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NIWA
Taihoro Nukurangi

The Climate Update

A monthly newsletter from the National Climate Centre

January – cool in the south and mostly warm in the north. High rainfall and stream flows in some areas.

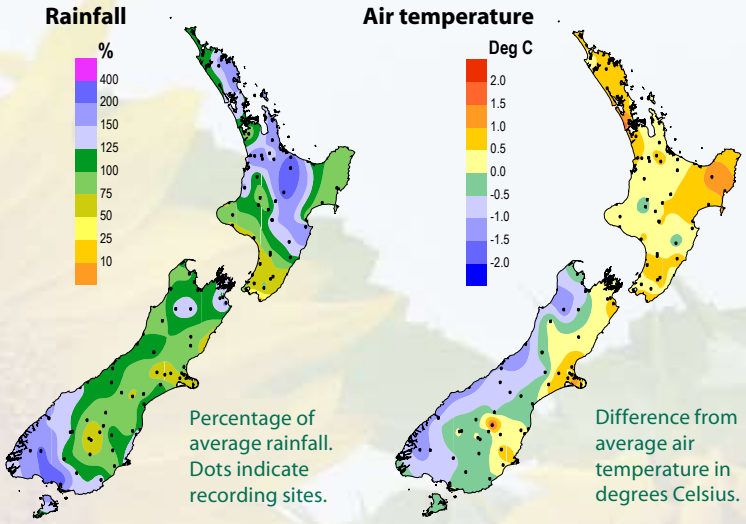
Outlook for February to April – lighter than normal westerlies; temperatures average or above; rainfall average or below, with low streamflows likely in the southwest North Island and eastern South Island.

New Zealand climate in January 2006

Western South Island temperatures plummeted in January, after one of the warmest Decembers on record. Mean January temperatures were up to 1.5 °C below average in parts of Westland and Fiordland. Temperatures were above average in the east and north of the North Island.

A mixed pattern of rainfall occurred over New Zealand in January, with relatively high totals in parts of Northland, Bay of Plenty, Taupo, Hawke's Bay, and Southland, and comparatively low totals in Horowhenua.

For more information on the climate in January, visit the climate summaries page at www.niwascience.co.nz/ncc/cs/mclimsum_06_01

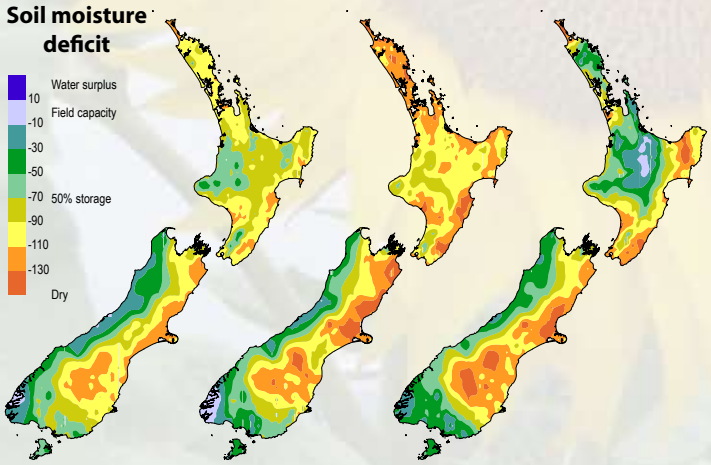


Percentage of average rainfall. Dots indicate recording sites.

Difference from average air temperature in degrees Celsius.

Persisting soil moisture deficits

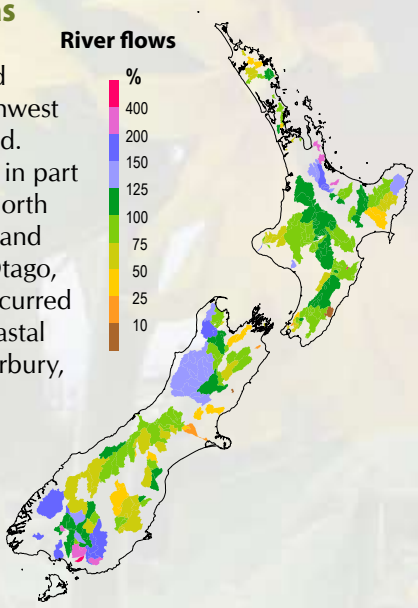
Greater than normal soil moisture deficits developed in northern and eastern regions of both islands until the substantial rainfall of 24-25 January. However, significant soil moisture deficits persisted in Manawatu, Wellington, and Wairarapa, and in parts of Canterbury and Central Otago.



