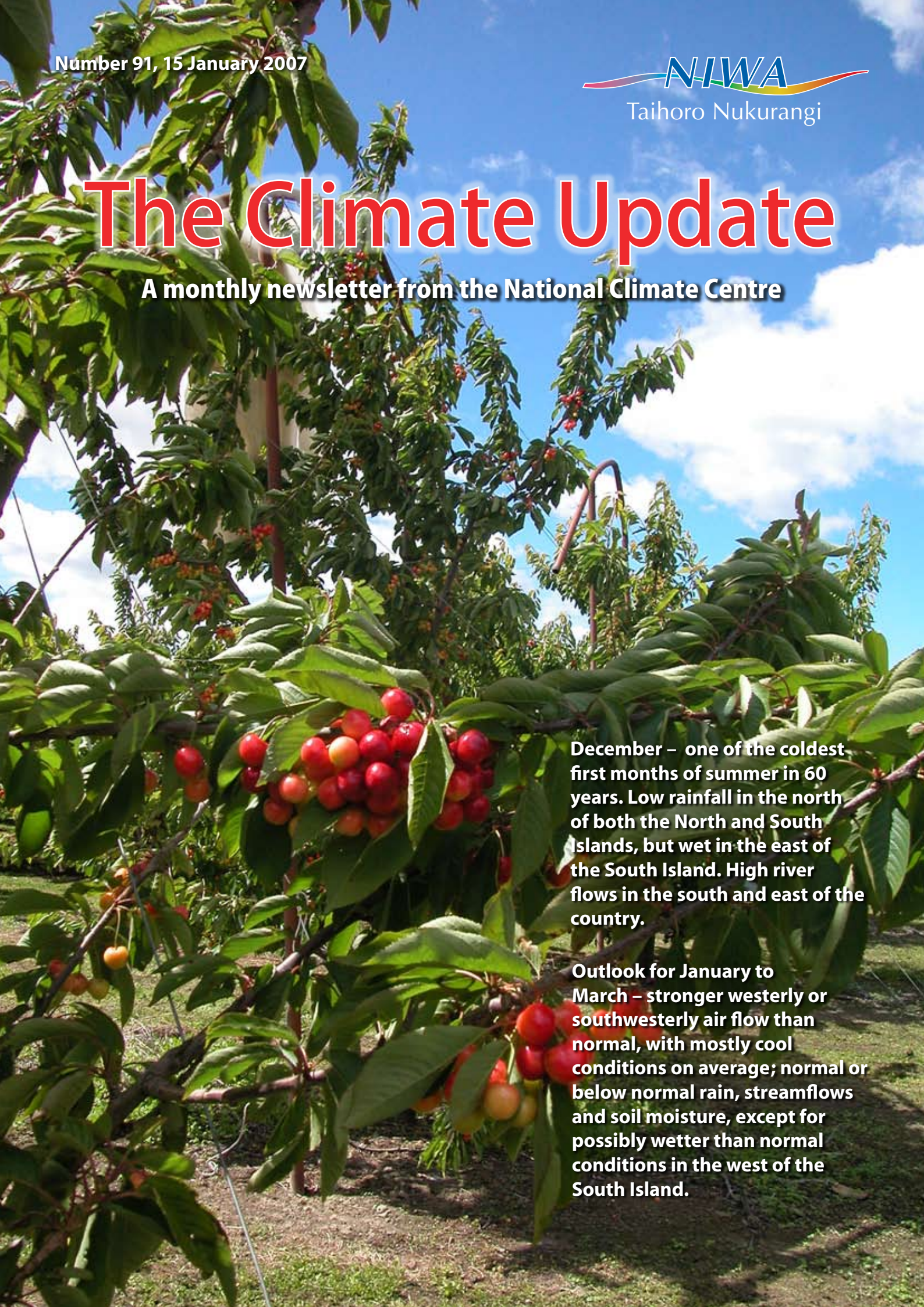
Number 91, 15 January 2007

NIWA
Taihoro Nukurangi

# The Climate Update

## A monthly newsletter from the National Climate Centre



**December – one of the coldest first months of summer in 60 years. Low rainfall in the north of both the North and South Islands, but wet in the east of the South Island. High river flows in the south and east of the country.**

**Outlook for January to March – stronger westerly or southwesterly air flow than normal, with mostly cool conditions on average; normal or below normal rain, streamflows and soil moisture, except for possibly wetter than normal conditions in the west of the South Island.**

