



CLIMATE CHANGE: A GUIDE FOR LAND MANAGERS 2

New Zealand's variable climate

This fact sheet is the second in a series of five from the resource pack: **CLIMATE CHANGE: A GUIDE FOR LAND MANAGERS**

Other fact sheets in this series are:

No 1. The theory, the history, the science

No 3. Climate change scenarios and uncertainty

No 4. Future New Zealand: Possible effects on our climate

No 5. Future New Zealand: Possible impacts of climate change

Other material contained in this resource pack includes climate change projections at a regional level.

To view other material in this resource pack visit www.maf.govt.nz/climatechange or phone **0800 CLIMATE** to request a hard copy.

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".

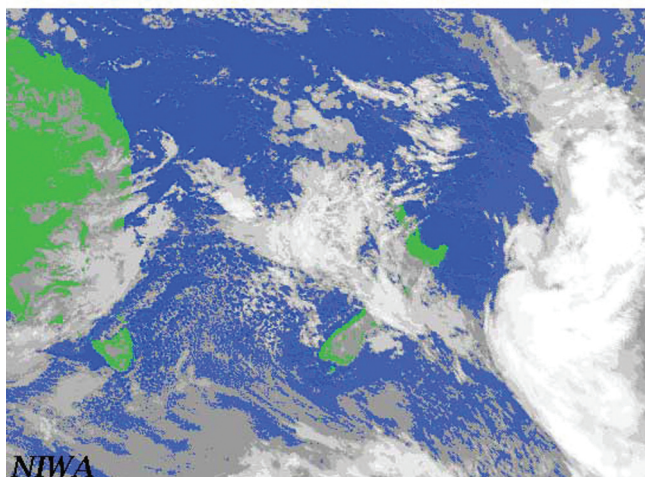
It provides information on climate change through reports based on the continually growing body of scientific evidence. The comprehensiveness of the content is achieved through the contributions of thousands of experts across all relevant disciplines and in all regions of the world including New Zealand.

NEW ZEALAND'S CLIMATE

New Zealand's climate is inherently variable and as a result might be described as "predictably unpredictable". The variability is the result of our South Pacific location and our small, but mountainous, land area. Our location in the mid latitudes of the southern hemisphere means that westerly winds dominate. Seasonal fluctuations and north to south differences are influenced by the tropics to the north, and Antarctica and the southern ocean to the south. West to east variations are the result of the modifying effect of the Southern Alps and the mountainous ranges of the North Island.

The benefit of our geographic location and landform is a very moderate climate – a resource that gives a production advantage to New Zealand farmers and growers who have learned to live with the climate variability. This has not been without significant cost at times, as can be experienced through extended drought periods or with extreme rainfall and associated flood events.

GMS IR Cloud Imagery – 0732NZST, 13 AUG 1998



THE IMPACT OF CLIMATE CHANGE

With climate change, the most obvious effect will be changes to climate variability and extremes. There are three key challenges associated with this:

- At present only about half of the climate variability within the growing season is predictable. Some farmers and growers are saying that things are generally becoming more unpredictable.
- Extreme events, such as floods and droughts, can occur at any time. In different regions the frequency and intensity of such events may increase.
- With a changing climate we cannot rely on the past as a complete guide to the future.

