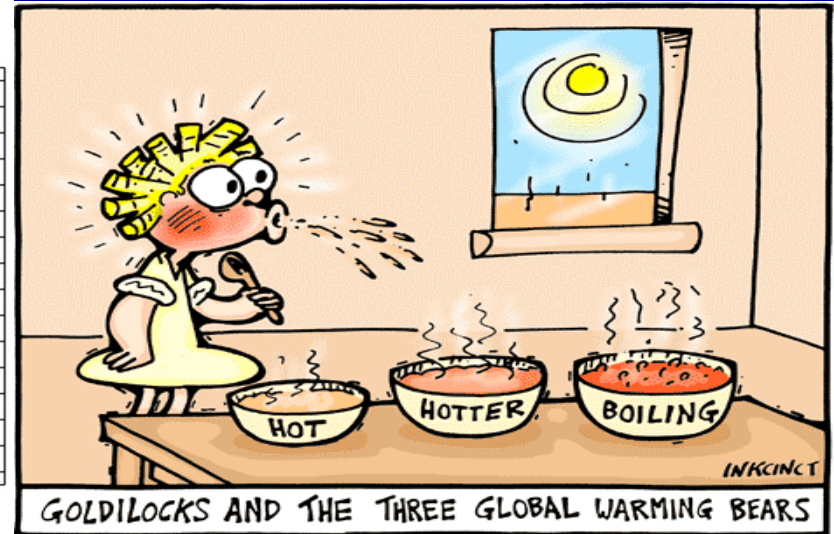
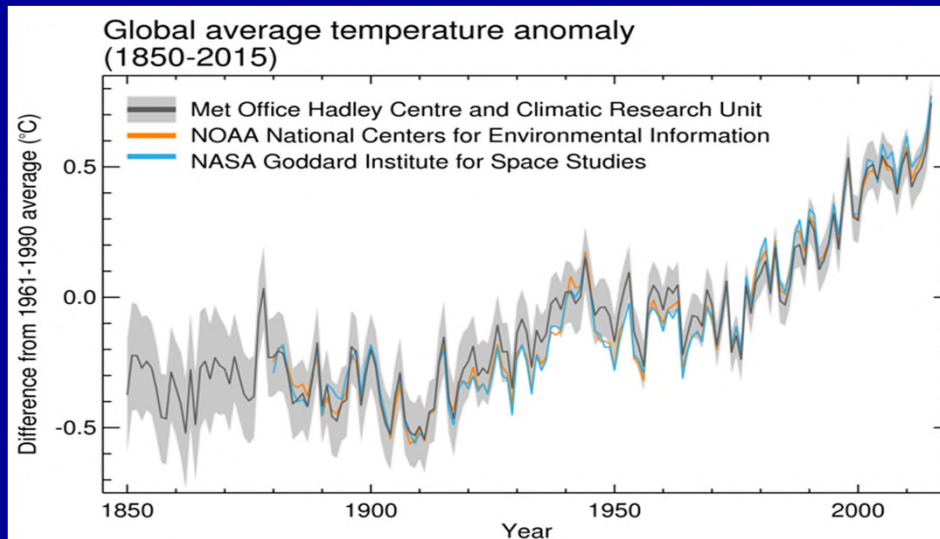


Climate change and impacts on agriculture

Professor David Karoly

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Outline

- The latest assessment of climate change science
- Implications for agriculture
- Addressing climate change globally and in Australia

References

IPCC 5th Assessment Report 2014 www.ipcc.ch

Aust Acad Science “Science of Climate Change: Q&A”
2015 <https://www.science.org.au/climatechange>

