



Australian Government
Bureau of Meteorology

ACT Legislative Assembly

Inquiry into ACT Greenhouse Gas Reduction Targets

Climate Change and Variability

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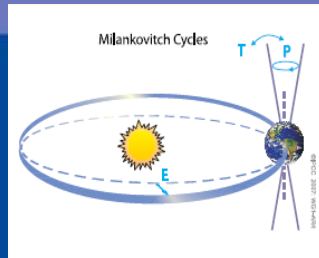
18 February 2009

Acknowledgements: BoM CSIRO, DAFF, DCC



Many factors act to change our climate on various timescales

• Physical 'external' factors

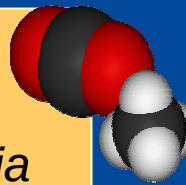


Orbital
Changes:
millenia



Solar Changes:
millenia to decadal

Changes in
Atmospheric
Chemistry: *millenia
to years*

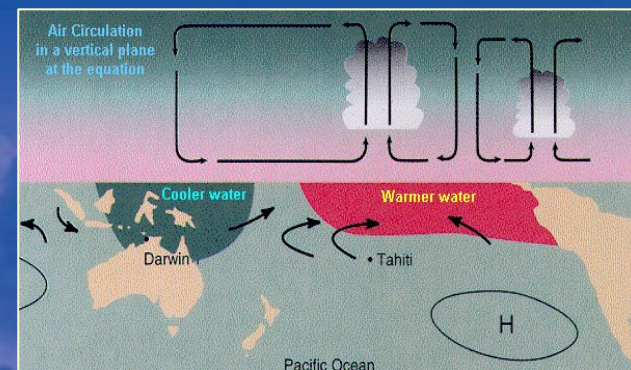


Volcanic
Eruptions:
years



• Intrinsic 'internal' factors

E.g. The El Niño Southern
Oscillation: *year-to-year,
month-to-month*

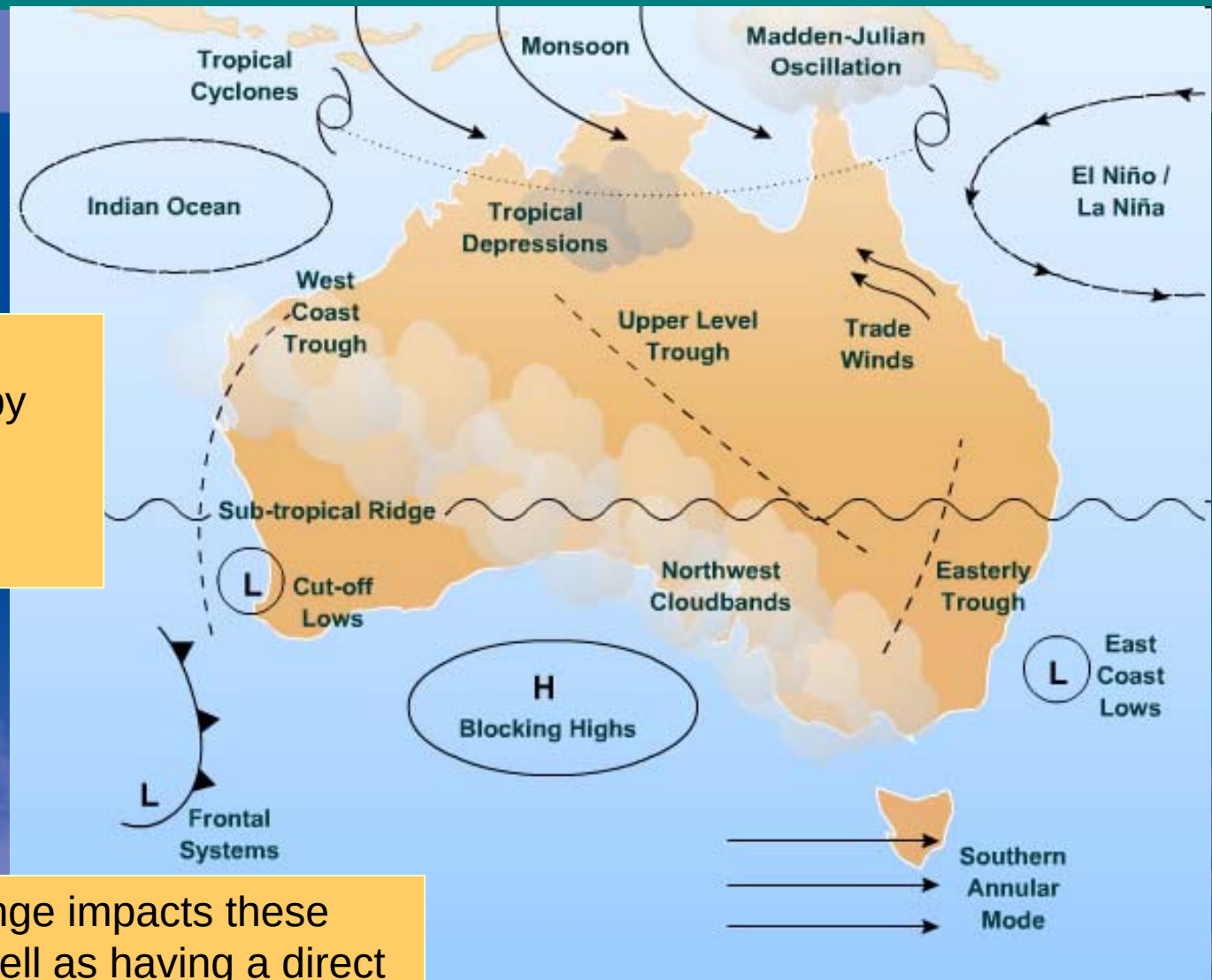




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What drives the climate of Australia (and the ACT)?

