Australian National University

Managing a changing and variable climate

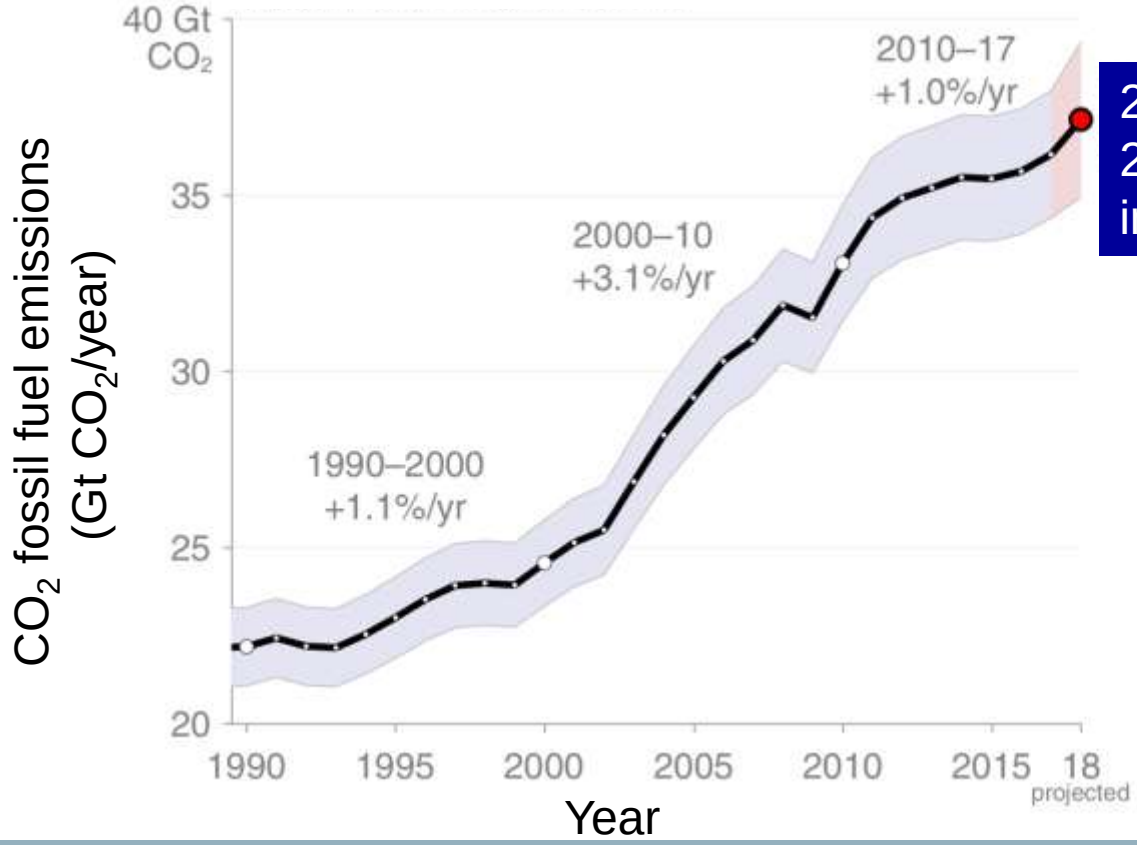
Professor Mark Howden

@ProfMarkHowden

ANU Climate Change Institute

Vice Chair, IPCC Working Group II

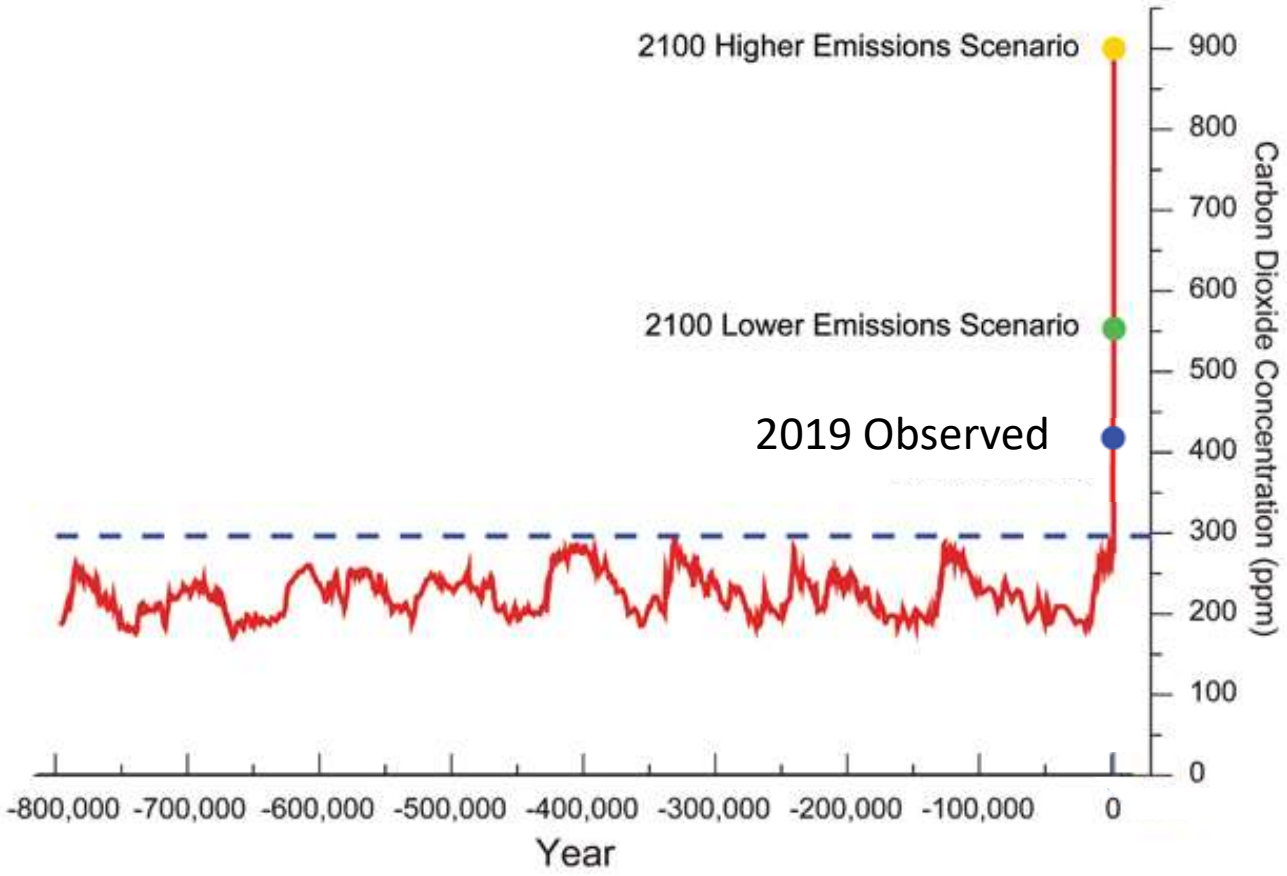
CO_2 emission rising again: record levels



