Climate Change and Infrastructure

Paul Holper
CSIRO Marine and Atmospheric Research
National Plumbing Regulators Forum Conference
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www.csiro.au

CSIRO

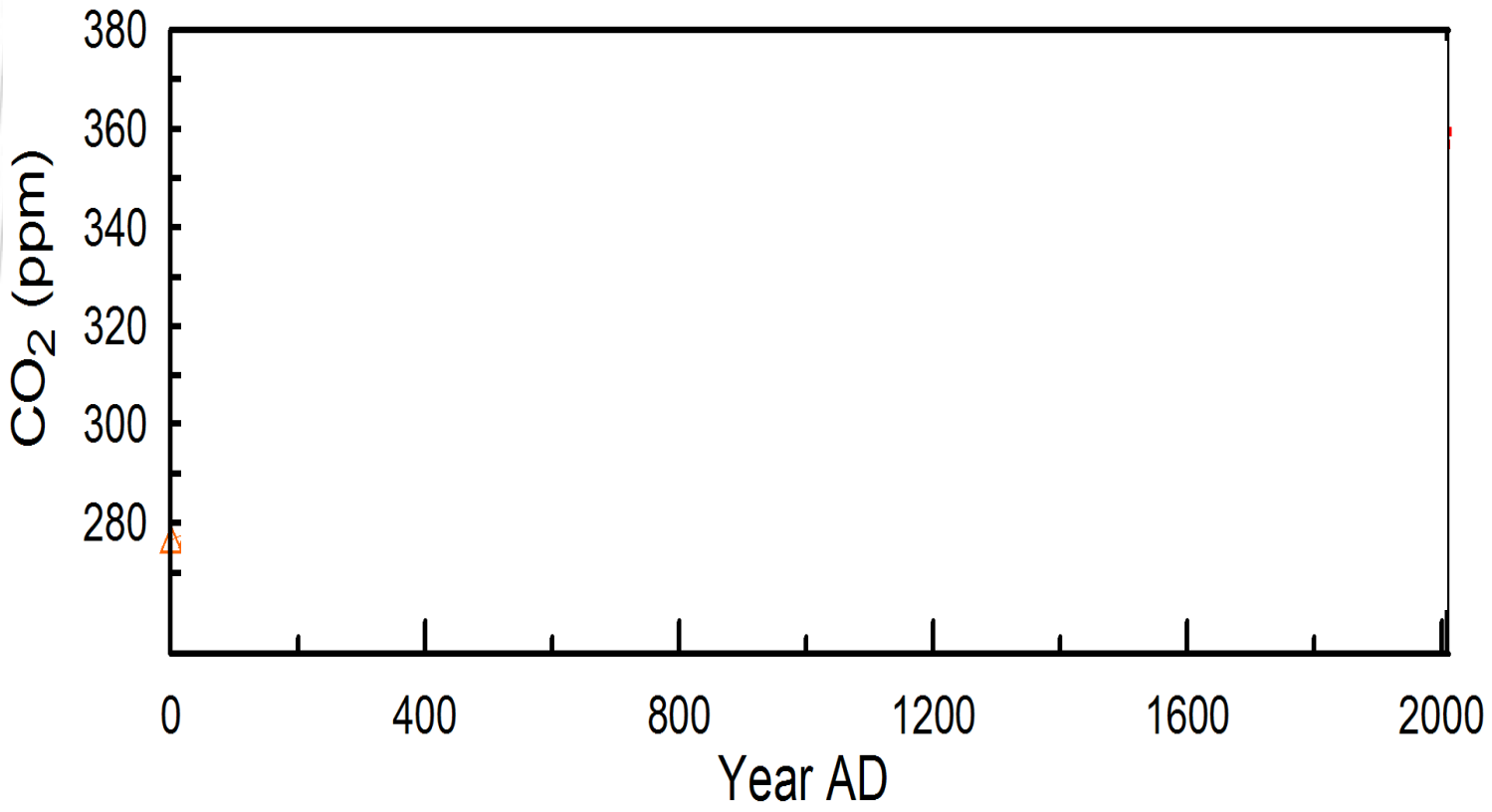
Outline

- Changes to our air and to our climate
- What's our climate going to be like in future?
- Likely impacts of climate change
- Adapting to the challenges