# New Zealand climate in December

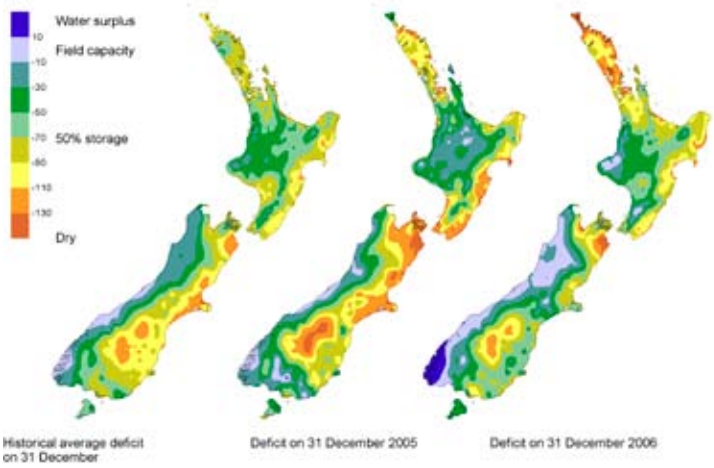
December was unusually cool for the first month of summer, due to more frequent than normal southerly winds. Air temperatures were 2 to 3 °C below normal in many places for much of the month. The national average temperature of 13.7 °C was 1.9 °C below normal. The same temperature was recorded in 1946, but since then only December 2004 has been colder, at 13.4 °C.

Rainfall was less than 50% of normal in the north of both the North and South Islands, but twice normal in some eastern areas.

## Dry in Northland and Nelson-Marlborough

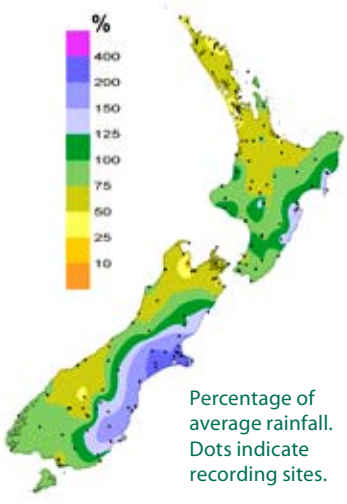
At the end of December soils were drier than normal in much of Northland, and also in parts of Nelson and Marlborough. Soil moisture levels were low also in parts of Gisborne, Hawke's Bay, and Wairarapa, but soils in many Canterbury and Otago districts were wetter than normal.

**Soil moisture deficit**



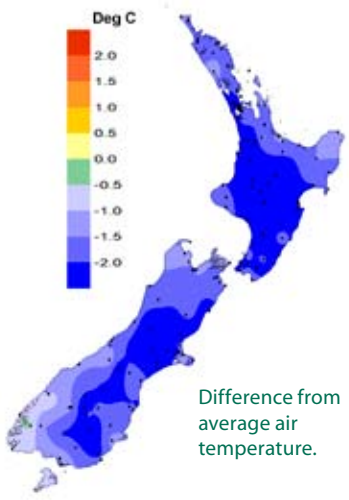

Water balance in the pasture root zone for an average soil type, where the available water capacity is taken to be 150 mm.

**Rainfall**




Percentage of average rainfall. Dots indicate recording sites.

**Air temperature**




Difference from average air temperature.

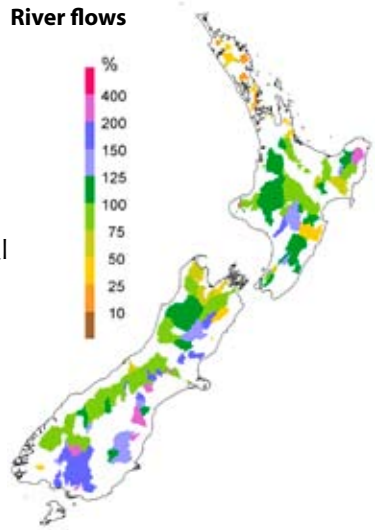
For more information on the climate in December 2006, visit the climate summaries page at www.niwascience.co.nz/ncc/cs/mclimsum_06_12

## High flows in south and east

Southerly weather conditions generated high river flows in many catchments in southern and eastern parts of the country, and in some areas of Manawatu and Taranaki. Flows were normal in central and western districts and low in Northland.

Percentage of average December river and stream flows at monitored catchments. NIWA field teams, regional and district councils, and hydropower companies are thanked for providing data.

**River flows**




## October to December – the climate we predicted and what happened

### Rainfall

Rainfall was as forecast in the north of both main islands, but higher than expected in the south of the North Island and east of the South Island. Westland was drier than predicted.