2018
2.7%
increase

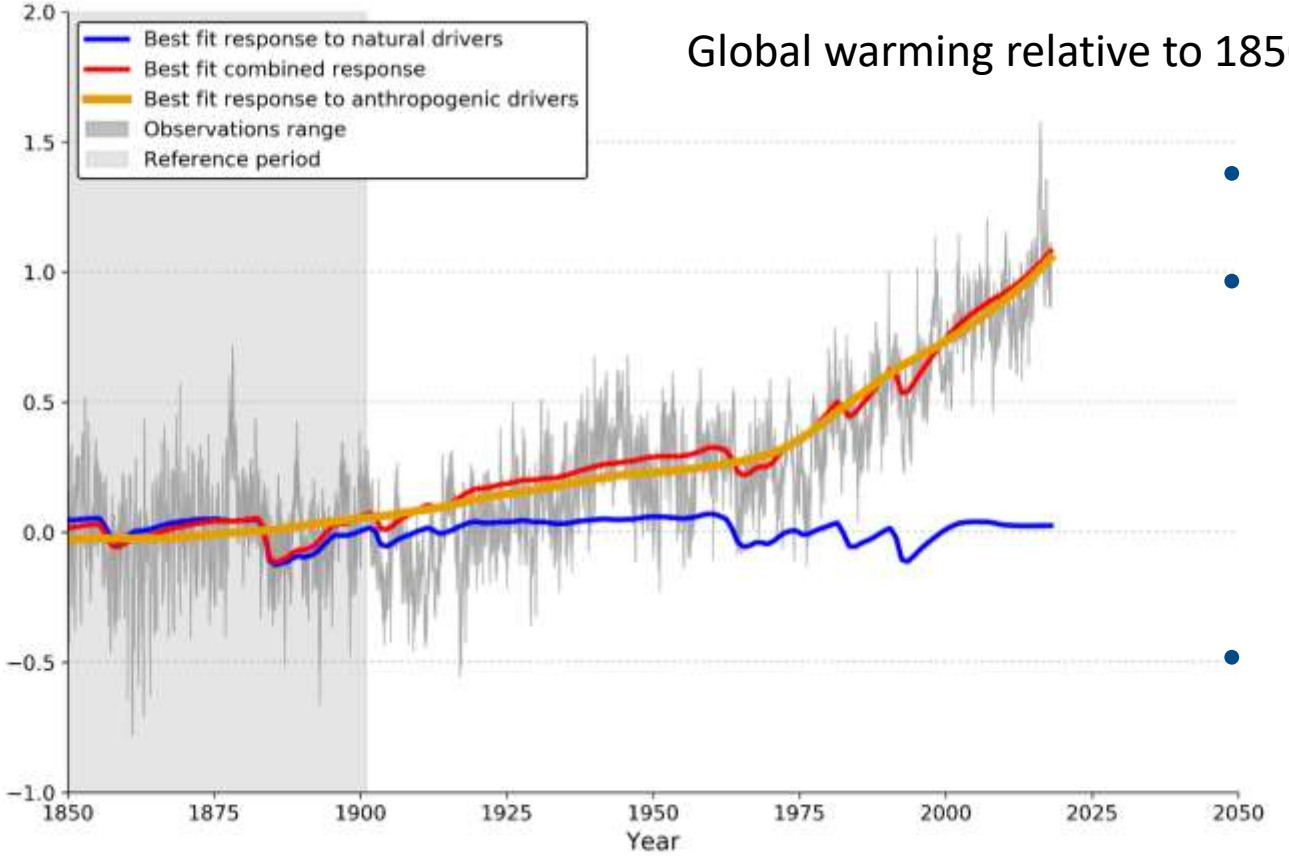
Global Carbon Project 2018, IPCC 2018

Atmospheric CO_2: the long view



Luthi et al. 2008

Global warming: human *and* natural

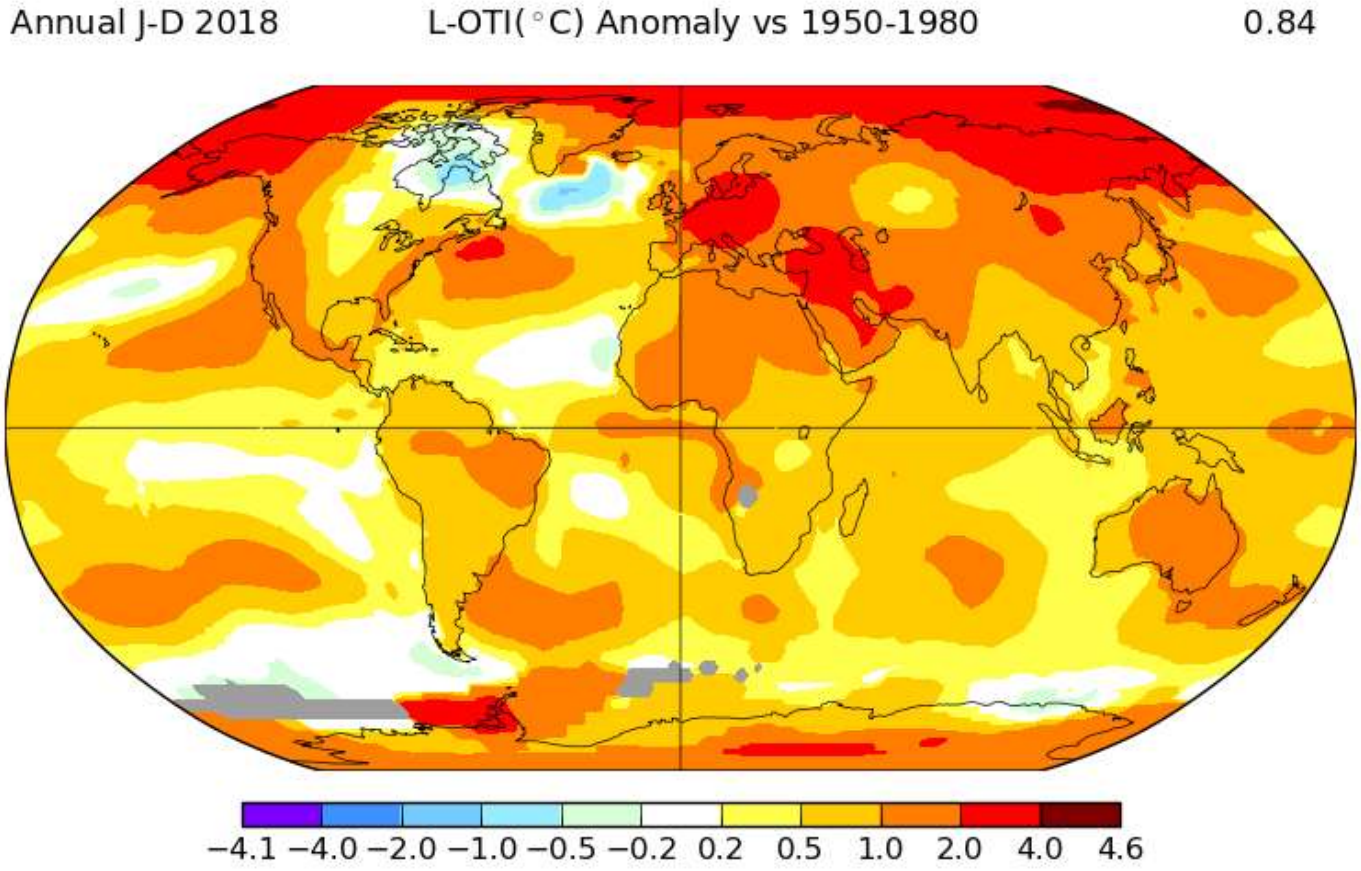


Global warming relative to 1850-1900 (°C)

- Already 1°C
- Likely to reach 1.5°C by 2040 and perhaps as early as 2026
- Already about 1.5°C over land

