Number 60, 15 June 2004

NIWA
Taihoro Nukurangi

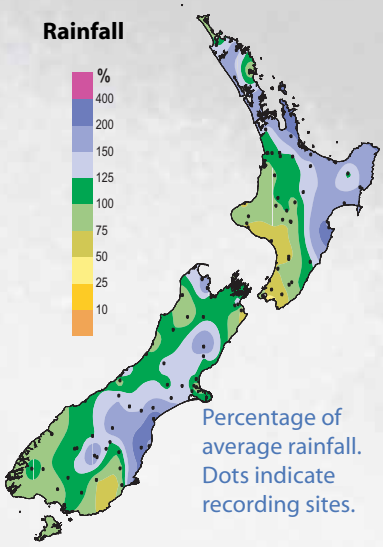
The Climate Update

A monthly newsletter from the National Climate Centre

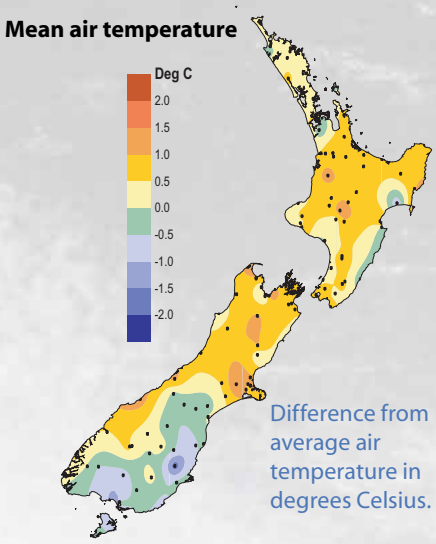
May – mostly warm; wet in the north and east. Low river flows in the southern North Island and inland Southland.

Outlook for June to August – near average temperatures and normal rainfall for most places.

New Zealand climate in May 2004



Percentage of average rainfall. Dots indicate recording sites.



Difference from average air temperature in degrees Celsius.

Warm and wet in the east

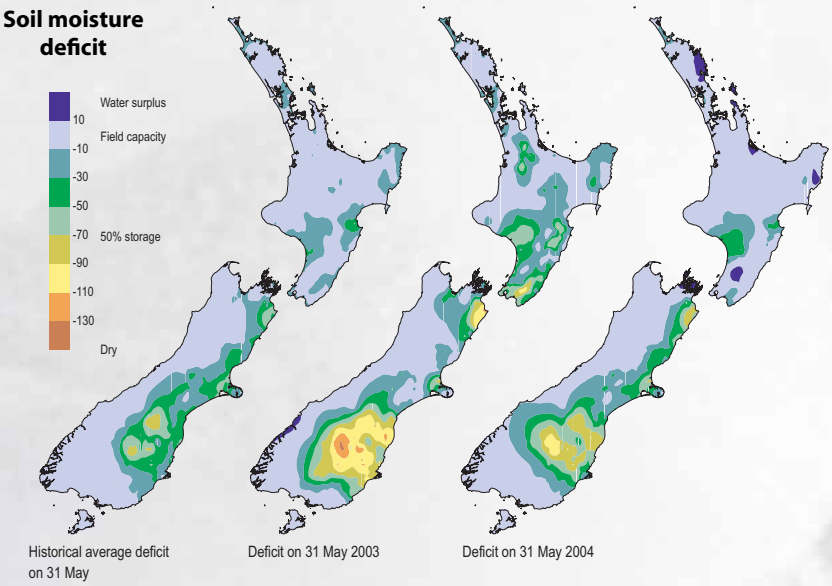
May's climate was much warmer than usual, with temperatures almost the same as in April 2004. Rainfall was well above average in parts of Auckland, Coromandel, and Bay of Plenty, and below average in Wanganui, Manawatu, Kapiti, and Wairarapa. Mean temperatures were above normal in most districts, especially Bay of Plenty and Gisborne. A record 27.3 °C was recorded at Nelson Park, Napier, on 2 May, the highest May temperature since measurements began there in 1869, and a new May all-time record for the North Island.