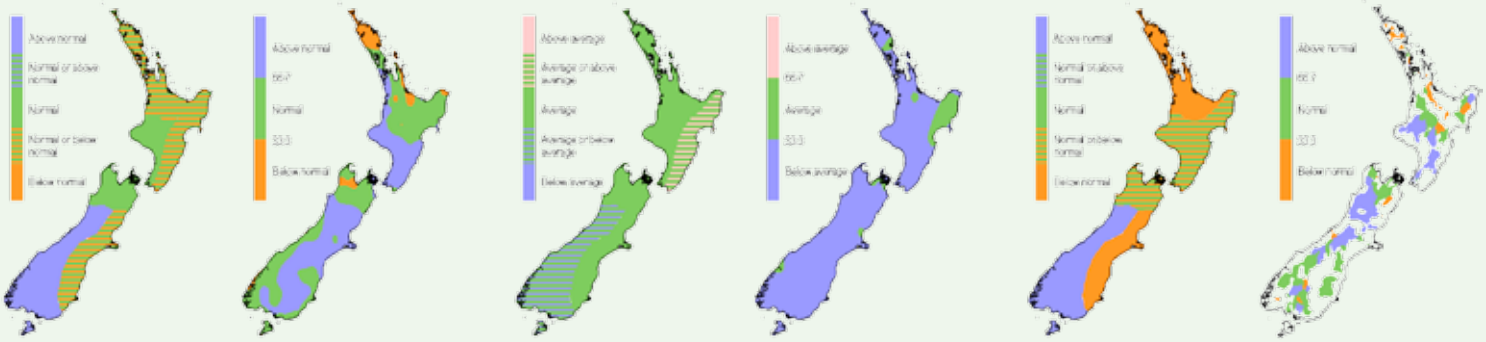
### Air temperature

Air temperatures were as forecast for the south and west of the South Island, but lower than expected in other regions.

### River flows

Streamflows were below normal as predicted in the north of the North Island, but mostly higher than predicted elsewhere. In many parts of the north and east of the South Island, streamflows were higher than predicted.

**Outlook** **Outcome** **Outlook** **Outcome** **Outlook** **Outcome**



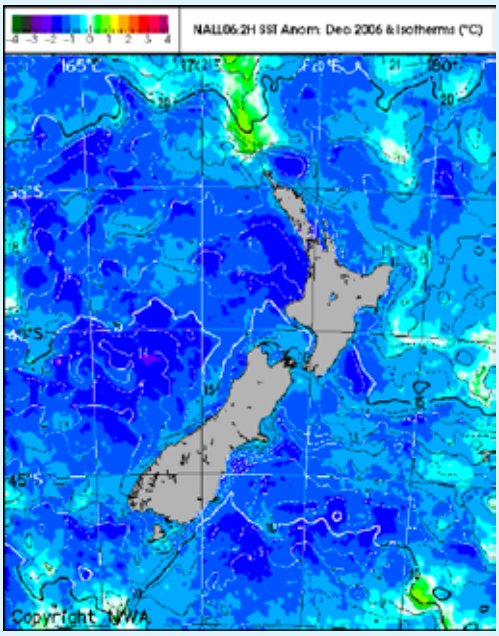
The three outcome maps give the tercile rankings of the rainfall totals, mean air temperatures, and mean river flows that eventuated from October to December, in comparison with the forecast conditions.

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

## Sea surface temperatures around New Zealand

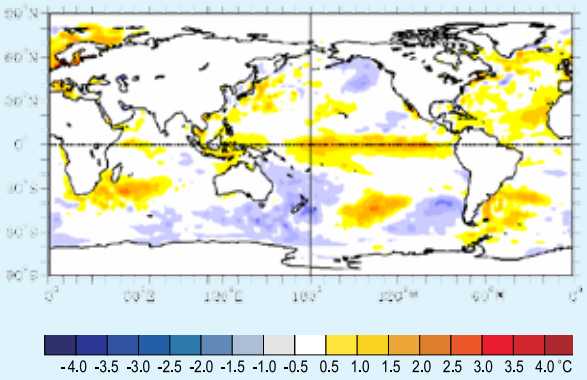
Sea surface temperatures in the New Zealand region continued to cool in December to 0.8 °C below normal for the month and 0.3 °C below normal for the October to December mean. Temperatures were between 1 to 1.5 °C below average in parts of the eastern Tasman Sea and to the east of the country, and are likely to remain below normal on average for the next three months.



