Weather and Climate

Key Information	Why is this Useful?	What is Happening?
Total annual rainfall.	Rainfall governs the amount of soil moisture available for plant growth. Periods of low rainfall result in increased water consumption and pressure on groundwater and surface water resources.	↓ Between July 1997 and June 1999 total rainfall was 75 per cent of the average annual rainfall.
Variation of monthly temperature from long-term averages.	Temperatures influence water availability and the rate of water consumption. Warm temperatures during winter also relate to lower levels of winter air pollution and demand for energy resources.	↑ Eighteen of the 24 months between July 1997 to June 1999 had warmer than normal temperatures.

Other Related Sections: Natural Hazards, Energy; Surface Water, Groundwater, Open Space and Natural Ecosystems, Part 2: The City's Economy

The weather affects much of the natural and physical environment. Extreme weather events result in stresses on the environment. For example, drought reduces groundwater and surface water quantities at times when consumption is also increased. The weather not only influences peoples' behaviour regarding resource use (especially water consumption), it also affects recreational resources and amenity values.

Two main climatic zones – the Port Hills and the Canterbury Plains – exist in the Christchurch area. The Port Hills have higher humidity and greater seasonal variability of rainfall than the plains, which are drier and have more evenly distributed rainfall. The plains are affected by north-westerly winds which dry out the soils, increasing their erosion potential and placing limits on forestry and agricultural productivity. In coastal areas the climate tends to be milder.

Table 2.1 shows some summary statistics for two climate stations in Christchurch; the Botanic Gardens in the centre of the urban area and Christchurch Airport, which is on the urban-rural boundary. This table illustrates that urban areas typically modify the climate in a number of ways. Trees and irrigated grass reduce summertime temperatures, whereas hard surfaces such as car parks and buildings increase temperatures. In winter, the urban night-time temperature is warmer than non-urban temperatures due to energy released from vehicles, buildings and other urban processes. This is evident in the lower mean annual minimum temperature and 11 more days of frost recorded at the Airport than the Botanic Gardens.

El Nino Southern Oscillation

Climatic influences on the environment can occur from either short-term, high-intensity local events or from long-term, large-scale events that are related to global circulation patterns such as the El Nino Southern Oscillation (ENSO). ENSO is controlled by surface water temperature patterns in the southern Pacific Ocean and is measured as an index of air pressure difference between Tahiti and Darwin (Figure 2.2).

The two years between July 1997 and June 1999 were characterised by a significant El Nino event for the first 12 months, followed by a La Nina event for the second 12 months (Figure 2.2).

The El Nino event between July 1997 and June 1998 produced the following weather in Christchurch:

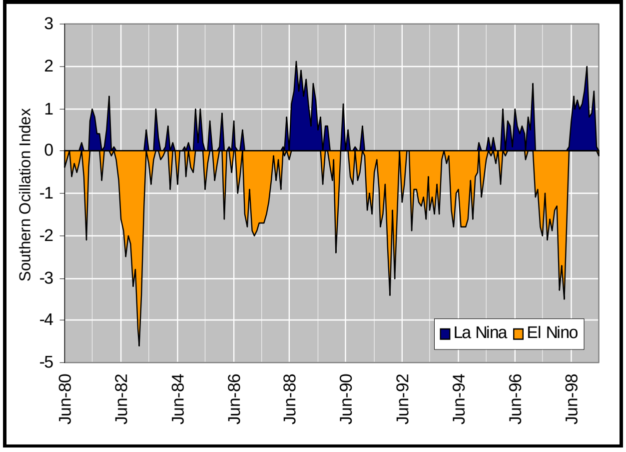
- Frequent westerly and south-westerly winds

Table 2.1 Summary of the City's Main Climatic Features

		Botanic Gardens	Airport
Temperature (°C)			
Mean daily maximum	January	21.7	22.4
	July	10.3	10.6
Mean daily minimum	January	11.8	12.0
	July	1.5	0.7
Mean annual maximum		32.0	33.4
Mean annual minimum		-3.9	-4.7
Sunshine			
Average sunshine hours (per annum)		1982	2049
Rainfall			
Average rain days 1mm or more		85	82
Average annual rainfall		644.6	621.4
Relative Humidity			
Average relative humidity (9am)	January	80.8	72.0
	July	91.9	87.6
Frost			
Average days of screen frost (minimum air temps. less than 0°C)		34.7	45.9
Winds			
Average number of days with gusts reaching 63km/h or more (Gale force)			54.7
Average number of days with gusts reaching 96km/h or more (Storm force)			2.5

Source: National Institute of Water and Atmospheric Science.

Fig 2.2 El Nino Southern Oscillation 1980 – 1999



Source: National Oceanic and Atmospheric Administration (NOAA) world wide web site. http://nic.fb4.noaa.gov/data/cddb/cddb/soi.