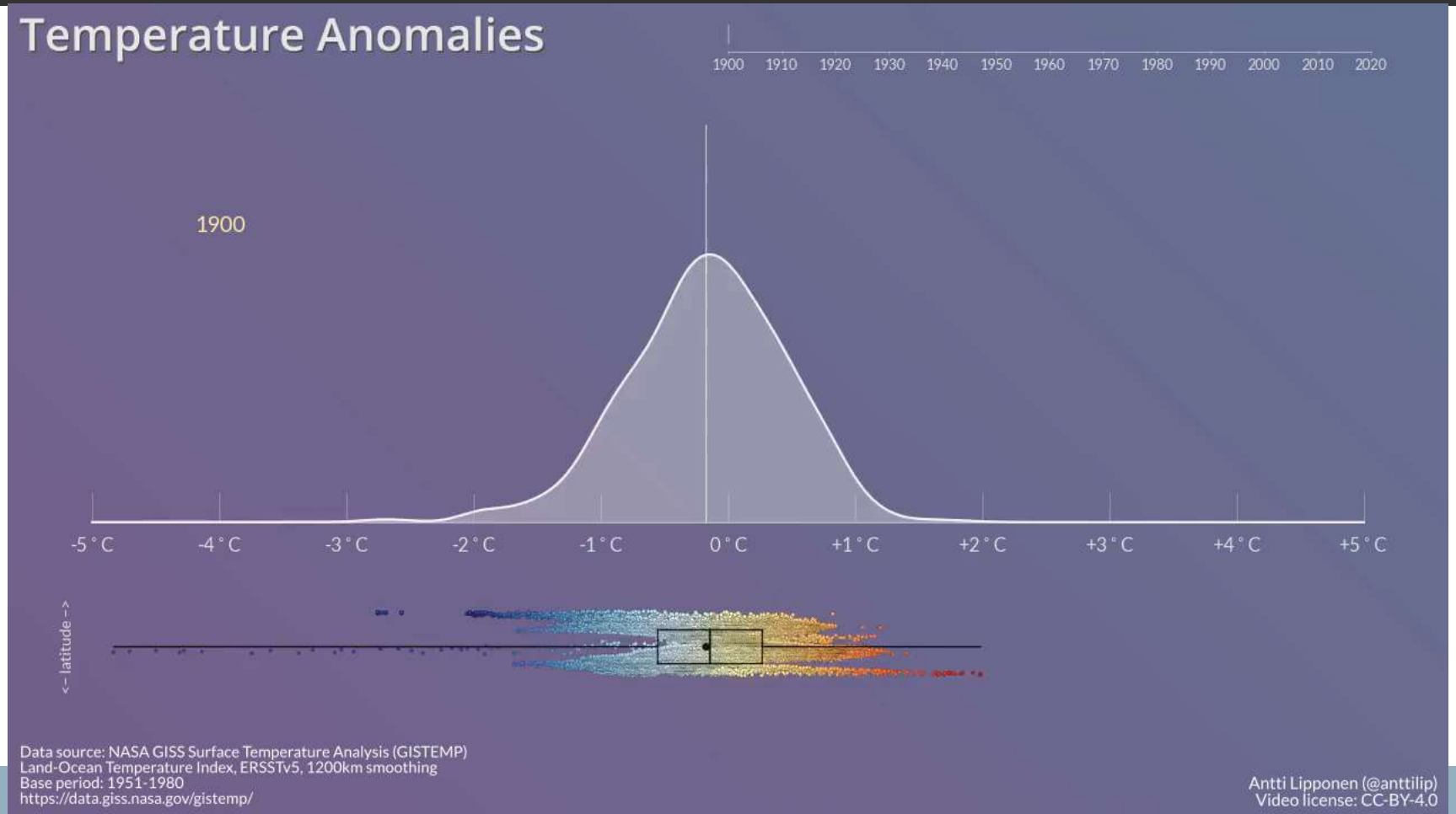
ipcc INTERGOVERNMENTAL PANEL ON climate change

High temperatures almost everywhere



NASA 2019

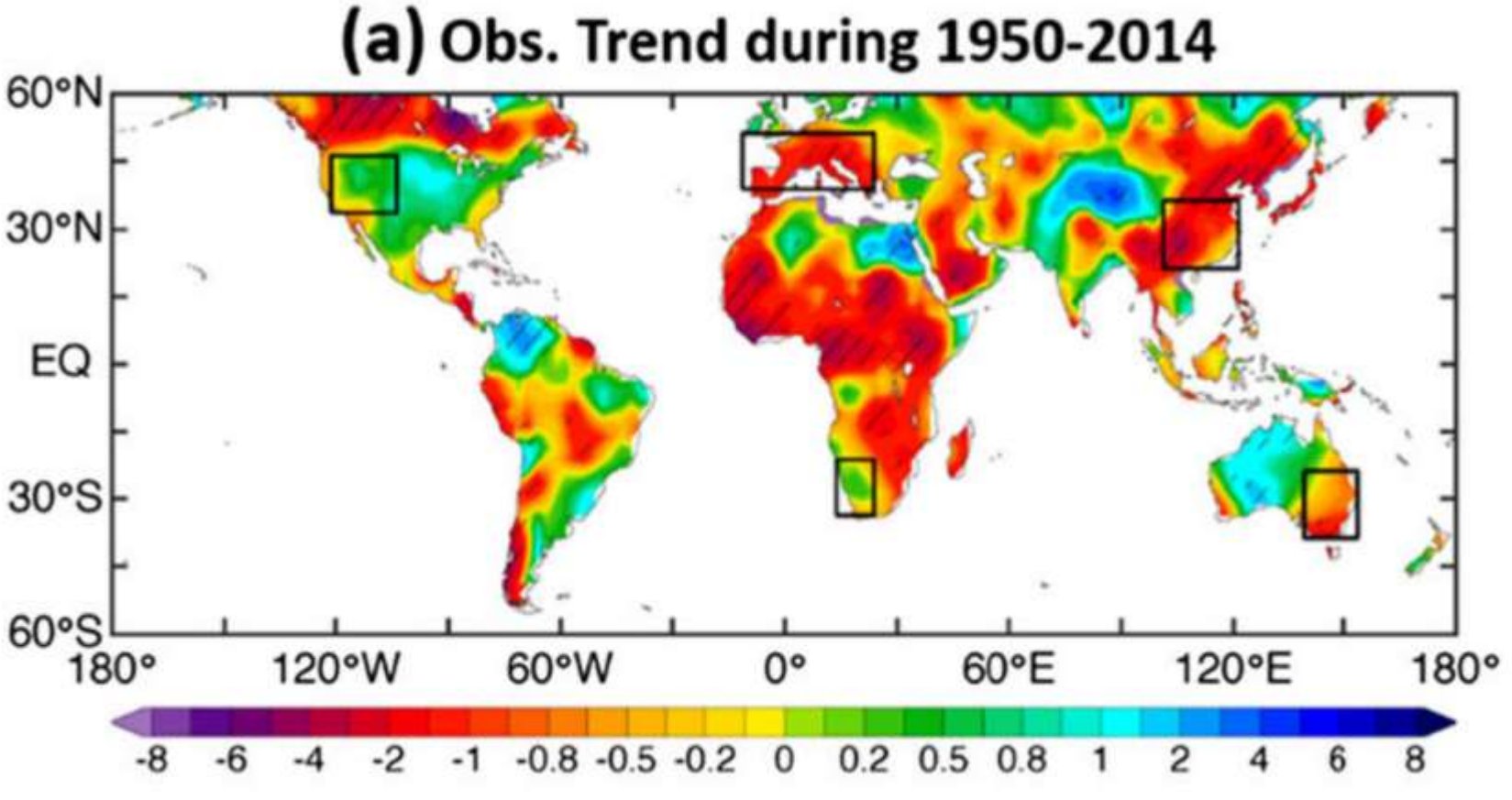
Temperature variability increasing



Other climate changes globally

- Increased duration and intensity of heatwaves
- Droughts have increased in frequency and intensity in some regions
- Increase in heavy precipitation events which increase soil erosion risk and flood risk
- Increase in dust storms
- Shifts in climate zones (arid zone expansion, polewards contraction)

