



## INTRODUCTION TO CLIMATE CHANGE: 4

# Possible effects on our climate

### WHAT IS THE IPCC

#### THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

A scientific intergovernmental body set up in 1988 by the World Meteorological Organization and by the United Nations Environment Programme. In 2007, it was awarded the Nobel Peace Prize for “efforts to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures that are needed to counteract such change”.

It provides information on climate change through reports based on the continually growing body of scientific evidence. The comprehensiveness of the content is achieved through the contributions of thousands of experts across all relevant disciplines and in all regions of the world including New Zealand.

Scenarios for New Zealand's future climate are derived from global climate change models. The scenarios are not predictions, but rather they are plausible pictures of future climate for New Zealand.

Scenarios provide information on possible future effects while recognising the uncertainties associated with computer modelling, international decision-making on greenhouse gas emissions, feedbacks in, and effects on, the regional climate system, and the translation of global models to regions within New Zealand.

In discussing possible effects on our climate it is important to bear in mind that some climate parameters show more consistent patterns over space and time than others. This is an important consideration when looking at the future scenarios for New Zealand.

Based on evidence to date, there is confidence that temperatures are increasing on average and will continue to do so with a relatively uniform pattern of change over the country. There is also confidence that there will be a more prevalent west to east pattern of rainfall and of westerly airflow.

However, there is uncertainty around scenarios of rainfall change and even more so with scenarios of wind change. The level of uncertainty is indicated by the ranges provided in both the results of modelling and the climate change guidance produced by the government. Uncertainty is discussed in Fact Sheet 3, *Models, scenarios and uncertainties*. Variability in New Zealand's climate is detailed in Fact Sheet 2, *New Zealand's variable climate*. These caveats need to be kept in mind with the following summary information.



Cattle moving to high ground during the 2006 Wairarapa floods.

## EFFECTS OF CLIMATE CHANGE IN NEW ZEALAND

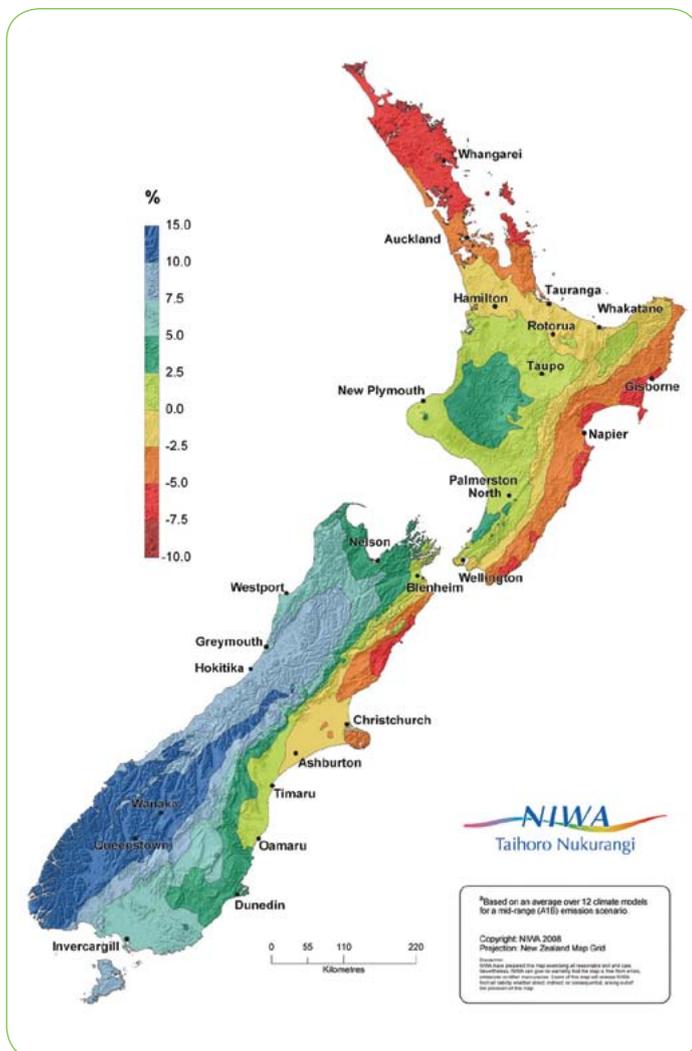
The following effects of climate change on New Zealand are based on a “mid-range” scenario and in some cases the range of uncertainty is also given.

A mid-range scenario, as defined by the International Panel on Climate Change (IPCC), assumes ongoing global economic growth and associated greenhouse gas emissions, with declining global population from mid-century and the introduction of new, more efficient, technologies.