Positive proof of global warming.
18th Century
1900
1950
1970
1980
1990
2006

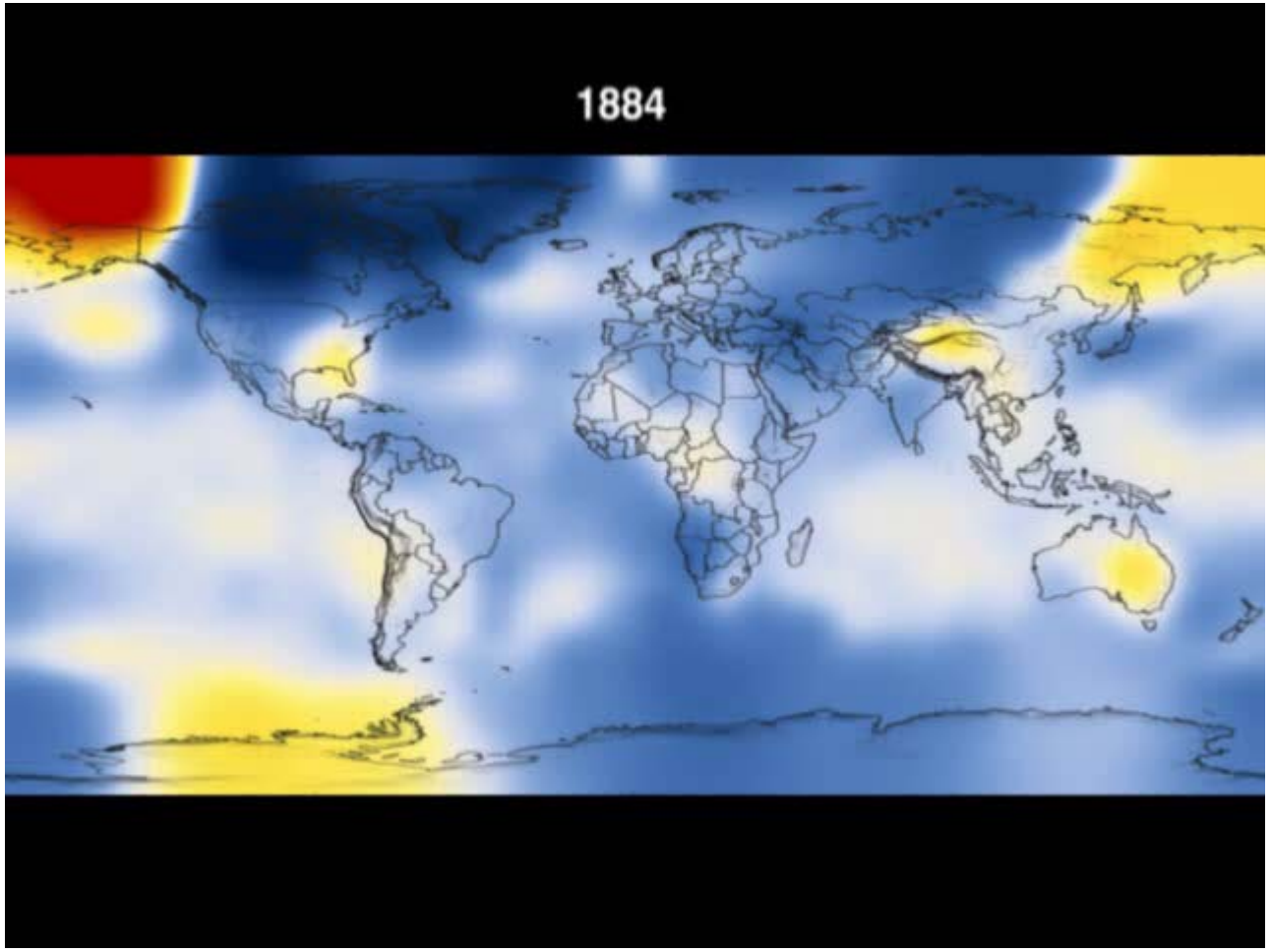

QANTAS
Spirit of Australia

Atmospheric carbon dioxide concentrations