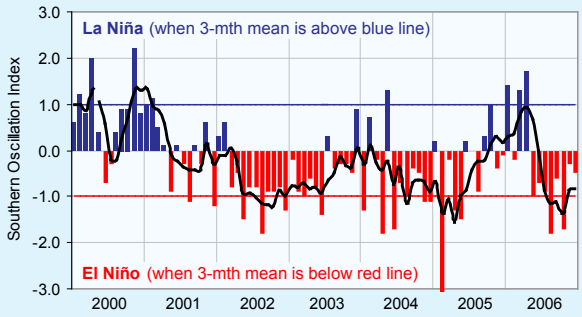

Difference from normal December surface temperatures in the seas around New Zealand.

## El Niño may weaken in autumn

A moderate El Niño event has peaked in the tropical Pacific, and will continue to influence New Zealand's climate to at least February 2007. Several indicators suggest that the event may weaken during autumn.




Difference from average global sea surface temperatures for December 2006. Map courtesy of NOAA Climate Diagnostics Centre. Positive temperature anomalies in the equatorial eastern Pacific peaked in December. Note the cool seas around New Zealand.




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).

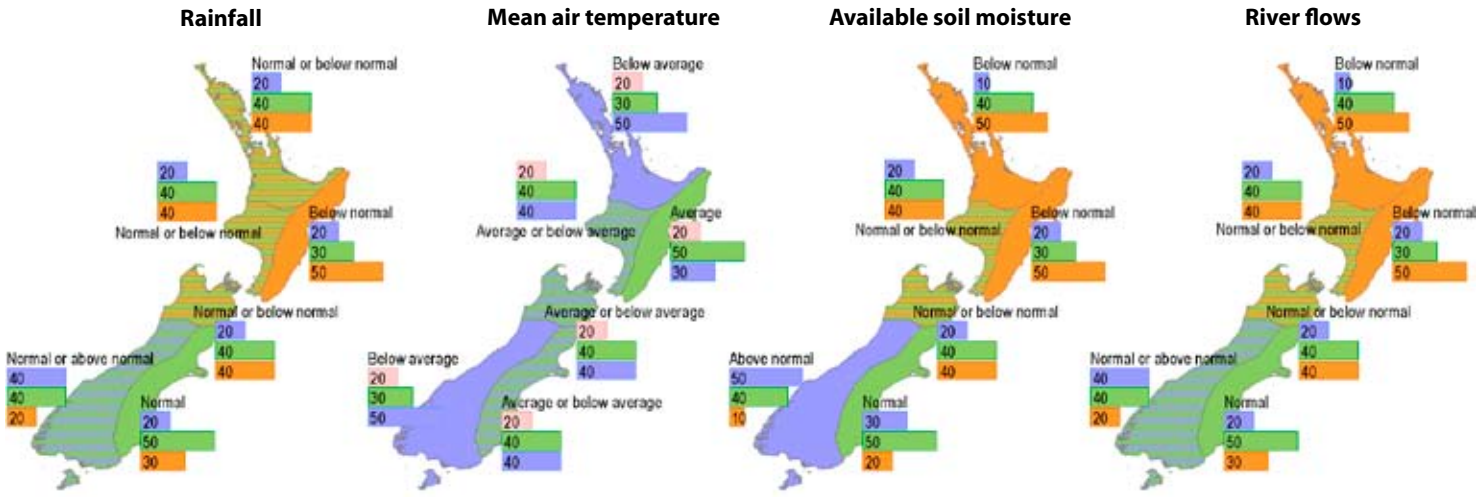
The SOI remained steady during December, averaging -0.5, with an average of -0.8 for the three months October to December.

## Outlook for January to March 2007

Atmospheric circulation patterns for January to March are likely to feature a stronger than normal westerly or southwesterly airflow over the country, with below average mean sea level air pressures over the south or to the southeast of New Zealand, and higher pressures to the north.

Air temperatures are expected to be average in the east of the North Island, and average or below average in all other regions.

Rainfall is expected to be normal or below normal in all regions except the west of the South Island, where normal or above normal rainfall is expected. Soil moisture and riverflows are expected to be normal or below normal in many areas except the west and south of the South Island, where they are likely to be above normal or normal.




