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CLIMATE VARIABILITY AND CLIMATE CHANGE

Implications for Tourism

Jordy Hendrikx - NIWA

Susanne Becken – Lincoln University

10 November 2010, Paihia



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Today's presentation

- Overview – research project
- Tourists and the weather
- Climate Variability
- Climate Change
- Questions



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What is our research project about?

- Tourism often depends on the weather for participation, satisfaction, safety, business viability etc.
- Tourism also depends on natural resources and environmental attractions.
- Climate models predict increasing temperatures, changing intensity and distribution of rainfall, decreased snow cover, and sea level rise.
- **Need to plan proactively and adapt to variability and change**



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Weather impacts on tourists

- **Rain:** flooding, slips, bridges washed away, damage to walking tracks, river flooding, cancellation of commercial activities;
- **Wind:** road closure, falling trees, debris, high seas, disruption to water and air transport (scheduled and scenic), power outages;
- **Fog:** transport disruptions, commercial activity cancellations;
- **Drought and hot spells:** closure of recreation areas, damage to road and rail infrastructure, fire risks, algae bloom, water shortages, low lake and river levels, increases in wasps/mosquitoes;
- **Unseasonal weather:** outdoor recreationists, rescue attempts difficult.



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What do tourists expect?

- In our survey, 60% of tourists found the weather different from expected (more often worse than better)
- 94% of respondents sought weather/climate information before their trip
- Temperature, rainfall and sunshine most important
- Climate/weather influence trip timing and planning
- 44% report that the weather had an influence on their satisfaction
- 51% get weather information whilst in NZ (Internet, newspaper, TV, i-site, accommodation)



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WELCOME TO LAKE WANAKA

100% of New Zealand's official network of lakes centres dedicated to providing you with free, friendly, and practical information on attractions, transport and accommodation.

Our professionally trained staff can answer questions, give advice, book holiday accommodations and check a local directory to help make your experience one you will never forget.

We will look after:

- Accommodation
- Activities
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Please see us at:

- Breweries and Ciders
- Phone Booth and Storage
- Toilet Street

Opening hours:

Monday - Friday
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Emergency numbers:
For all emergencies dial 111

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Accommodation available tonight




ROADS

CROWN RANGE - *chairs essential!*
to Queenstown

LINDIS PASS *NOW OPEN!*
to Christchurch

HAAST PASS - *CHAIRS ESSENTIAL*
to Fox + Franz Joseph
no roads

100% **SITE**

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- 📍 leisure & shopping
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- 📍 towns & maps
- 📍 local information



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Climate Variability and Change



Weather versus Climate

“Climate is what you expect,
weather is what you get.”

Climate change is a change in the long-term average expected weather conditions.



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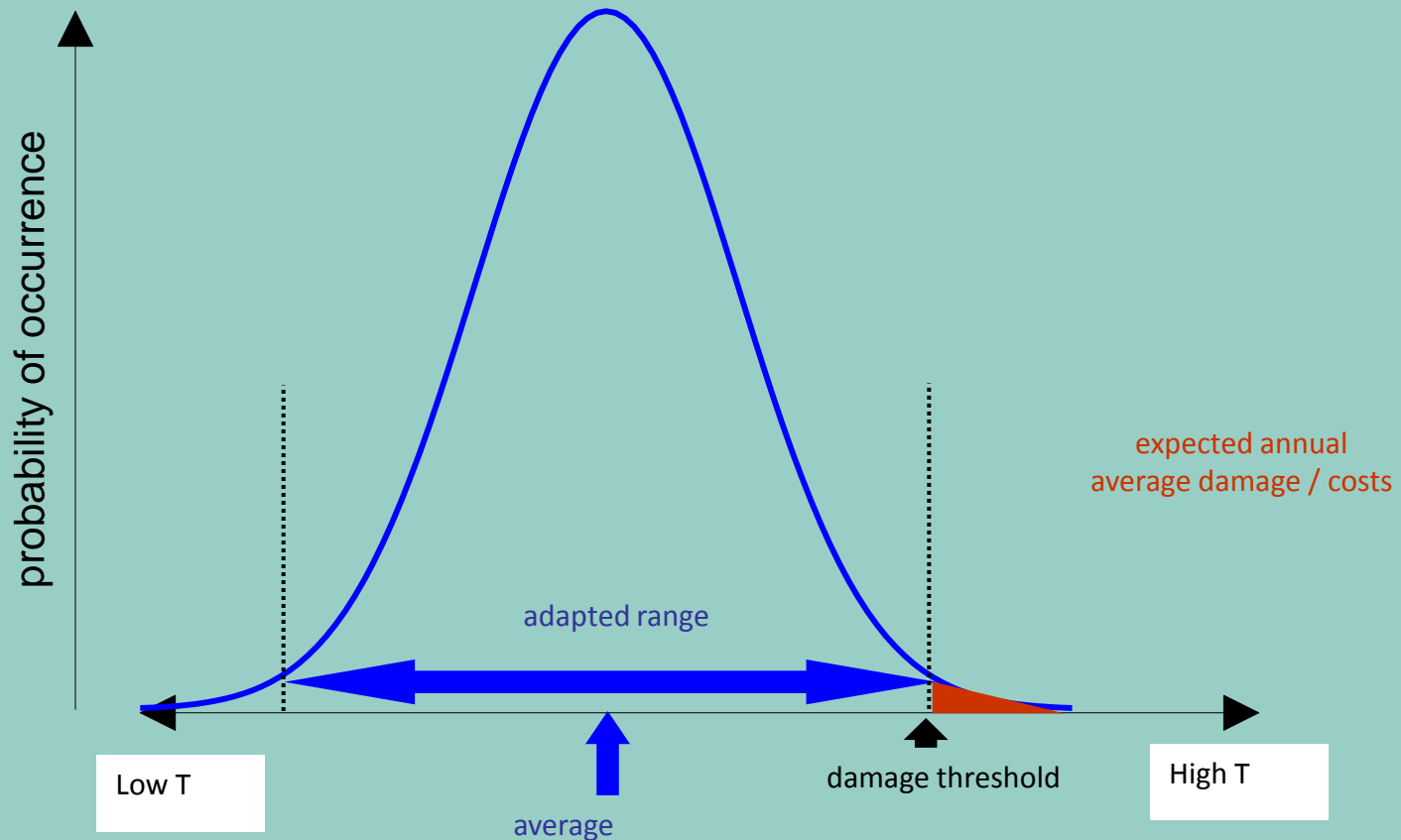
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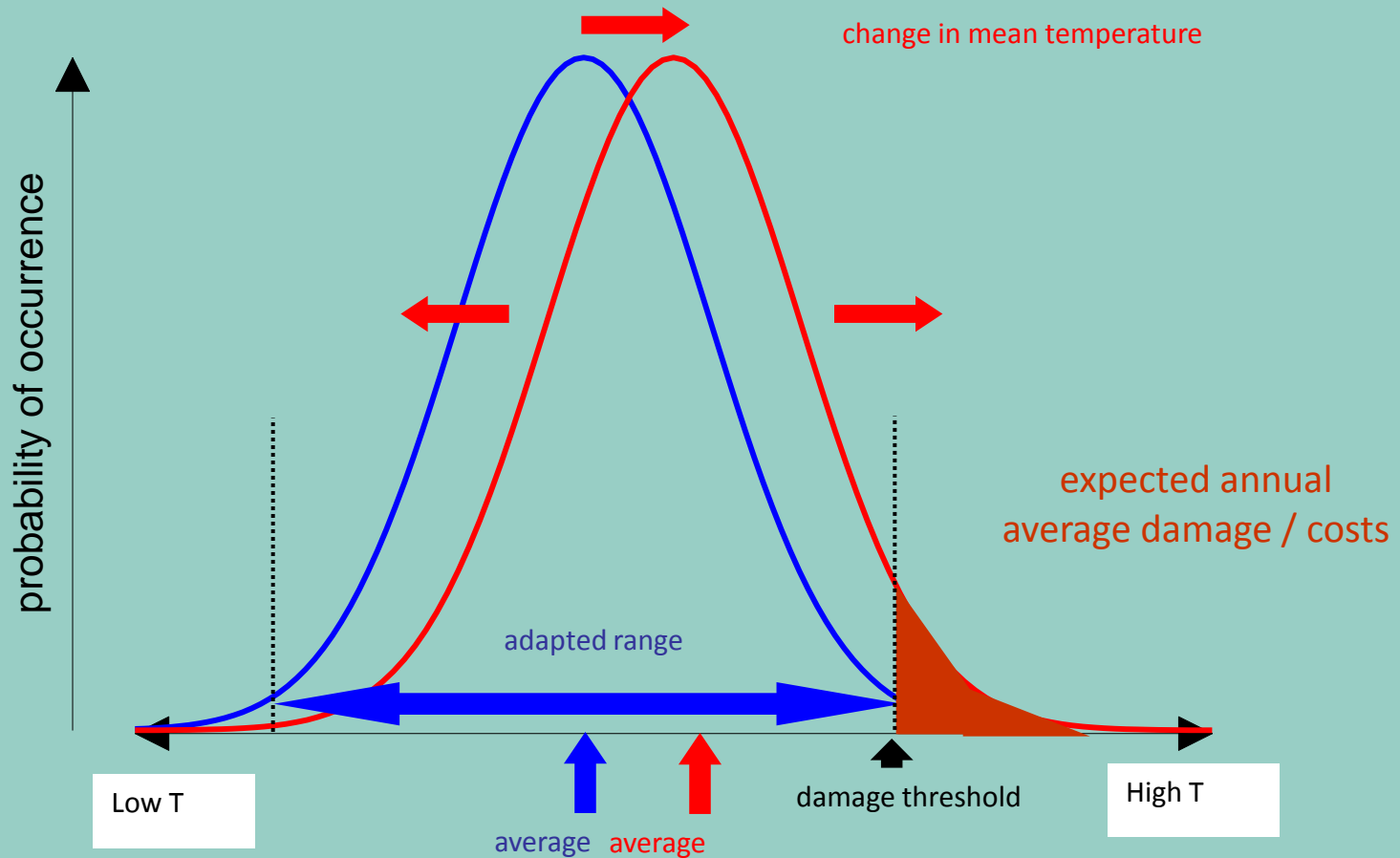
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Weather vs average climate