OBSERVED CHANGES IN VARIABILITY AND EXTREMES

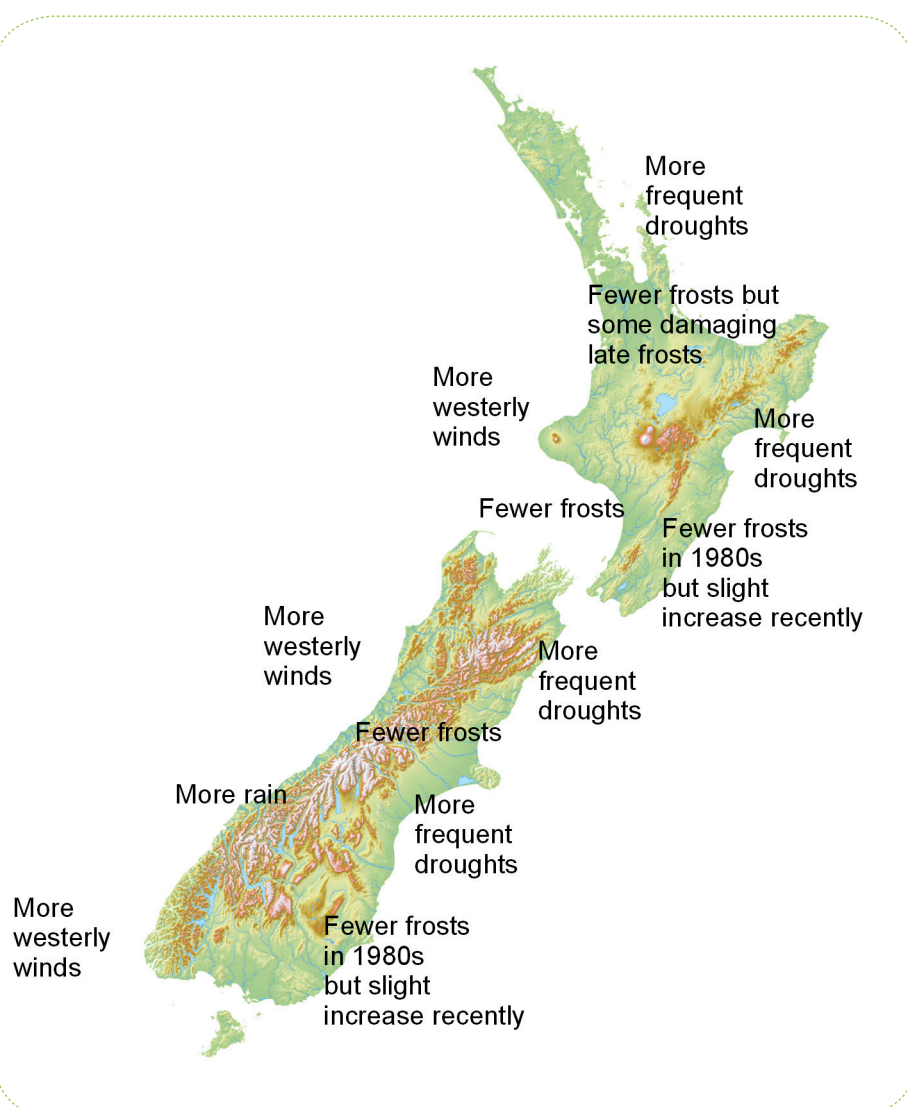
The effects of climate change are likely to happen more slowly in New Zealand than in the Northern Hemisphere for example, simply because of the moderating or lag effect of the huge ocean area that surrounds us. Despite this, there are observed changes in variability and extremes in New Zealand that are consistent with changes reported by the Intergovernmental Panel on Climate Change (IPCC). These changes have been observed over the last three decades.

INFLUENCES ON CHANGE AND VARIABILITY

There have likely been two main, and possibly inter-related, influences on these observed changes:

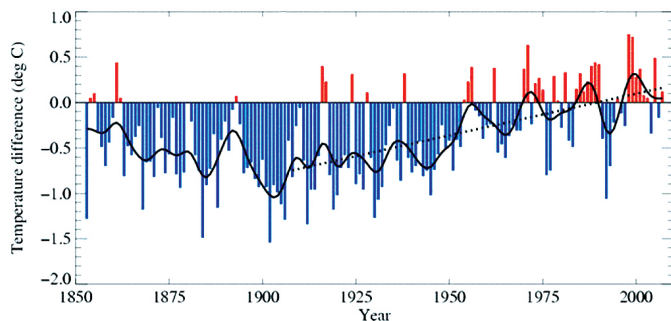
- 1 An underlying warming trend, with close to a 1.0 °C increase in average air temperature over the last century.
- 2 Fluctuations in the El Niño-Southern Oscillation (ENSO, see box) and another natural fluctuation called the Interdecadal Pacific Oscillation (IPO).

FIGURE 1: CLIMATE CHANGES OBSERVED IN RECENT TIMES



	Observed global changes reported by IPCC	Observed New Zealand changes
Wind	Mid latitude westerly winds have strengthened in both hemispheres since the 1960s.	Westerly circulation has increased across New Zealand, with more persistent westerlies onto central and southern New Zealand.
Drought	More intense and longer droughts have been observed over wider areas since the 1970s.	The north and east of the North Island have been ten percent drier and five percent sunnier on average since the late 1970s. Eastern regions have experienced more frequent droughts.
Heavy rainfall	The frequency of heavy rainfall events has increased over most land areas.	Since the late 1970s the west and south of the South Island have been about ten percent wetter and five percent cloudier with an increase in damaging floods. There is some evidence that extreme daily rainfall amounts have increased in the west.
Extreme temperatures	Widespread changes in extreme temperatures have been observed over the last 50 years.	There is no clear evidence of more extreme high temperatures. In general there have been fewer frosts since the 1950s, but since the 1970s there has been a small increase in frosts in some eastern areas. In recent years there has been a greater incidence of damaging late spring frosts.
Tropical cyclones	There is some suggestion of increased intense tropical cyclone activity, but no clear trend in the annual numbers of tropical cyclones.	There is no evidence at present of more intense ex-tropical cyclones over New Zealand or of more annual numbers of cyclones.