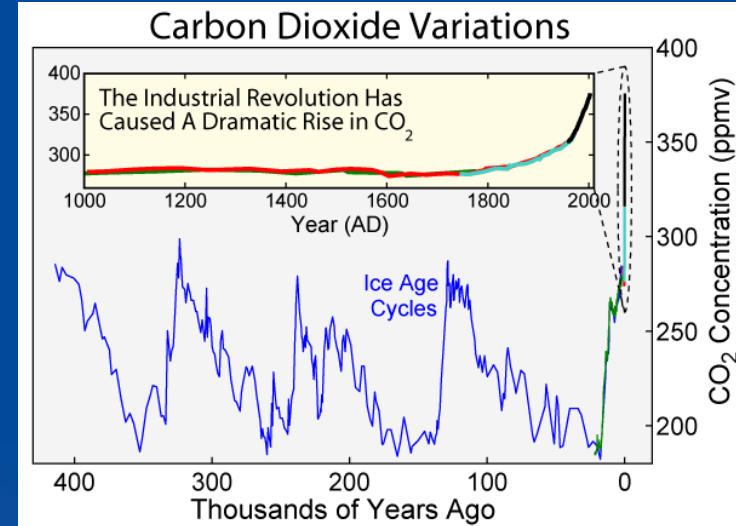
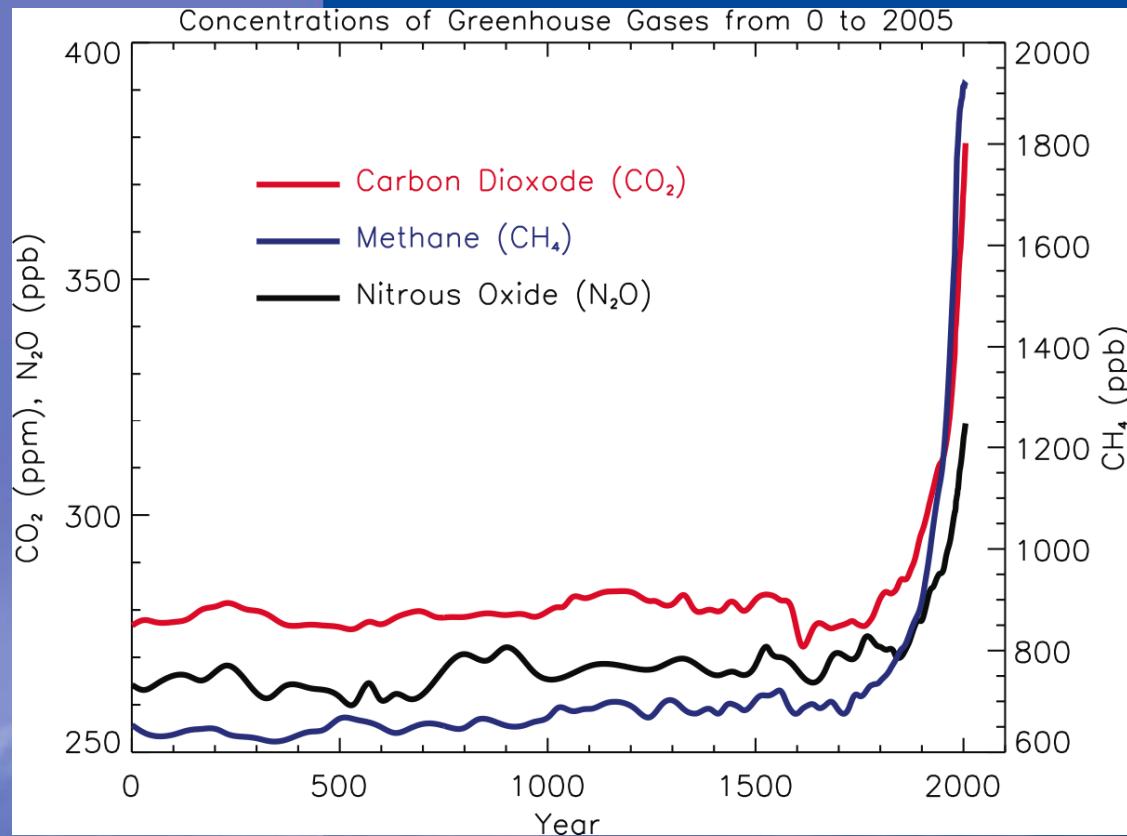
The climate of a location is driven by the complex interaction of a number of factors



Climate change impacts these drivers, as well as having a direct warming role

<http://www.bom.gov.au/watl>

Greenhouse gas concentrations have increased dramatically since the industrial revolution



Greenhouse gases are currently at a higher concentration than at any time in the last million years and human activity is responsible



Conclusions of the IPCC Fourth Assessment Report

- Warming of the climate system is **unequivocal**
- Most of the observed increase in globally averaged temperatures since the mid-20th century is **very likely** due to the observed increase in anthropogenic greenhouse gas concentrations.



