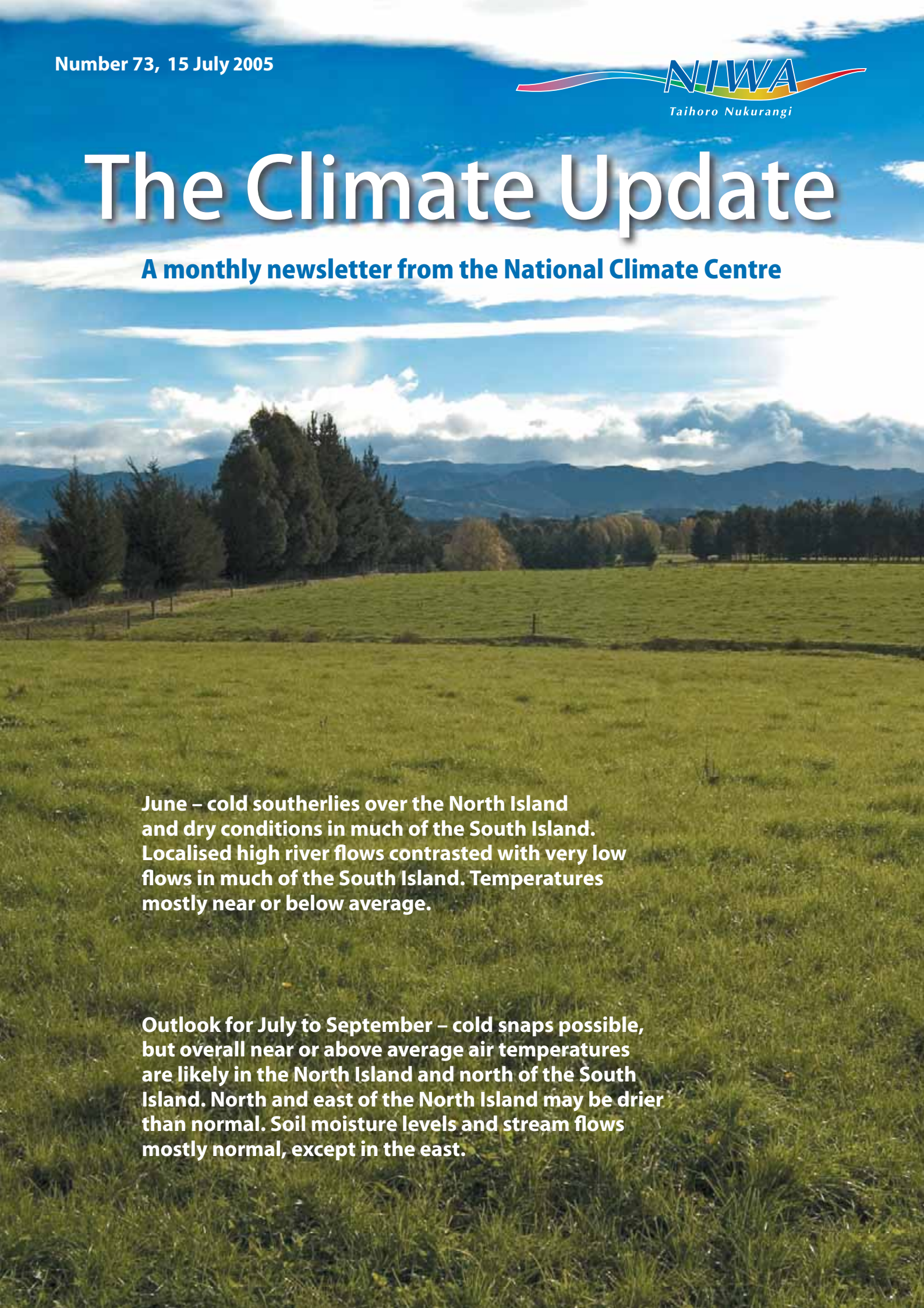
NIWA
Taihoro Nukurangi

The Climate Update

A monthly newsletter from the National Climate Centre



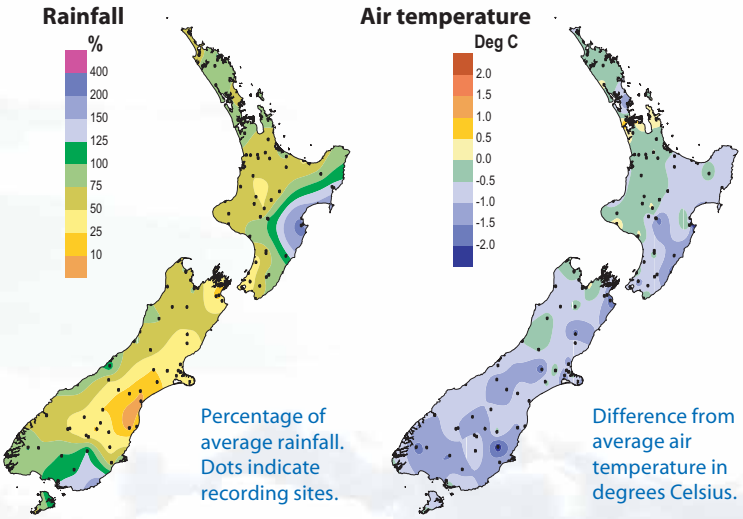
June – cold southerlies over the North Island and dry conditions in much of the South Island. Localised high river flows contrasted with very low flows in much of the South Island. Temperatures mostly near or below average.

Outlook for July to September – cold snaps possible, but overall near or above average air temperatures are likely in the North Island and north of the South Island. North and east of the North Island may be drier than normal. Soil moisture levels and stream flows mostly normal, except in the east.