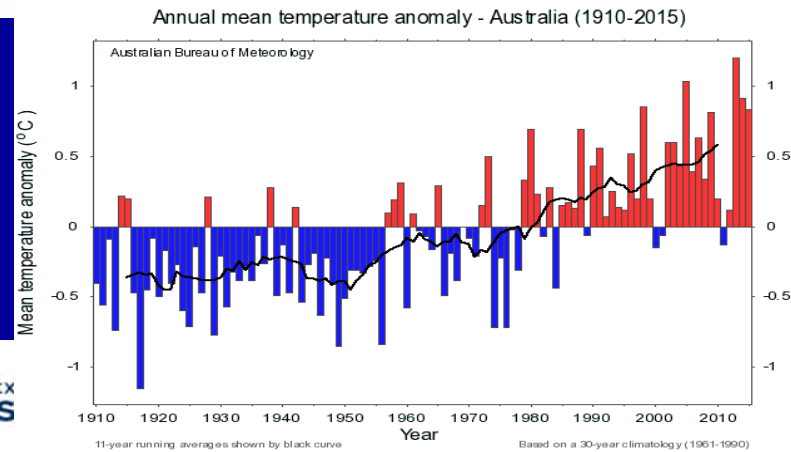
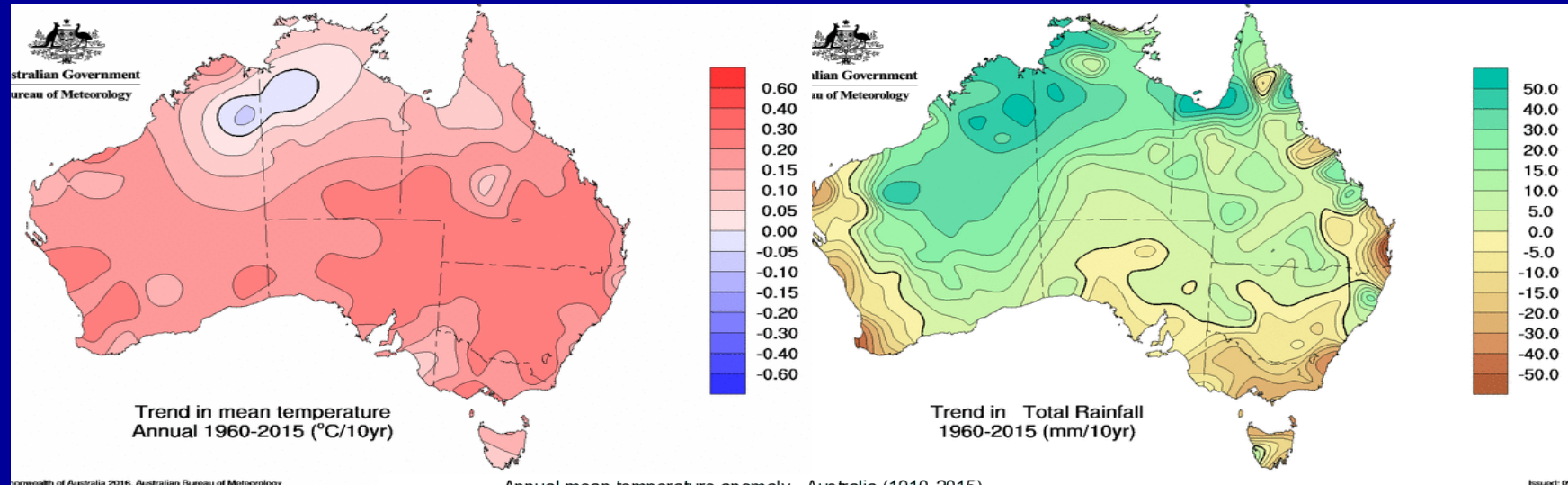
CSIRO Climate change projections for Australia’s NRM regions
<http://www.climatechangeinaustralia.gov.au/en/>

IPCC Fifth Assessment Report 2013

Key conclusions

- ‘Warming of the climate system is unequivocal’
- ‘It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century’
- ‘It is *virtually certain* that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales’
- ‘Extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions will *very likely* become more intense and more frequent by the end of this century’