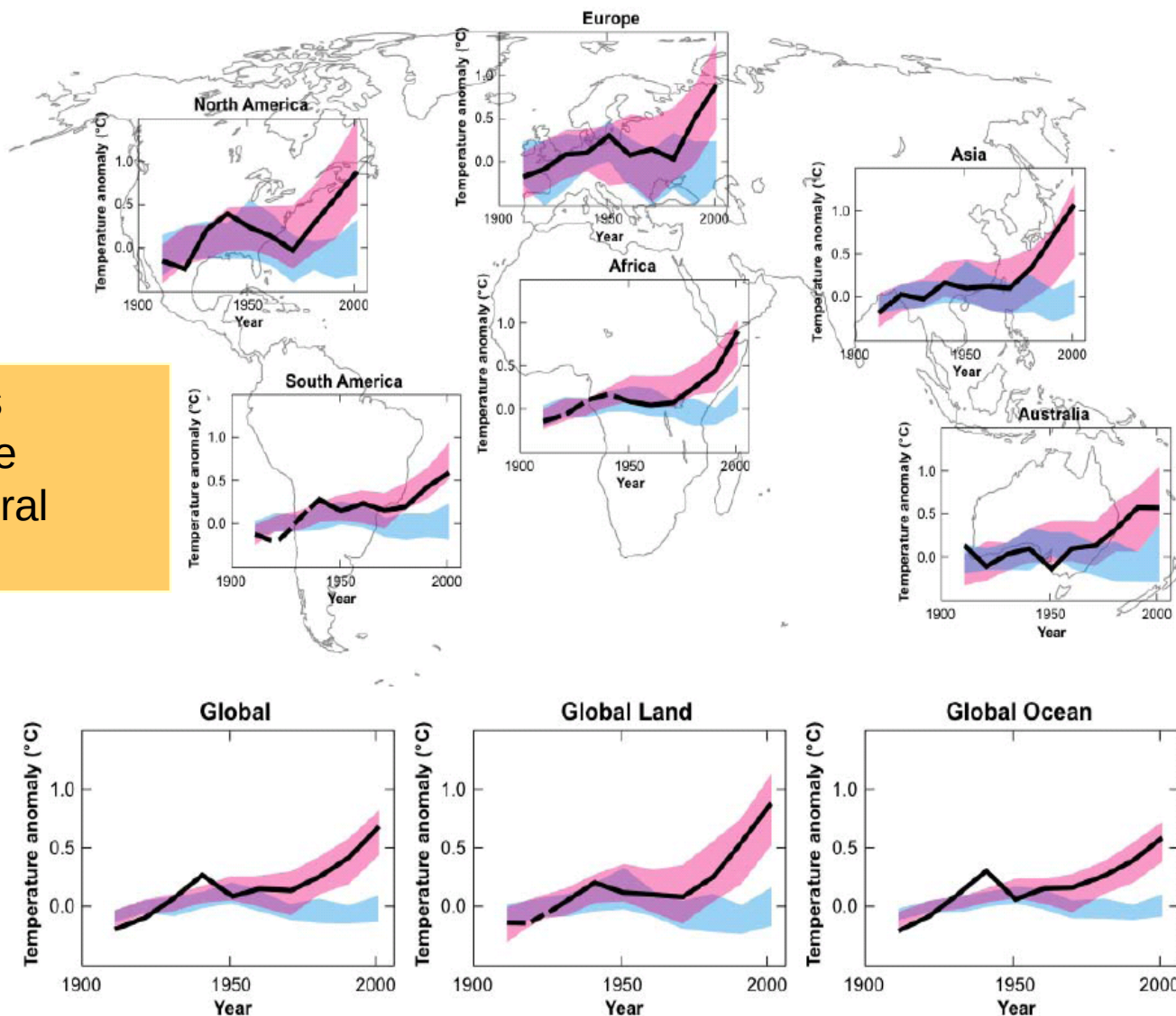
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Climate change over the 20th century has been heavily influenced by human activity

Temperature rise is beyond what can be expected from natural variability alone.



GLOBAL AND CONTINENTAL TEMPERATURE CHANGE



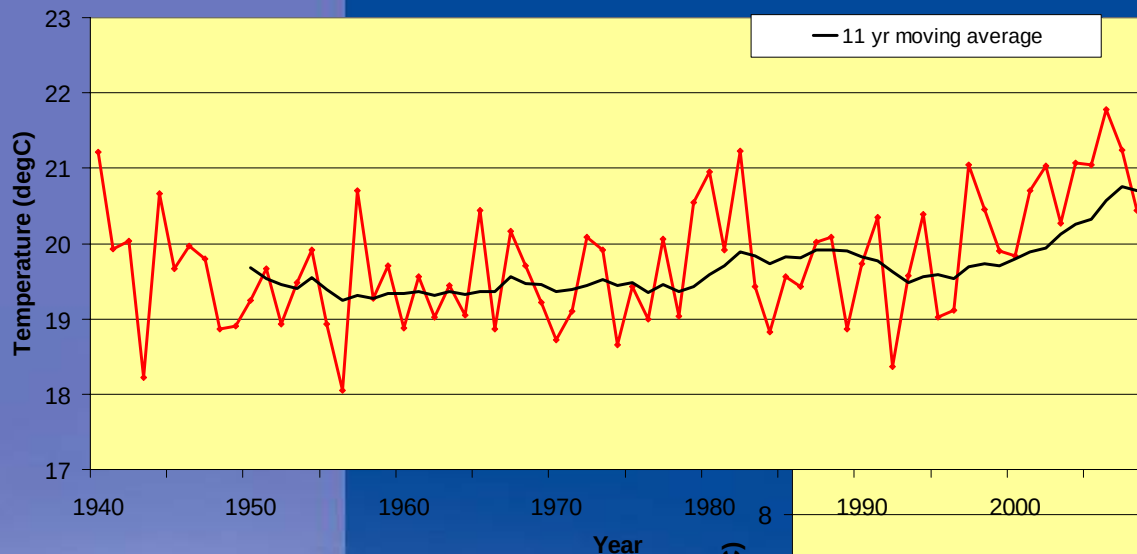


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ACT's Changing Climate - Temperature