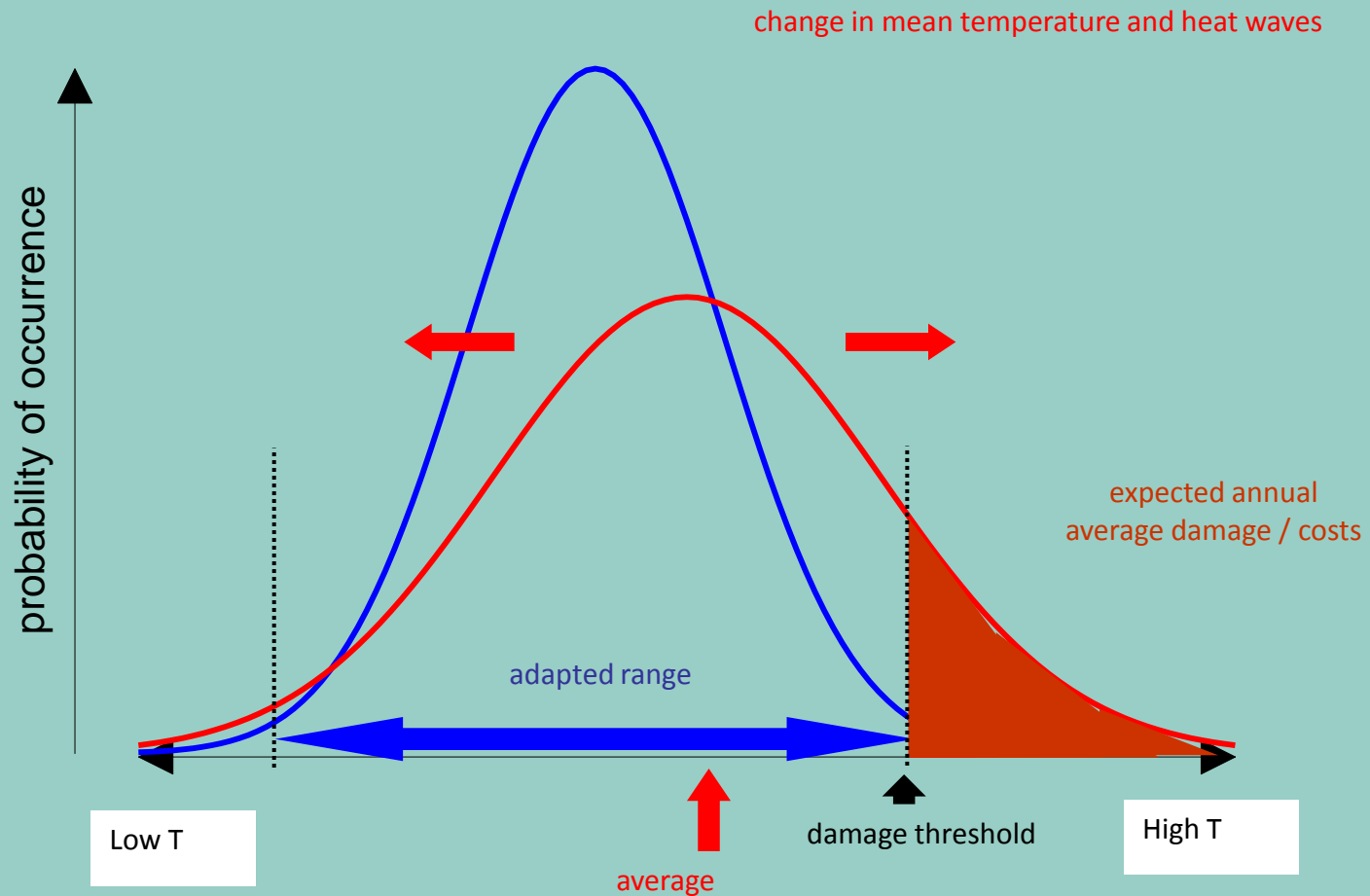
Schematic example: warmer temperatures



Weather vs average climate



Weather vs average climate



Climate Influences on NZ

- New Zealand is affected by
 - El Niño-Southern Oscillation (ENSO) Duration
1-2 years
 - Interdecadal Pacific Oscillation (IPO) 20-30 years
 - Climate change/global warming 50-100+ years
- Climate features influence westerly winds over N.Z.
 - Track of storms, temperature, rainfall (N.Z. mountains)
 - Decades of stronger/weaker westerlies
 - Westerlies increasing in winter through the coming century



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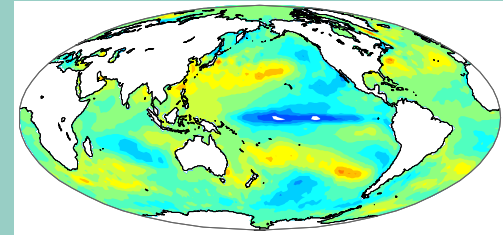
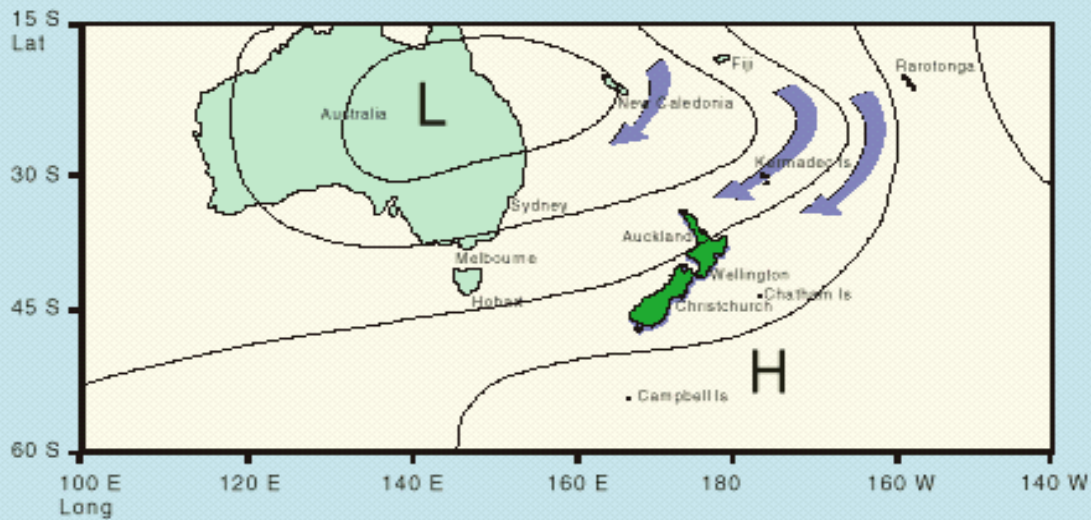
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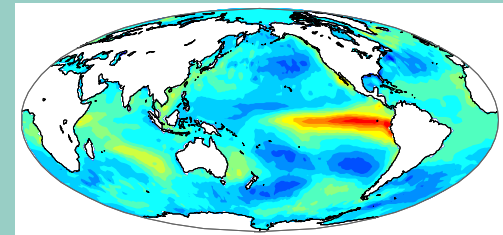
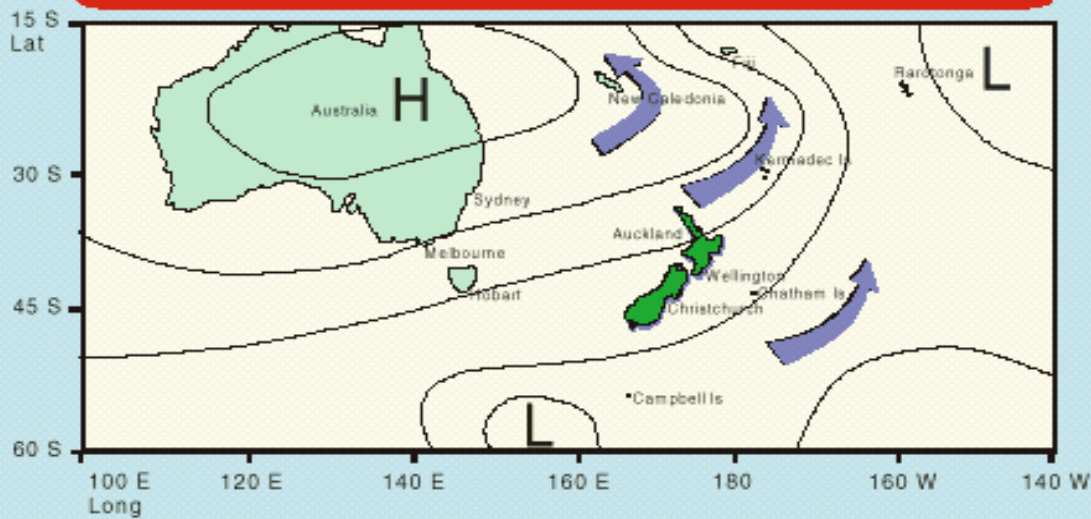
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La Niña



