



Australian Government

Bureau of Meteorology

# Adapting to Climate Change, East Coast Lows.

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Bureau of Meteorology

National Low Chill Stone Fruit Conference

Wednesday 28<sup>th</sup> April 2010

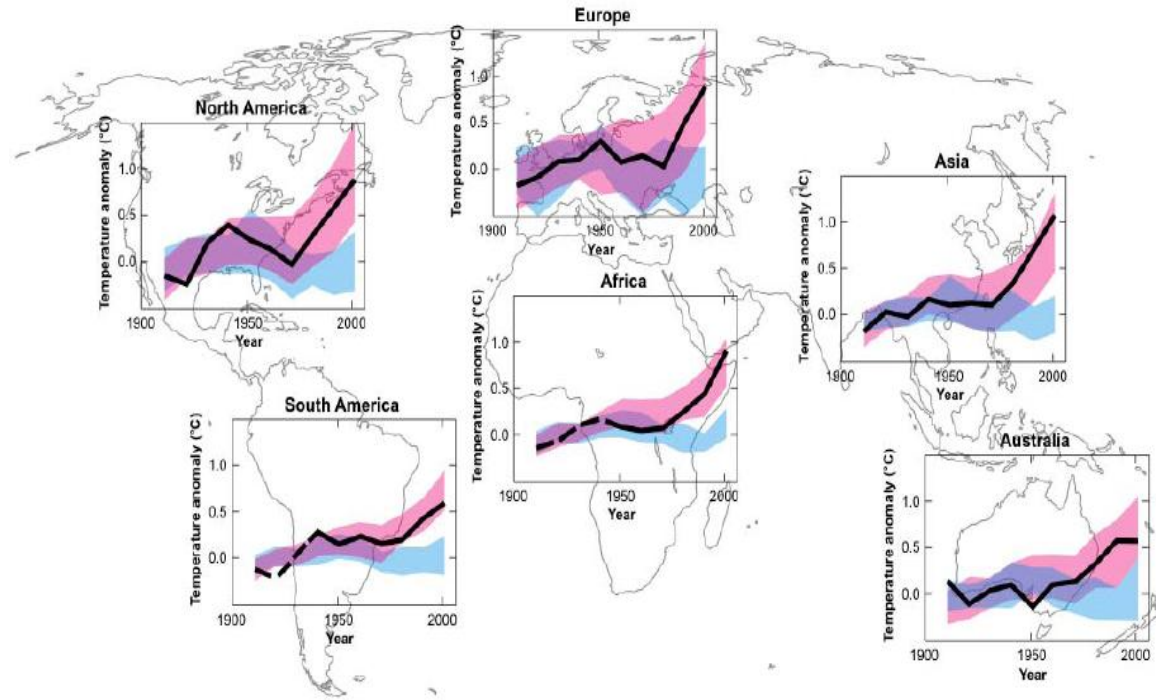
# Outline

- Climate Change: Observed Changes
- NSW Climate Change Projections
- East Coast Lows
- Summary

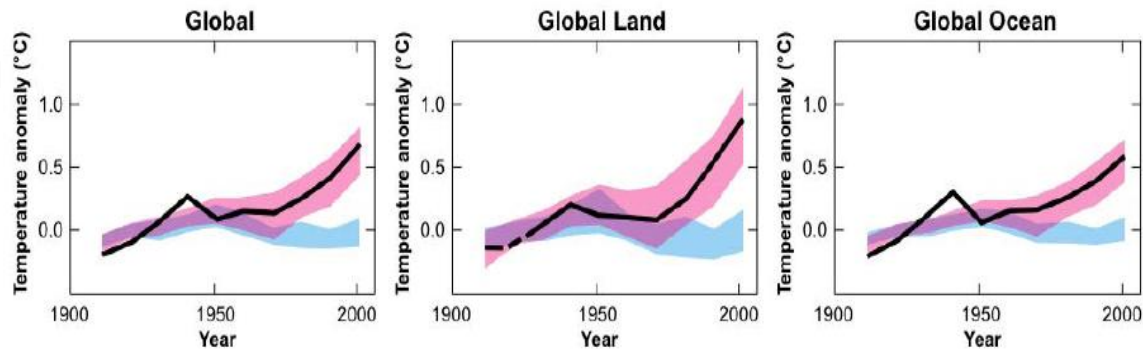
# Climate Change

## GLOBAL AND CONTINENTAL TEMPERATURE CHANGE

Temperature rise is being driven by greenhouse gases



- Observed
- Climate models: Human and Natural Forcing
- Climate models: Natural Forcing Alone



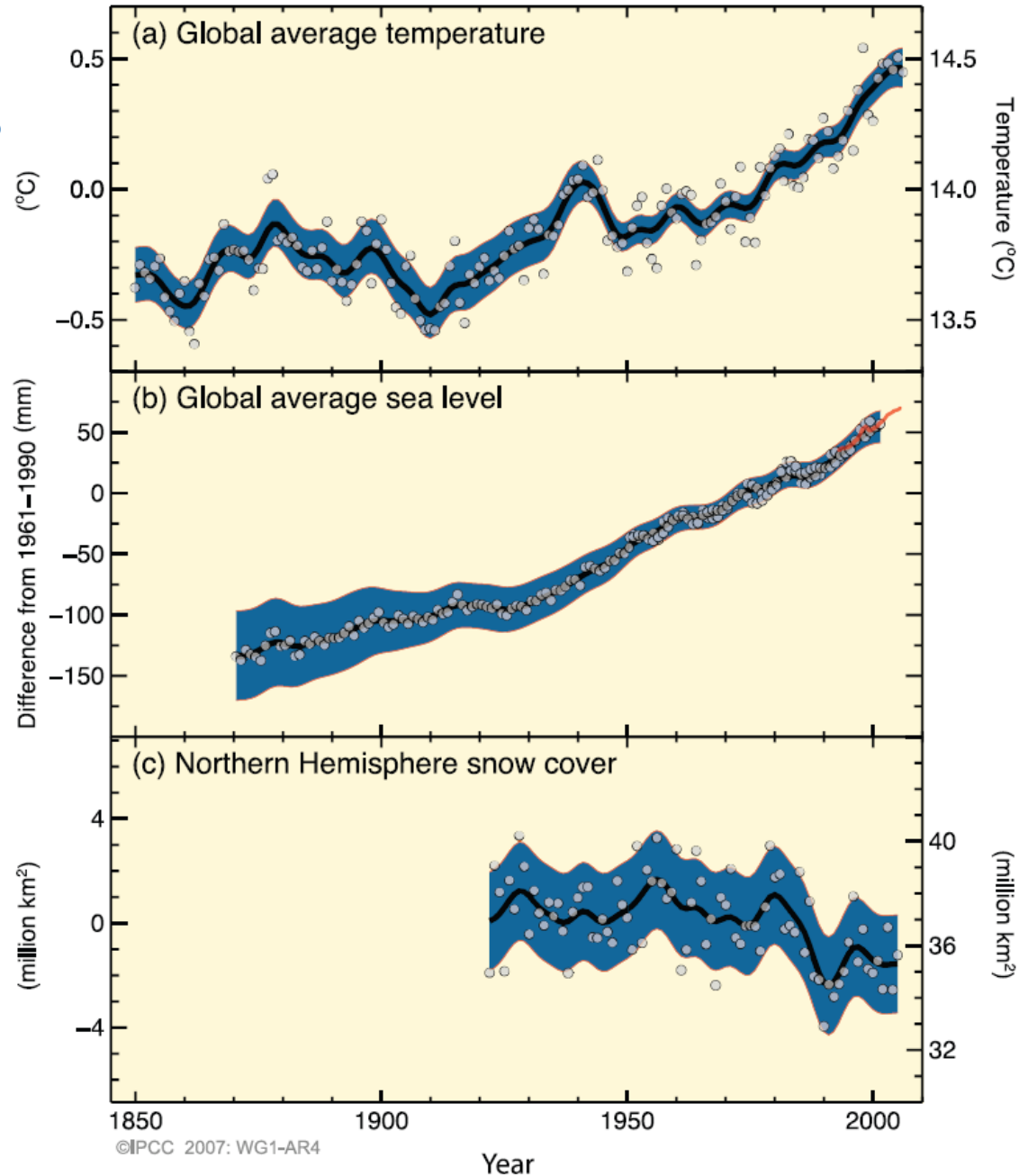
# Observed Global Changes

## CHANGES IN TEMPERATURE, SEA LEVEL AND NORTHERN HEMISPHERE SNOW COVER

Increase in temperatures.