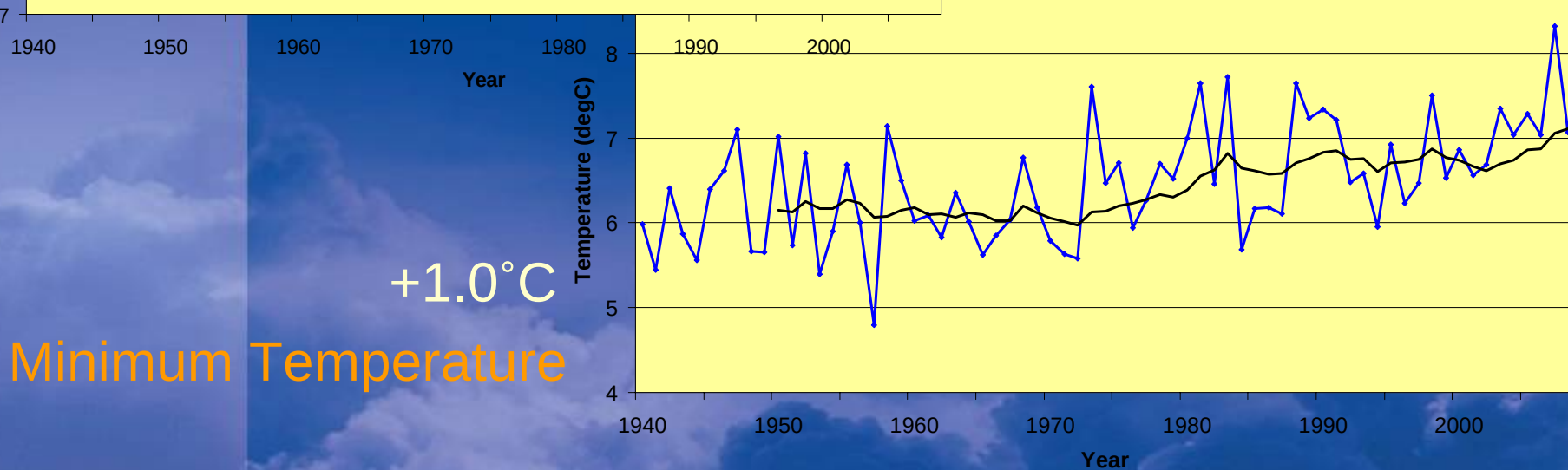
The ACT has been getting hotter and drier;
2006 was Canberra's hottest year on record.

Maximum Temperature for Canberra Airport



Maximum Temperature
+1.2°C

Minimum Temperature for Canberra Airport



+1.0°C

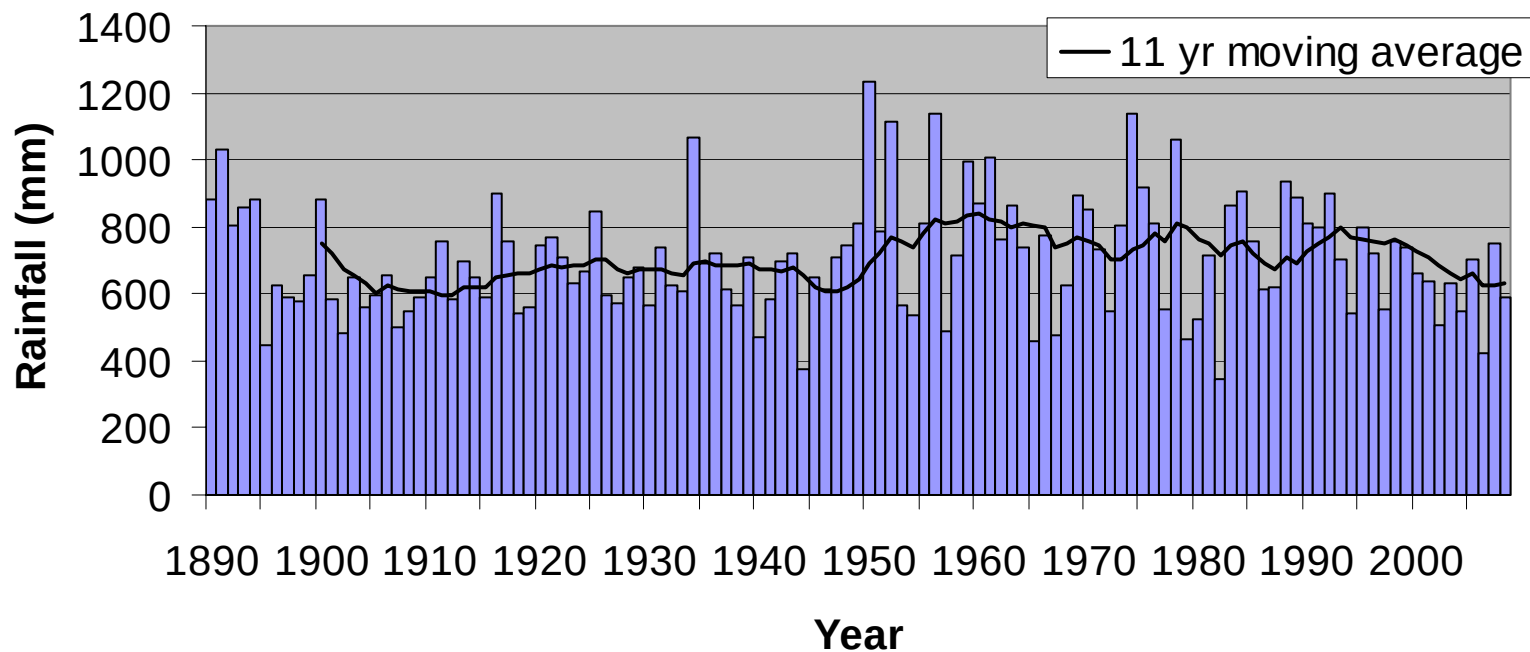
Minimum Temperature



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ACT's Changing Climate - Rain