The May climate pattern was due to warm air flow fron the northerly quater prevailing over the country with more frequent depressions in the Tasman Sea, and anticyclones east of New Zealand.

For more information on the climate in May, visit the climate summaries page at www.niwa.co.nz/ncc/cs/mclimsum_04_05

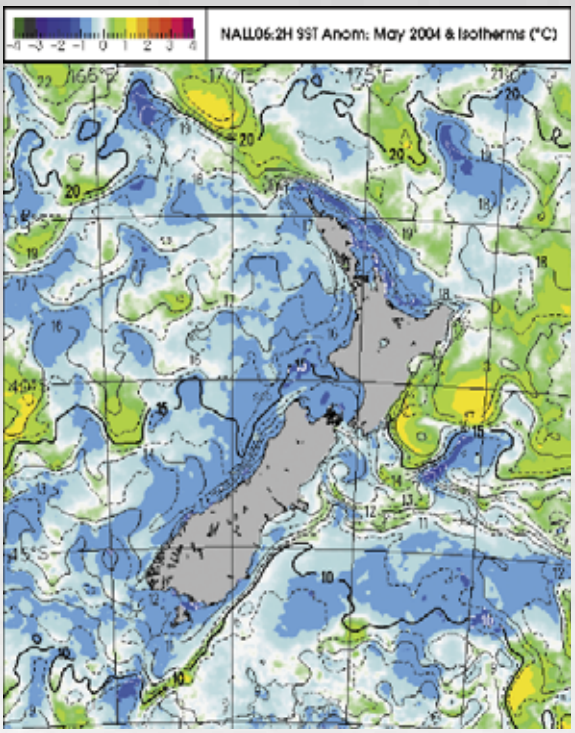
Diminished deficits

End of April soil moisture deficits in eastern regions of the South Island, and in Hawke's Bay and Northland, were largely overcome during May. Parts of Otago remained at less than 50% total root zone moisture storage at the end of the month, although conditions were generally better than at the same time last year.



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

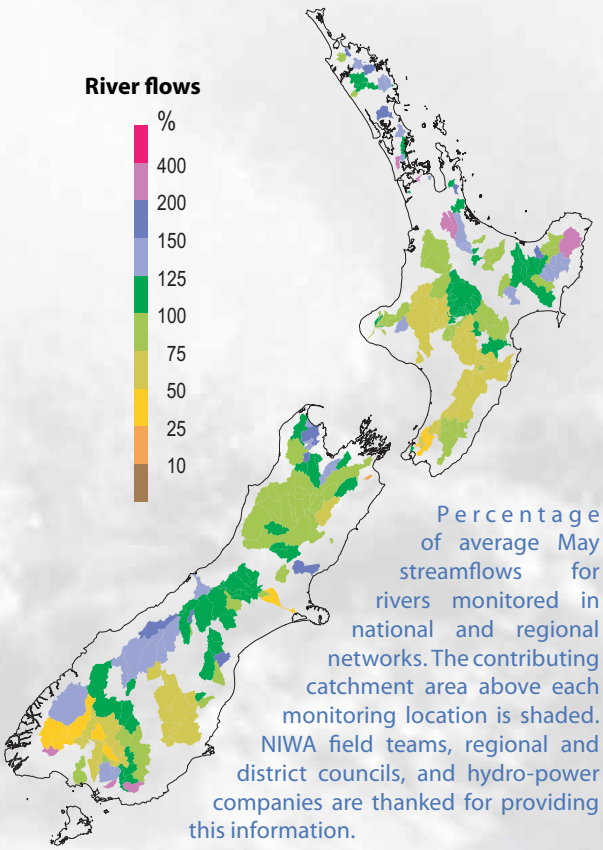
Sea surface temperatures



Difference from normal surface water temperatures in the seas around New Zealand. The New Zealand region average SST rose in May, most likely as a result of heat uptake from the atmosphere associated with warm northerly quarter wind flow anomalies.