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

High flows in some areas

High January streamflows occurred in the northern and central North Island, in northwest Nelson, Buller, and Southland. Near normal flows occurred in part of Northland, much of the North Island east coast, Nelson, inland Marlborough, Canterbury, Otago, and Westland. Low flows occurred in Taranaki, Kapiti Coast, coastal Marlborough, parts of Canterbury, and the Otago high country.

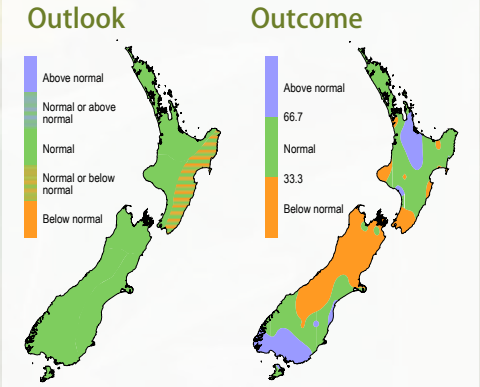


Percentage of average January river and stream flows at monitored catchments. NIWA field teams, regional and district councils, and hydro-power companies are thanked for providing data.

November to January: the climate we predicted and what actually happened

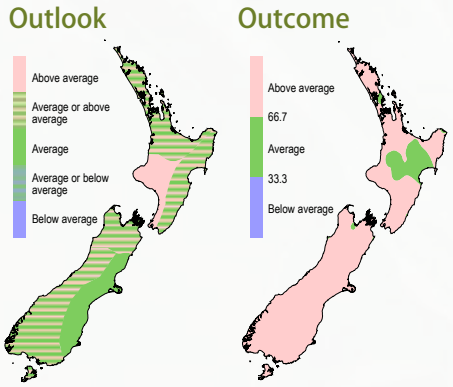
Rainfall

Rainfall was higher than predicted in parts of Waikato and the south of the South Island, and lower than predicted in northern and central parts of the South Island.



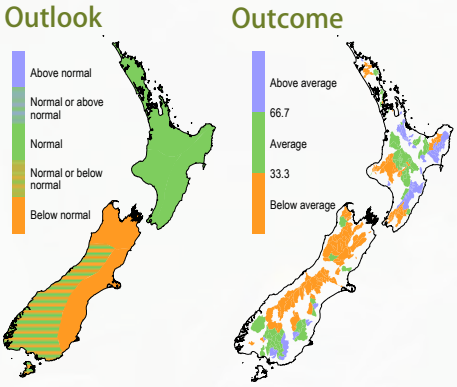
Air temperature

Air temperatures were above average or average in most areas as predicted, but higher than expected in the east of the South Island.



River flows

Streamflows were normal or above in much of the North Island, coastal Otago, and Southland, and below normal in Taranaki, Wairarapa, Kapiti Coast, and much of the rest of the South Island.



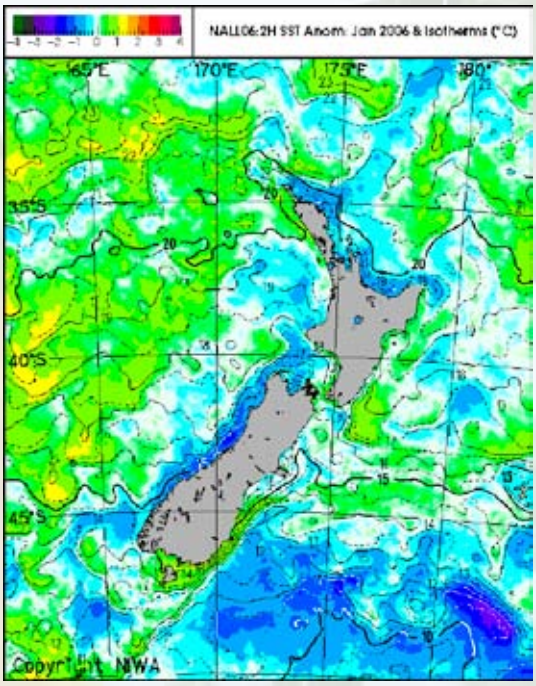
The three outcome maps give the tercile rankings of the rainfall totals, mean air temperatures, and mean river flows that eventuated from November to January, in comparison with the forecast conditions.

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 (SST) around New Zealand

The average difference from the historical normal SST in the New Zealand region eased in January, in association with cooler enhanced westerly atmospheric circulation. The SST anomaly was about +0.3 °C in January, down from +0.8 °C in December, and +0.6 °C for the three month November to January average.



