

Climate change: observations, projections and responses

Dr Simon Torok, Director, Scientell

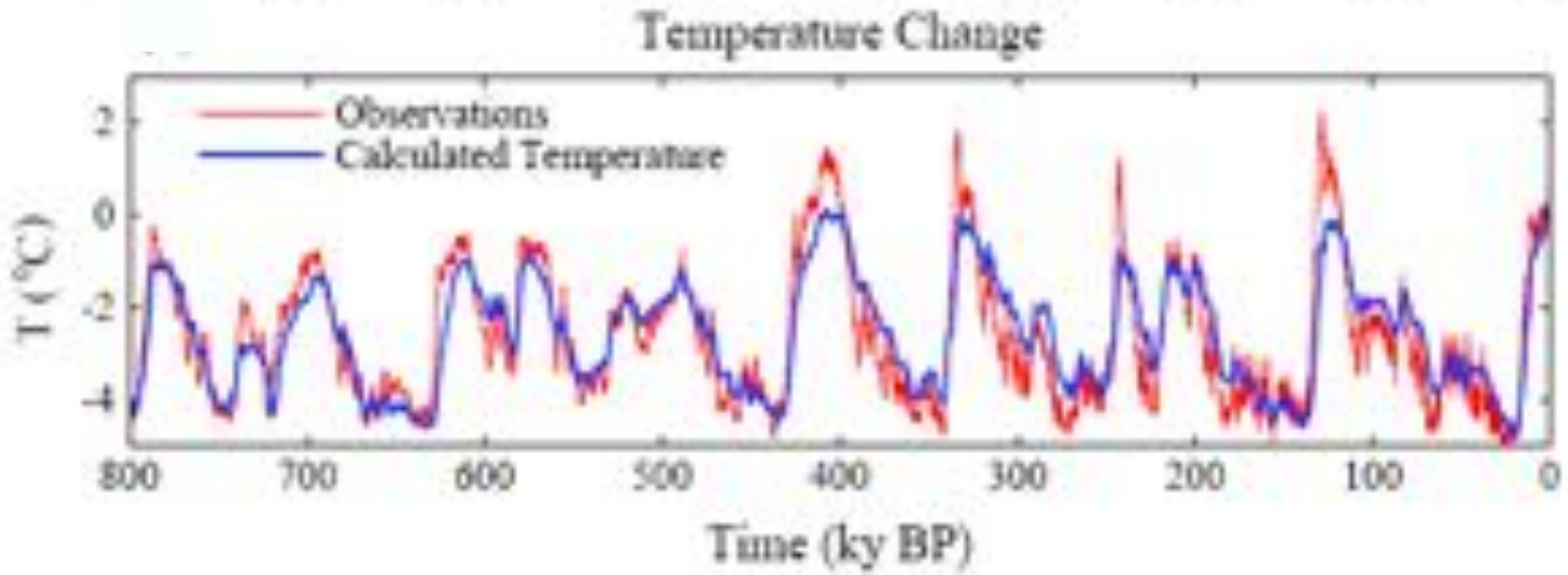
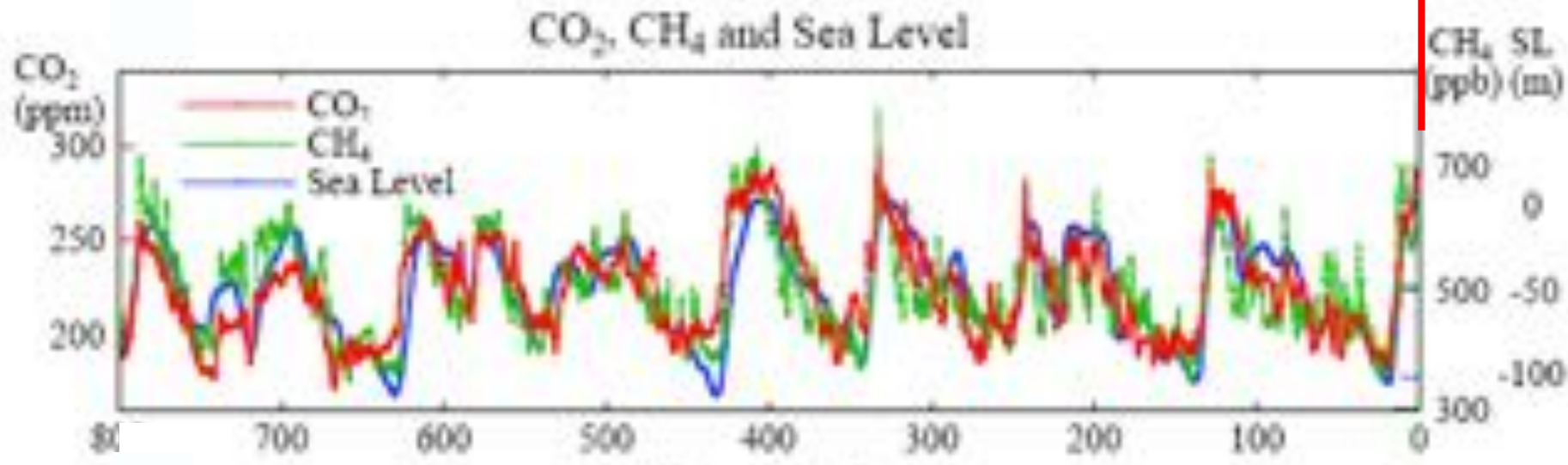
Goulburn, 14 November 2015