River flows

Streamflows were below normal in the southern North Island and in inland Southland. Flows were generally normal or above normal in western regions (except the Buller and Grey rivers), and near normal elsewhere.



Percentage of average May 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

March to May 2004

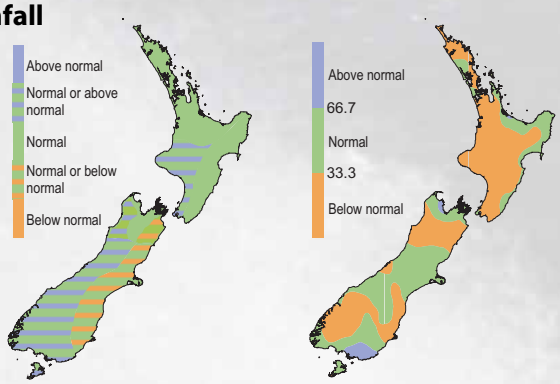
Rainfall was lower than predicted in the west of the North and South Islands, in Northland, and in parts of the east and south of the North Island. In other areas, rainfall was normal or below normal as expected.

Air temperatures were average or below average as predicted in most places, although it was cooler than expected in the north and east of the North Island.

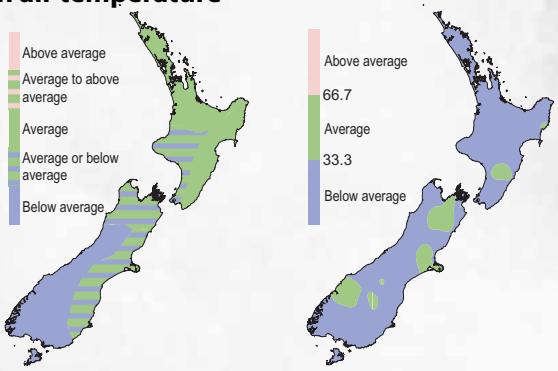
River flows were expected to be normal or above normal in western regions, normal or below normal in the east of the South Island, and near normal elsewhere. Flows were generally normal or above normal in western regions, and near normal elsewhere.

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

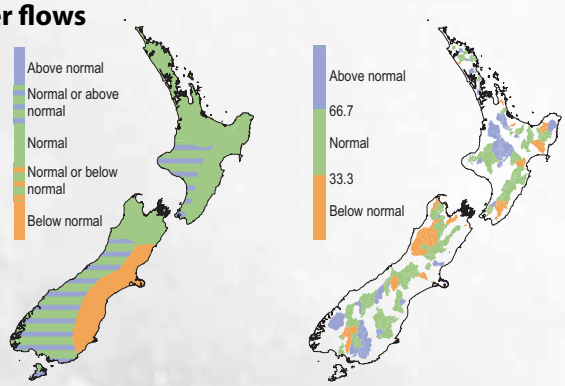
Rainfall



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 March to May, 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 in the range of the average plus or minus 0.5 °C.

Outlook

June to August 2004

Below average mean sea level pressures are expected to the south of New Zealand, with slightly enhanced westerly quarter winds, during winter 2004.

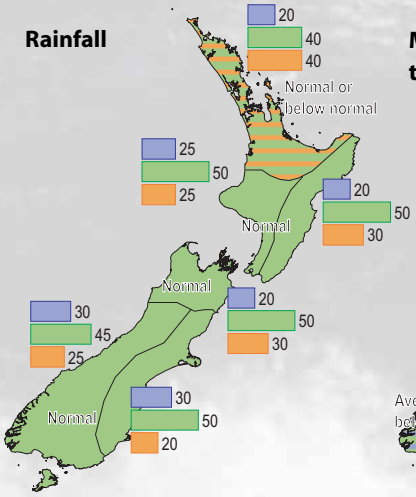
Mean three-month sea surface temperatures around New Zealand are likely to be near the long-term winter average.

Temperatures are expected to be average or below average for the southern two-thirds of the South Island, and average elsewhere.