- Lower than normal rainfall
- Higher than normal temperatures
- Increased sunshine.

The subsequent La Nina event (between July 1998 and June 1999) influenced the Christchurch climate in the following ways:

- Increased easterly and north-easterly winds
- Warmer temperatures
- Less than average rainfall
- Reduced snowfall during winter.

Temperature

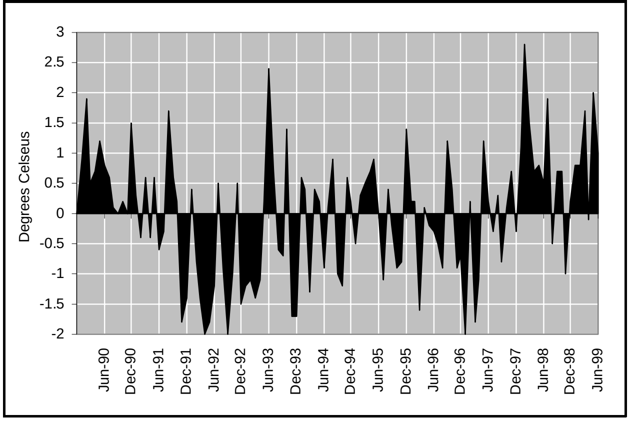
Changes in temperature often affect people's environmental behaviour. Periods with hot temperatures and reduced rainfall result in increased water loss from vegetation as a result of greater evapotranspiration. Consequently people water more, leading to increased water consumption. In addition, energy consumption increases with higher demand for air conditioning. Temperature can also affect the comfort of people and animals, with extreme temperatures impacting on normal behaviour.

In the two years from July 1997 to June 1999 the average temperature at the Botanic Gardens was 0.6° higher than normal. Eighteen of the 24 months had higher average monthly temperatures than normal (Figure 2.3).

Rainfall

During the two year period from July 1997 to June 1999, rainfall in Christchurch was 75 per cent of the normal level in the City. The beginning of this period corresponded with the beginning of the drought which affected much of the east coast of the South Island. During the first 12 months, only 63 per cent of the mean annual rainfall fell at the Botanic Gardens' site. The second 12 months had more rainfall, but it was

Fig 2.3 Variation between Actual and Normal Monthly Temperatures – Botanic Gardens



Source: National Institute of Water and Atmospheric Research.

still below 90 per cent of normal. Any potential relief that this could have produced was reduced by dry conditions from the previous year.

Figure 2.4a shows the mean annual rainfall[1] for the Christchurch City Council's rain-gauge network. The general pattern of rainfall over the City shows a gradient from high rainfall on the Port Hills (due to orographic influences), to lower rainfall in north-eastern coastal areas. Much of the urban part of the City receives an average of 600 to 700 millimetres of rainfall a year, compared with between 550 and 850 millimetres for the whole territorial local authority.

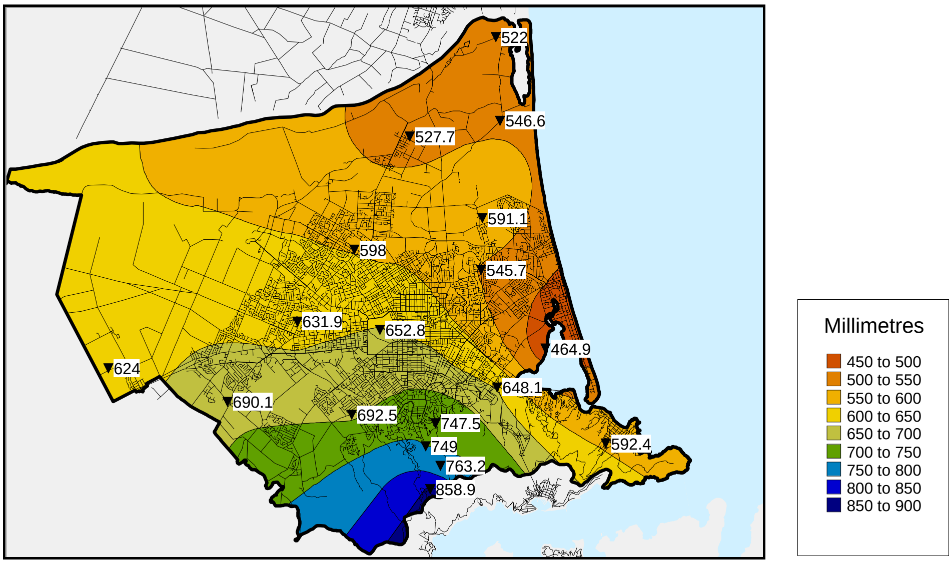
Figures 2.4b and c show the percentage difference between the annual rainfall for the 1998 and 1999 June years, and the mean annual rainfall (Figure 2.4a). Rainfall in Christchurch during the 1998 June year was below 75 per cent of the mean annual rainfall at all the sites. Some areas, especially near the coast, received just over half the mean annual rainfall. The distribution for this period is consistent with the prevailing El Nino conditions mentioned earlier.