New Zealand climate in June 2005

New Zealand experienced frequent cold southerlies in June, especially over the North Island. Air temperatures were lower than normal in the east and south of the country. Christchurch Airport recorded –6.1 °C on 25 June, the lowest temperature for 30 years.

It was sunny and dry along the east coast of the South Island. Dunedin had its sunniest June in more than 50 years of measurements, while Timaru Airport recorded just 4 mm of rain (11% of normal).



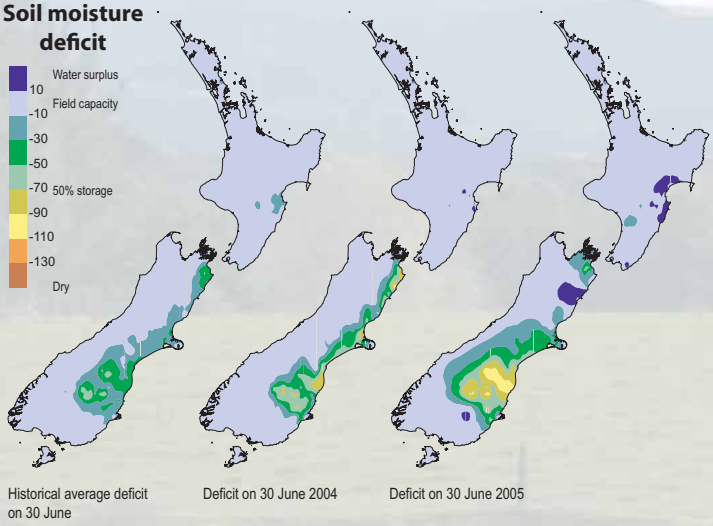
Percentage of average rainfall. Dots indicate recording sites.

Difference from average air temperature in degrees Celsius.