Increase in sea levels  
which will affect coastal  
areas during storms (sea  
surge etc.)

Decrease in snow cover.



# Global Projections

Snow cover is projected to contract.

It is *very likely* that hot extremes, heatwaves and heavy rainfall events will become more frequent.

It is *likely* that future tropical cyclones will become more intense.

Extra-tropical storm tracks are projected to move poleward.

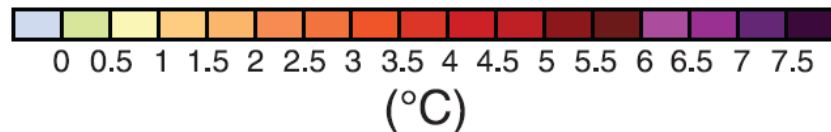
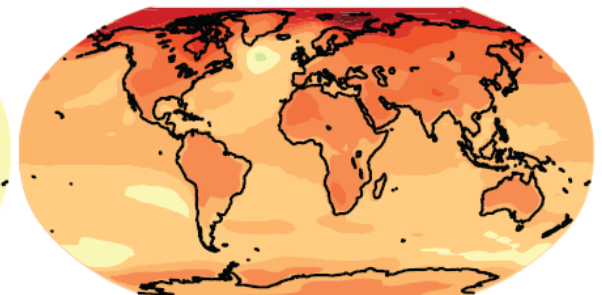
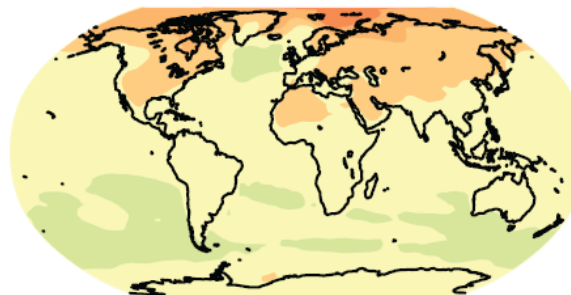
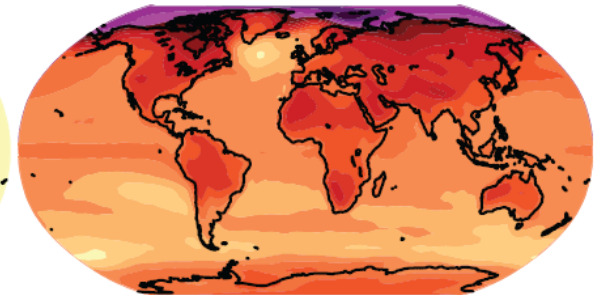
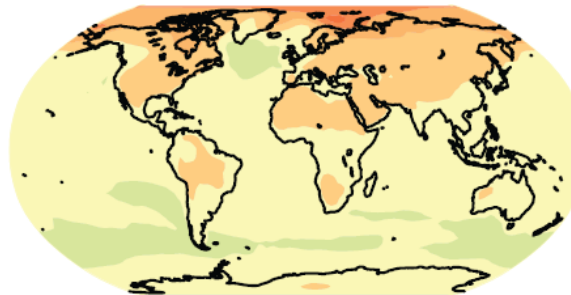
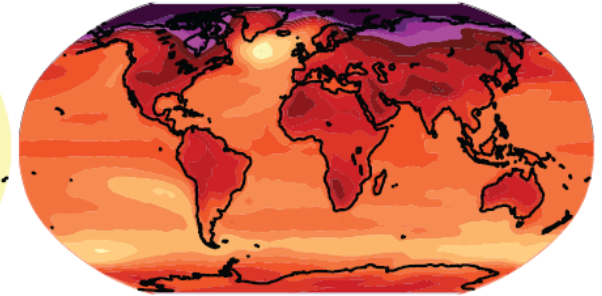
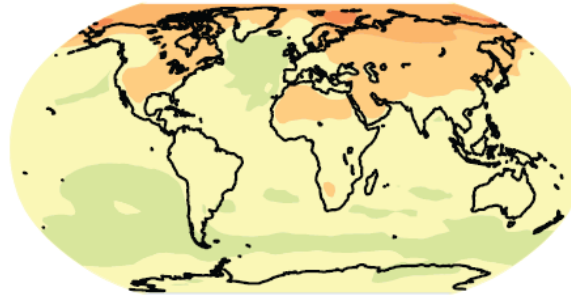
**A2**