Climate change observations, projections and responses

- **Introduction**
- **Observed changes**
- **Future changes**
- **Communicating climate change**
- **Responses**

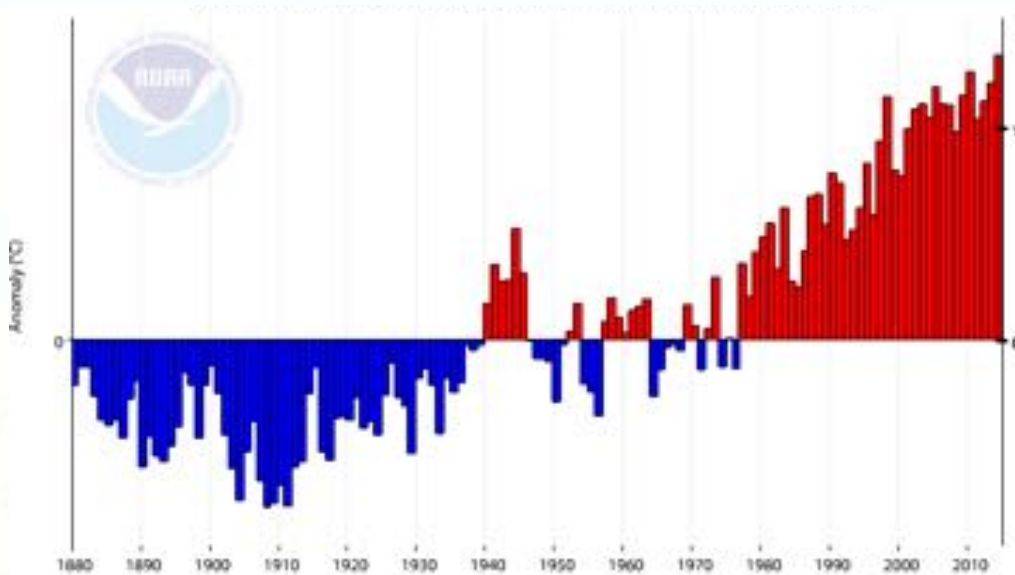
Climate has always changed

Present CO₂ ●



Hansen et al. (2008) Target atmospheric CO₂

Global warming



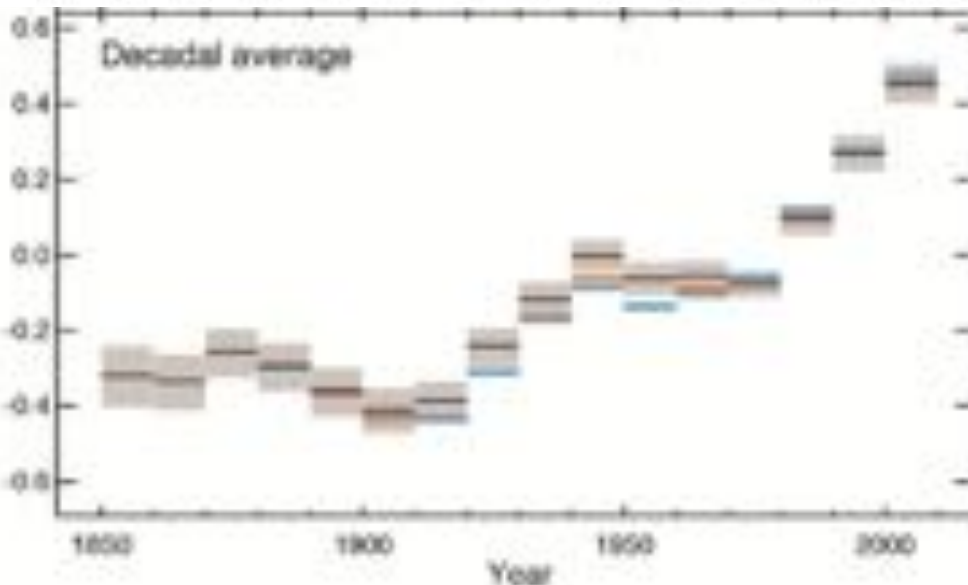
Warming of 0.85 °C

2014 warmest year globally, and 2015 shaping up to be warmest globally

14 of the 15 warmest years ever measured occurred in the 21st century.