Trends in Australian climate

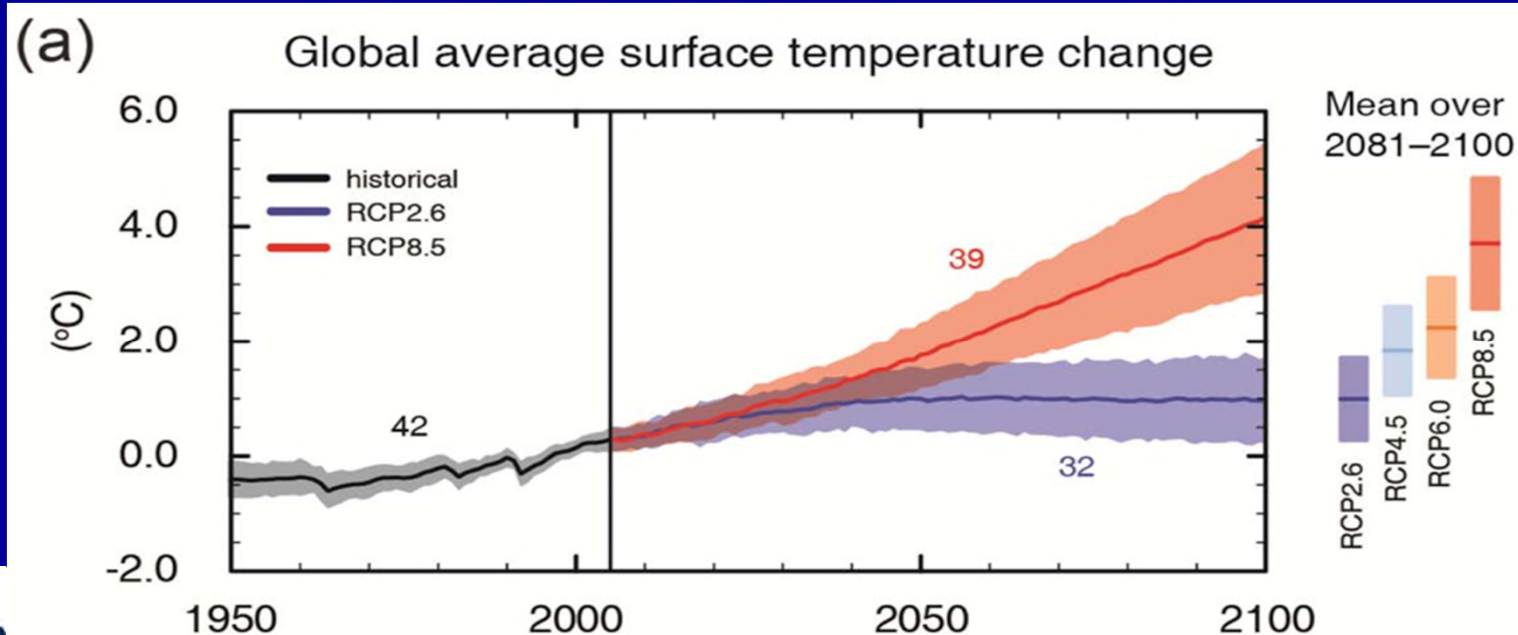


Observed changes in ecosystems

- Poleward movement of terrestrial and marine ecosystems
- Upward movement of ecosystems in alpine areas
- Advanced phenology in plants, birds and insects; earlier flowering, earlier migration, earlier hatching
- Longer growing season, enhanced forest growth in NH higher latitudes
- Increases in bushfire frequency and intensity
- Increased plant growth due to higher CO₂
- Coral bleaching associated with marine heatwaves and increased CO₂ in sea water

Projected changes

‘Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.’ (IPCC 2013)



Projected changes

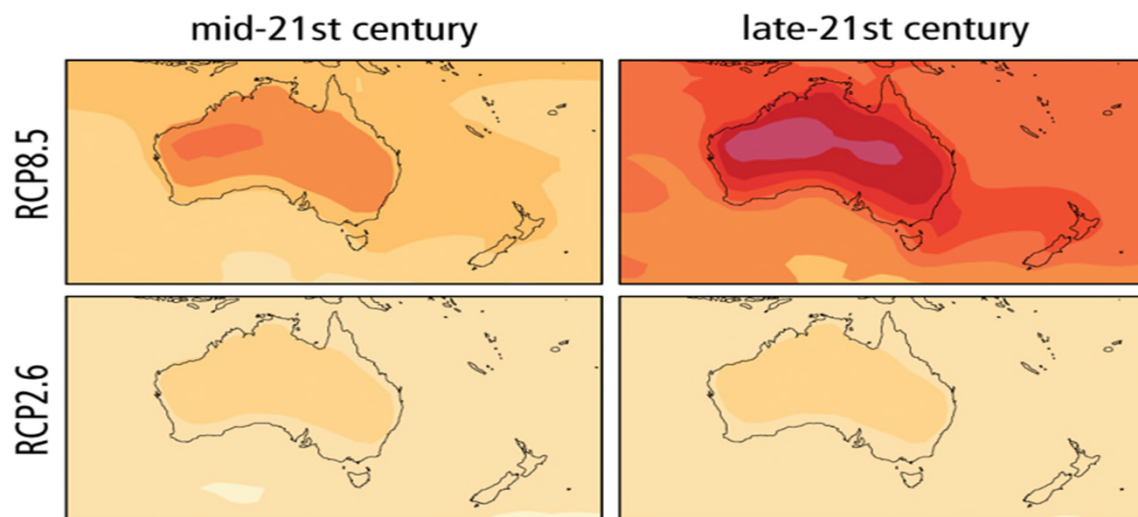
- It is *virtually certain* that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales as global mean temperatures increase.
- Extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions will *very likely* become more intense and more frequent by the end of this century, as global mean surface temperature increases.
(IPCC 2013)