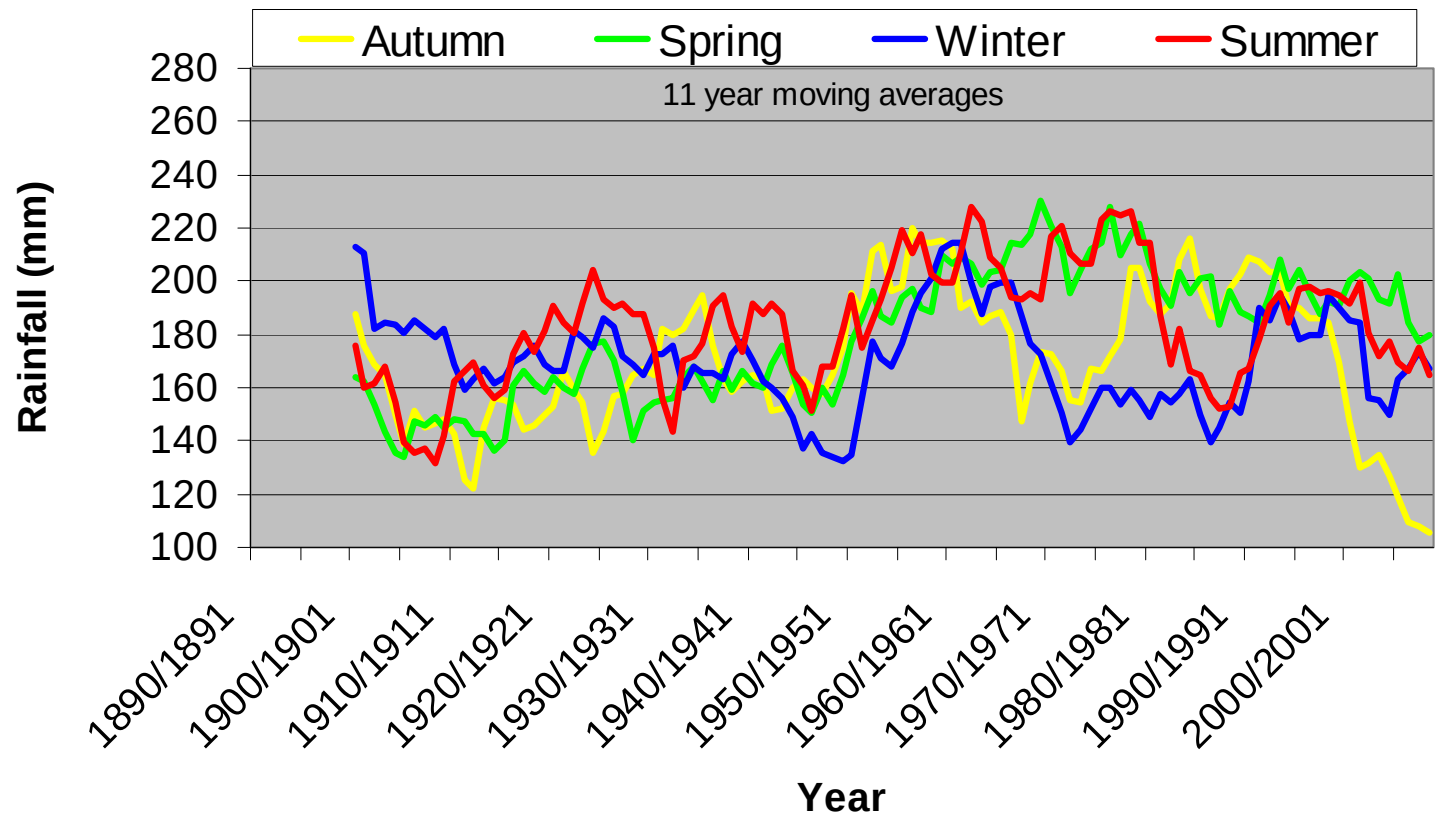
**Annual Rainfall Totals (mm) for District 70:
Southern Tablelands (Goulburn-Monaro)**