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

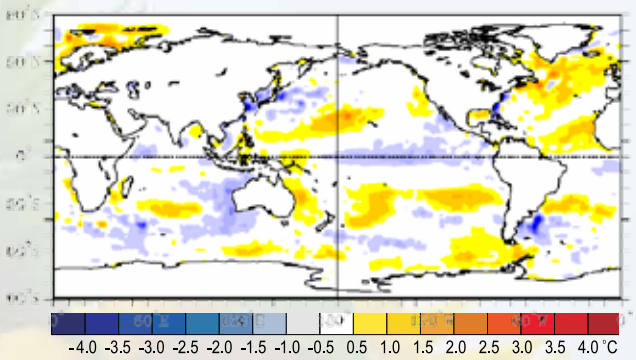
Outlook for February to April 2006

Westerly wind patterns over New Zealand during February-April are likely to be weaker than normal. Air temperatures are expected to be average or above average in all districts.

Rainfalls are expected to be near normal in most places, but normal or below normal in the southwest of the North Island and the east of the South Island. Normal or below normal soil moisture levels and below normal streamflows are expected in the southwest of the North Island and the east of the South Island, with mostly normal soil moisture and stream flow conditions elsewhere.

Weak La Niña

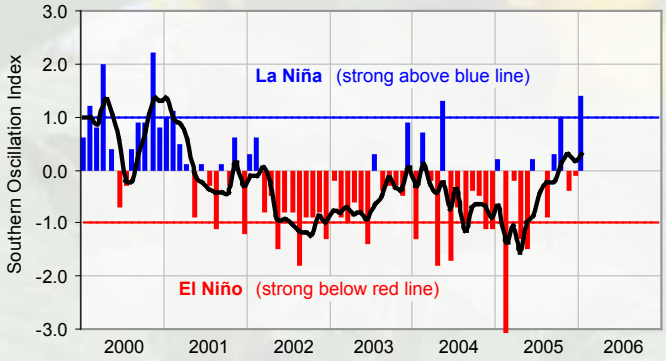
The state of the tropical Pacific Ocean and atmosphere is now characteristic of weak La Niña conditions. Trade winds across the equatorial region of the Pacific are stronger than normal, and convection is enhanced over northern Australia and Indonesia.



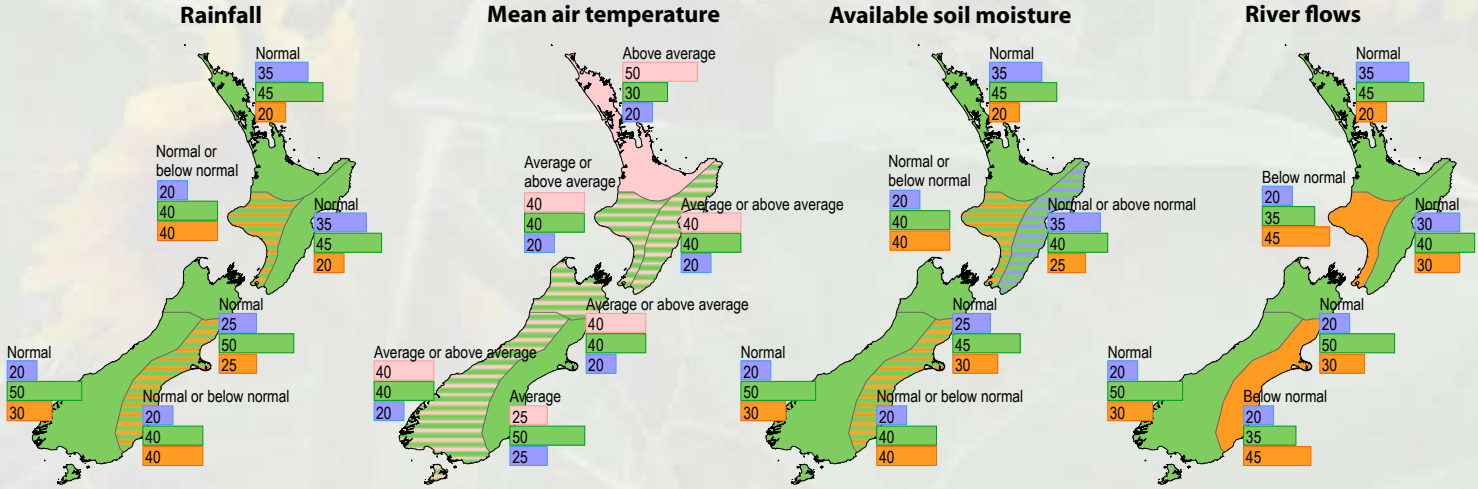
Difference from average global sea surface temperatures for January 2006. Map courtesy of NOAA Climate Diagnostics Center.