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**B1**

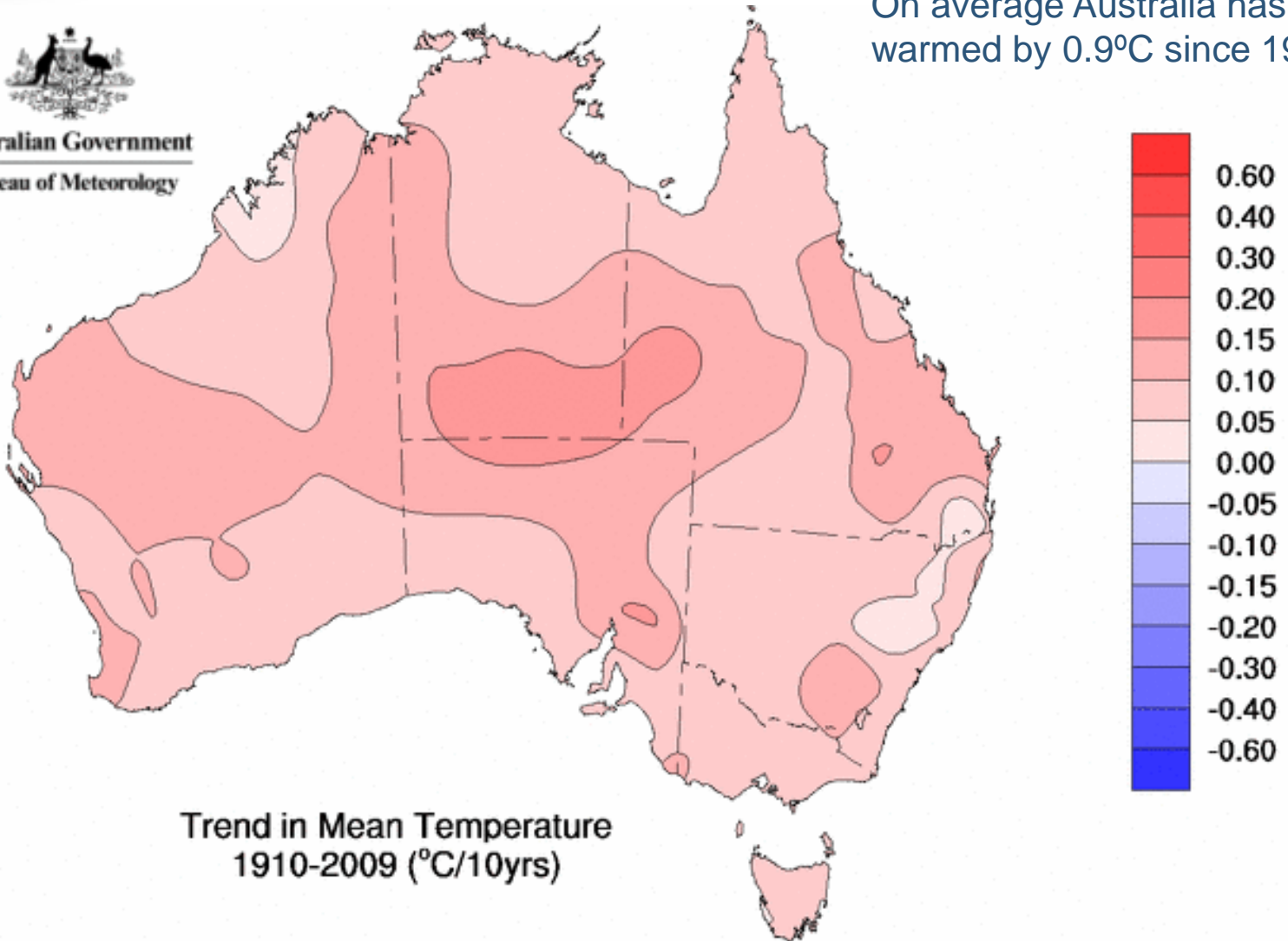
2020 - 2029

2090 - 2099



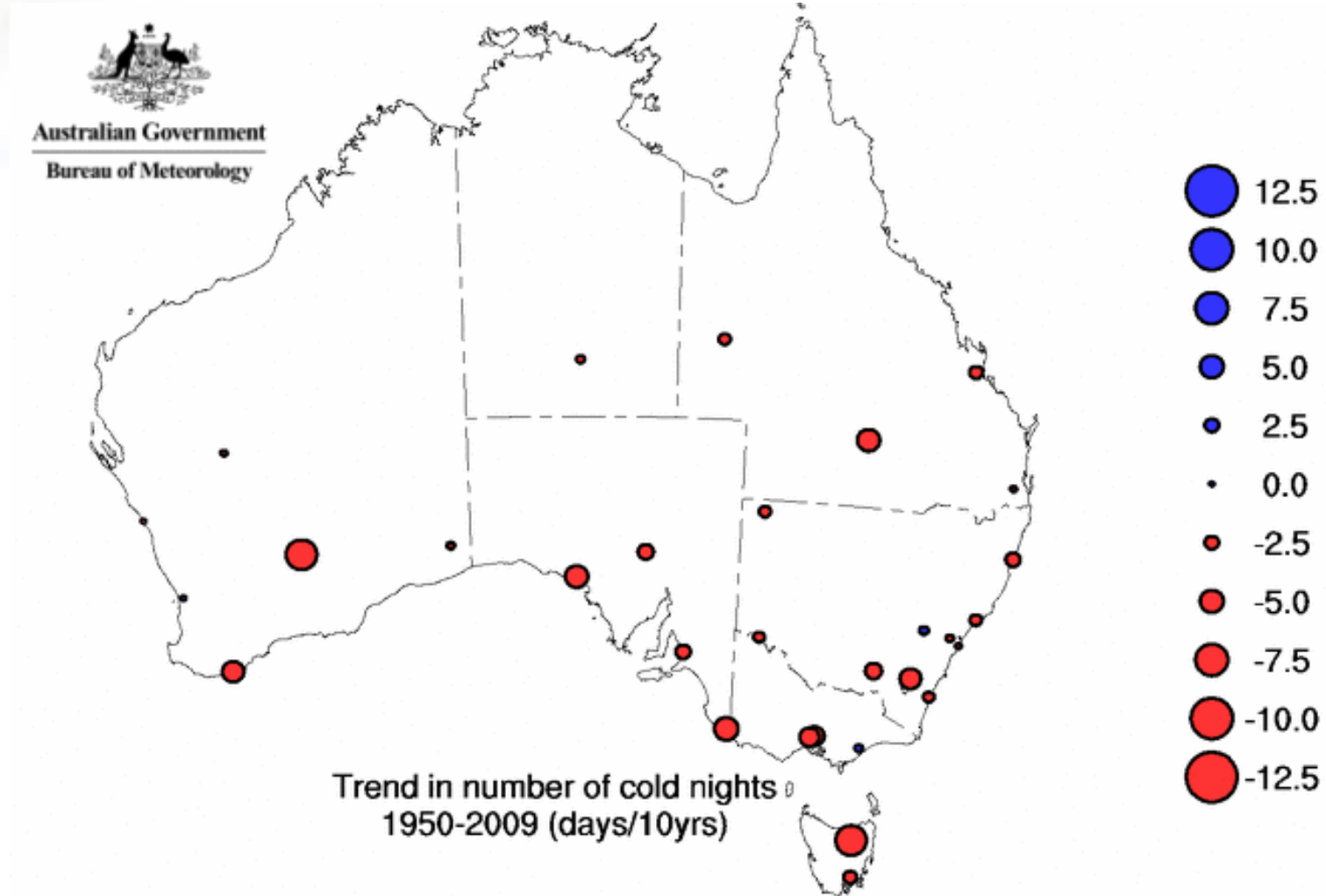
# Changes in Australian Climate: Mean temperatures

On average Australia has warmed by 0.9°C since 1950.