For more information on the climate in June, visit the climate summaries page at www.niwa.co.nz/ncc/cs/mclimsum_05_06

Low South Canterbury and Otago moisture

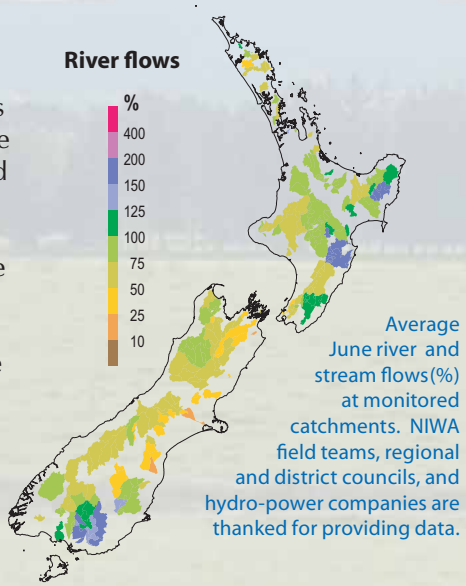
Soil moisture levels in parts of South Canterbury and Otago remained lower than normal in June, following low June rainfalls in the region. Elsewhere in the country, soils were mostly at field capacity or above, and unusually wet in Hawke's Bay and Kaikoura.



Water balance in the pasture root zone for an average soil type where the available water capacity is taken to be 150 mm.

Regional flow contrasts

Strong regional contrasts in June streamflows were seen, with both high and low streamflows in both islands. In the North Island, flows were above normal in Hawke's Bay and Wairarapa. In the South Island, flows were above normal in coastal Southland, but very low in most other places.

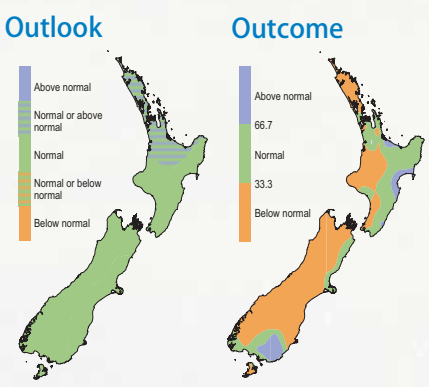


Average June river and stream flows (%) at monitored catchments. NIWA field teams, regional and district councils, and hydro-power companies are thanked for providing data.

April to June: the climate we predicted and what happened

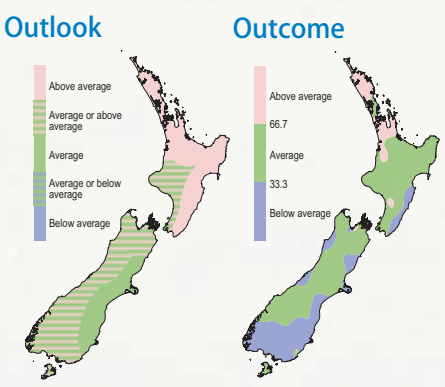
Rainfall

Rainfall was near normal as predicted in parts of the North Island, but lower than expected in the north and west of the North Island and much of the South Island.



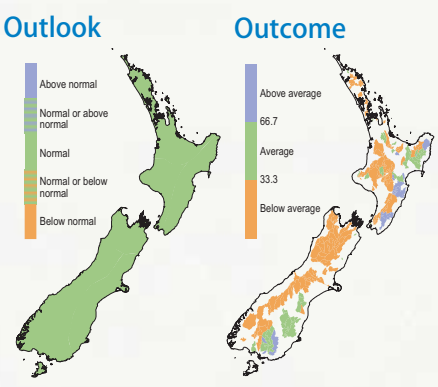
Air temperature

Air temperatures were above average in the north of the country, and near average in much of the South Island, as was predicted, but lower than expected in the east and south of the country.



River flows

Streamflows were above normal to normal on the east coast of the North Island and in the south of the South Island, and below normal elsewhere.