Although all rainfall recording sites received more rain in the 1999 June year than the previous year, most of the City received less rainfall than the mean annual rainfall (Figure 2.4c). Areas in the north-east received up to 15 per cent more rainfall than normal. However, the Port Hills and areas to the south-west received the lowest proportion of annual rainfall. This distribution pattern was consistent with the increased north-easterly airflow that results from La Nina events. The cumulative result of the weather during the two year period between July 1997 to June 1999 was a rainfall deficit of between 150 millimetres near the coast to over 500 millimetres on the Port Hills.

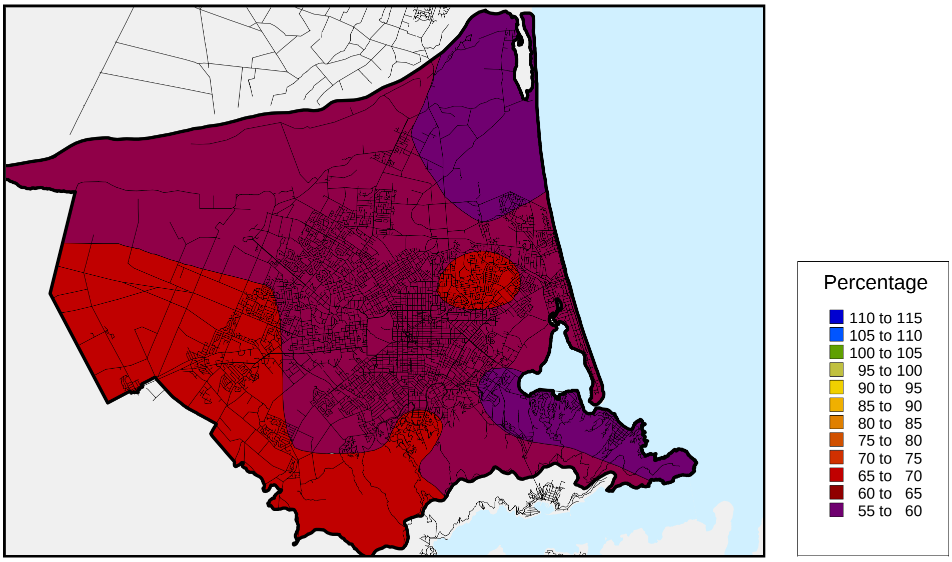
[1] Mean Annual Rainfall is the total amount of rainfall divided by the number of years records have been collected for a particular site.

Fig 2.4 Rainfall Distribution for Christchurch City

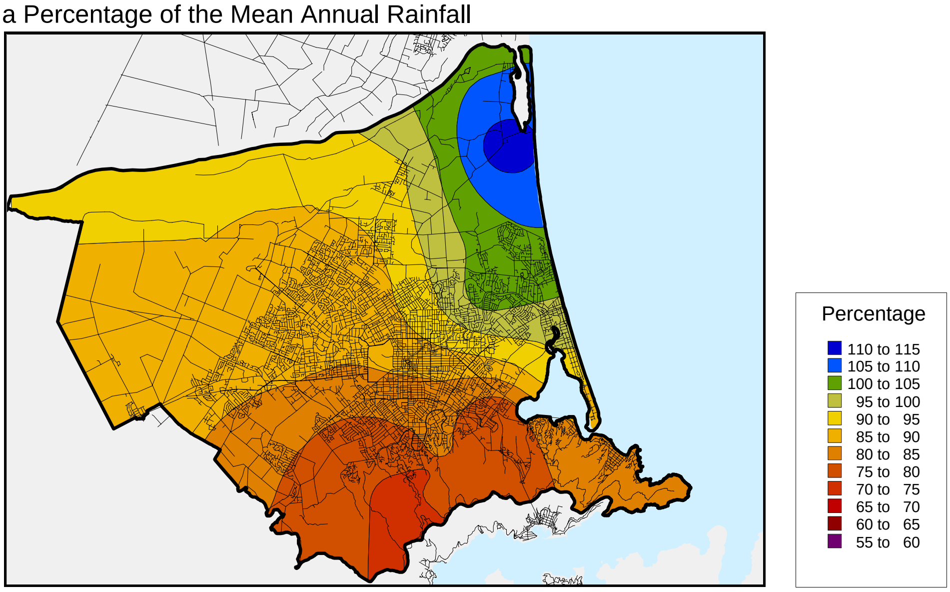
a. Mean Annual Rainfall Distribution



b. June 1998 Annual Rainfall as a Percentage of the Mean Annual Rainfall



c. June 1999 Annual Rainfall as a Percentage of the Mean Annual Rainfall



Source: Christchurch City Council.