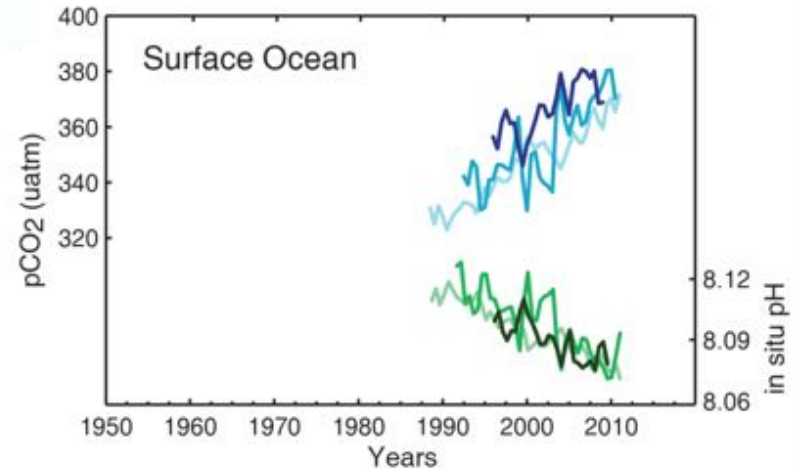
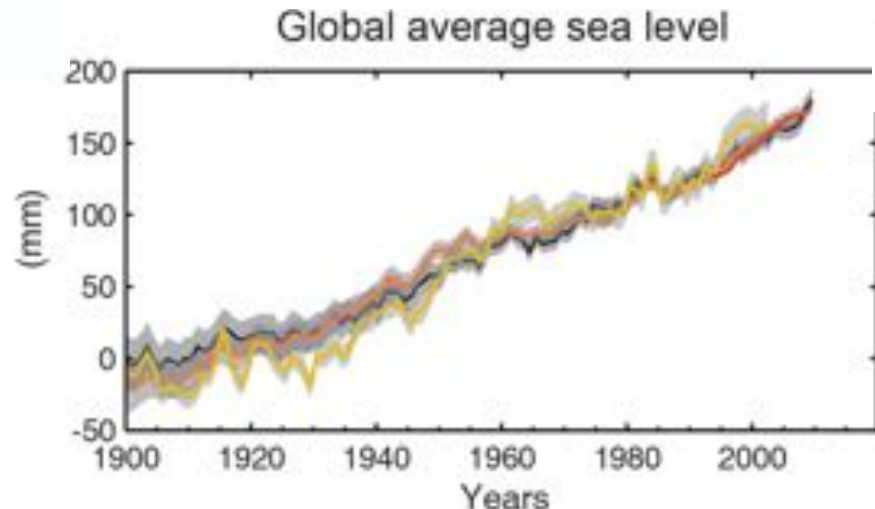
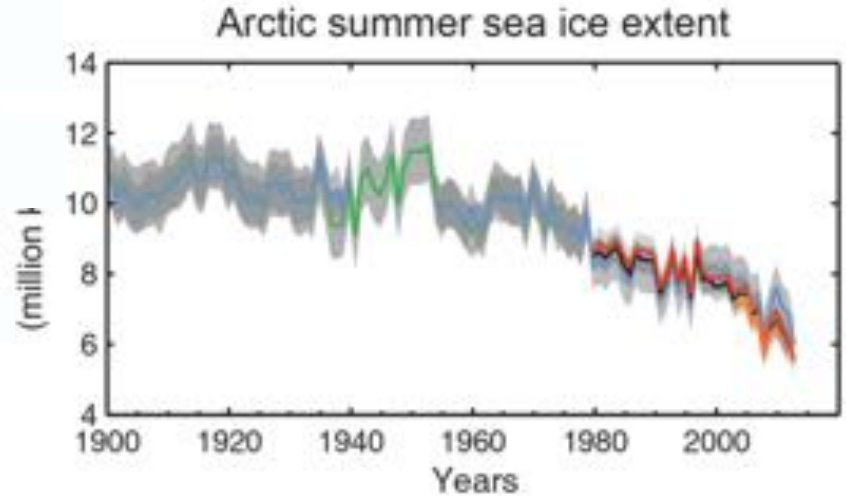
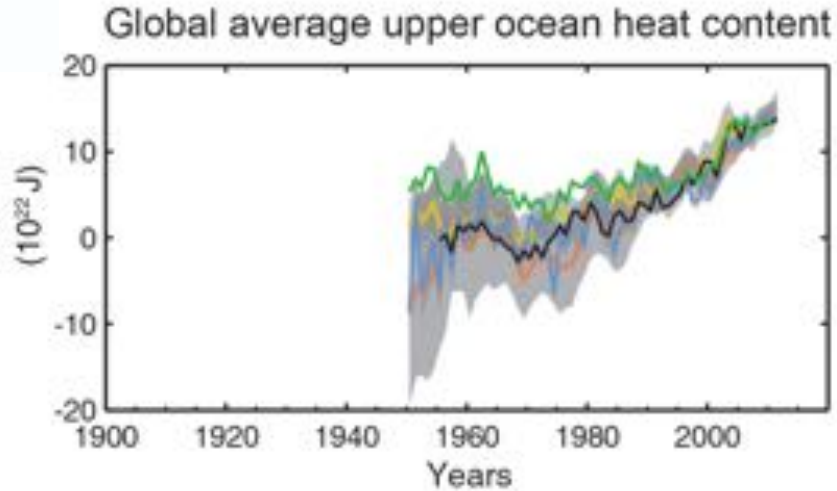
Each of the last three decades has been successively warmer than any preceding decade since 1850