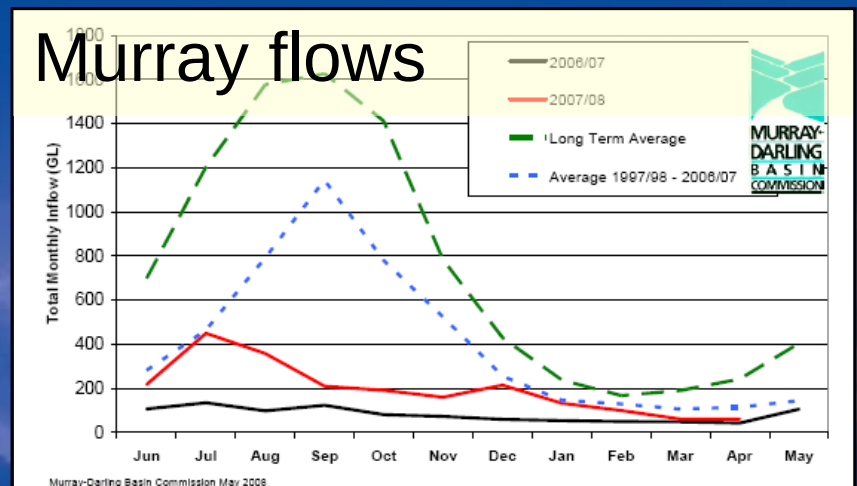
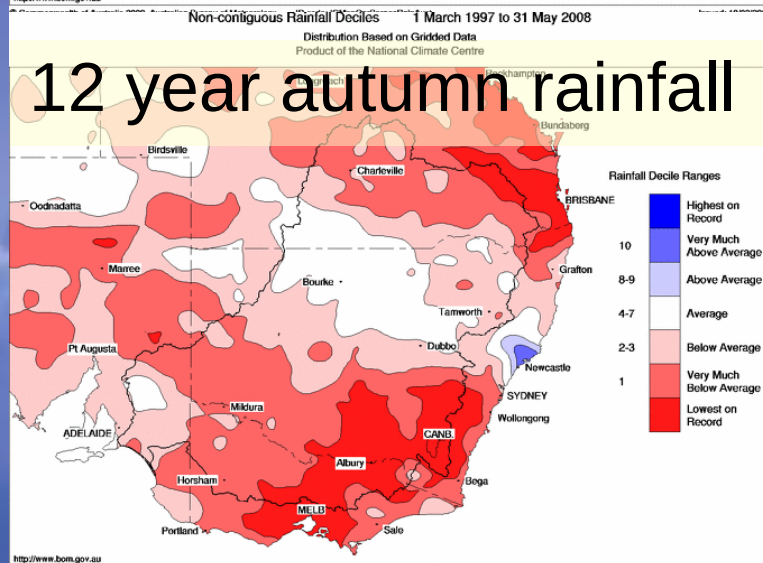
ACT's Changing Climate –Seasonal Rain

**Seasonal Rainfall for District 70:
Southern Tablelands (Goulburn-Monaro)**





The ACT, along with the southern MDB, has been affected for over decade (since 1997)

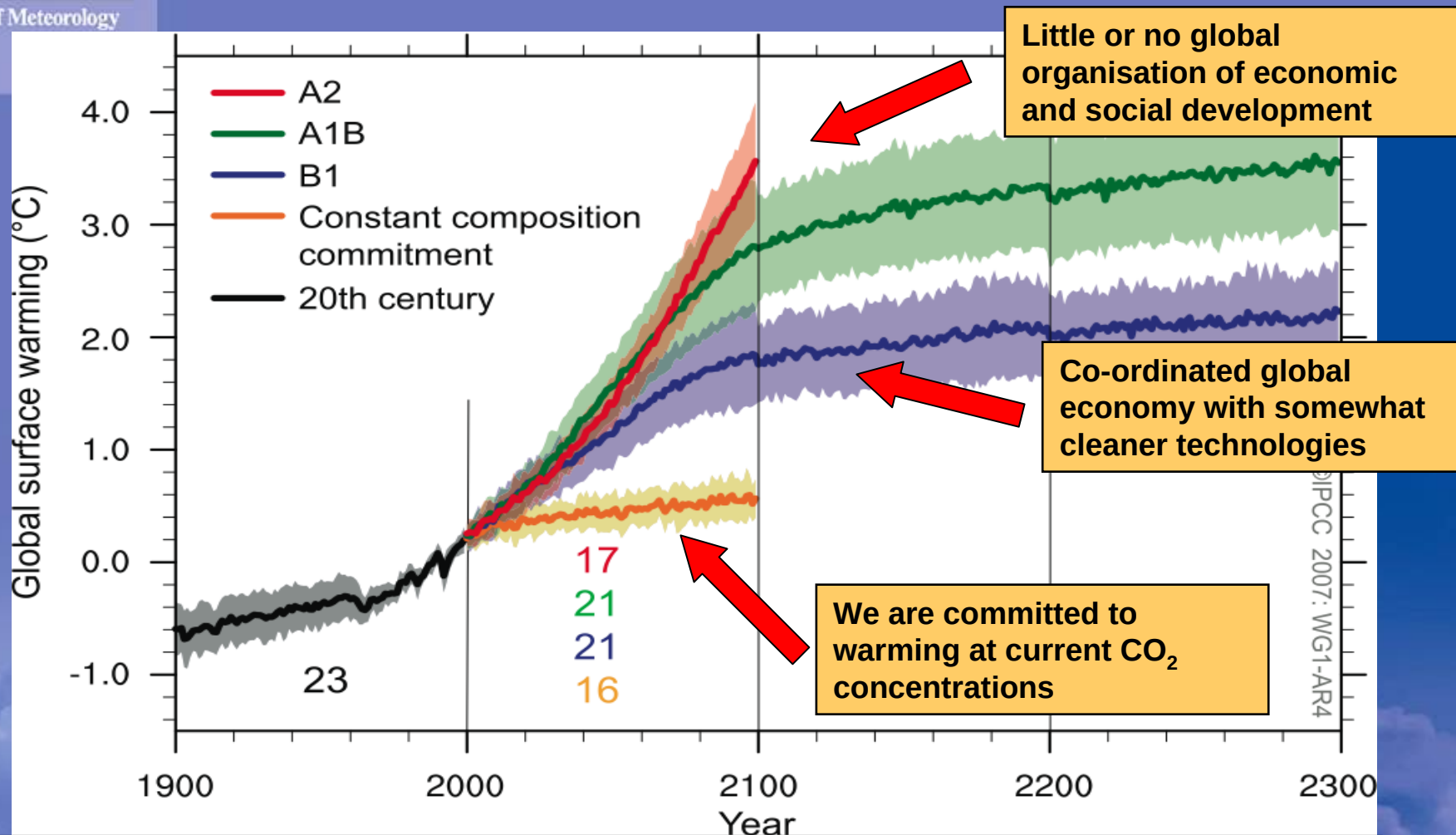




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Future global trends...