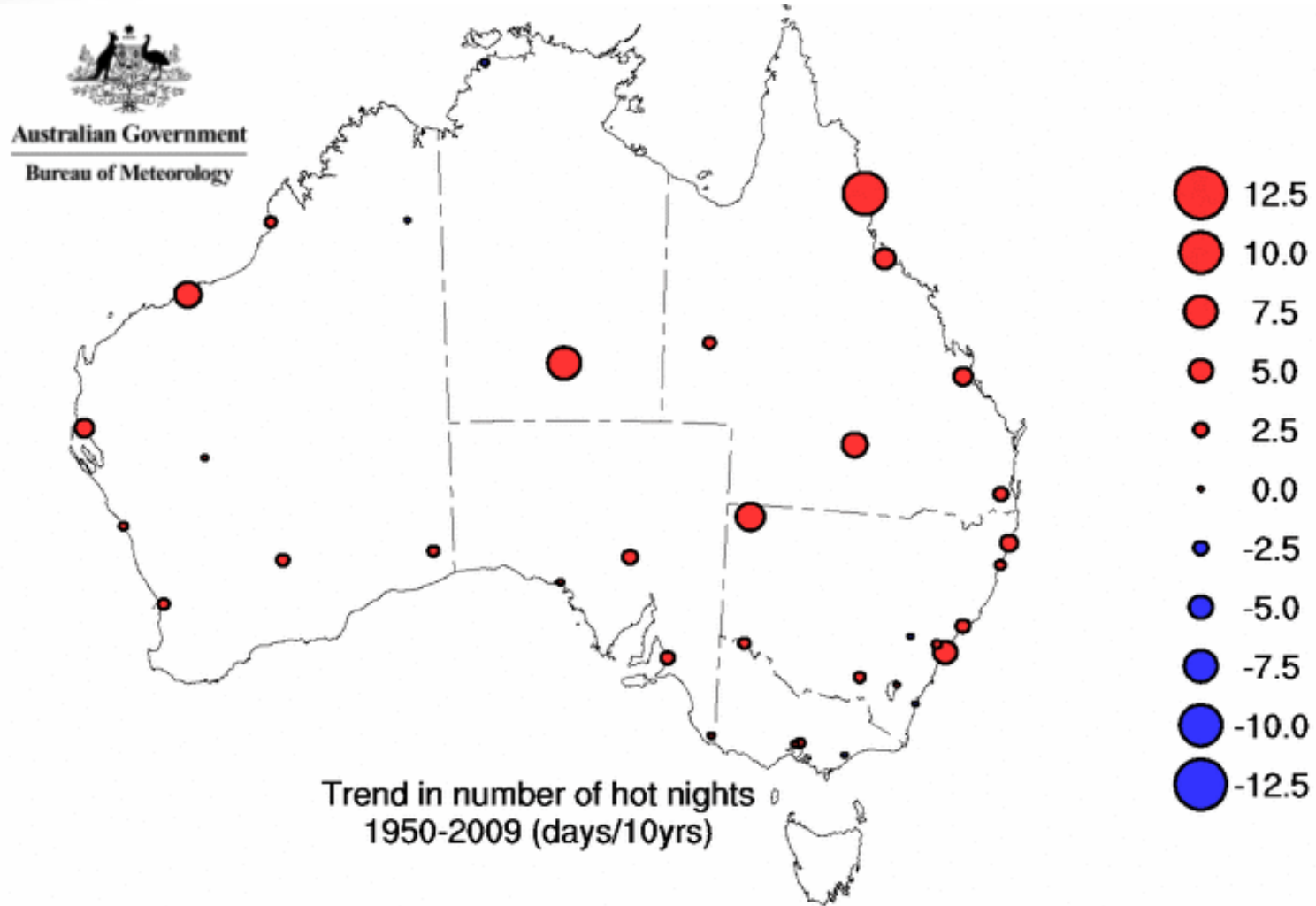


Trend in Mean Temperature  
1910-2009 (°C/10yrs)

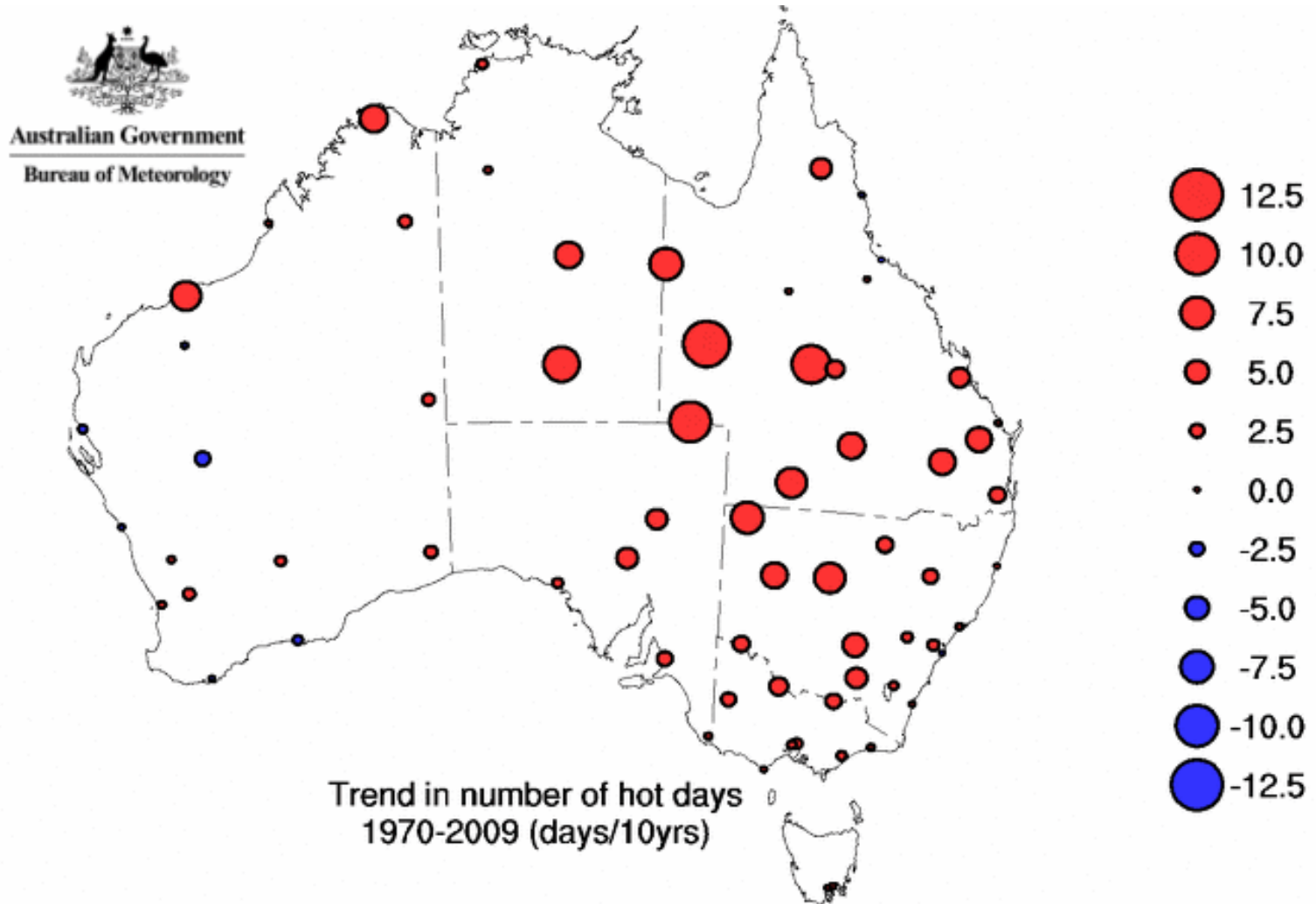
# Climate trends: Changes in number of cold nights (below 5°C)



# Climate trends: Changes in number of hot nights (above 20°C)

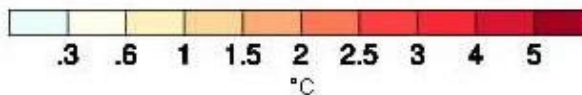
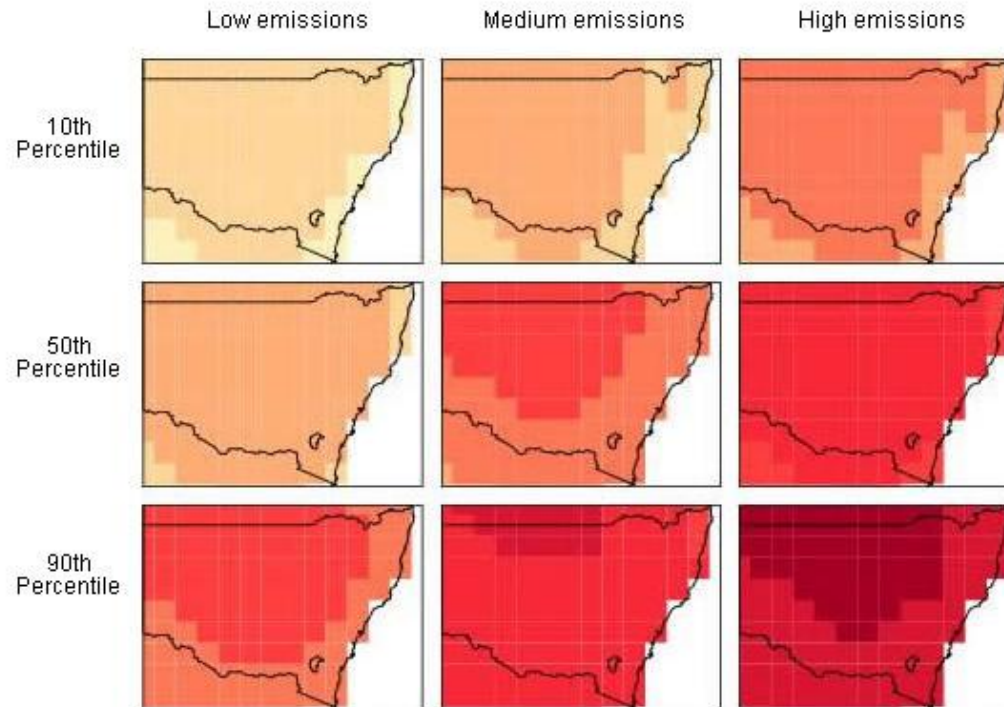


# Climate trends: Changes in number of hot days (above 35°C)



# NSW Climate Change Projections

Temperatures are projected to increase from 1.1°C to 5.9 °C by 2070 in NSW depending on future CO<sub>2</sub> emissions.