**How to interpret these maps**

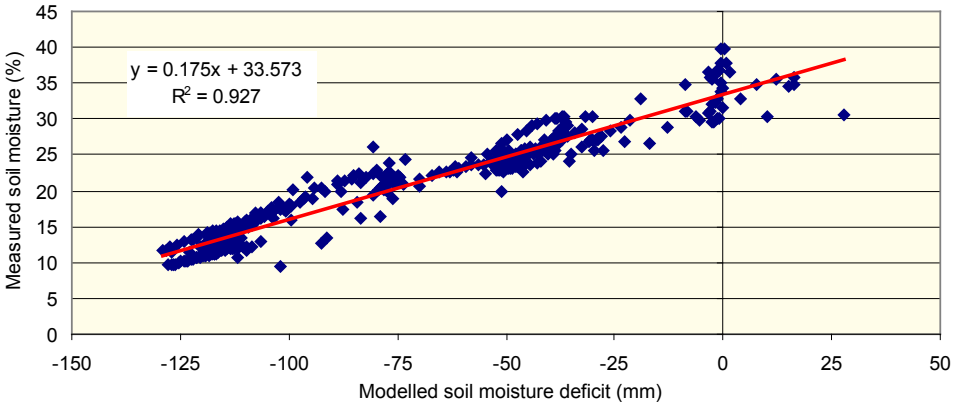
In the example here the climate models suggest that below average conditions are likely (50% chance), but, given the variable nature of the climate, the chance of normal or above normal conditions is also shown (30% and 20% respectively).

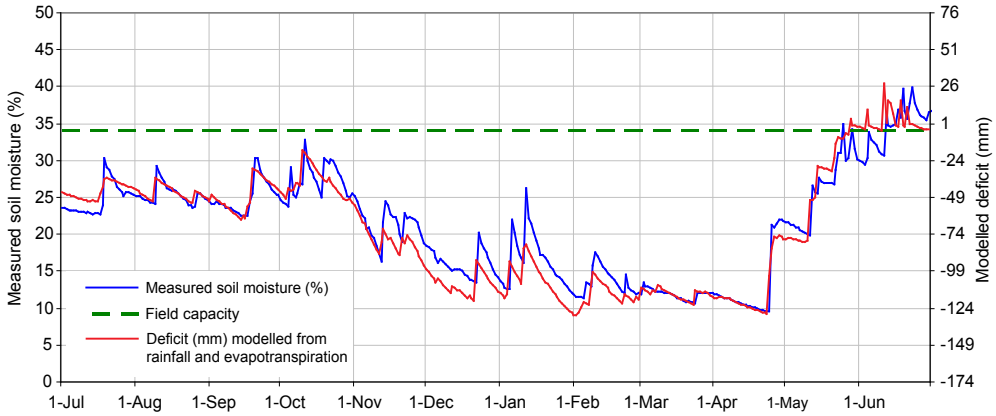
Below normal
20 — 20% chance of above normal
30 — 30% chance of normal
50 — 50% chance of below normal

# Predicting soil water balance

Knowing how much water is available in the soil is a key aspect of managing farm livestock feed budgets and pasture irrigation. Measurements of water content in the pasture root zone are essential to determine the water-holding characteristics of different soils. But once a reasonable number of measurements have been made, it becomes possible to model the ongoing soil water status.

The upper figure shows the relationship between measured soil moisture content at Winchmore, Canterbury, using an aquaflex sensor tape, and modelled soil moisture deficit using rainfall and evapotranspiration. The data are daily values from July 2005 to June 2006.




The figure shows that the soil moisture model explains more than 90% of the variation in the measured soil moisture. The relationship indicates that field capacity, when the modelled deficit is zero, occurs at about 34% moisture by volume. In the driest conditions, at just under 10% moisture by volume, the modelled deficit is about 130 mm. This tells us that, for this particular soil, the depth of soil water for each percent of moisture by volume is about 5.4 mm. This figure is important for irrigation planning, as it enables the farmer to calculate both the number of 'growing days' left before some critical deficit is reached if there is no rainfall, and the volume of water that is required in an irrigation application to lift volumetric water content by a specific amount.

The lower figure shows the daily time series of the observed and modelled soil moisture. There are some discrepancies in water content, for example in mid October and mid November where the aquaflex measurements (blue curve) show a disproportionately large response to rainfall, and these may indicate measurement errors. Apart from that, the relationship between the two datasets is reasonably consistent (although it should be noted that only one year of data has been used in this example).

These data at Winchmore are shown for a non-irrigated site. The model can also be used to monitor trigger point soil deficits, track irrigation applications, and anticipate irrigation requirements well in advance by using forecast weather conditions. Fifteen day rainfall forecasts that could be adapted for use in water balance models are available through ClimateExplorer (http://climate-explorer.niwa.co.nz).

Central Otago cherries in early December. Helicopters and chemical sprayers helped blow-dry the fruit to mitigate damage from mid December rain.
Cover photo: *Steve Le Gal*

*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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