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

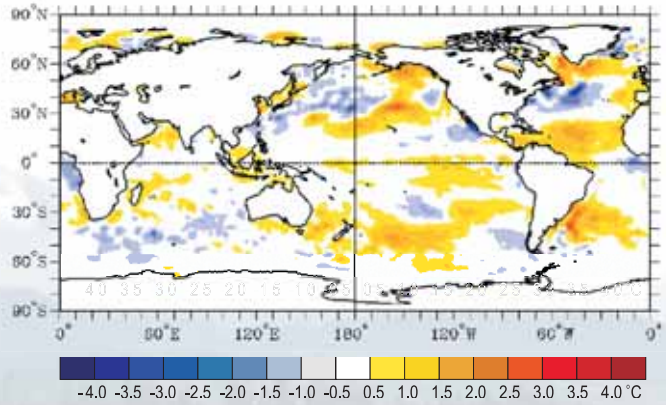
As an approximate guide, middle tercile rainfalls typically range from 80 to 115% of the historical normal, and middle tercile temperatures range about the average by plus or minus 0.5 °C.

Global setting and climate outlook

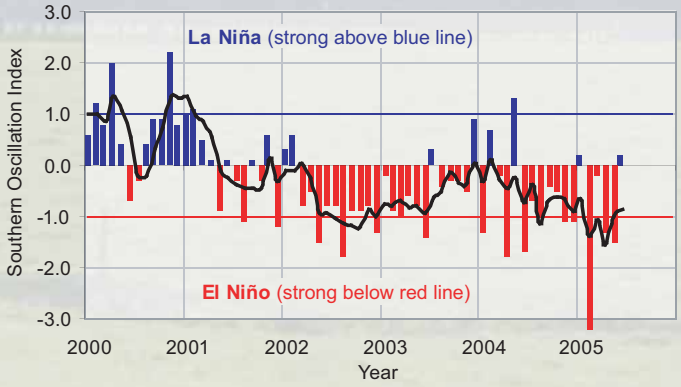
Neutral conditions remain

The tropical Pacific Ocean is in a neutral state (no El Niño or La Niña), but equatorial Pacific sea surface temperatures (SSTs) remain above average. Although this positive anomaly is often a sign of El Niño, most forecast models indicate that neutral conditions will continue until the end of 2005.

The Southern Oscillation Index (SOI) rose to near zero in June, after a strong negative excursion in May. The 3-month mean including April to June is –0.9.



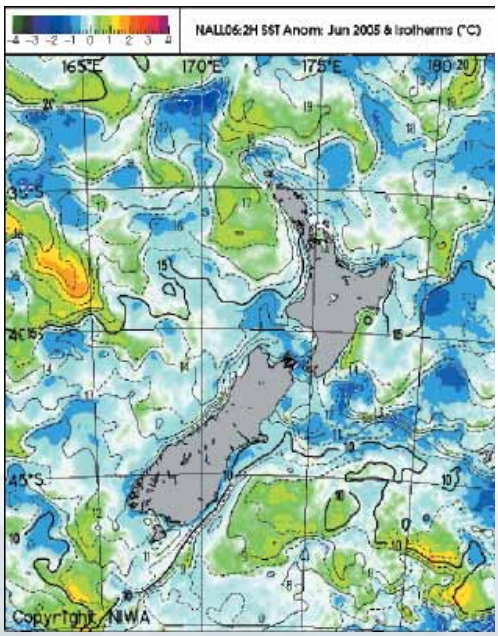
Difference from average global sea surface temperatures for June 2005. Map courtesy of NOAA/Climate Diagnostics Centre



Monthly values of the Southern Oscillation Index (SOI), a measure of the changes in atmospheric pressures across the Pacific, and the three-month mean (black line).

Sea surface temperatures around New Zealand

The New Zealand average sea surface temperature anomaly dropped to about +0.5 °C in June, with a 3-month mean anomaly for April to June of about +0.7 °C. Temperature anomalies are positive between 20°S and 50°S around most of the southern hemisphere. Sea surface temperatures around New Zealand are likely to be near average through September 2005.