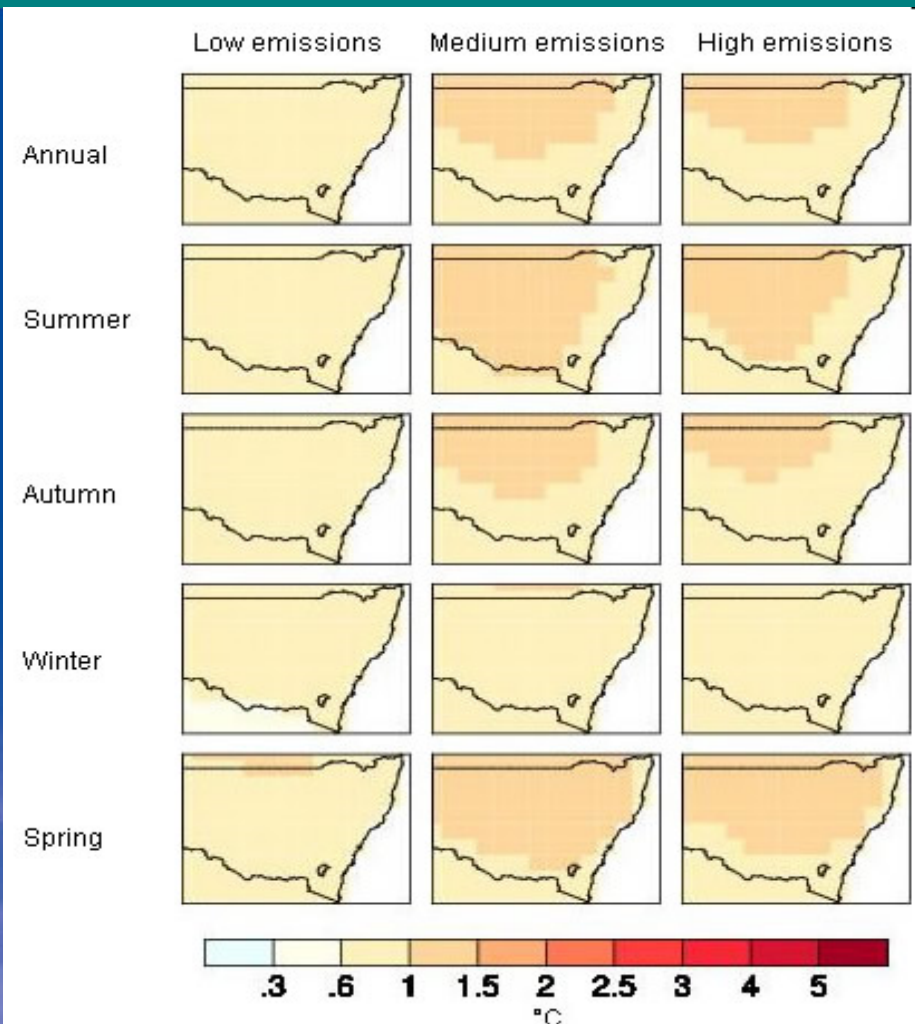


The world would continue to warm even if carbon dioxide levels are fixed at year 2000 concentrations



Projected Changes in ACT Temperature 2030: Likely Warmer

- Changes are the best estimate (mean) from a range of different climate models
- Changes to NSW/ACT temperature are projected to be largest in spring and summer
- Warming of 0.6-1.0°C across all seasons
- At *least* (i.e, 10th percentile) 0.3-0.6°C increase in spring and summer temperatures by 2030