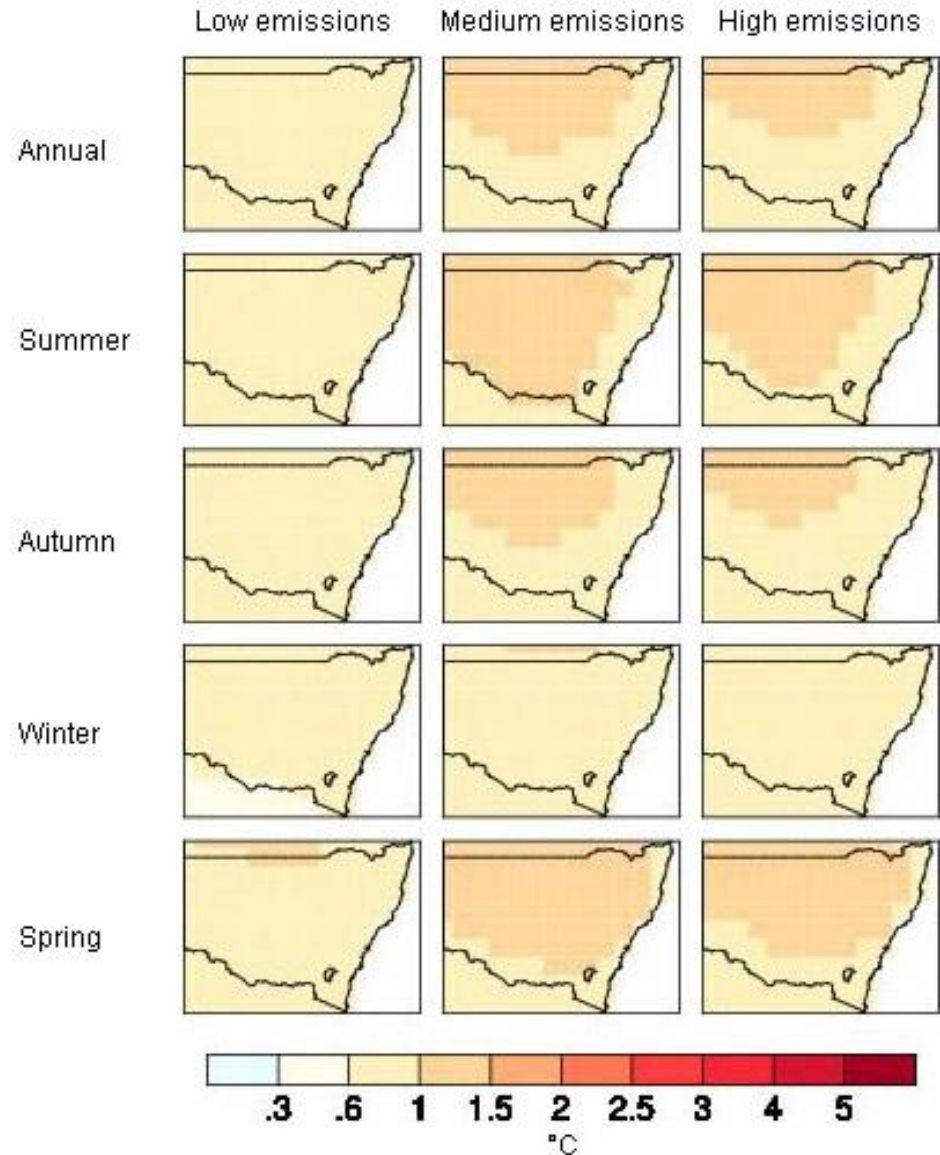


# NSW Climate Change Projections

Projections are the best estimate (mean) from a range of different climate models.

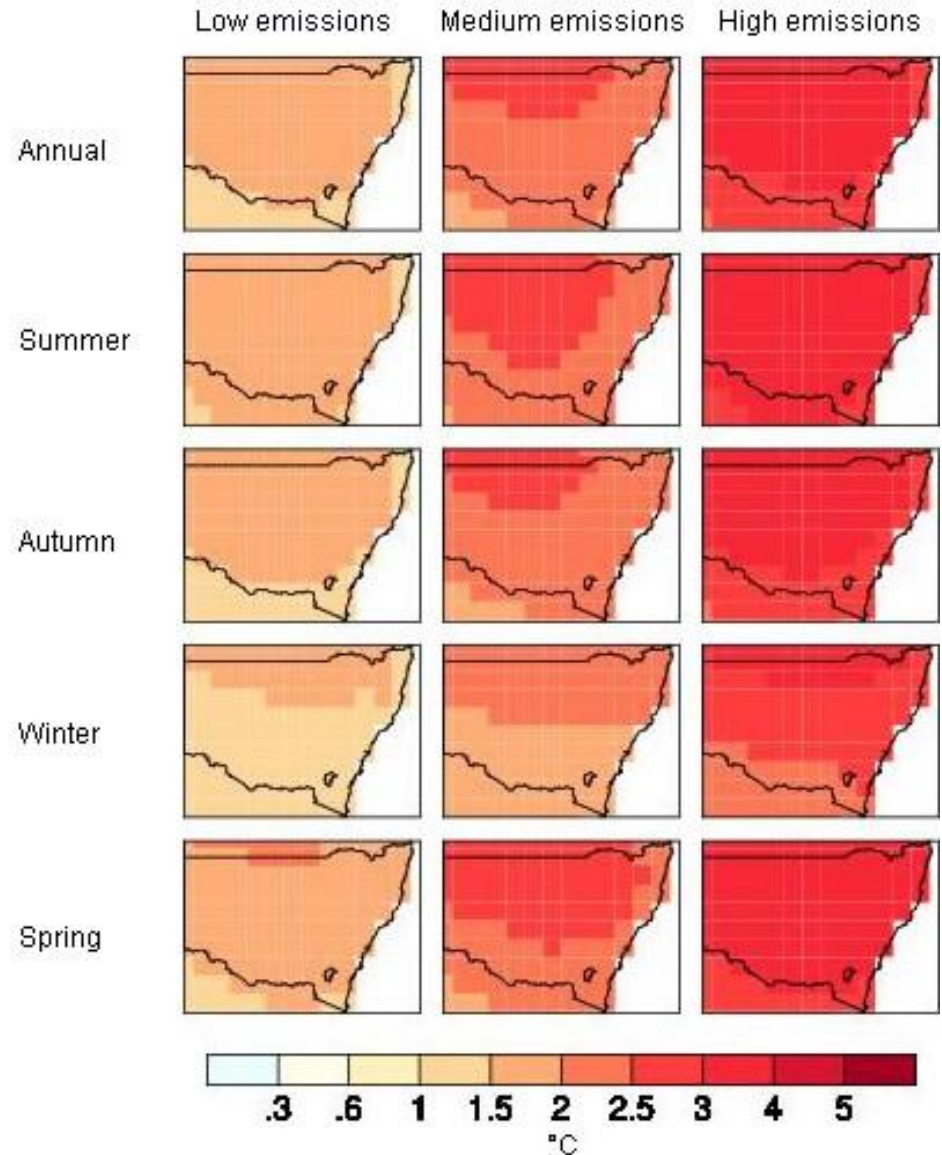
Increases in NSW temperature are expected in each season.

An increase of +1.0 to +1.4°C is predicted in all months by 2030.