The Southern Oscillation Index (SOI) rose above +1 in January, from a neutral value in December (-0.1). The 3-month mean SOI is still in the neutral range. The weak La Niña may ease to neutral conditions by winter 2006.

For the tropical cyclone season through to April 2006, normal cyclone activity is expected. For New Zealand, this means a 70% chance of a cyclone affecting the country over the next three months.



Monthly values of the Southern Oscillation Index (SOI), a measure of the changes in atmospheric pressure across the Pacific, and the 3-month mean (black line).



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

Stratosphere holds potential for predicting NZ climate

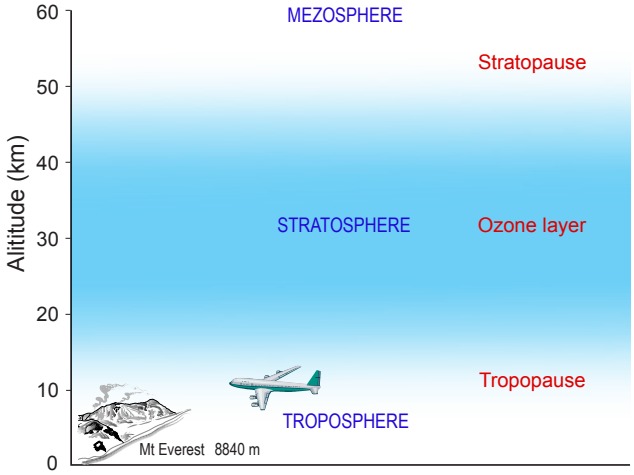
How the atmosphere behaves from one day to the next – the weather – can be predicted only a few days in advance. That's because weather patterns are short-lived; cyclones and anticyclones form and decay over just a few days. Chaotic behaviour in the atmosphere sets a practical limit of about two passing weather systems before predictability is lost. Occasional exceptions are tropical cyclones which may endure for a week or 10 days, but even in those cases, their paths and durability are hard to predict.

So when it comes to climate outlooks covering 2–3 months, we require much more stable patterns of atmospheric circulation, patterns that can be relied on to persist for long enough to enable useful predictions to be made.

Since the 1970s, climate scientists have used the effects of slowly evolving ocean conditions, recognisable in ocean surface temperature patterns and subsurface conditions, to predict shifts in mean climate patterns over land. The best known of these is the El Niño – Southern Oscillation phenomenon.

Since then, scientists worldwide have been sifting through many data sets to find patterns of variability that might be useful for predicting seasonal climate. While the resulting climate dynamics literature abounds with patterns of climate variability, in the end only a few patterns emerged as contenders for climate prediction. Two of these are described as 'rings of climate variability, each circling a pole at high latitudes'. In the southern hemisphere, the ring of climate around the South Pole is referred to as the Southern Annular Mode (SAM), or the High Latitude Mode.

It seems clear that wind patterns in the stratosphere (see figure) are accompanied by similar patterns at ground level. For example, stronger westerly winds at ground level occur when the wind is strong at high altitudes. The pressure patterns associated with SAM tend to alternate every few weeks, in a fairly symmetrical pattern around the South Pole. Higher pressures in the stratosphere over New Zealand (north of about 50° S) and lower pressures over the Pole, lead to more anticyclonic conditions over the country, with weaker westerly wind flow over New Zealand. The alternative phase of the SAM, when the pressure fields are reversed, leads to stronger, more disturbed westerly flow over the country. So we could say that the stratospheric layer 'nudges' tropospheric weather. The sum effect of all those 'nudges' influences seasonal climate near the ground.



The layers of the atmosphere shown schematically. The weather we experience is influenced by the overlying stratospheric layer. Note that the Earth's protective ozone layer is concentrated in the stratosphere.

The phase changes of the SAM are not predictable more than a few days in advance; however, once changed, the phases tend to persist for a few weeks.

There is some evidence that stratospheric ozone depletion, the popularly termed ozone hole, also leads to a strengthening of circumpolar winds and higher atmospheric pressures in the mid latitude New Zealand region. This may have an effect on the strength of westerlies over New Zealand during spring – they might be expected to be weaker than normal during late winter and early spring when the ozone hole is most pronounced.

As forecasting techniques are developed further, what's happening in the stratosphere may enable us to forecast climate patterns near the ground with more lead time.

For more information about the Southern Annular Mode, see http://horizon.atmos.colostate.edu/ao/

Sunflowers near Richmond. Stratospheric conditions play a role in growing conditions and the weather at the beach.

Cover photo: *Wendy St George*

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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