El Niño



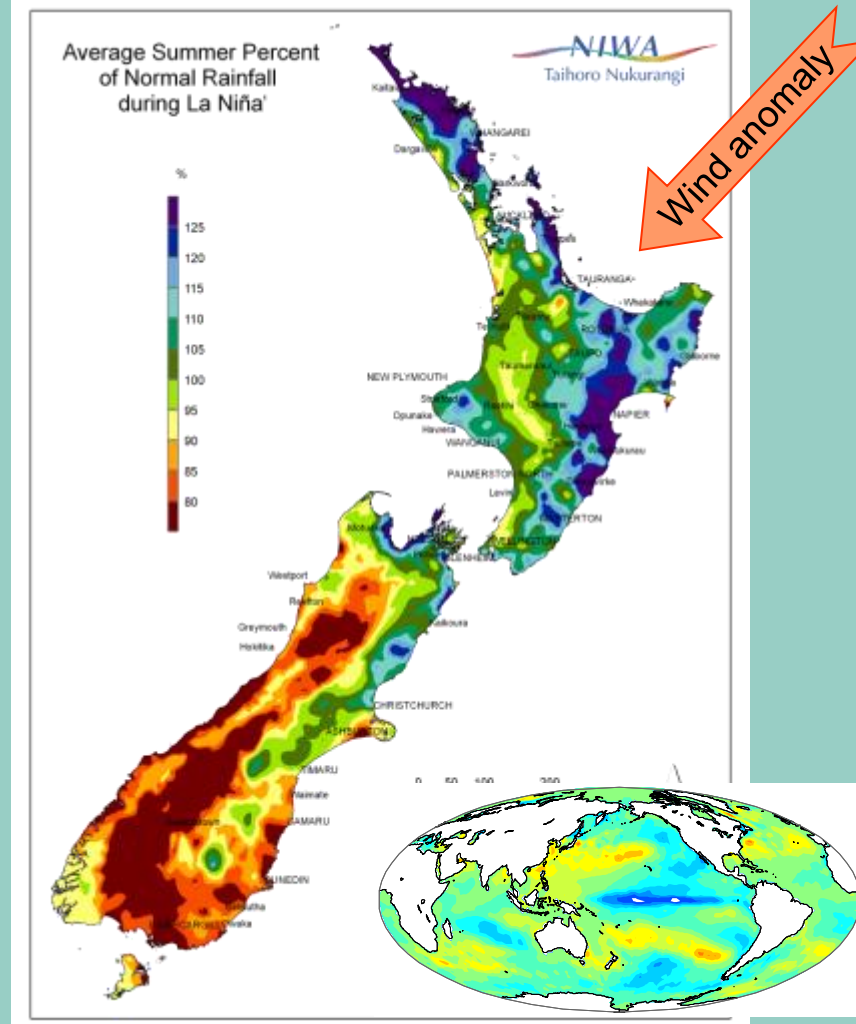
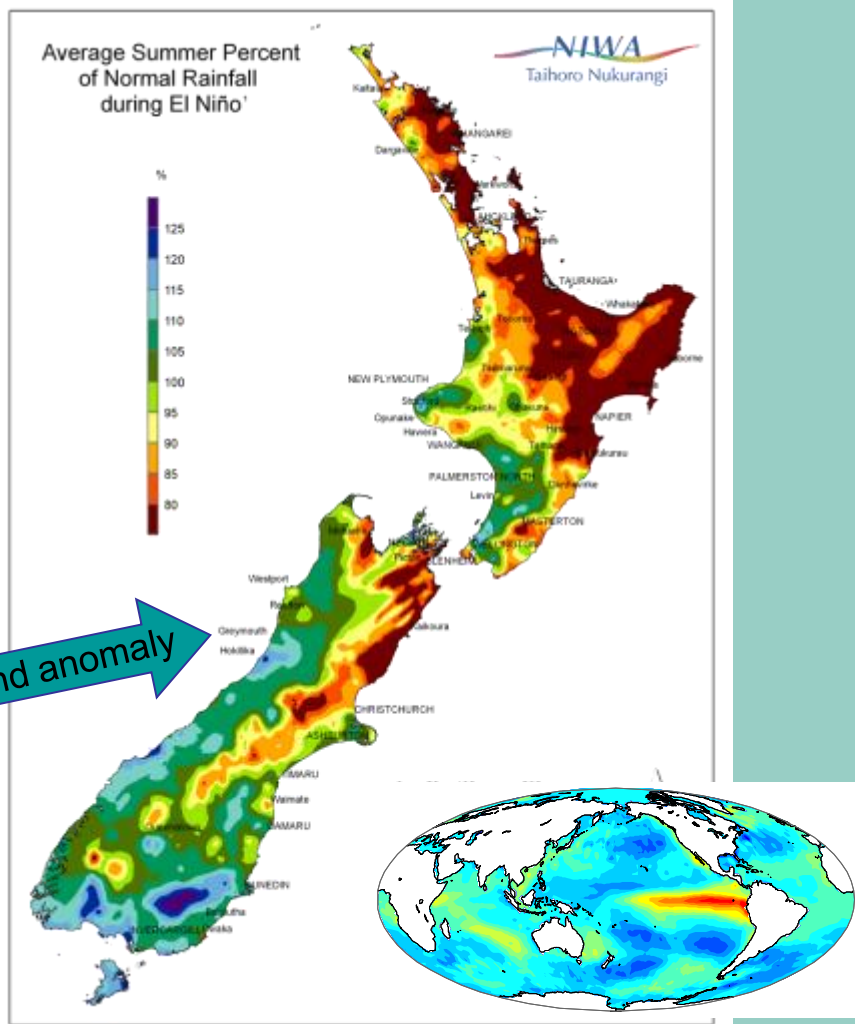
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ENSO: NZ Summer rainfall