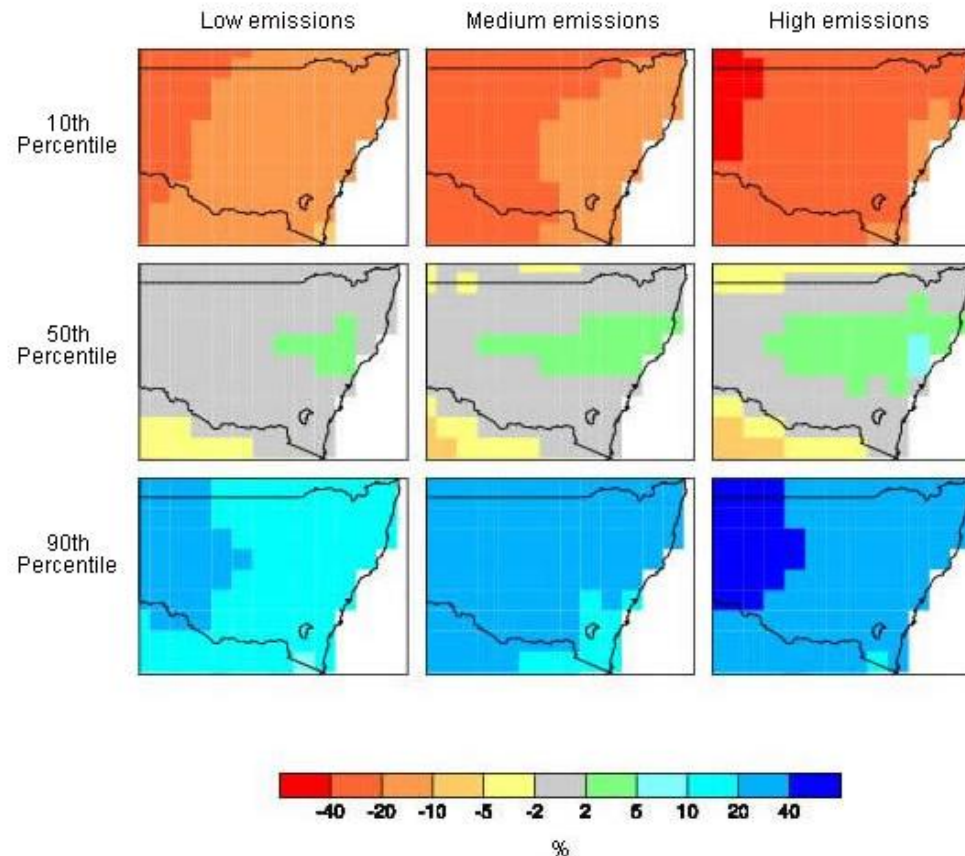
# NSW Climate Change Projections

An increase of +1.5 to +3.9°C is predicted in all months by 2070.



# NSW Climate Change Projections

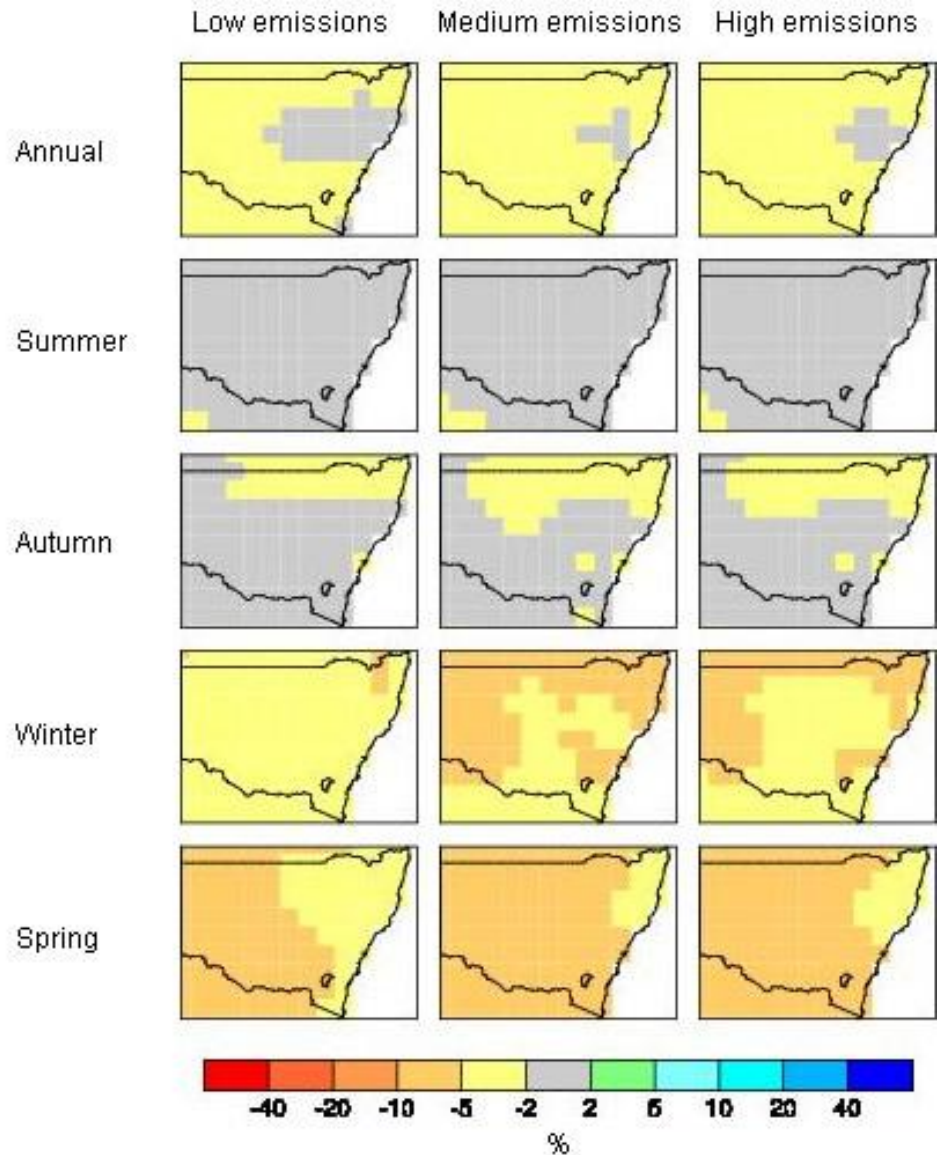
Rainfall projections have large uncertainties. The projections vary from large reductions to large increases in rainfall by 2070. This is due to the models lack of spatial resolution (in many cases there's poor representation of topography) and computing power to be able to capture a chaotic systems such as rainfall.