38th consecutive year (since 1976) and 364 months in a row warmer than the average



IPCC (2013)

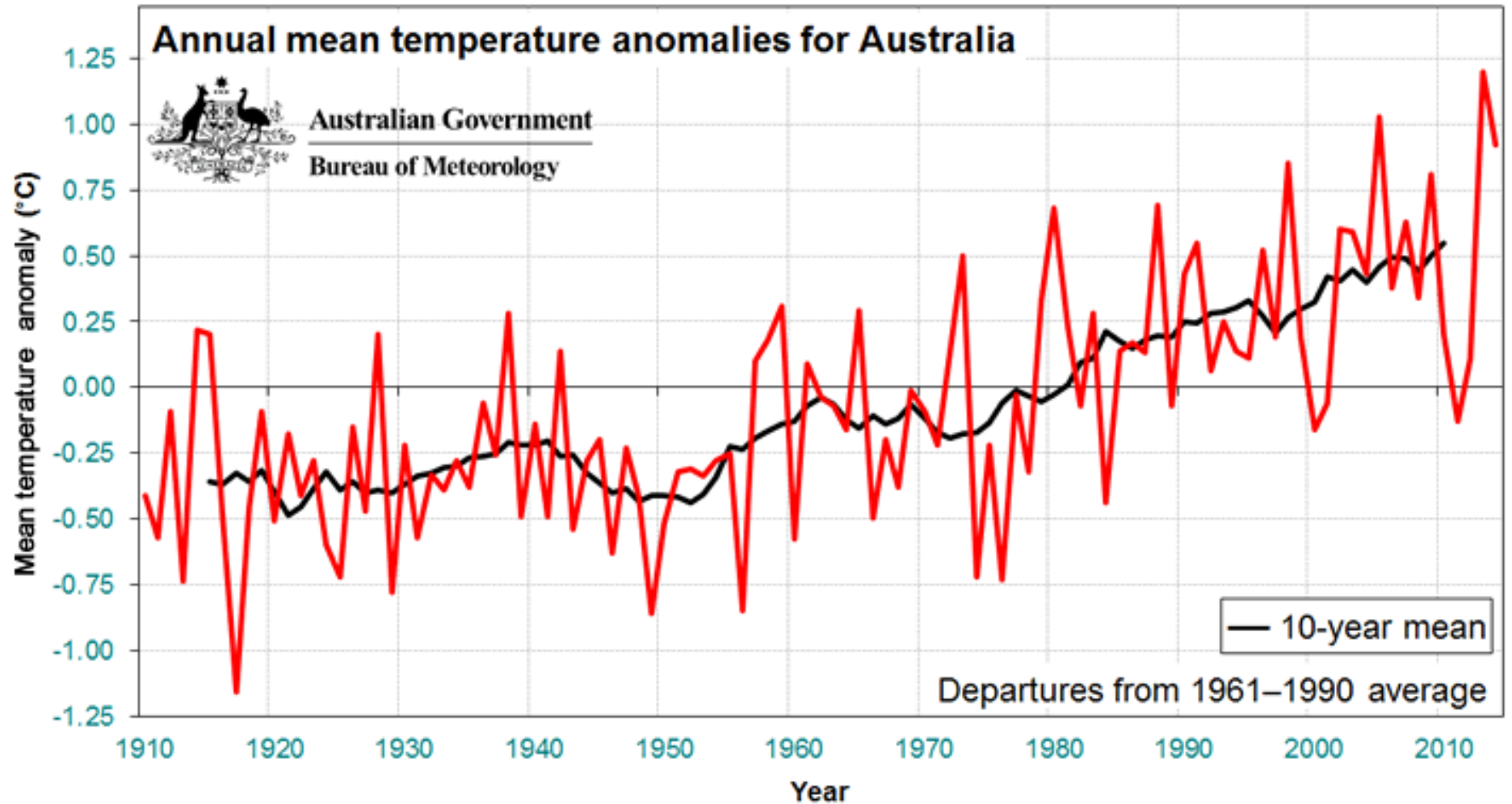
Multiple lines of evidence show that many aspects of the climate system have changed