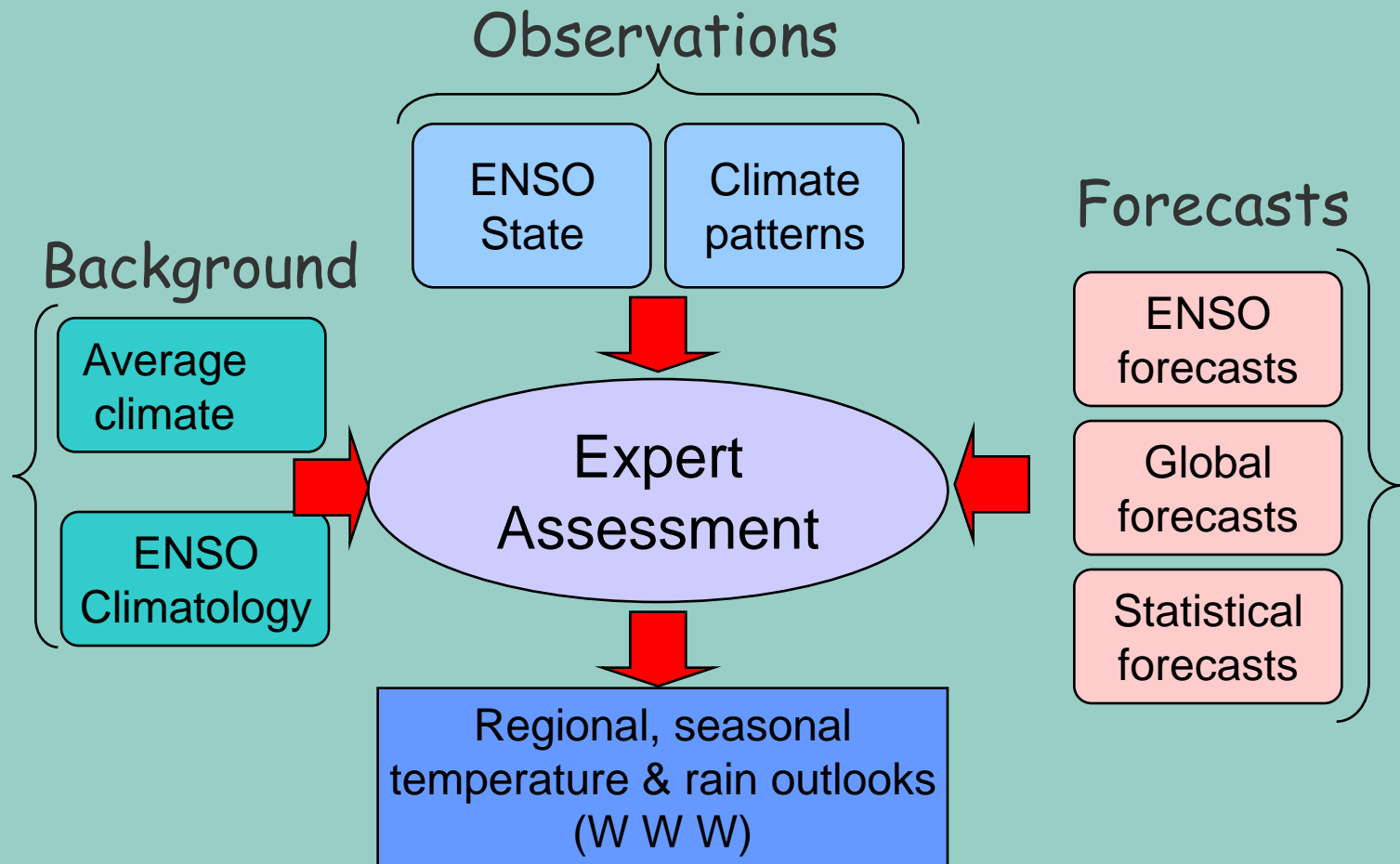
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Basis of NIWA National Climate Centre predictions



NIWA Seasonal Climate Outlook: November 2010 - January 2011

- A moderate to strong La Niña is well-established in the tropical Pacific, and may strengthen further through the rest of 2010. La Niña conditions are likely to continue through to autumn of 2011.
- Early summer (November to January) temperatures are likely or very likely to be above average for this time of year across the whole country.
- In the North Island, rainfall is likely to be normal or above normal, with above normal soil moisture levels and stream flows in the east.
- Mean sea level pressures are likely to be above normal near New Zealand and to the south of the country, for the three months as a whole.
- <http://www.niwa.co.nz/our-science/climate/publications/all/seasonal-climate-outlook/>



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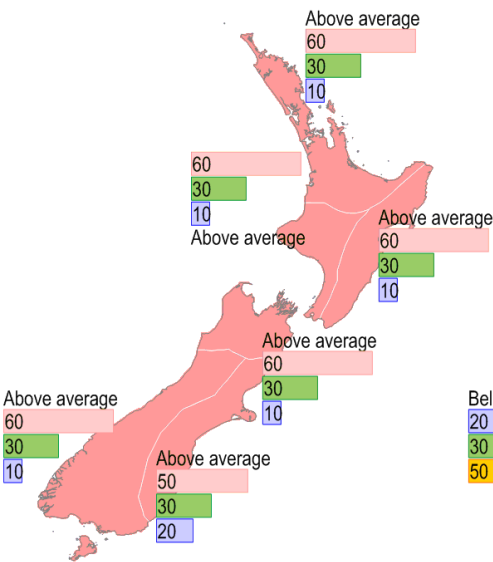
Northland, Auckland, Waikato, Bay of Plenty:

Plenty:

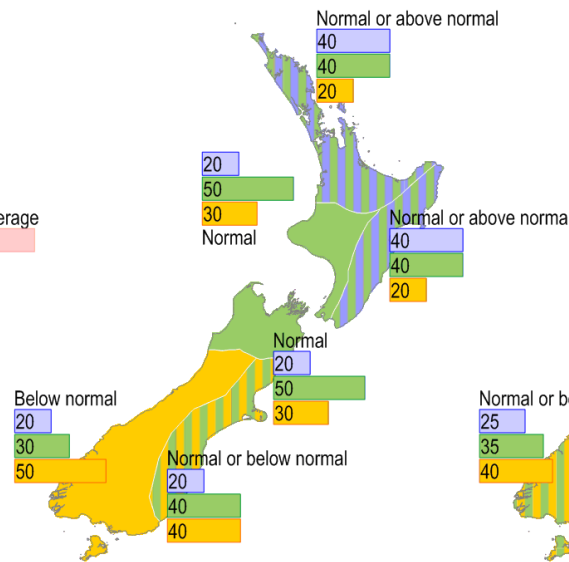
Outlook for November-January 2011



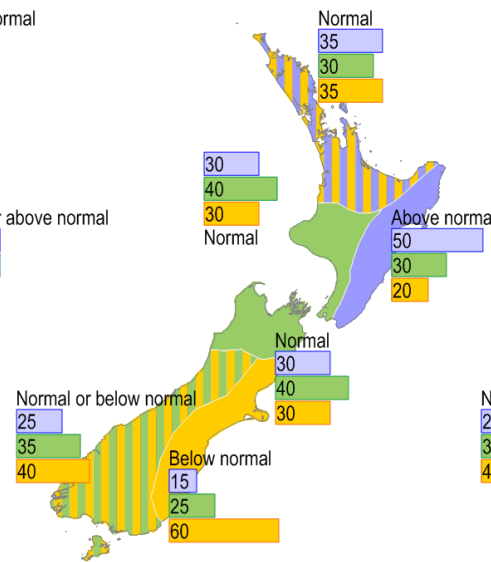
Mean air temperature



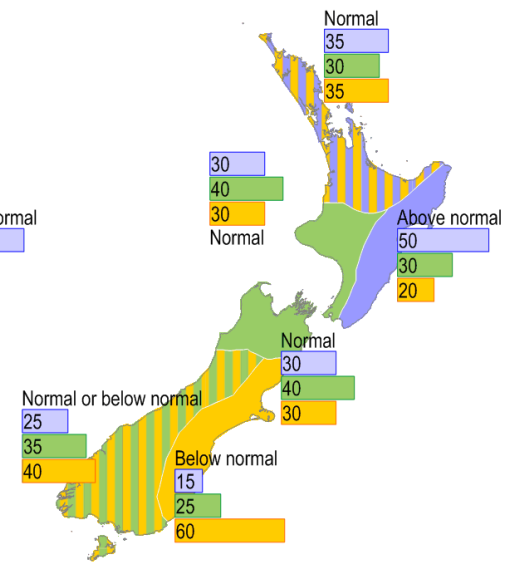
Rainfall



Available soil moisture



River flows



Key to maps (example interpretation)

- Temperatures are very likely to be in the above average range.
- Seasonal rainfall is equally likely to be near normal or above normal.
- No clear guidance for soil moisture levels and stream flows.

Tropical Cyclone outlook

- Climate and weather organisations across the Pacific are predicting **average or above average** tropical cyclone occurrence for the 2010–11 season.
- On average, nine named tropical cyclones occur in the SW Pacific (between 135°E to 120°W) each season (November – April).
- Risk is expected to be higher than normal to the west of Fiji, with elevated activity within the Coral Sea extending into the North Tasman Sea region.
- Higher risk because of the moderate-to-strong La Niña conditions that currently exist in the region.
- During moderate-to-strong La Niñas, ex-tropical cyclones are known for crossing the central and south Tasman Sea and it is typical for at least one ex-tropical cyclone to pass within 550km of the New Zealand coastline.
- <http://www.niwa.co.nz/news-and-publications/news/all/tropical-cyclone-outlook-oct2010>



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Access to information

www.niwa.co.nz

Provides free climate data & products on <http://cliflo.niwa.co.nz/>

The screenshot shows the 'Database Query' interface on the NIWA website. At the top, it says 'The National Climate Database' and 'NIWA Taihoro Nukurangi'. There are navigation links for 'help', 'home', 'subscription', and 'query'. Below this, there are buttons for 'Save Settings', 'Preview', and 'Send Query'. A 'login | logout' link is also present. A red message indicates 'Your subscription details: username= public'. The main section is titled 'Database Query' and contains several sections: 'Datatype', 'Location', 'Date/time', and 'Format'. Each section has a 'last used' dropdown menu and a 'Manage' button. The 'Datatype' section has a 'select datatype(s)' button and a 'Remove All Datatypes' button. The 'Location' section has a 'choose station(s)' button and a 'station agent number(s)' input field with the value '3925'. The 'Date/time' section has two rows of date inputs, both set to '2009 11 14 00' and '2009 11 17 00'. The 'Format' section has a 'last used format' dropdown and a 'Manage' button. A note at the bottom left of the form says 'Time standard for output: T is NZ Standard Time'.