# NSW Climate Change Projections

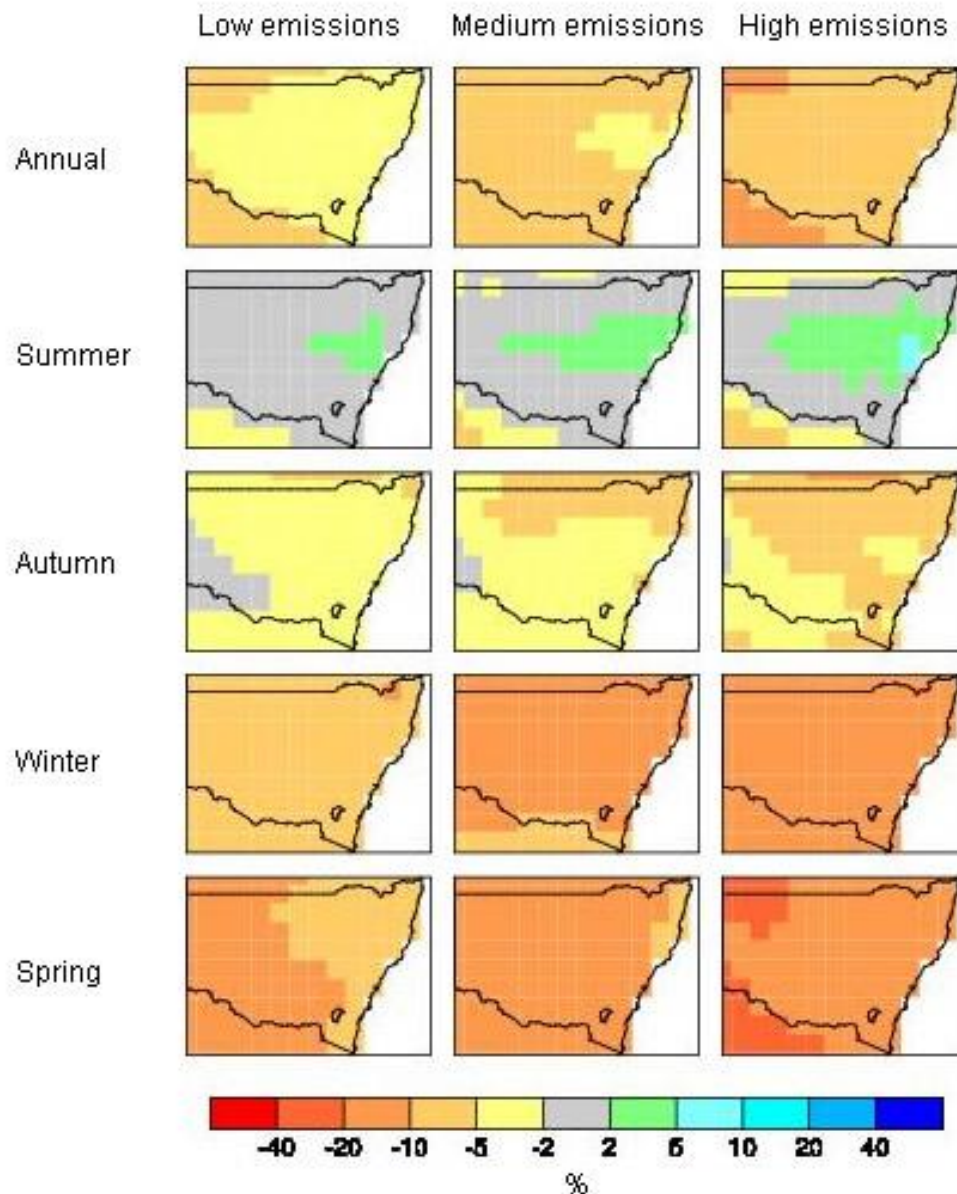
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Changes to NSW rainfall are projected to be largest in winter and spring (projections for 2030).



# NSW Climate Change Projections

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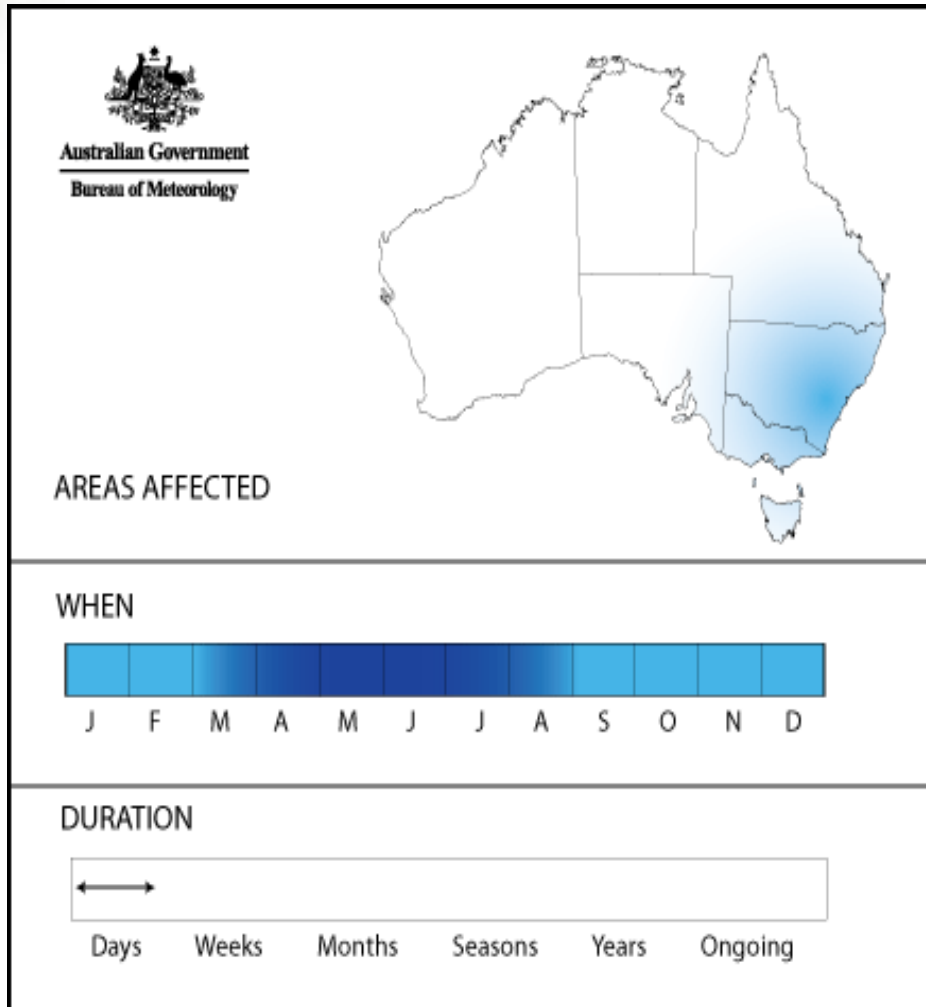
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# East Coast Lows

# East Coast Lows (ECLs)

- Intense low-pressure systems.
- Occur on average several times each year off the eastern Australian coast
  - southern Queensland, New South Wales and eastern Victoria.
- Often rapidly intensify overnight.
- One of the more dangerous weather systems to affect the east Australian coast.

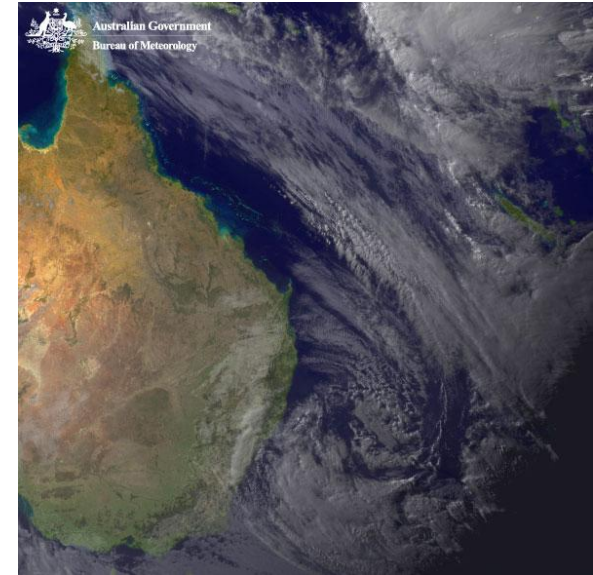
# East Coast Lows (ECLs): Where and when?