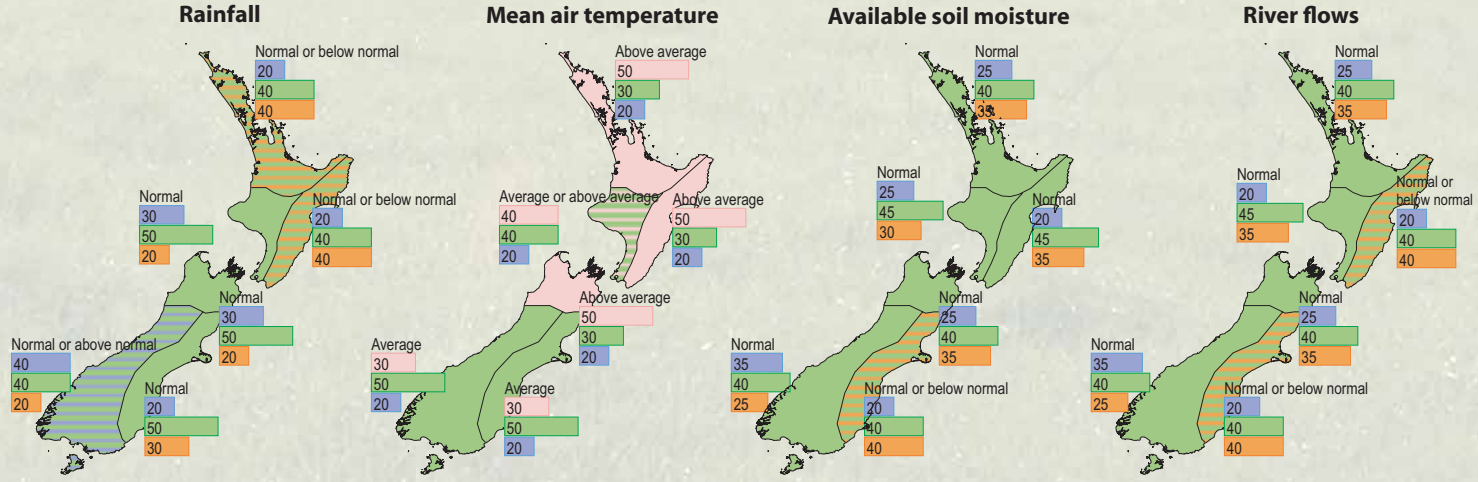
Average difference from normal June surface temperatures in the seas around New Zealand.

Outlook for July to September 2005

In contrast to June's southerly conditions, a return to wind flows of average variability over New Zealand is expected for the rest of winter. Enhanced westerly flows are likely to the south of the country.

Expected conditions are mapped below. Air temperatures are expected to be near or above average in all regions. Despite this, cold outbreaks, typical of winter, will occur at times.

Rainfalls are likely to be normal or above normal in the west and south of the South Island, normal or below normal in the north and east of the North Island, and near normal elsewhere. Normal soil moisture levels and streamflows are expected in most regions, except for normal or below normal soil moisture levels in the east of the South Island, and normal or below normal



Below normal

Upper tercile: 20% chance of above normal 20

Middle tercile: 30% chance of normal 30

Lower tercile: 50% chance of below normal 50

Key to maps (example interpretation)

In this example the climate models suggest that below average conditions are likely (50% chance of occurrence), but, given the variable nature of the climate, the chance of normal or above normal conditions is also shown (30% and 20% respectively).

Soil water balance – a quick guide to droughts

The soil water balance is a method of calculating how much rain or irrigation water in a given soil depth is used by plants, or is lost through drainage or by surface runoff. The historical climate record enables us to see how the water balance varies across a range of climatic conditions, an aid to evaluating the impact and frequency of dry conditions due to low rainfall.

Evapotranspiration

A key factor in the water balance is evapotranspiration, which is the combined 'use' or loss of soil water by transpiration through plants and evaporative loss from the soil and other surfaces. Evapotranspiration is dependent on meteorological conditions – solar radiation, wind, temperatures, and humidity. It also depends on the ability of plants to extract and transpire water from the ground, which in turn is dependent on soil conditions.

Evapotranspiration is measured in millimetres of water depth, like rainfall. New Zealand pasture in average silt-loam soils, for example, needs about 5–6 mm of water per day in summer, and about 1 mm in winter, to meet both its physiological requirements and the atmospheric demand.