Droughts: increasing in many regions

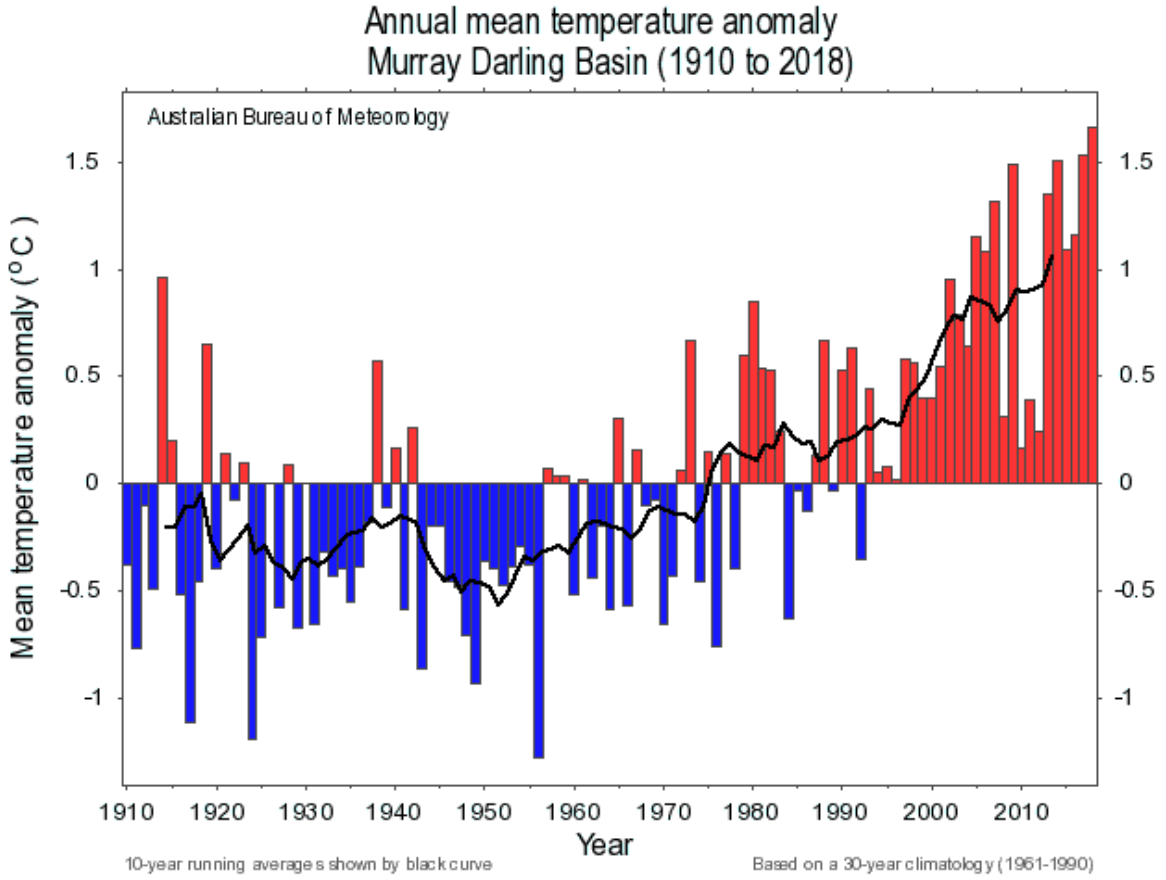


Zhao and Dai 2017

Other climate changes globally

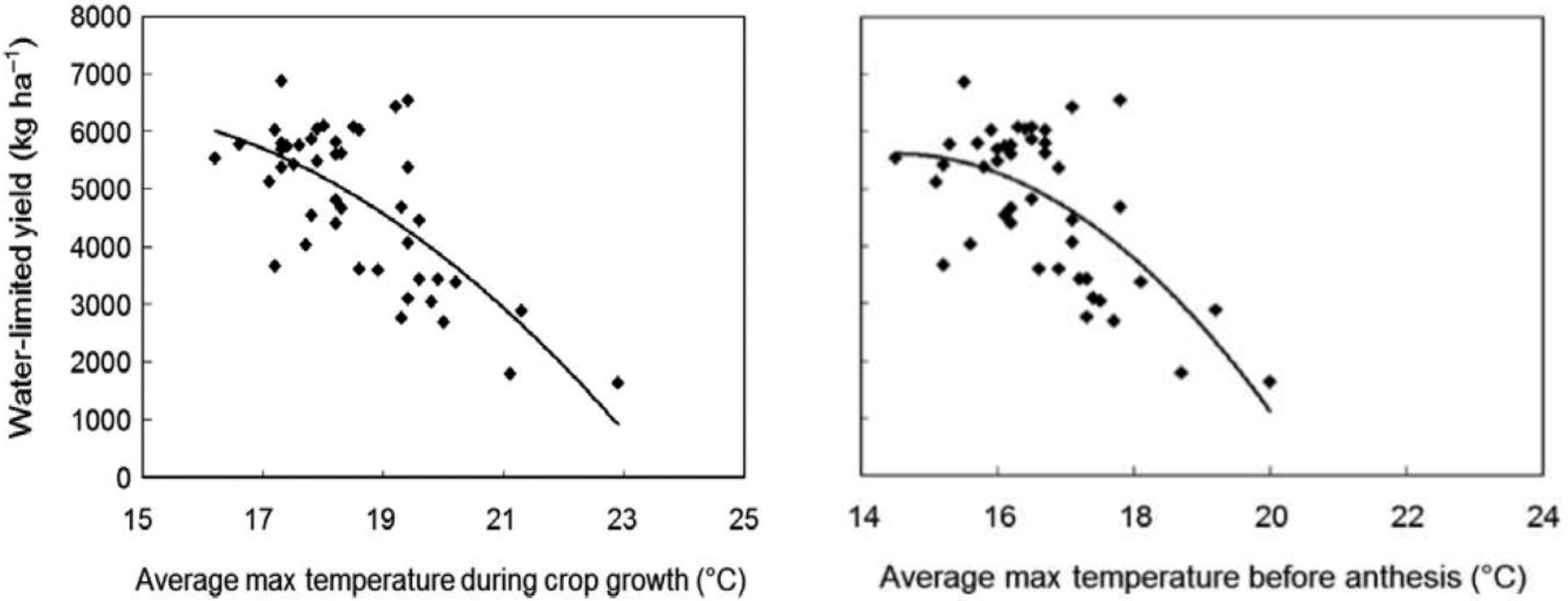
- Increased duration and intensity of heatwaves
- Droughts have increased in frequency and intensity in some regions
- Increase in heavy precipitation events which increase soil erosion risk and flood risk
- Increase in dust storms
- Shifts in climate zones (arid zone expansion, polewards contraction)