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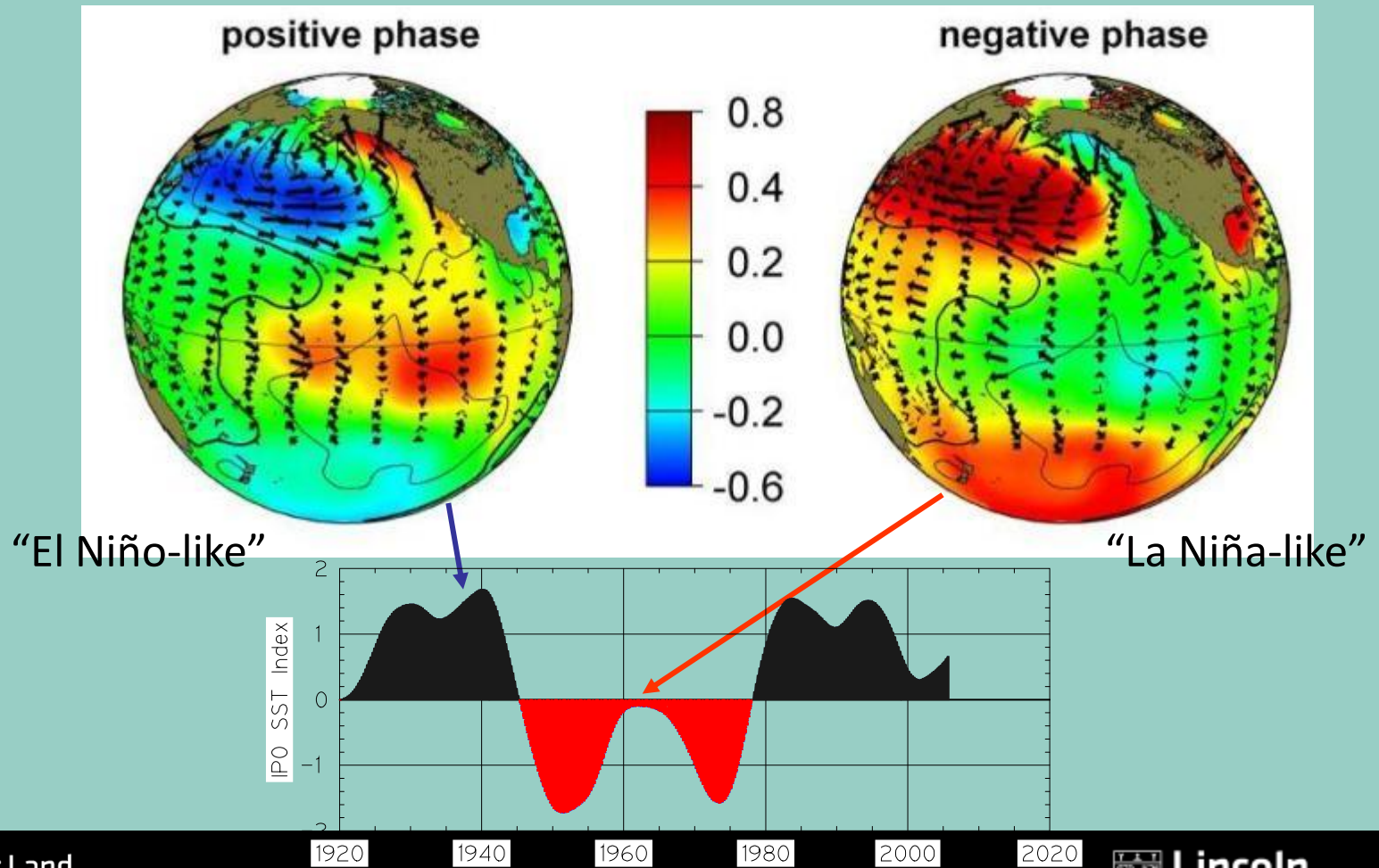
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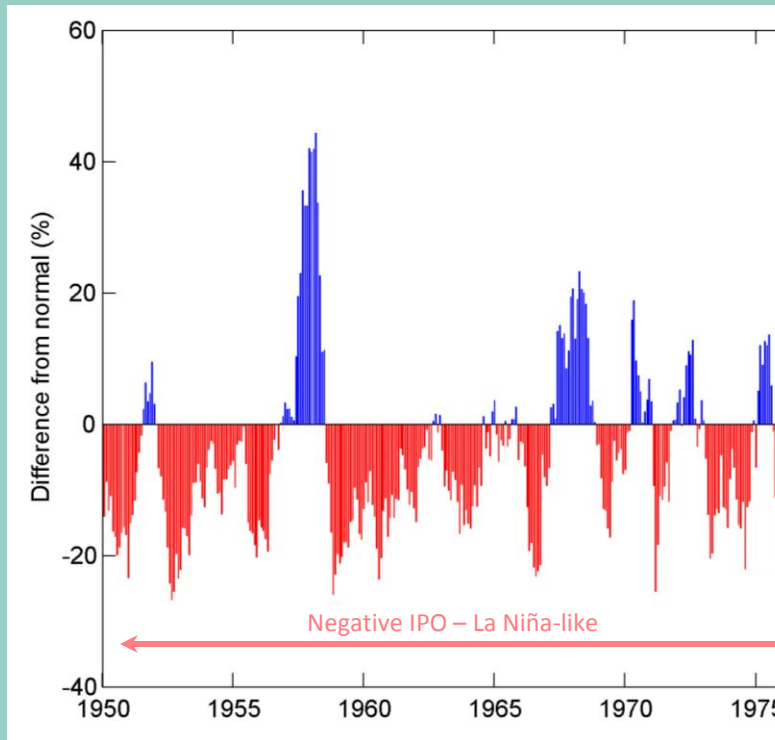
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IPO (Interdecadal Pacific Oscillation)