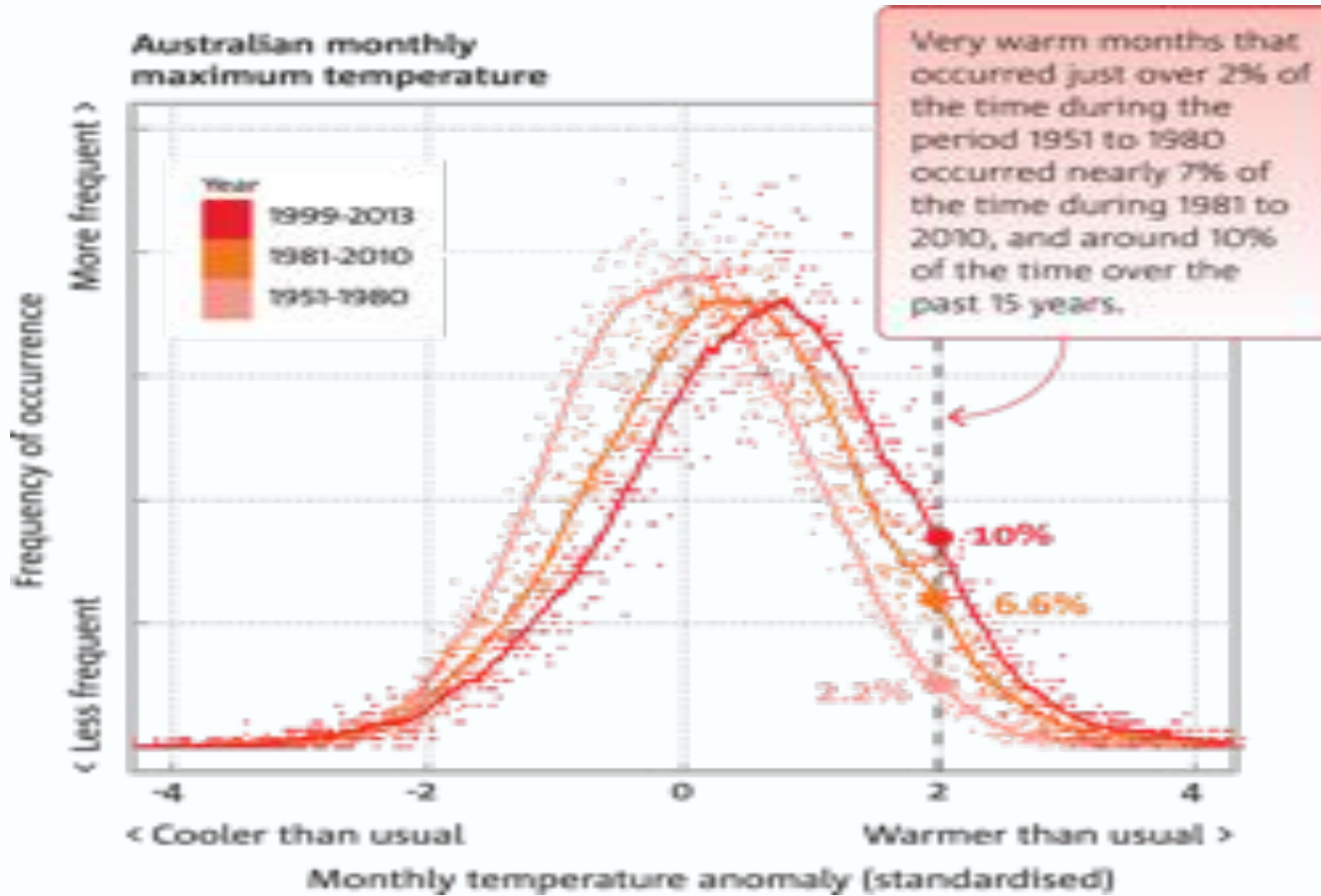
IPCC 2013

Australian temperatures

Warming of 0.9°C since 1910



More frequent warm months in Australia



The consensus opinion

2013: “Warming of the climate system is unequivocal, and since the 1950s many of the observed changes are unprecedented over decades to millennia.