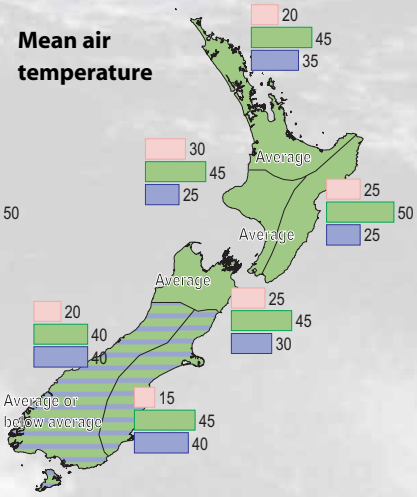
Rainfalls are expected to be near normal in most regions, but tending to below normal in the northern North Island. Normal winter soil moisture levels and streamflows are expected in all regions.

No El Niño or La Niña is expected through winter 2004.

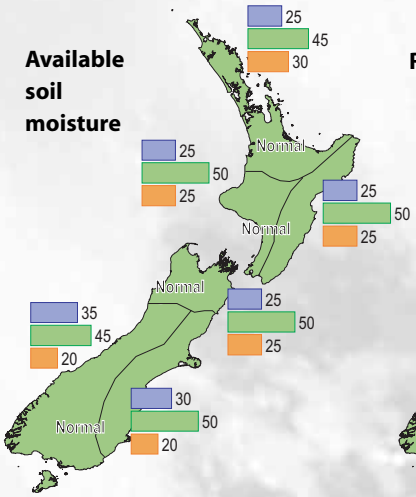
Rainfall



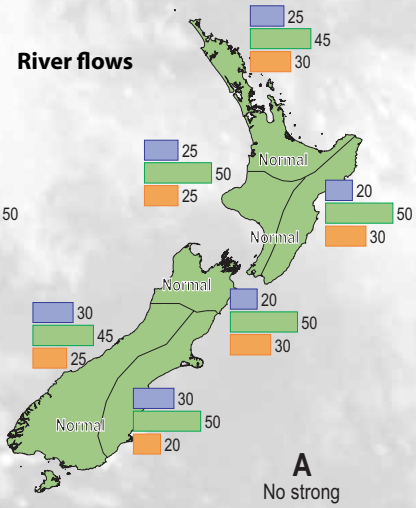
Mean air temperature



Available soil moisture



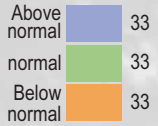
River flows



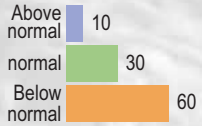
Key to maps (example interpretation)

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).