MDB is warming quickly



BoM 2019

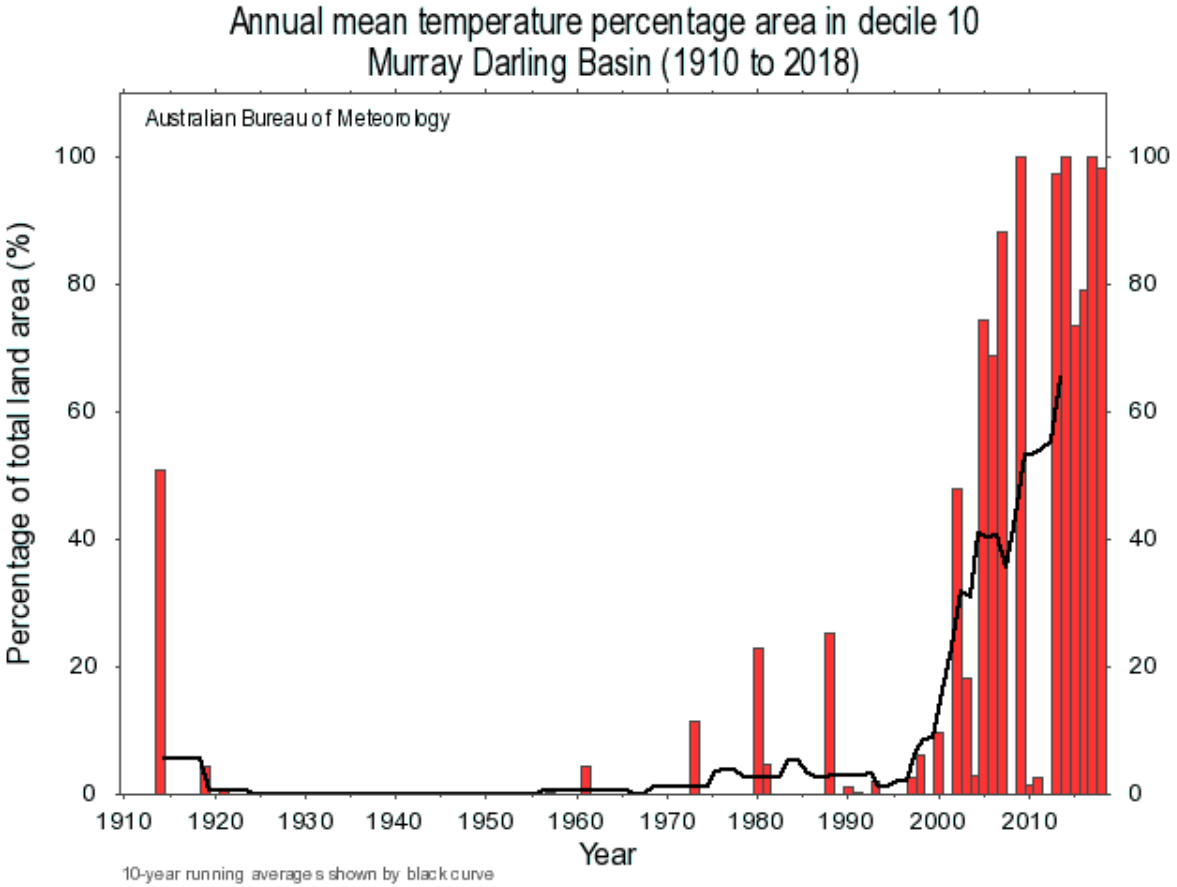
Higher temperatures reduce crop yield



Hochmann et al. 2017

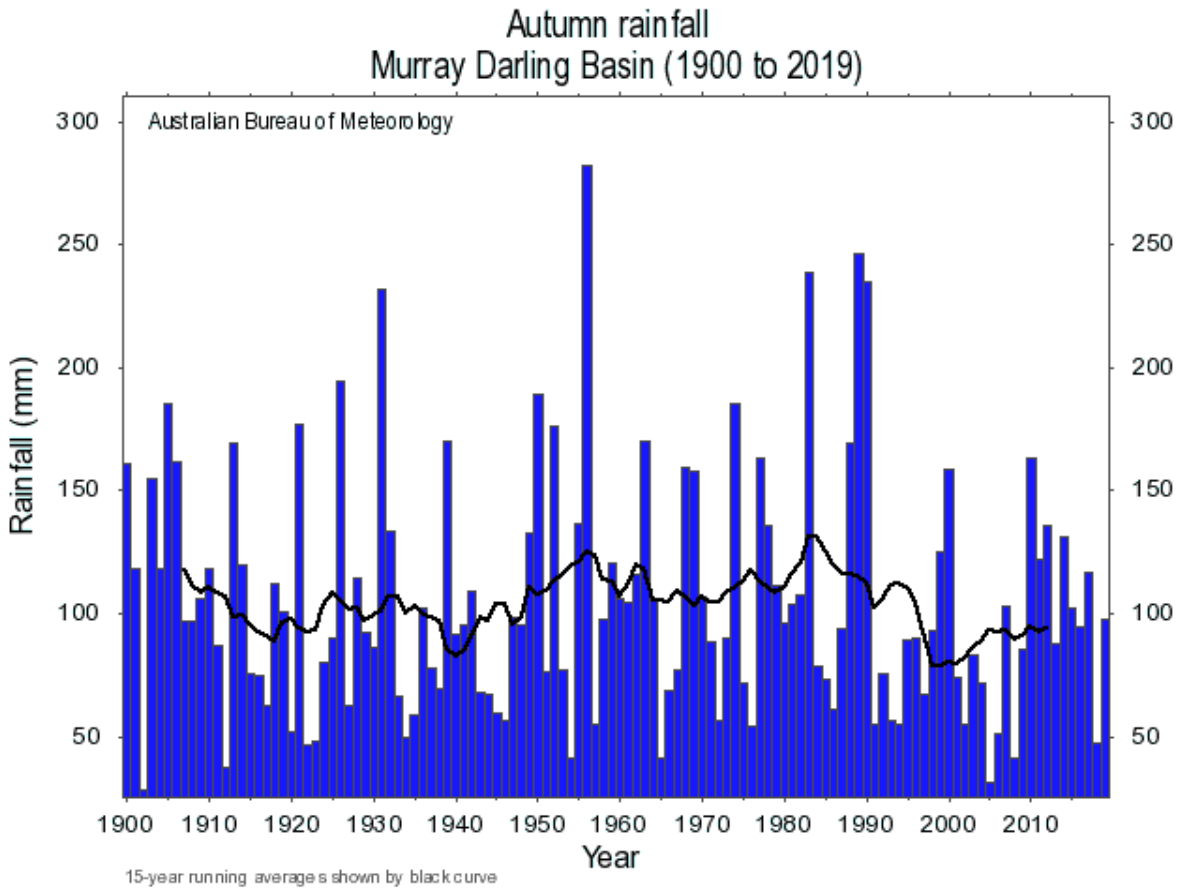
Australian National University

Extremes are ‘normal’ - everywhere



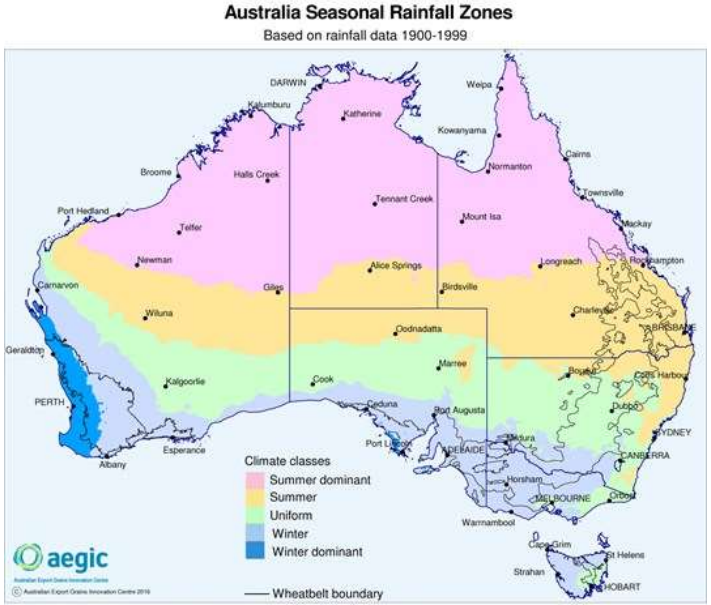
BoM 2019

Autumn rainfall changes



BoM 2019