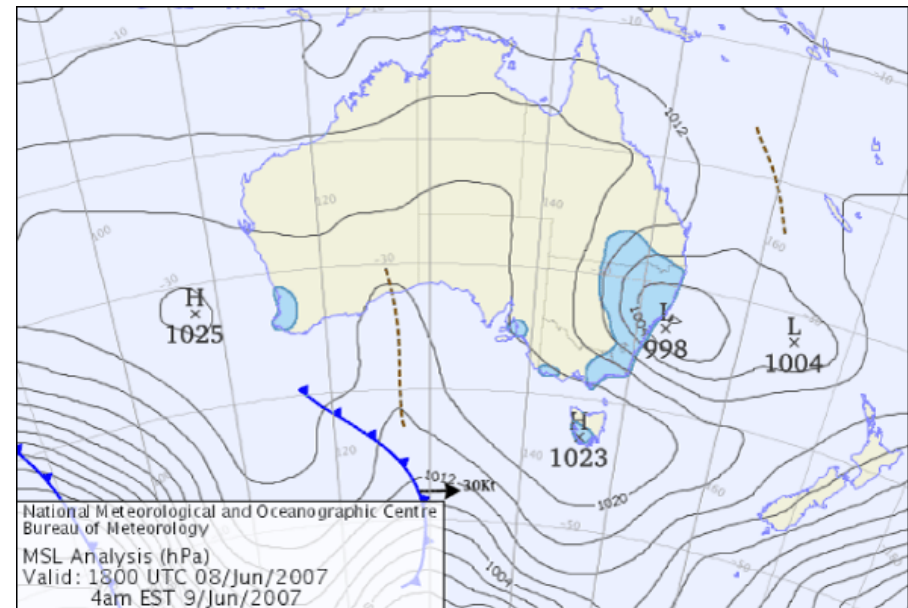
- ECLs can form at any time of year
- Most common during autumn and winter
- Maximum frequency in June
- Individual ECLs generally only last for a few days

# How do they form?

- Form in a variety of weather situations
- In summer, they can be ex-tropical cyclones
- Other time, develop rapidly, offshore within a pre-existing trough of low pressure



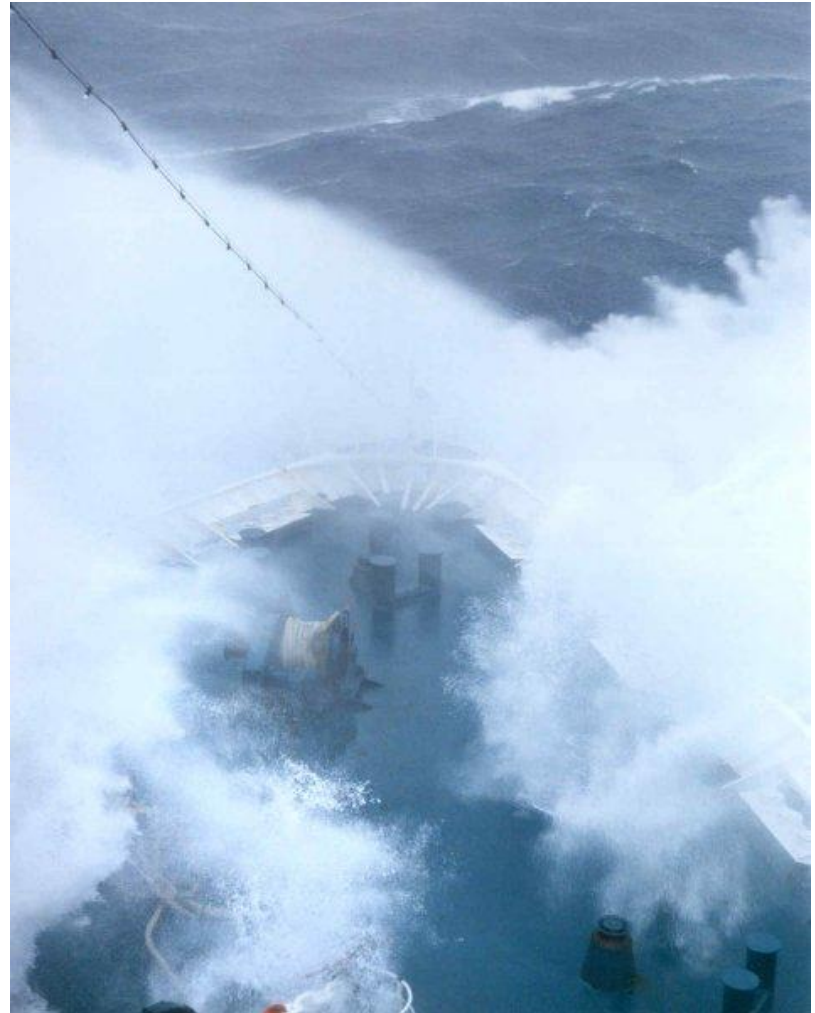
- Wake of a cold front moving across from Victoria into the Tasman Sea
- The sea surface temperature gradients associated with the warm eddies of the East Australian Current also contribute to their development





# ECL impacts

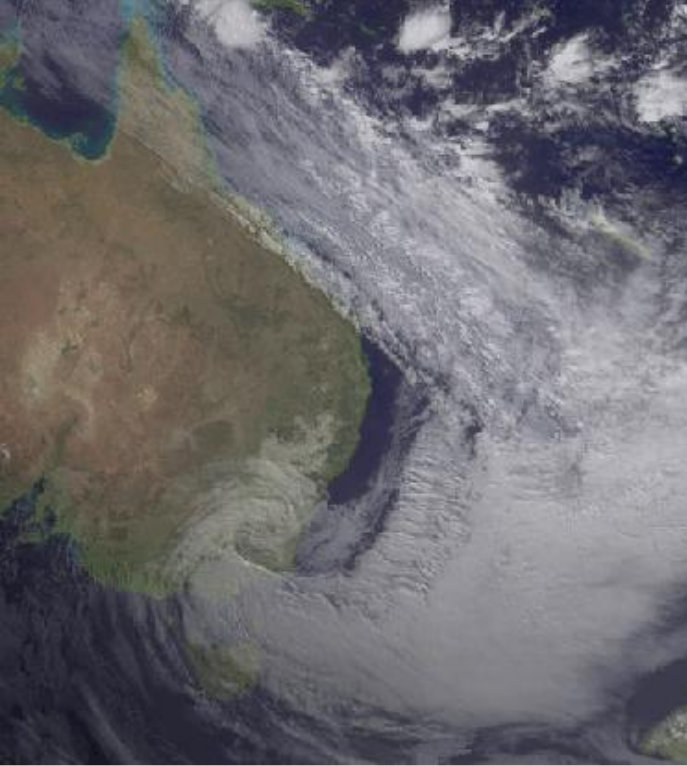
- Gale or storm force winds along the coast and adjacent waters
- Heavy widespread rainfall leading to flash and/or major river flooding
- Very rough seas and prolonged heavy swells over coastal and ocean waters
- The gales and heavy rain occur on and near the coast south of the low centre, while to the north of the low there can be clear skies



# June 2007

- June 2007 saw an extraordinary 5 ECLs lash the NSW coast
- Rare, if not unprecedented monthly frequency
- The event of June 8 and 9 severely affected the Hunter which developed in a pre-existing trough of low pressure:
  - Record rainfall at many locations in the lower Hunter
  - Major flooding in and around Newcastle causing 10 fatalities
  - Worst flooding in 52 years
  - Period of gales lasting over 18 hours
  - Winds averaged 105km/h, gusting to 124 km/h at Nobbys Head

# June 2007 East Coast Low





# East Coast Lows: Future

- A new Eastern Seaboard Climate Change Initiative (ESCCI) has received funding for research into East Coast Lows.
- The information arising from this research will include a climatology of the systems, development of forecasting indicators to improve forecasts, and future projections.
- ESCCI was established to address the existing gaps in knowledge about the climatology of the eastern seaboard which is home to ~one third of Australia's population.

# Summary

- Climate change will result in warmer temperatures which will decrease frosts and cold nights on the north coast.
- It is very likely that the frequency of heavy rainfall events as well as extreme heat (heatwaves) will increase.
- The intensity of tropical cyclones is likely to increase.
- East Coast Lows are one of the more dangerous weather systems to affect the east Australian coast.
- Research is being undertaken to investigate East Coast Lows.



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**Thank you!**