### AVERAGE TEMPERATURE

New Zealand temperatures are likely to increase by about 1°C by mid-century and more than 2°C by 2090, relative to average temperatures in 1990. Temperature increases are likely to accelerate with time – warming later in the century will be greater than in the next few decades. There will be less warming in spring than in other seasons, although the seasonal differences are small. The average annual temperature is likely to increase slightly more in the North Island than in the South Island.

**FIGURE 1: PROJECTED ANNUAL MEAN PRECIPITATION CHANGE FOR NEW ZEALAND BETWEEN 1980–1999 AND 2080–2099 BASED ON AN AVERAGE OF 12 CLIMATE MODELS FOR A MID-RANGE SCENARIO**



### DAILY TEMPERATURE EXTREMES

In addition to changes in mean temperature, daily temperature extremes will also vary with regional warming. A large decrease in the number of frost days is projected for the central North Island and in the South Island as the 21st century progresses. An increase in the number of days above 25°C is also likely, particularly in northern locations.

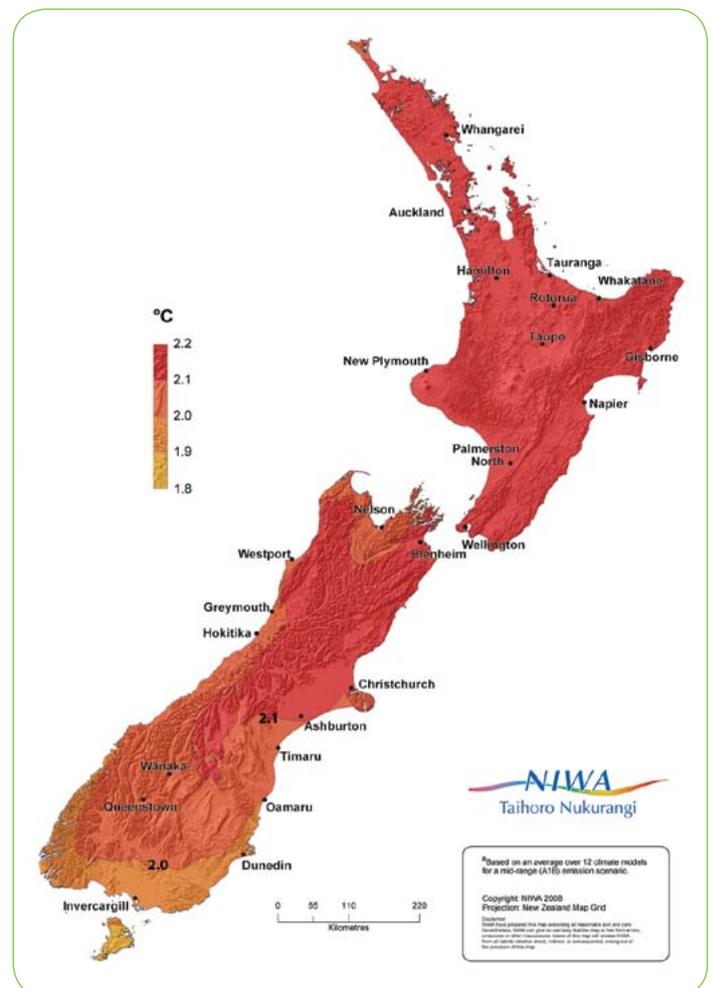
These average changes should not be confused with recent experience of unseasonal extremes. For example, a decrease in total frost days does not preclude the possibility of damaging late frosts, as have been experienced in recent years.

### FREQUENCY AND STRENGTH OF STRONG WINDS

Evidence suggests that westerly winds will increase on average. Strong seasonal differences are apparent in the scenarios with increased westerly flow in winter and spring, and decreased westerly flow in summer and autumn.

In spring, westerly winds could increase by about ten percent by 2040 and 20 percent by 2090. Increases in winter could be greater. There could be a decrease of between 5 and 20 percent in summer and autumn. An increase in severe wind risk is possible.

**FIGURE 2: PROJECTED ANNUAL MEAN AIR TEMPERATURE CHANGE FOR NEW ZEALAND BETWEEN 1980–1999 AND 2080–2099 BASED ON AN AVERAGE OF 12 CLIMATE MODELS FOR A MID-RANGE SCENARIO**





*“I work on the assumption that our weather events are going to get more dramatic, we’re going to have more droughts, we’re going to have more weather bombs.” Bruce Wills, Hawke’s Bay farmer*

### **RAINFALL**

Changes in rainfall vary around the country, and with the season. Increases in annual mean rainfall are projected for Tasman, West Coast, Otago, Southland and the Chathams; decreases in annual means are likely in Northland, Auckland, Gisborne and Hawke’s Bay. These annual changes are dominated by winter and spring rainfall. There is a tendency to increased rainfall in south and west in the winter and spring. In summer and autumn there is a tendency of decreased rainfall in the western North Island, and increased rainfall in Gisborne and Hawke’s Bay.