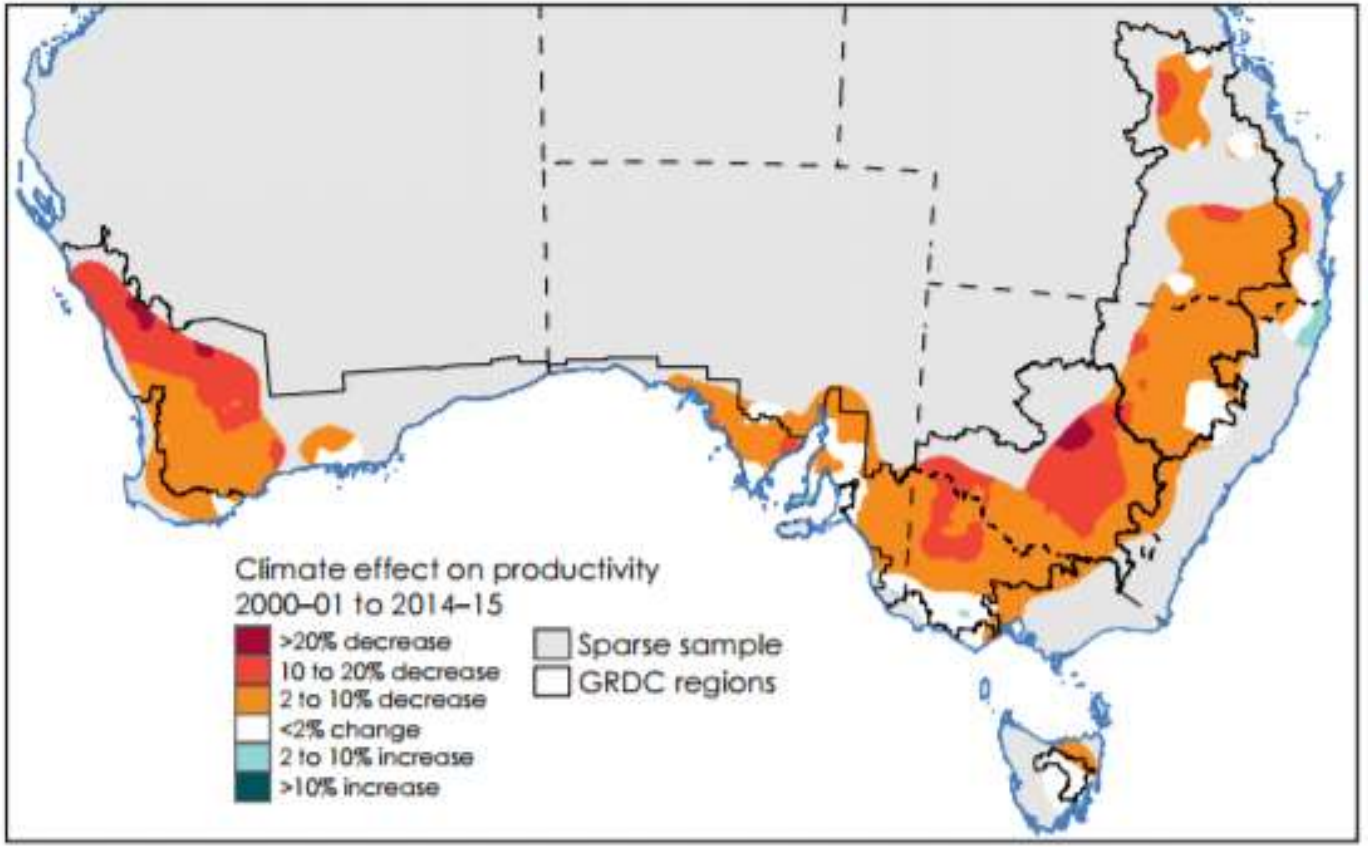
Rainfall zones ‘moving south’



- Impacting on distribution of production systems

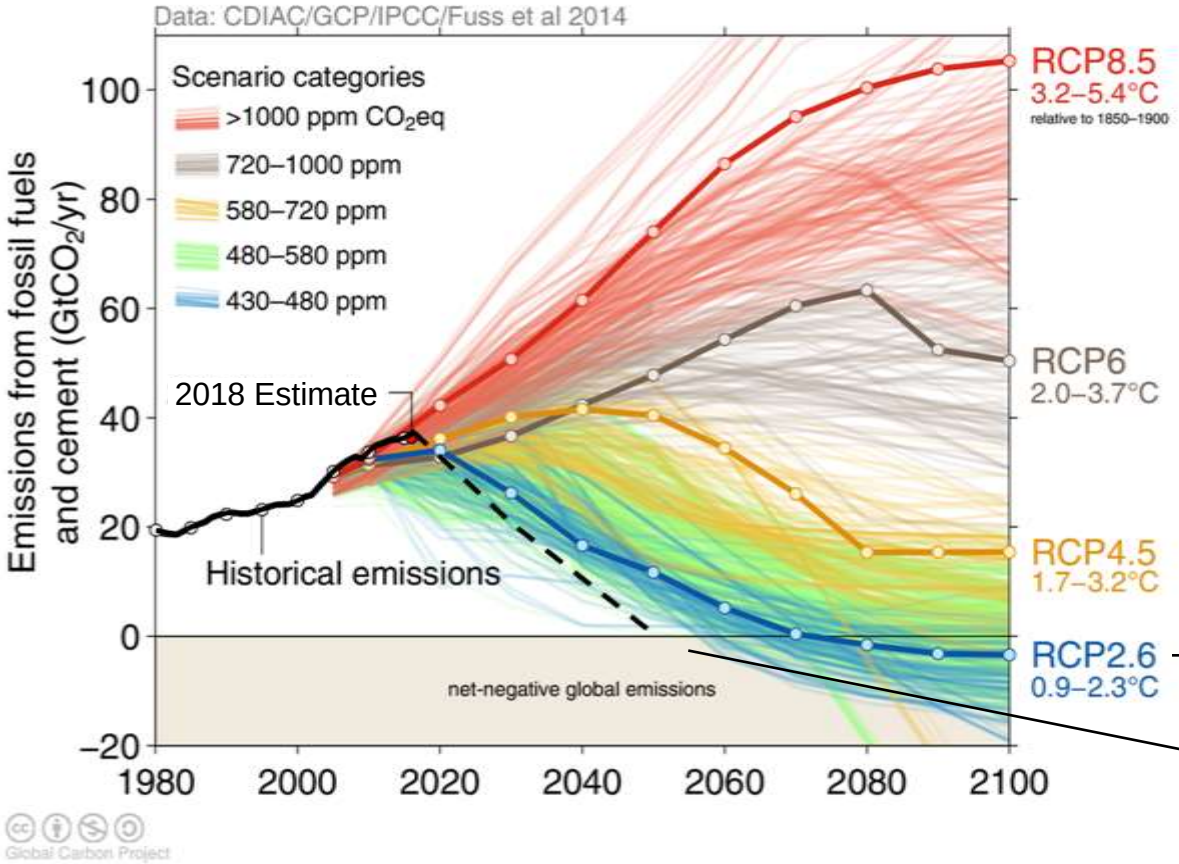
Stephens et al. 2016, BoM 2016

Climate already putting brakes on agriculture



Hughes et al. 2017

What are we adapting to ? Choices.



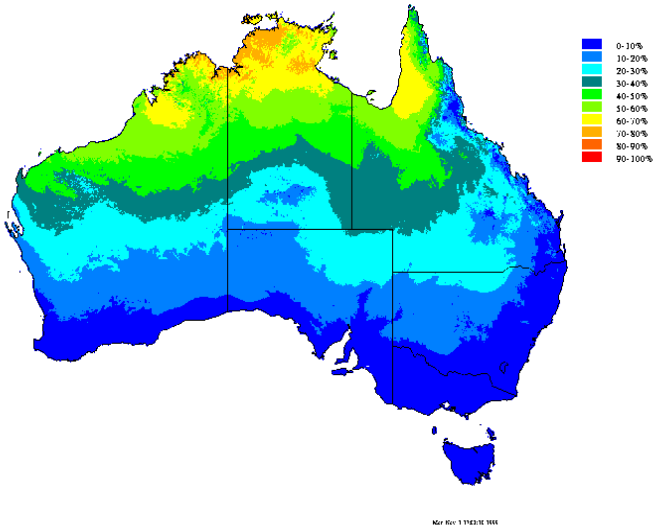
Paris Agreement goals:

2°C

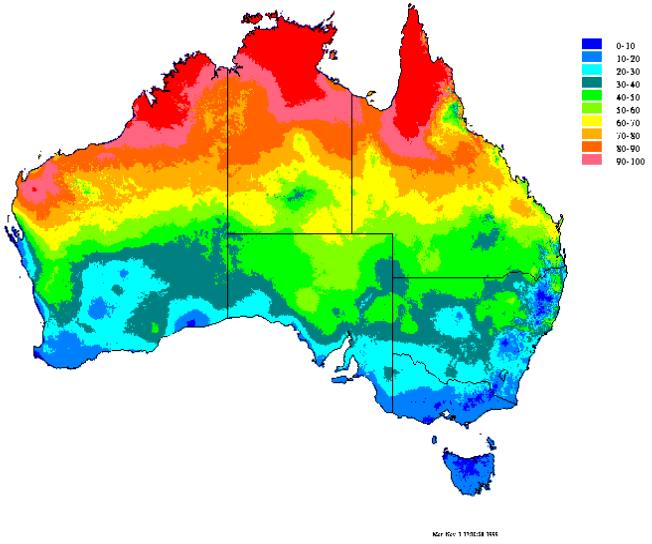
1.5°C

Changes in heat stress frequency

Current heat stress

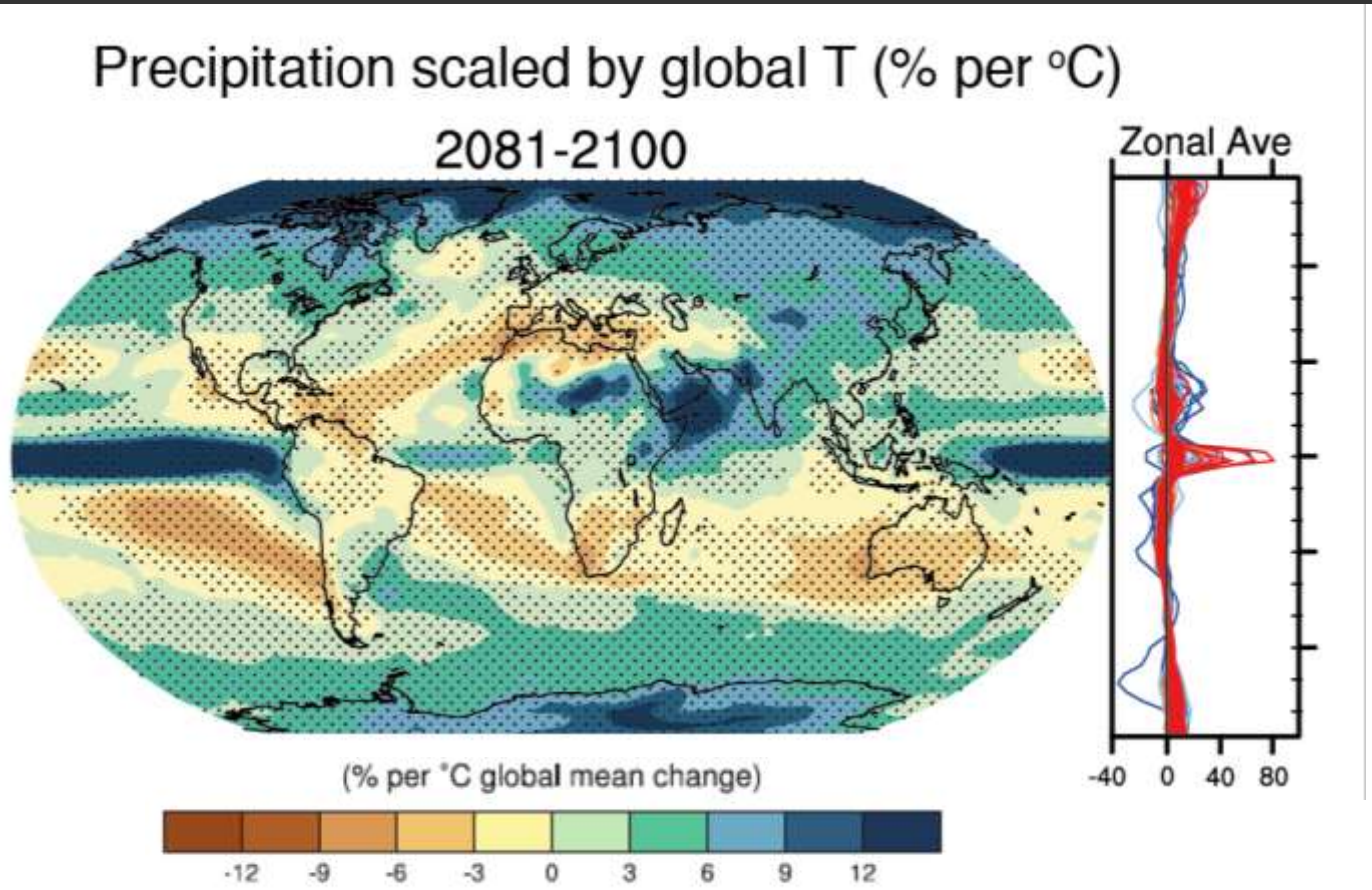


Heat stress 2.7ºC warmer



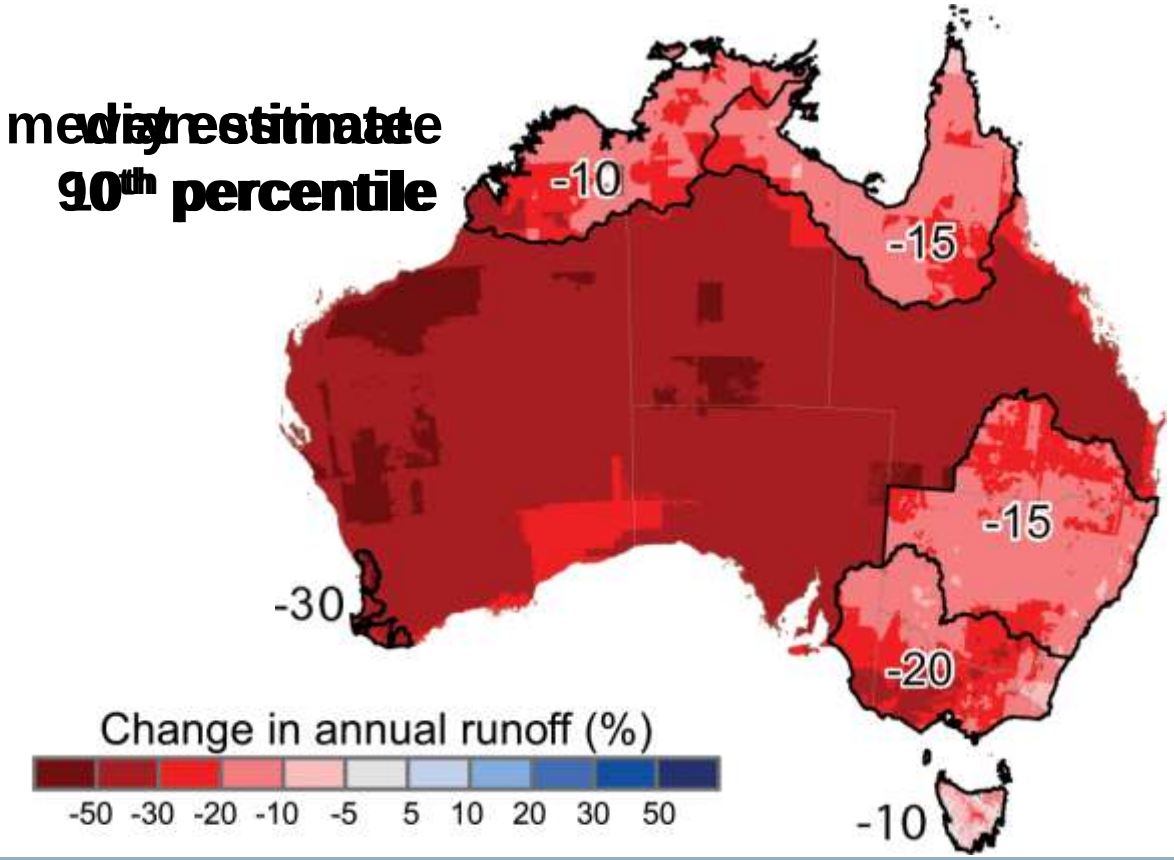
Howden et al. 1999: BoM 2019

Precipitation change



IPCC 2013

Run-off change per °C warming



IPCC 2014

The rationale for adaptation

‘Past performance is not a reliable indicator of future performance’

– *Aust Securities & Investment Commission*

‘The past climate is no longer a reliable indicator of the future climate’

— *message from scientific community*

Not matching the genetics, management or strategy to changing climate, results in either underperformance and/or increasing risk