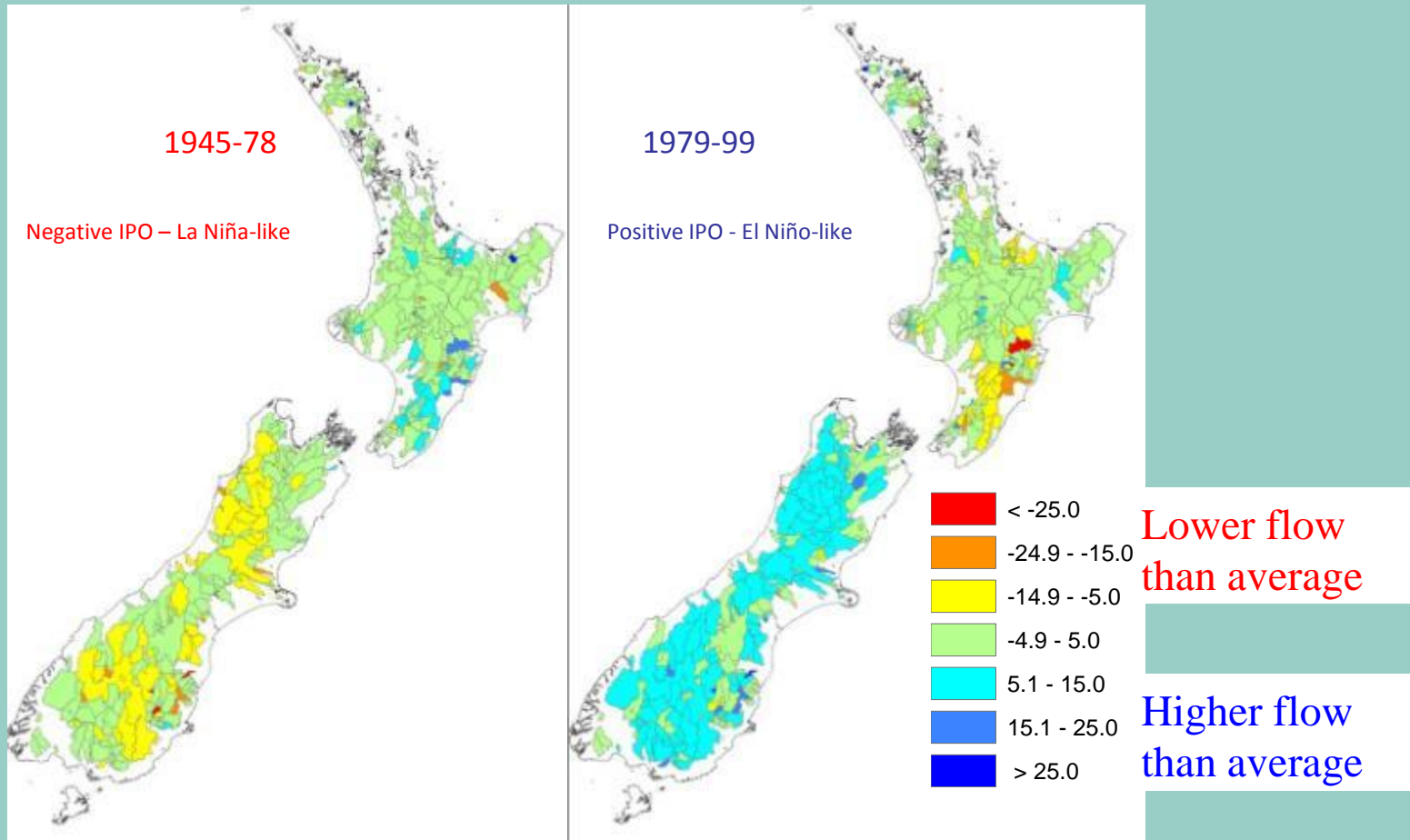
IPO: Effect on Rainfall



Pre-1978, half of the summers were “dry”, while post-1978, only a quarter were dry. By “dry” we mean in the bottom third, that is, not “normal”, and not “wet”. This halving of dry season occurrence happened with only an 11% increase in mean rainfall.

- Circulation change modulates rainfall
 - More El Niño, westerlies → more rain
- Much other seasonal-interannual variability
 - Very wet year in 1958 during “dry” period

IPO: Effect on Mean Flows



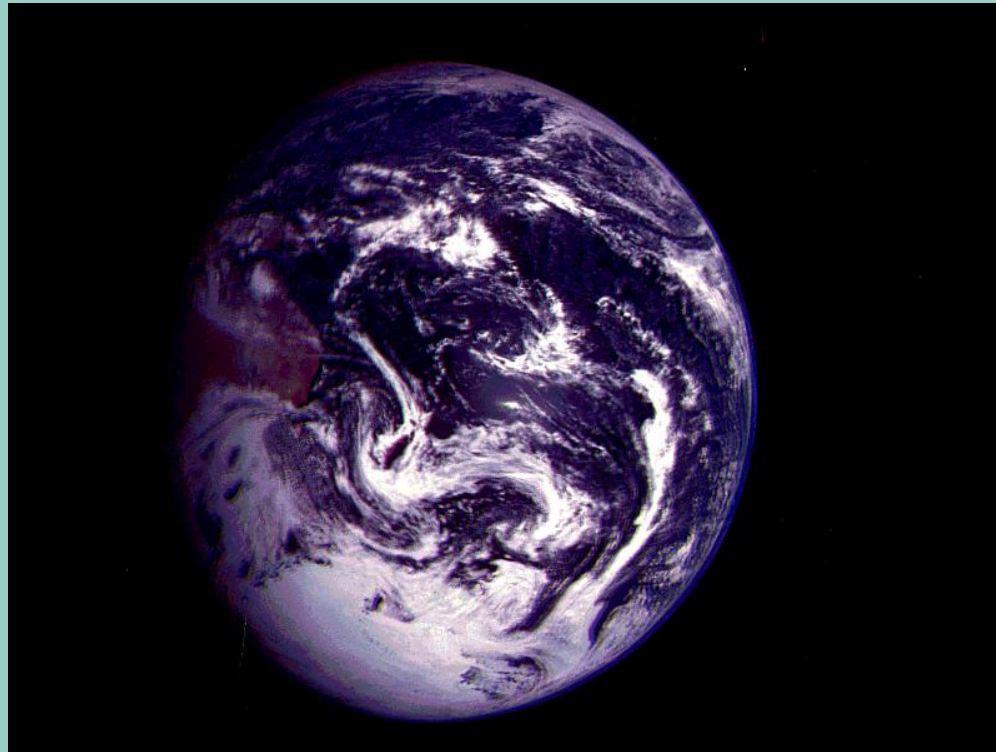
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Climate Change in New Zealand



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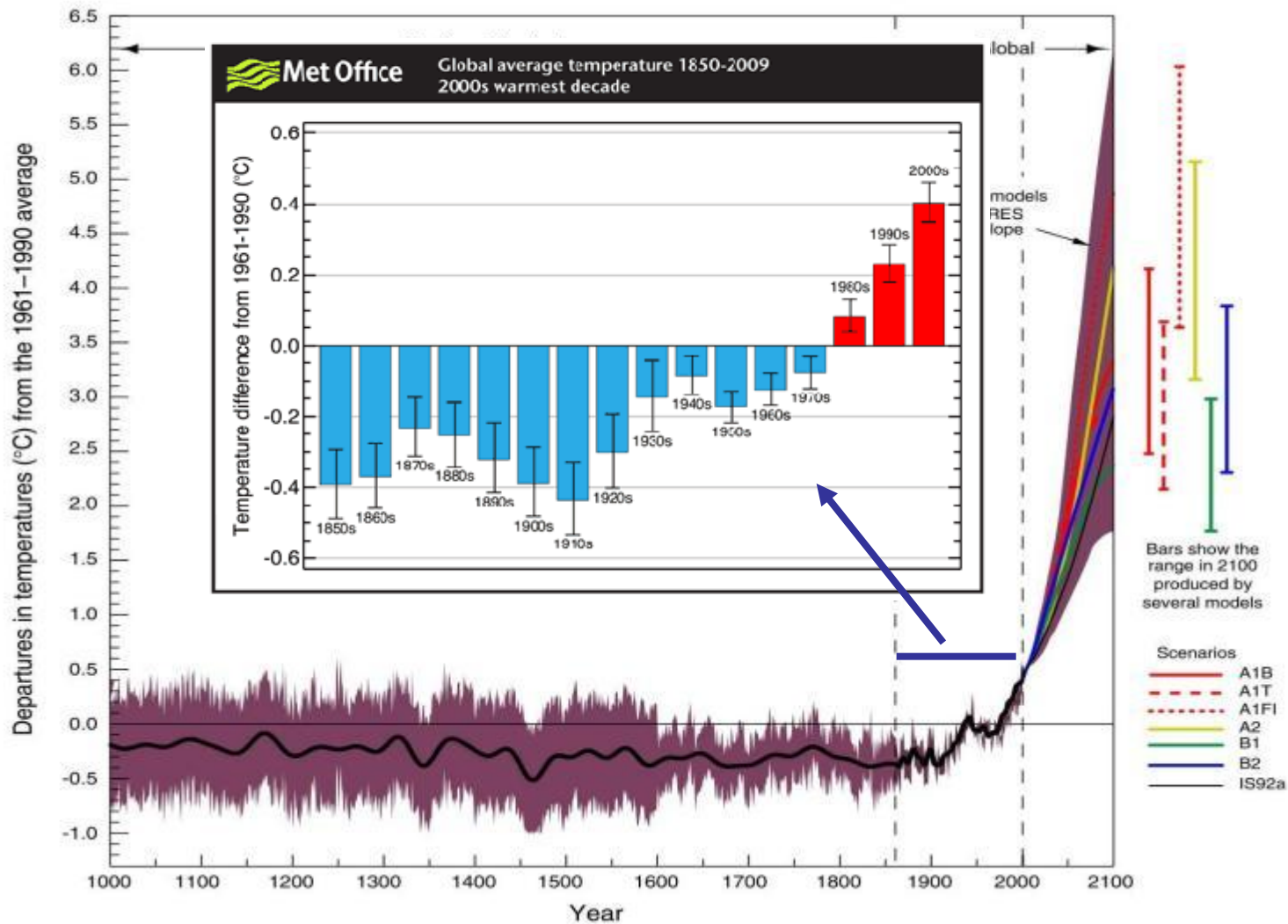
Taihoro Nukurangi