A
No strong climate signal



B
Strong expectation of below normal



Backgrounder

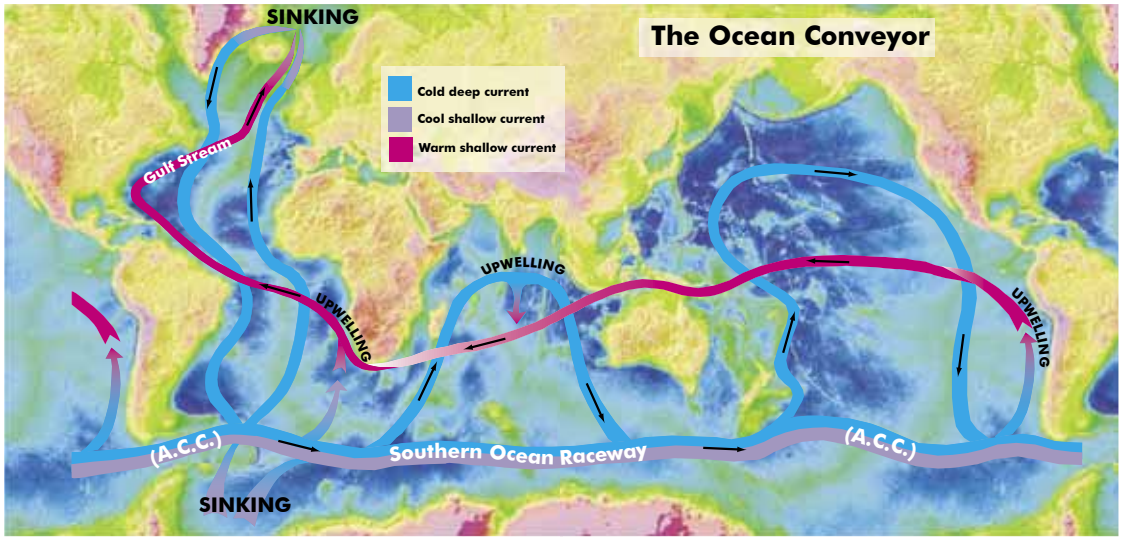
The world's oceans and our climate

Alan Porteous, Phil Sutton, and Lionel Carter , NIWA, Wellington

The circulation of the world's oceans helps to keep the climate of the land masses relatively stable. Ocean currents have evolved over a long time – in spite of suggestions of near-instant climate change in the recent film *The Day after Tomorrow,* abrupt breakdown in ocean circulation is unlikely this century.

The circulation of the world's oceans is driven by tidal forces, wind stress, and changes in the density of the water. The density of seawater is controlled by its temperature (thermo) and its salt content or salinity (haline). Hence ocean circulation driven mainly by density differences is called the thermohaline circulation (THC). Because of the global extent of the THC, it is often referred to as the 'Ocean Conveyor'.

The key driver of the THC is cooling and subsequent sinking of relatively salty sea water in the North Atlantic, as shown in the adjacent figure. The cooled salty water then flows south at depth through the North and South Atlantic Oceans before being entrained in the Antarctic Circumpolar Current (ACC). Further sinking occurs near Antarctica, as cold water from beneath the ice shelves becomes even more dense as salt is expelled from the freezing sea ice.



The 'Ocean Conveyor'.

From the Southern Ocean, the Ocean Conveyor carries the cold dense water north at depth into the Indian and Pacific Oceans, where it gradually warms and returns to the surface. Warm surface water flowing back to the North Atlantic completes the Conveyor.

Is breakdown of the THC possible?

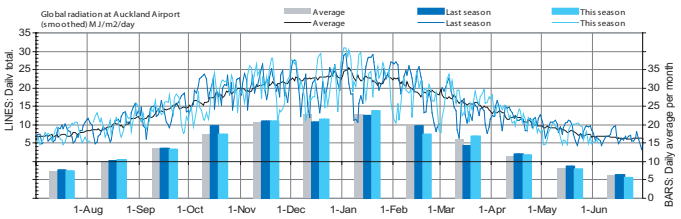
The sinking in the North Atlantic is critically dependent on the salinity of the surface waters. As these warm waters approach Europe heat is lost to the atmosphere, thus providing Europe with its moderate climate. This 'radiator' effect is continuously maintained by the THC as it brings more warm water from the tropical and South Atlantic. Therefore, to a large extent, the THC appears to be self-sustaining.

There are theories that the North Atlantic sinking could cease due to increased freshwater input into the North Atlantic as a result of global warming (e.g., from more rainfall, or more rapid melting of Greenland glaciers). However, the Ocean Conveyor is very complex, and detailed studies suggest it would only be gradually weakened by global warming, and that it is unlikely to change much during this century.

Impact on New Zealand

Although a breakdown in the THC would have a net cooling effect on the North Atlantic, current climate models suggest there may be a warming of 1-2 °C or less in the New Zealand region, and that this would reinforce the background global warming trend. Such behaviour has been documented the last time North Atlantic sinking ceased, 12 800 years ago. At that time, the North Atlantic was plunged into a mini ice age, whereas maritime New Zealand barely cooled.

On-line climate graphics



Climate maps and line plots of climate site observations are available on subscription from the Climate Now website at www.niwa.co.nz/ncc/climatenow

Wild sea.
Cover photo: *Rob Murdoch*

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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