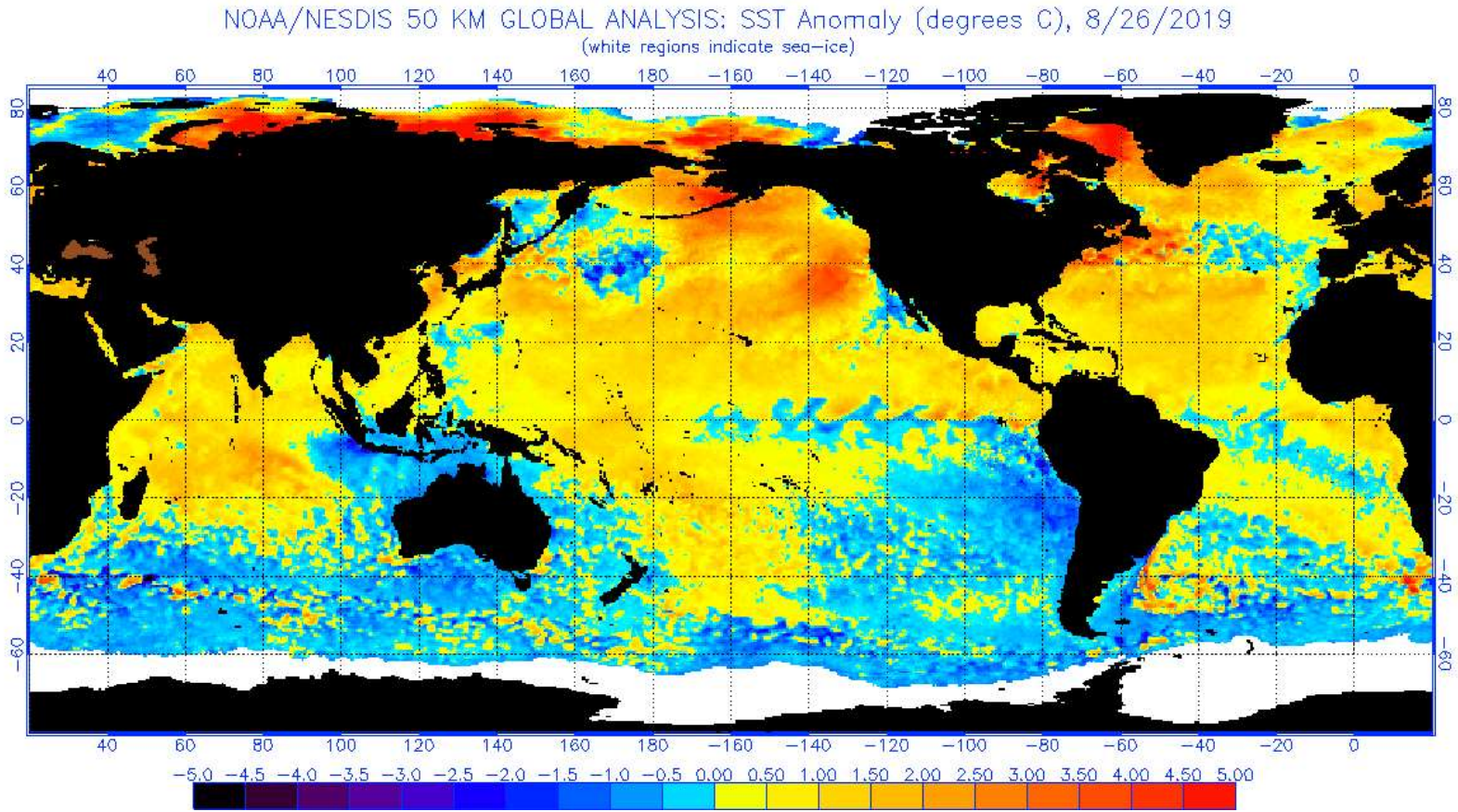
Adaptation: ‘*changing what we do to get what we want*’

How do we adapt well ?

- Highly contextual - values
- Huge diversity of options
  - on farm and off farm, diversification
  - tactical and strategic
  - incremental to transformational
  - institutional, regional, value chain etc
- All involve costs, require some change in knowledge as well as action
- Always in anticipation of net benefits
- Empowers, reduces stress

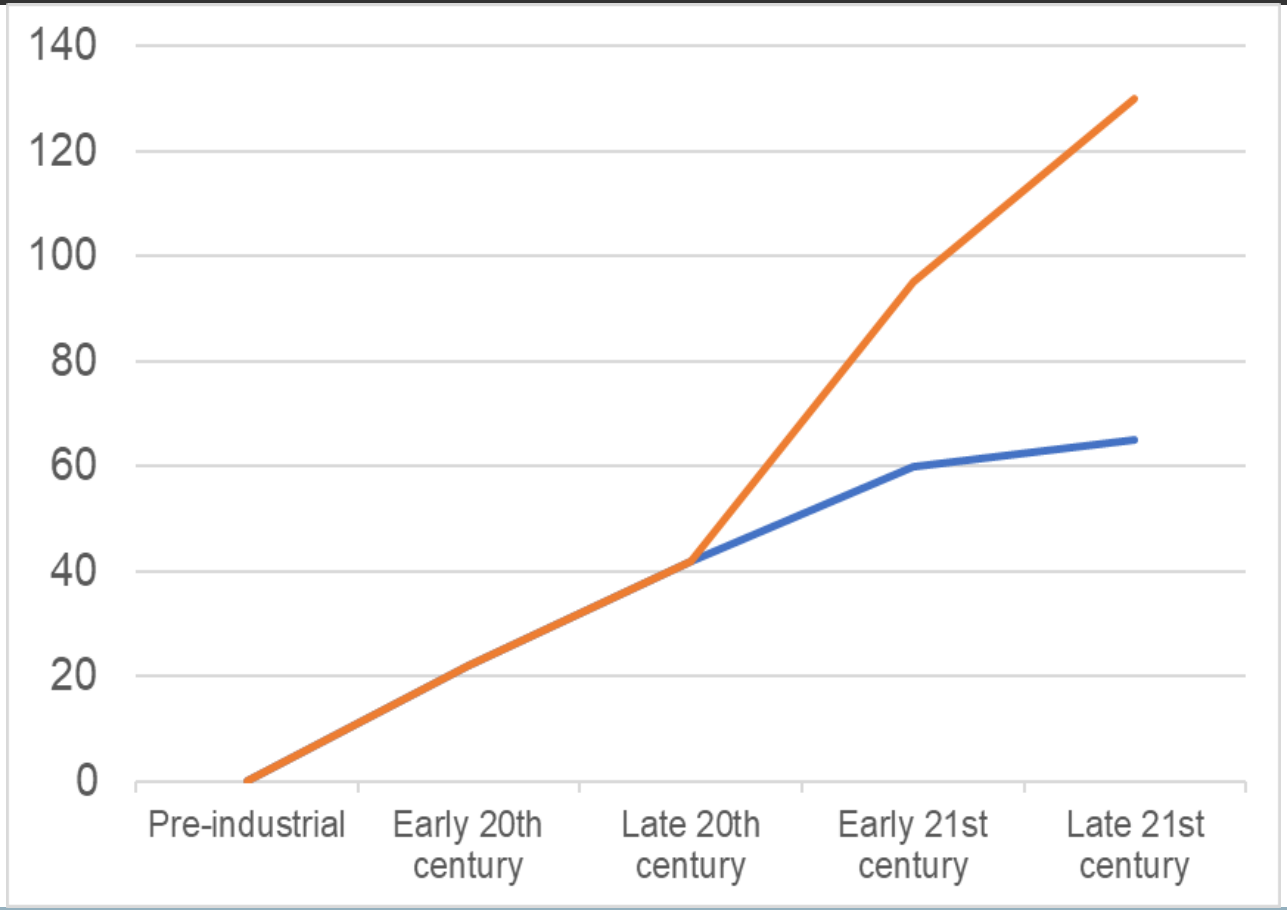
Australian National University

Sea surface temperatures now



NOAA 2019

ENSO-related disruptions increasing



High emissions scenario

Low emissions scenario

Power et al. 2017

Australian National University

Thankyou

Prof Mark Howden
ANU Climate Change Institute
mark.howden@anu.edu.au
@ProfMarkHowden
+61 2 6125 7266

Vice Chair, IPCC Working Group II