Projected changes in temperature

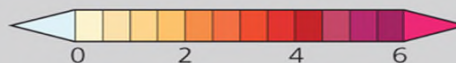
Difference from 1986–2005 mean
(°C)

High
emissions

Rapid
emission
reductions



Annual Temperature Change

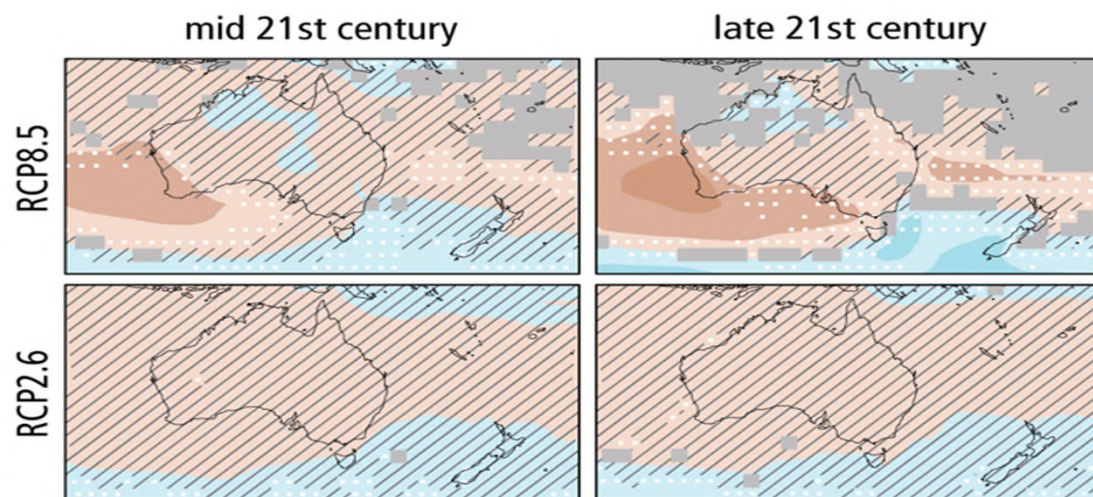
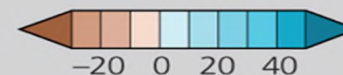


Projected changes in rainfall

High
emissions

Rapid
emission
reductions

Difference from 1986–2005 mean (%)