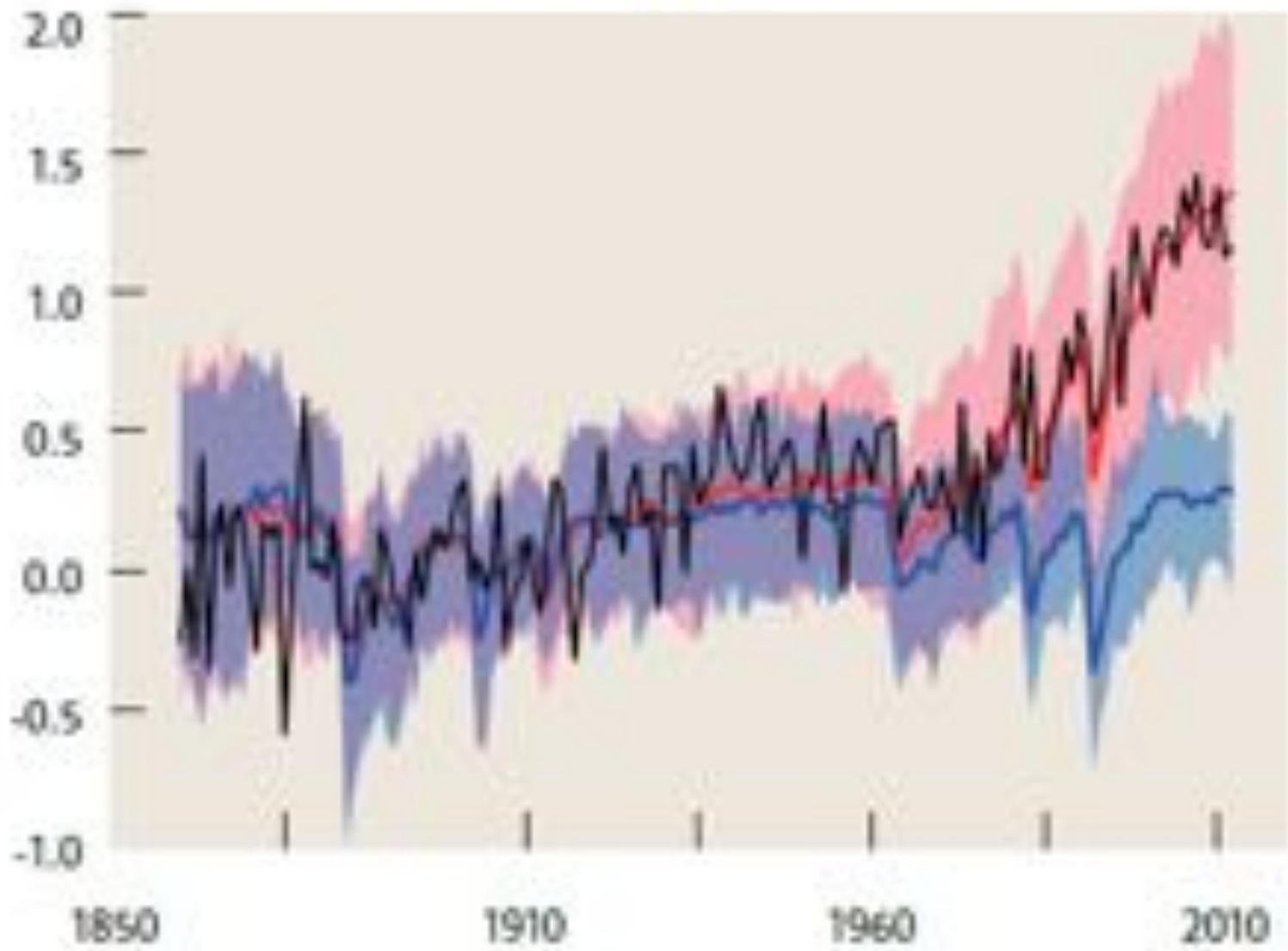
Human influence on the climate system is clear.

Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. This evidence for human influence has grown since AR4.

It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.”

Since the IPCC, recent research has attributed individual events (e.g. record Oct Aus warmth) to human activities

Temp change (°C)