Often, this water requirement is not fully available, and the gap that develops between water demand and what is actually available is referred to as the potential evapotranspiration deficit or PED. This can be thought of as the amount of water that would need to be added, by rainfall or irrigation, to keep the pasture growing at its potential seasonal rate.

Days of potential evapotranspiration deficit

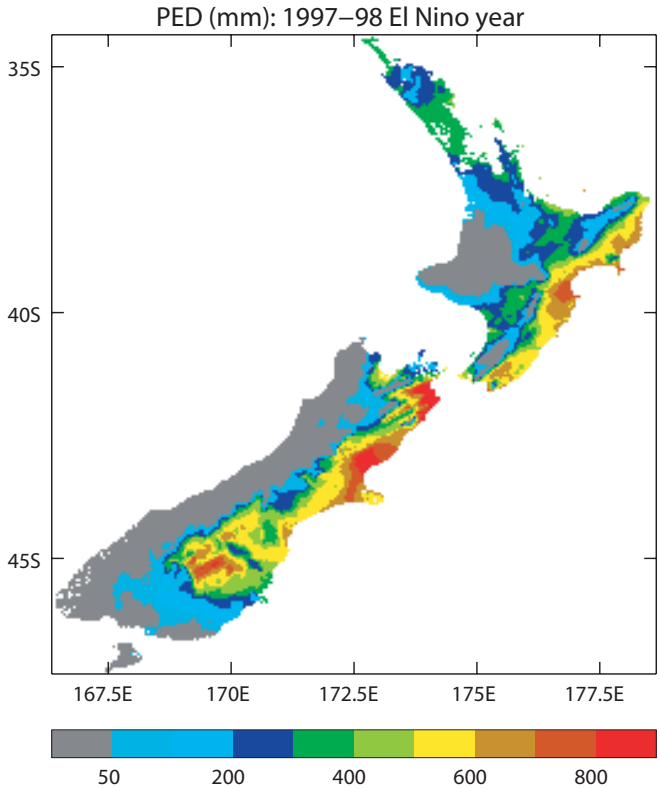
Days when water demand is not met, and pasture growth is reduced, are often referred to as days of potential evapotranspiration deficit. As a rule of thumb, an accumulation of 30 mm more PED corresponds to an extra week of reduced grass growth.

Many east coast regions of New Zealand, for example, typically experience about 400 mm of PED each year, resulting in about 3 months of reduced pasture production.

Past droughts

Droughts are hard to define because they arise from several causes, and can then affect different activities in different ways. PED is a useful means of ranking the severity of dry periods from a meteorological viewpoint. The choice of whether a dry period takes on the more sinister term of 'drought' might then be made on how often a given level of dryness (as defined by PED) might occur or be exceeded.

The well-remembered El Niño drought of 1997–98, for example, shown in the figure below, recorded 835 mm of PED in Marlborough, or more than 6 months of low or nil growth. The historical record in Marlborough shows that this level of drought occurs on average just once in 60 years. Other severely affected areas during this drought were Hawke's Bay, Kaikoura, north Canterbury, and inland Otago.



Accumulated growing year (July to June) PED for the extreme drought year of 1997–98. PED was close to or exceeded 800 mm in some eastern regions and parts of Otago.

The more recent 2000–01 drought recorded 802 mm of deficit in Marlborough. A drought like this occurs on average about once in 20 years. The difference in PED, 33 mm, represents a loss of about a week of pasture production.

Future droughts

Using historical patterns of climate variability and future scenarios of climate change, NIWA scientists have calculated that, for drought prone regions of New Zealand, the risk of drought is likely to increase during this century. The results of this study can be found at http://www.climatechange.govt.nz

For more information on water balance analysis for New Zealand, contact ncc@niwa.co.nz

Wairarapa pastures in late autumn. The typical autumn recovery from low summer soil moisture may become less reliable under climate change scenarios projected for late this century.

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
Email: ncc@niwa.co.nz
Phone: 0-4-386 0300.
Visit our webpage: www.niwa.co.nz