### **DROUGHT RISK**

Drought risk is projected to increase in frequency during the coming century for all areas that are currently drought prone. Areas particularly affected will be eastern regions from Gisborne to Canterbury, as well as parts of Bay of Plenty and Northland. A greater frequency of more severe droughts is likely over time.

For example, what are currently defined as one-in-twenty year droughts could occur on average once every 5 to 10 years. Droughts could also begin earlier in the season.

### **HEAVY RAINFALL EVENTS**

Heavy rainfall events are likely to occur more frequently in New Zealand over the coming century, particularly where average annual rainfall is projected to increase. What is considered an extreme rainfall in the current climate might occur about twice as often by the end of the 21st century. A warming atmosphere will be able to hold more moisture, increasing the potential for heavier rainfall and consequently increasing the risk of floods.



Waterlogged paddocks north of Matata, Bay of Plenty.

### **SNOWFALL AND SNOWLINE**

Snow cover might be expected to decrease and snowlines rise as the climate warms. However, there are confounding issues. Warmer air holds more moisture and during winter this moisture could be precipitated as snow at high altitudes. For the same reason, there could also be increased winter snowfall to low elevations in some cases. However, with the projected increase in temperatures, snow cover will melt more quickly and thus the duration of seasonal snow lying on the ground should be shortened.

## **FOR MORE INFORMATION**

- For general information on climate change for land-based sectors visit the Ministry of Agriculture and Forestry website [www.maf.govt.nz](http://www.maf.govt.nz)
- For more information on climate change in New Zealand visit [www.climatechange.govt.nz](http://www.climatechange.govt.nz) or the Ministry for the Environment’s website [www.mfe.govt.nz](http://www.mfe.govt.nz)
- For a popular guide to the IPCC reports, visit the website of the United Nations Environment Programme [www.grida.no](http://www.grida.no)
- *Preparing for coastal change – a guide for local government* is a publication with more information on sea level rise and coastal hazards. It can be found on the Ministry for the Environment website [www.mfe.govt.nz](http://www.mfe.govt.nz)

### EX-TROPICAL CYCLONES AND MID-LATITUDE STORMS

The IPCC 4th Assessment Report concludes that it is likely that future tropical cyclones will become more intense. There is less confidence in projected changes in numbers of tropical cyclones. Of interest to New Zealand is the future behaviour of “ex-tropical” cyclones. The IPCC projects a poleward shift in ex-tropical storm tracks, which means an increase in Southern Hemisphere storminess is certainly possible.

### SEA LEVEL

The IPCC in its 4th Assessment Report projects that global mean sea level will rise by between 0.18 to 0.59 metres compared to 1990 levels, by late this century. A further 0.1 to 0.2 metre rise could occur if ice sheet discharges in Greenland and Antarctica were to increase above their present contribution to rising sea levels.

The IPCC also notes that an even larger contribution to sea level rise from ice sheets cannot be ruled out. In addition, sea level rise is not expected to be globally uniform, and current models suggest that sea level in the New Zealand region could be 0.05 to 0.1 metres above the global average by late this century, for a mid-range emission scenario.

### EL NIÑO

Many climate models show that warming of the Pacific Ocean could result in a more El Niño-like state over the next 50 years. Such a change is consistent with an increase in westerly winds and a greater west-east rainfall gradient in New Zealand.

#### THIS FACT SHEET IS ONE IN A SERIES CALLED INTRODUCTION TO CLIMATE CHANGE

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Canterbury snowstorm, July 2006.

### KEY REFERENCES

Ministry for the Environment (2008) *Climate Change Effects and Impacts Assessment: A Guidance Manual for Local Government in New Zealand*. 2nd Edition. Mullan, B; Wratt, D; Dean, S; Hollis, M; Allan, S; Williams, T; Kenny, G; and MfE (Eds). Ministry for the Environment, Wellington. xviii + 149 p. Available from [www.mfe.govt.nz](http://www.mfe.govt.nz)

NIWA *Climate change scenarios for New Zealand*. Available from [www.niwa.co.nz](http://www.niwa.co.nz)