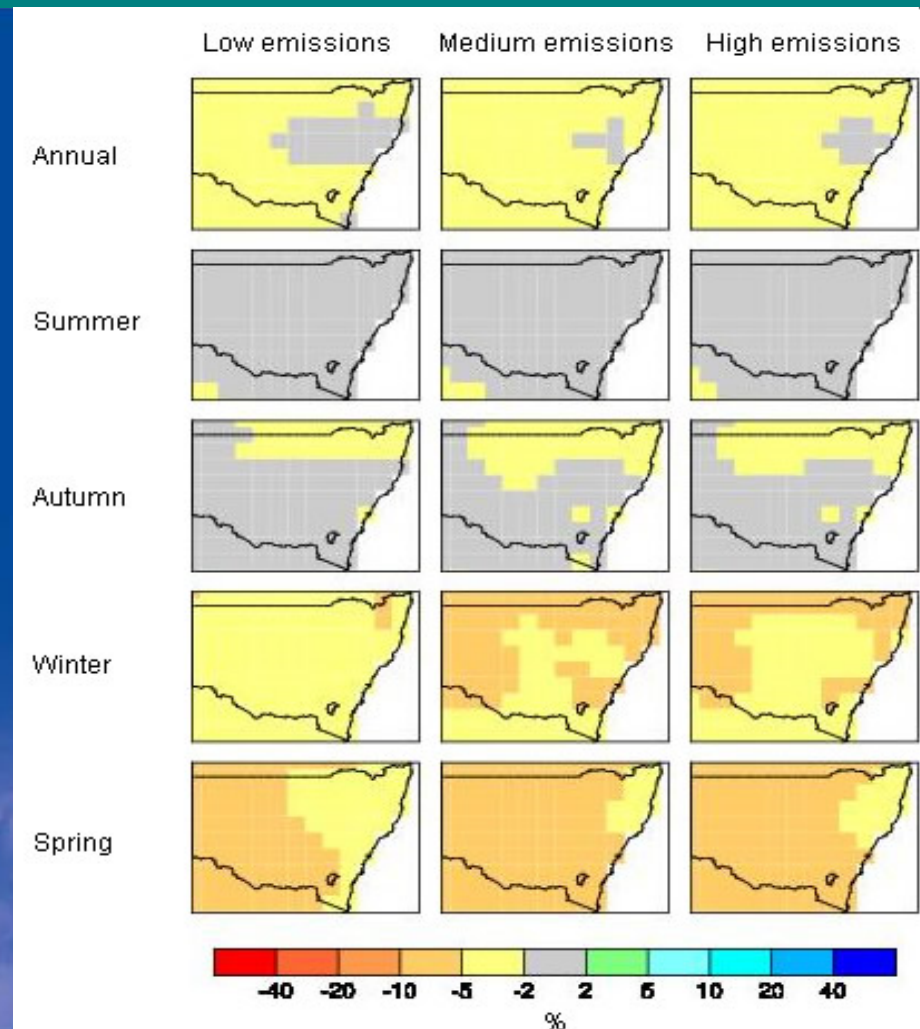


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Projected Changes in ACT Rainfall 2030: Likely Drier

- Changes are the best estimate (mean) from a range of different climate models
- Changes to NSW/ACT rainfall are projected to be largest in winter and spring
- 2-5% reduction likely across all seasons
- 5-10% reduction in spring rainfall likely regardless of emissions scenario



(Climate Change in Australia, 2007)



Extreme temperatures: frost

Town	Observed annual average frost days	% projected change B1 scenario (2050)		% projected change A2 scenario (2050)	
		Range	Best estimate	Range	Estimate
Canberra	63.8	-5 to -27	-14	-8 to -27	-17
Nhill	13.5	-18 to -53	-28	-24 to -47	-35
Cobar	2.0	-24 to -71	-50	-44 to -77	-61
Charleville	13.4	-34 to -55	-45	-44 to -70	-59

Frost reduction is larger in areas where frost is already marginal.

Relative resilience of frost occurrences is probably due to projected increase in diurnal temperature range due to reduced cloud cover and rainfall in the south.



Extreme temperatures: hot days

- Associated with the warming is a projected strong increase in frequency of hot days and warm nights.

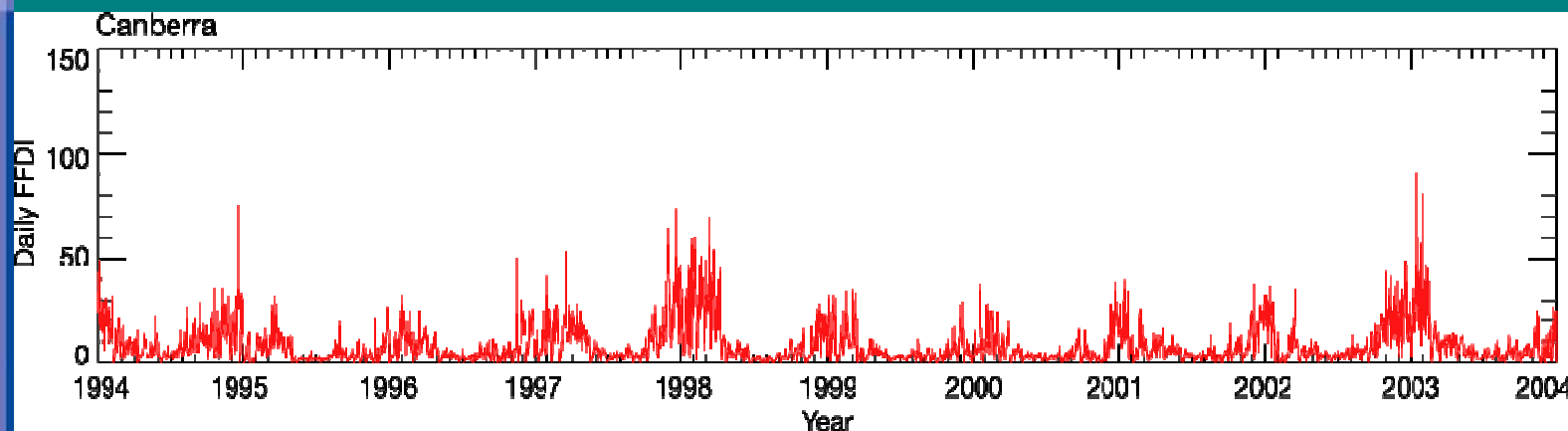
Town	Current days above 35°C	Projected days above 35 °C					
		2030		2050		2070	
		Range	Best estimate	Range	Best estimate	Range	Best estimate
Canberra	5	7-10	8	8-14	10	12-26	18
Dubbo	25	31-39	35	35-51	40	44-87	61
Mildura	32	36-43	39	39-51	45	48-76	60



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Extreme Weather: Fire danger



Forest Fire Danger Index for Canberra 1994 – 2004 (Lucas *et al.* 2007)

A substantial increase in fire weather risk is likely at most sites in south-eastern Australia

Site	Present	CCAM Mark2				CCAM Mark 3			
		2020 low	2020 high	2050 low	2050 high	2020 low	2020 high	2050 low	2050 high
Canberra	23.1	25.6	27.5	27.9	36.0	26.0	28.6	28.9	38.3

(Climate Change in Australia, 2007)



Further Information

- www.bom.gov.au
- www.bom.gov.au/climate/droughtec
- <http://www.climatechangeinaustralia.gov.au/>
- <http://www.climatechange.gov.au>
- <http://www.dse.vic.gov.au>
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