FIGURE 2: NEW ZEALAND TEMPERATURE (RELATIVE TO 1971–2000 AVERAGE)



This figure illustrates temperature variability from year to year (bars), and the kind of multi-decadal trend (dotted line) that we typically refer to as climate change.

The blue and red bars show annual differences from the 1971–2000 average (the current standard climate reference period used by the World Meteorological Organisation). The black line is a smoothed time series, to illustrate shorter term variability, and the dotted line is the linear trend over 1908–2007 ($0.92^{\circ}\text{C}/100$ years).

Source: www.niwa.co.nz

The period from the 1940s to late 1970s was dominated by a negative IPO phase, which coincided with several strong La Niña phases of ENSO. From the late 1970s to the late 1990s there was a positive IPO phase and a greater frequency of strong El Niño events. It appeared that another shift of the IPO occurred around 2000. Since that time there have been some similarities to weather events experienced in the 1960s and 1970s. However, recent weather has not been as consistently wet as some regions experienced in the past, and some areas have experienced ongoing drought conditions.

To say that recent climate changes in New Zealand are solely due to global climate change is too simplistic, but so is saying that it's all because of natural variability. Both are influences on our climate. What is likely is that, with current trends, the influence of climate change, both on long-term averages and climate variability, will increase over coming decades.

IS CLIMATE CHANGE NEW?

No. The climate has changed constantly over millennia due to natural processes, evident through the cooling and warming experienced with ice ages and interglacial periods. The relatively stable climate of the past 10 000 years or so has allowed human civilisation to flourish through settled communities and the development of agricultural production.

Two well documented changes since the end of the last major ice age are the Mediaeval Warm Period (10th to 14th century AD) and Little Ice Age (16th to 19th century AD). The relatively small climate changes that occurred during these periods had significant effects on agricultural production and human health.

WHAT IS EL NIÑO?

El Niño is a natural feature of the global climate system, more correctly known as the “El Niño–Southern Oscillation phenomenon” or ENSO. El Niño and La Niña refer to opposite extremes of the ENSO cycle, when major changes in the Pacific atmospheric and oceanic circulation occur.

In El Niño years, New Zealand tends to experience stronger or more frequent winds from the west in summer, which can lead to drought in east coast areas and more rain in the west. In winter, the winds tend to be more from the south, bringing colder conditions to both the land and the surrounding ocean. In spring and autumn south-westerlies tend to be stronger or more frequent, providing a mix of the summer and winter effects.

La Niña events have weaker impacts on New Zealand's climate. There is a tendency for more north-easterly winds, which bring moister, rainy conditions to the northeast parts of the North Island, and reduced rainfall to the south and south-west of the South Island.

Although El Niño has an important influence on New Zealand's climate, it accounts for less than 25 percent of the year-to-year variation in seasonal rainfall and temperature. The effects, however, are sufficient to warrant management actions and planning to be taken when an El Niño episode is expected or in progress.

“Summers are too dry, spring is too wet, there are more extremes, and when it does rain it's intense and hard to utilise properly.” Bay of Plenty dairy farmer

KEY REFERENCES

IPCC (2007) Summary for Policymakers In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Solomon, S; Qin, D; Manning, M; Chen, Z; Marquis, M; Averyt, KB; Tignor, M; and Miller, HL; (eds.), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available from www.ipcc.ch

FOR MORE INFORMATION

- For more information on the Royal Society, the national academy of science of the UK and the Commonwealth, visit www.royalsociety.org
- For general information on climate change for land-based sectors visit the Ministry of Agriculture and Forestry website at www.maf.govt.nz/climatechange
- For more information on climate change in New Zealand visit www.climatechange.govt.nz or the Ministry for the Environment's website www.mfe.govt.nz/issues/climate
- To link to the temperature graph in this fact sheet, visit www.niwa.co.nz/our-science/climate/information-and-resources/clivar/pastclimate#y140
- For more information on ENSO and the IPO visit the NIWA website www.niwa.co.nz/our-science/climate
- For a popular guide to the IPCC reports, visit the website of the United Nations Environment Programme www.grida.no/publications/climate-in-peril
- Information on droughts, floods and emergencies, land and water resources and irrigation practices can be found in the Rural New Zealand section of the MAF website www.maf.govt.nz
- Information on projects under MAF's Sustainable Farming fund targeting climate related issues can be found in the Sustainable Farming section of the MAF website www.maf.govt.nz



**THIS IS ONE IN A SERIES OF CASE STUDIES CALLED
CLIMATE CHANGE: A GUIDE FOR LAND MANAGERS THAT CAN BE
FOUND AT WWW.MAF.GOV.T.NZ/CLIMATE CHANGE**

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