Solid Color

Very strong
agreement

White Dots

Strong
agreement

Gray

Divergent
changes

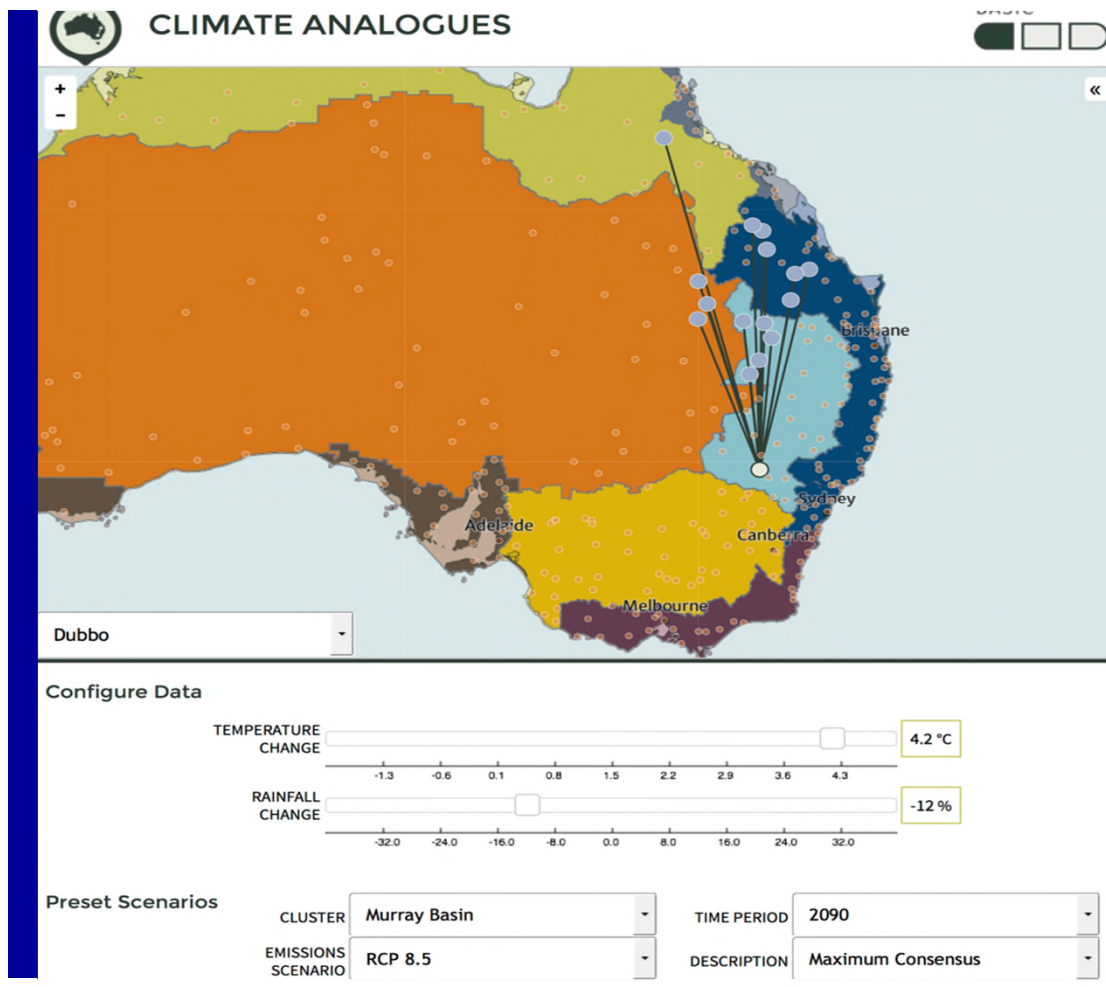
Diagonal Lines

Little or
no change

Future climate change in Dubbo

	2030	2090 low emissions	2090 high emissions
Ann mean temp	+1.0°C	2.1°C (1.4 to 2.7)	4.2°C (3.0 to 5.4)
Summer rainfall	+1%	0% (-14 to +17%)	+10% (-14 to +29%)
Winter rainfall	-3%	-10% (-17 to +3%)	-12% (-30 to +5%)
Days over 35°C (22)	31	44 (36 to 54)	65 (49 to 85)

- More hot days and warm spells (*very high confidence*), fewer frosts
- Increased intensity of extreme daily rainfall events (*high confidence*)
- Increased evapotranspiration (*high confidence*)
- A harsher fire-weather climate (*high confidence*)