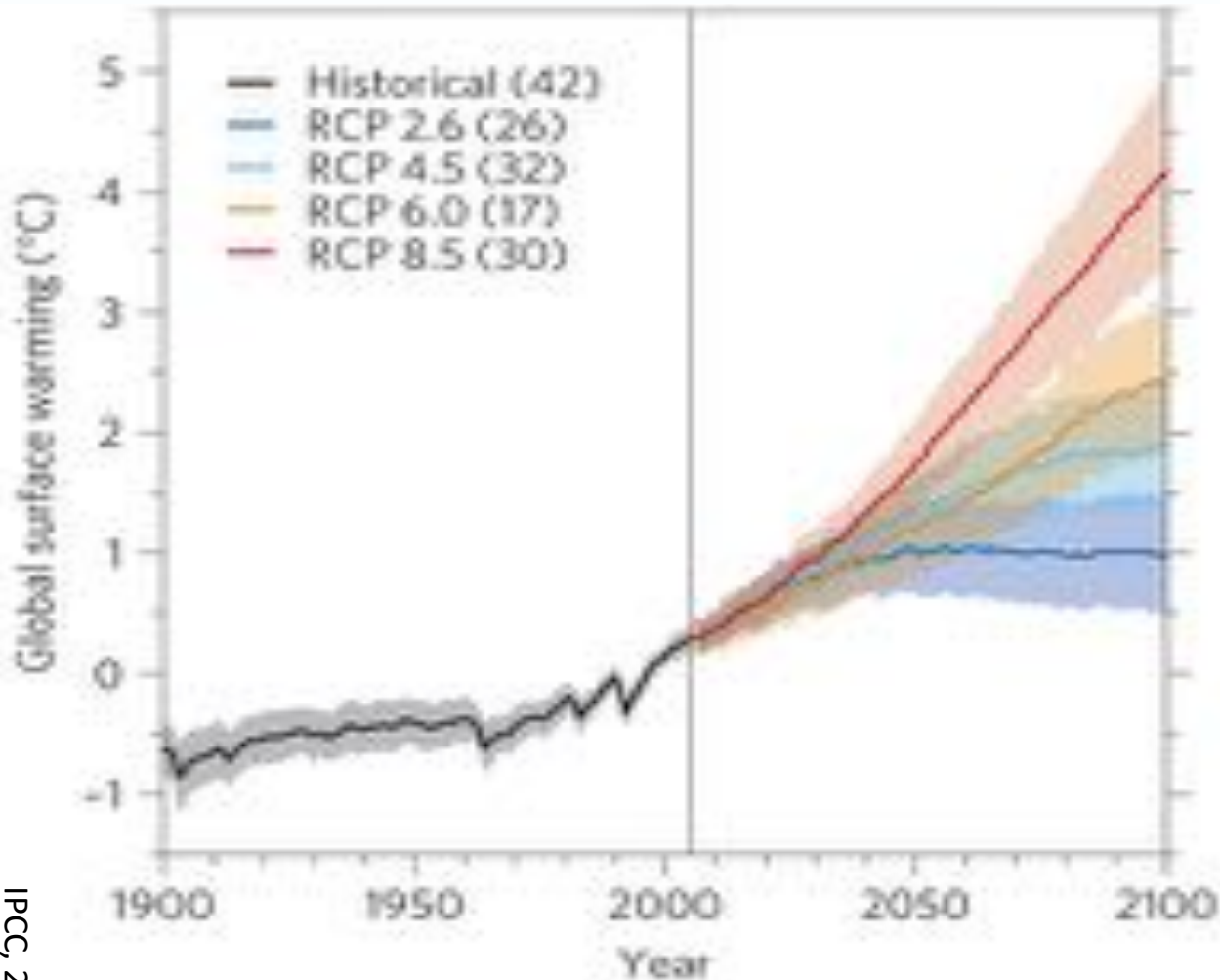


IPCC 2001

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Projected future warming



IPCC, 2013

Global warming of 0.3-4.8°C by 2100, depending on the emission scenario

For low emission scenarios, surface warming tapers off, but deeper ocean warming continues for centuries

Sea level rise of 0.26-0.98 metres by 2100

Carbon dioxide and temperature

‘Double the concentration of carbon dioxide in the atmosphere and the average surface temperature will rise by 4.9 to 6.05°C.’