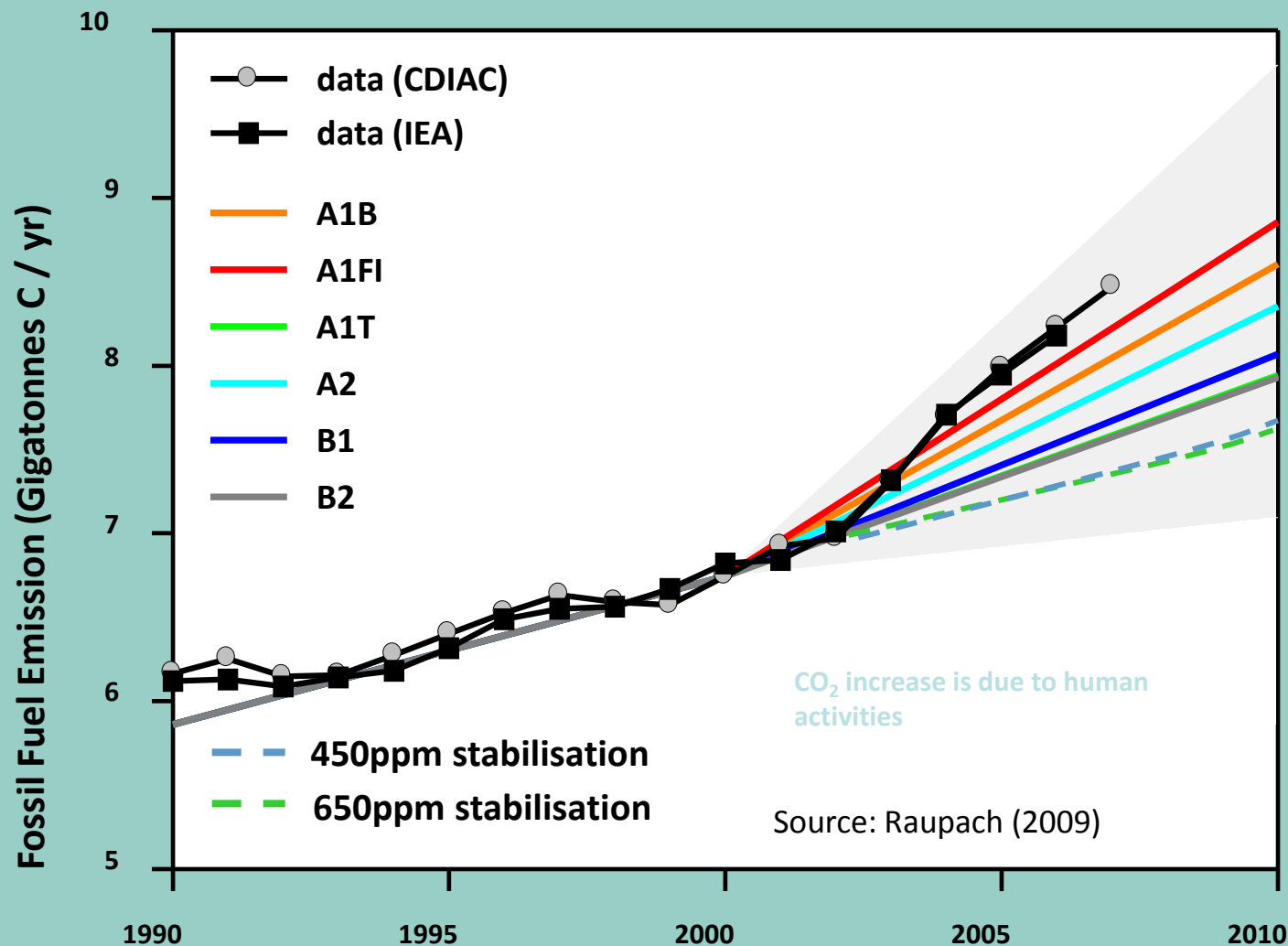
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Past & predicted future temperatures



Observed changes: greenhouse gases



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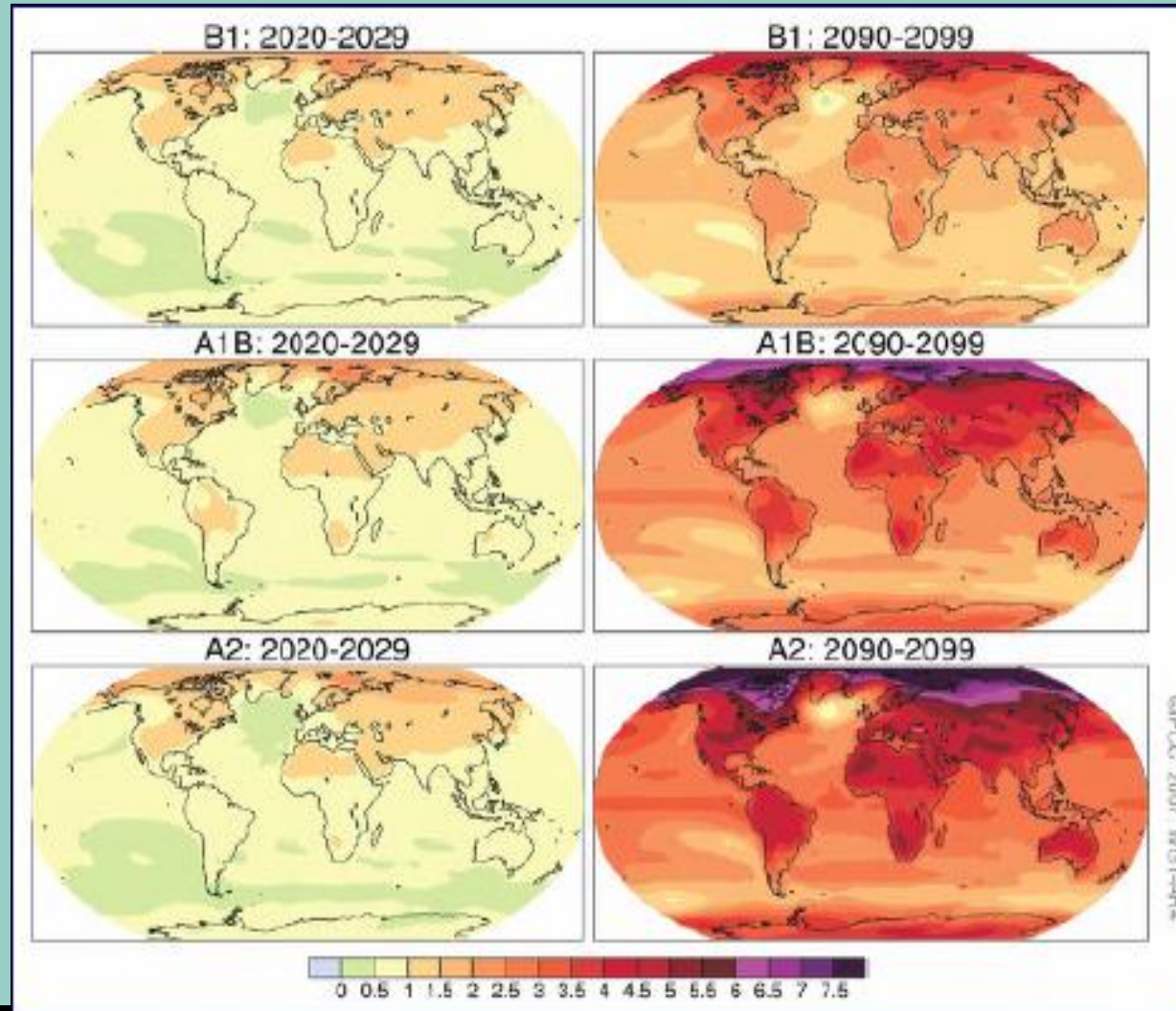