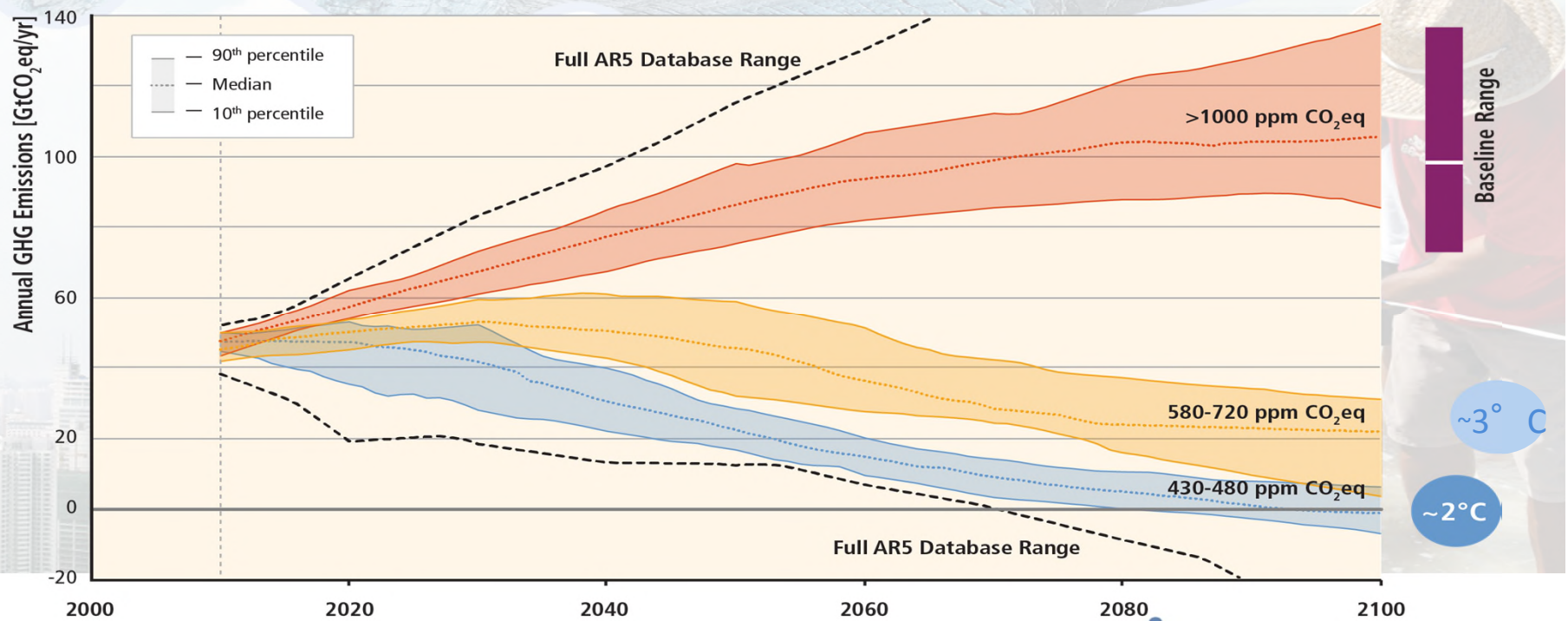


Future climate change in Dubbo

High warming scenario, 2090

Prepared using climate analogues explorer from CSIRO at www.climatechangeinaustralia.gov.au/en/climate-projections/climate-analogues/

Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



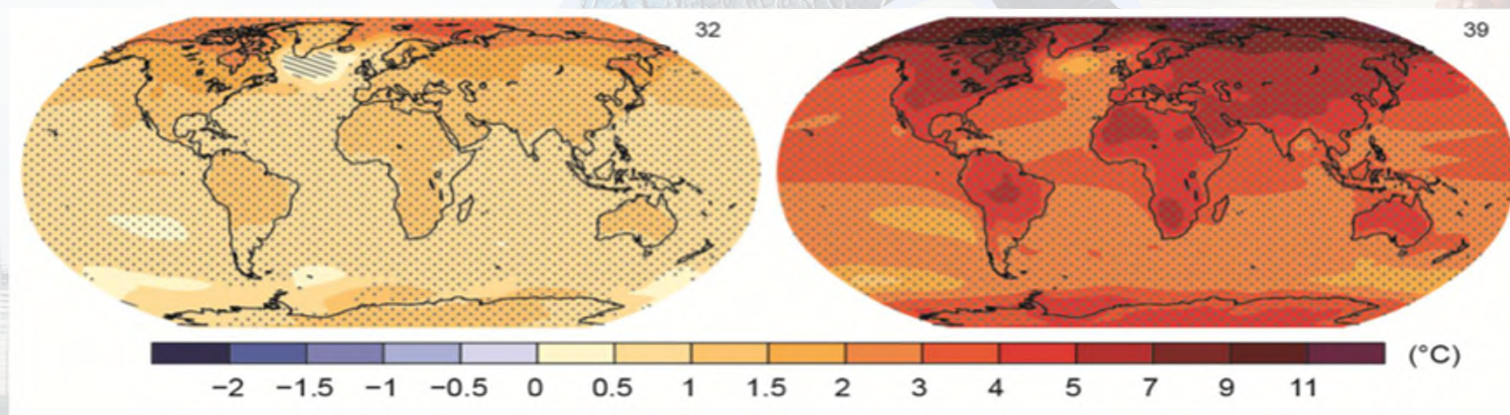
Based on Figure 6.7

IPCC AR5 Synthesis Report

The Choices We Make Will Create Different Outcomes

With substantial
mitigation

Without additional
mitigation



Change in average surface temperature (1986–2005 to 2081–2100)

AR5 WGI SPM

Key Messages

- Human influence on the climate system is clear
- The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts
- We have the means to limit climate change and build a more prosperous, sustainable future

AR5 WGI SPM, AR5 WGII SPM, AR5 WGIII SPM