Svante Arrhenius, 1859-1927

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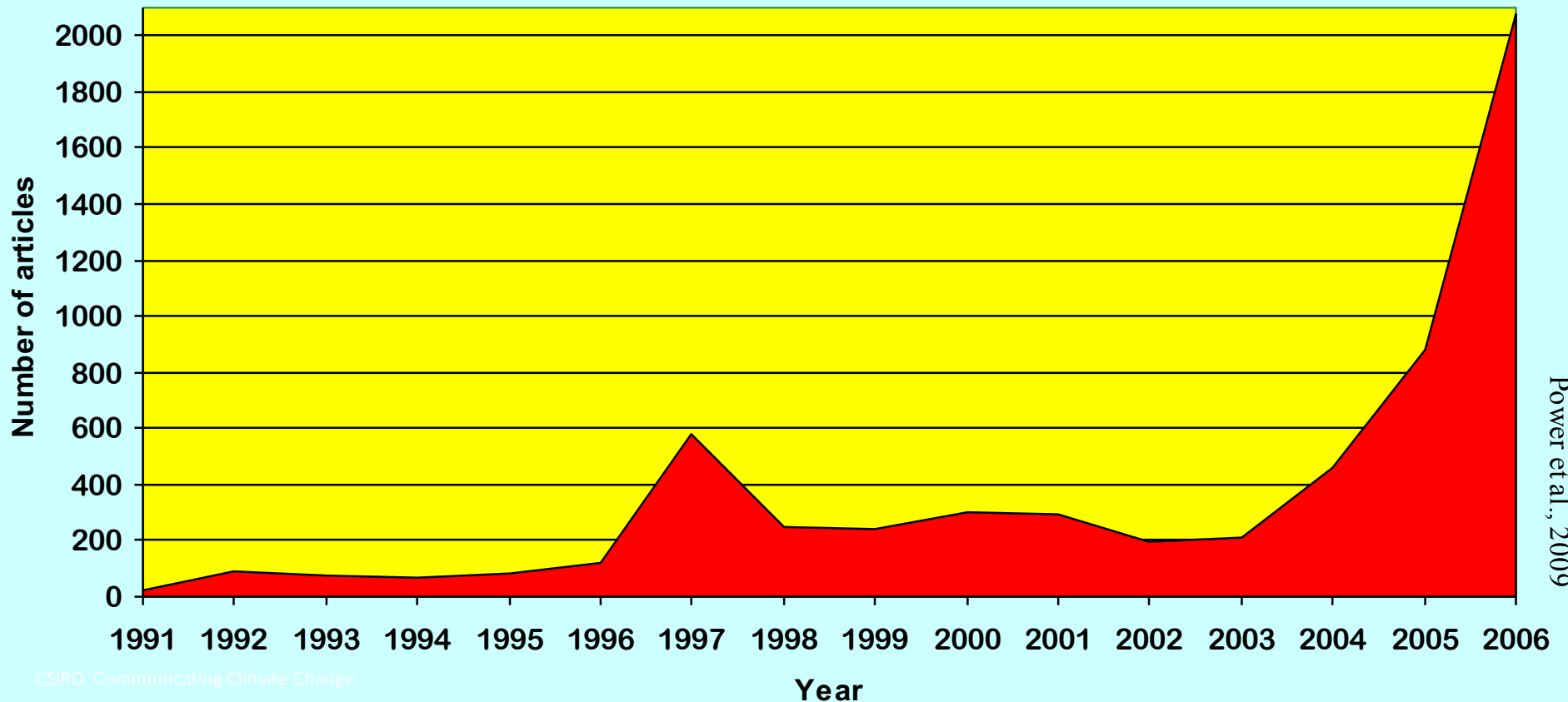
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Climate change in the media

In Australia, there was a ten-fold increase in the number of media reports about climate change from 2003 to 2006

2007: > 6000

References to climate change in articles from major metropolitan newspapers (1991-2006)



Denial to despair

A survey in 2007 of 600 young people aged 10 to 14 in Australia found 44% are nervous about the future impact of climate change, and 27% are so troubled about the state of the world they believe it will end in their lifetime.

Climate change is reported in an increasingly alarmist and urgent language, with extreme weather events blamed on climate change

The scale of the problem can be overwhelming for many and therefore lead to inaction through a belief that individual actions will be ineffective against such a vast, global problem.

This can be compounded by the common messages of simple individual actions that are provided.

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Tackling the Problem

Adaptation ('climate-proofing')

- **Preparing for the impacts of climate change**
- **Aim is to reduce the negative consequences, take advantage of any possible opportunities**
- **Autonomous vs planned**

For example

- **Reducing water demand through restrictions and incentives**
- **Increasing water supply (e.g. desalination, recycling, tanks)**
- **Engineering solutions and planning guidelines in coastal areas (e.g. sea walls, buffer zones, planned retreat)**
- **Snow making**
- **Changing crop varieties and farming practices**
- **Migration corridors for biodiversity.**

Tackling the Problem

Mitigation (reducing net greenhouse gas emissions)

- **Reducing greenhouse gas emissions to address the cause of climate change**
- **Reducing the risk of larger and dangerous changes to which we cannot adapt**

For example

- **Technologies to reduce emissions (renewables, biofuels, energy efficiency)**
- **Enhancing carbon uptake by increasing carbon sinks through carbon dioxide capture etc, and decreasing deforestation**
- **Policy mechanisms**

In conclusion . . .

Climate varies naturally, and the natural greenhouse effect has been enhanced by increased greenhouse gas concentrations.

Global temperatures have risen, and other observations show evidence of climate change globally and in Australia.

While climate has numerous drivers, human influence on the climate system is clear, and has been known for some time.

Projections indicate that changes to the climate are expected to continue into the future, being felt through extremes.

Adaptation is required to reduce impacts, mitigation is required to avoid dangerous changes.

There are many challenges in communicating climate change, which can be addressed through framing messages to include solutions to avoid despair; and using art-science collaborations to reach new audiences.

Thank you

Questions?

Simon Torok

simon@scientell.com.au

0409 844 302