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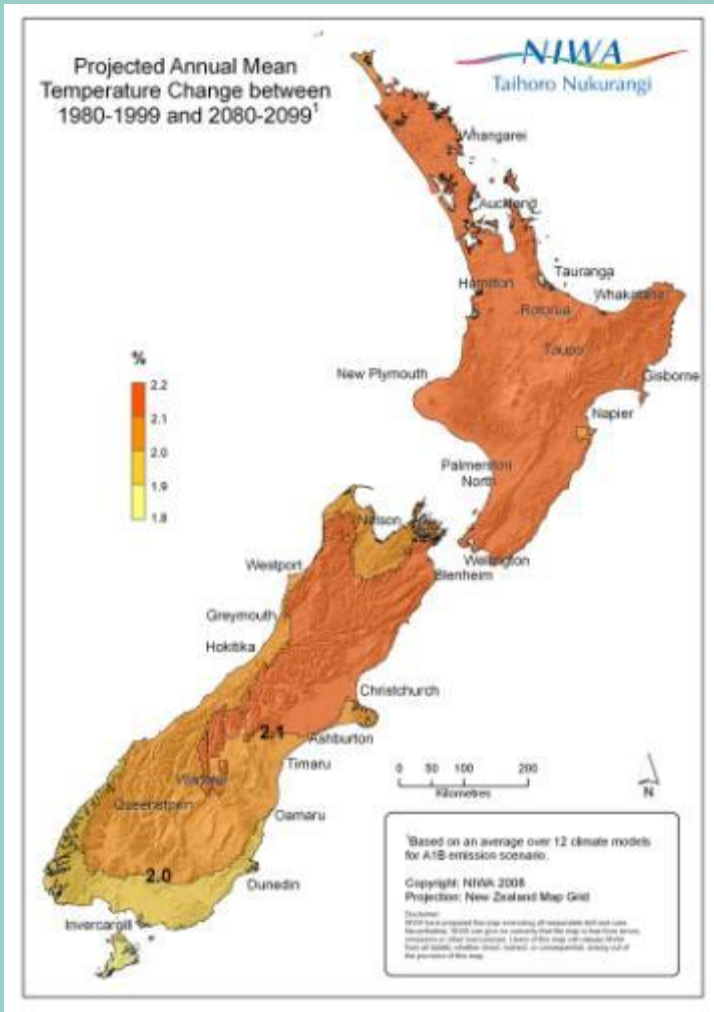
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Projected Future Temperatures

- Projected warming in 21st century is expected to be
- **Greatest** over land and at most northern latitudes
- **Least** over the Southern Oceans and parts of the North Atlantic Ocean



NZ Temperature Projections 2090s



- Increase of about 2°C by 2090 for mid-range scenario
- This is about the present annual difference between Wellington & Auckland
- An unusually warm year now could be the norm in 30-50 years and a cool year by 2100
- We expect fewer frosts, more very hot days

Average annual mean changes for A1B 2090s projections (12model average)



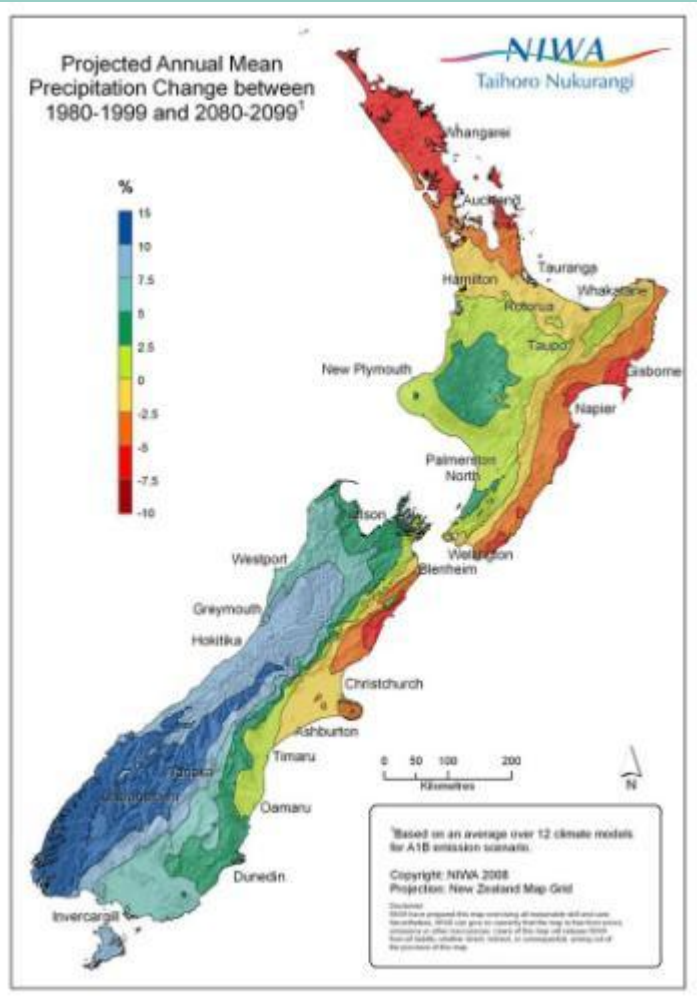
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NZ Rainfall Projections 2090s



- Reduction in annual rainfall in most of the east coast & north of the NI, coastal Canterbury and coastal Marlborough.
- Increase in annual precipitation in west & south of the South Island
- Seasonal precipitation changes:
 - Winter & spring: Increased westerly winds - For both islands drier in E & N, wetter in W
- Extreme rainfall: Heavy rainfall likely to get heavier &/or more frequent
 - for a mid-range scenario a 1-in-100 year event now could become a 1-in-50 year event by the end of the century

Average annual mean changes for A1B 2090s projections (12model average)

Ex-Tropical Cyclones and Mid-Latitude Storms

- The IPCC Fourth Assessment Report concludes that it is likely that future tropical cyclones will become more intense, with larger peak wind speeds and more heavy precipitation.
- Current knowledge suggests the most likely future outcomes over the coming century for New Zealand are that ex-tropical cyclones might be slightly less likely to reach New Zealand, but if they do their impact might be greater.
- The intensity or frequency of mid-latitude storms might also increase somewhat in our region.
- Our level of confidence in these projections is low.



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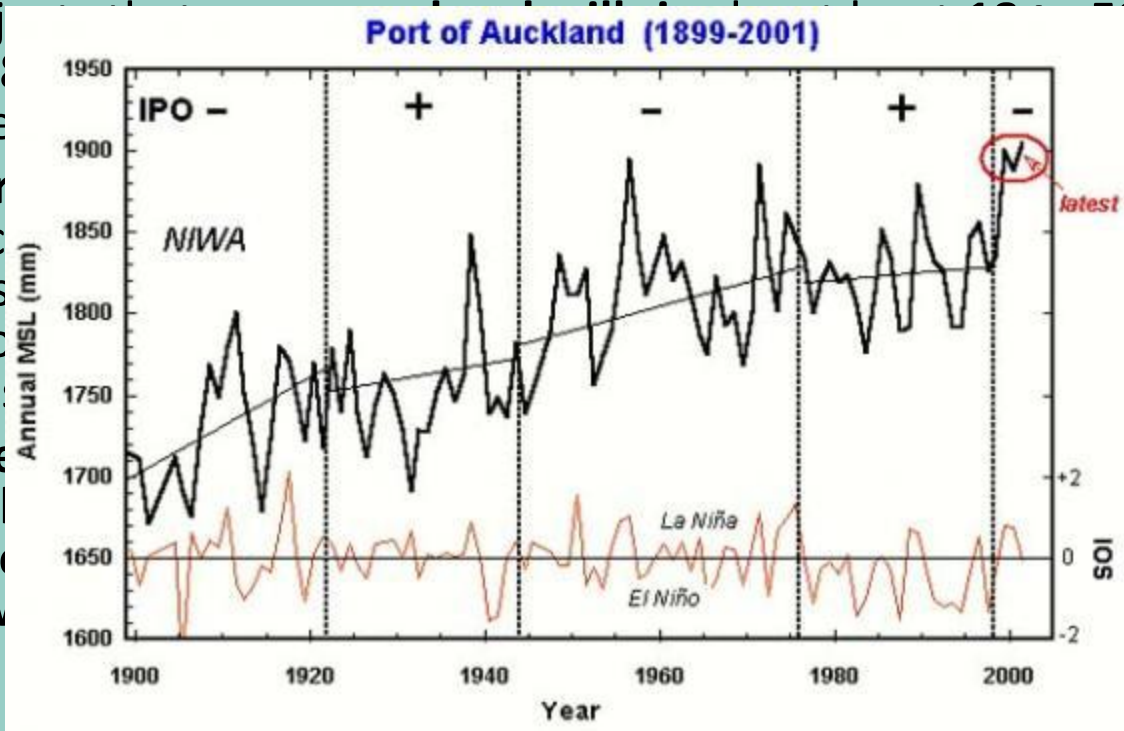


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Sea Level rise

- The rise of sea level around New Zealand is likely to be similar to the global projections of sea-level rise by the IPCC Fourth Assessment Report.
- IPCC projections show a rise of 10-95 cm between 1990 (1990-2100) depending on the full range of scenarios.
- A further rise of 10-95 cm between 1990 (1990-2100) depending on the full range of scenarios.
- Antarctic ice sheet melting increases sea level rise but no consensus on the processes.
- The projected sea level rise is due to the projected increase in heavy snowfall.



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Summary

- Climate variability and change will be important factors for tourism
- Weather and climate information can help prepare tourists and tourism businesses for adverse conditions
- Inter-annual variability will dominate weather patterns in the short term but climate change will become increasingly important
- Northland: warmer, drier, more extreme events and higher sea levels
- Adaptation options are available to increase resilience of tourist destinations



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- Participants in our survey and interviews
- Tourism stakeholders who provide input into this project



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