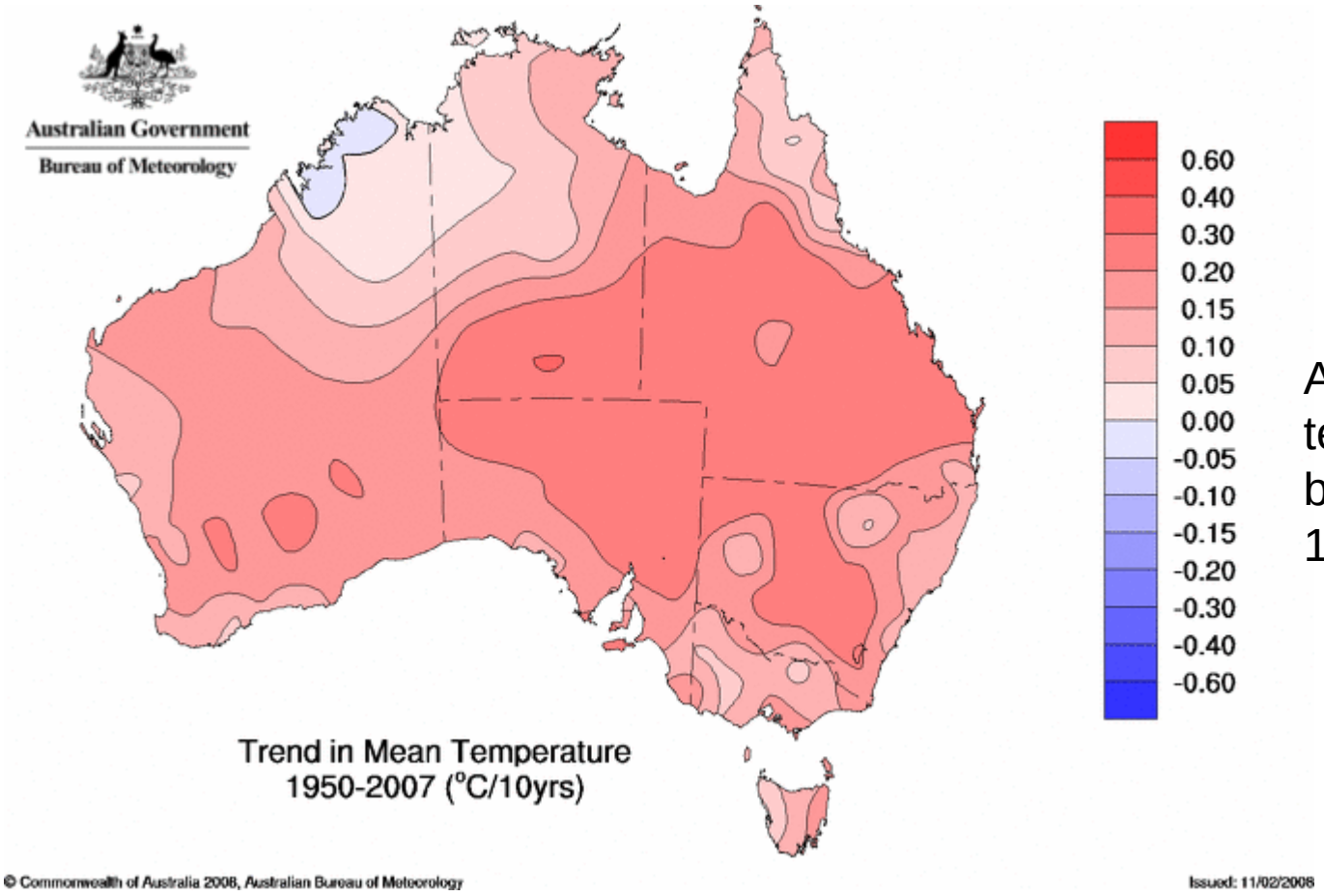
Carbon dioxide concentrations are now greater than at any time during the past 650,000 years. The growth rate is now accelerating.

Global warming, 1884 - 2006



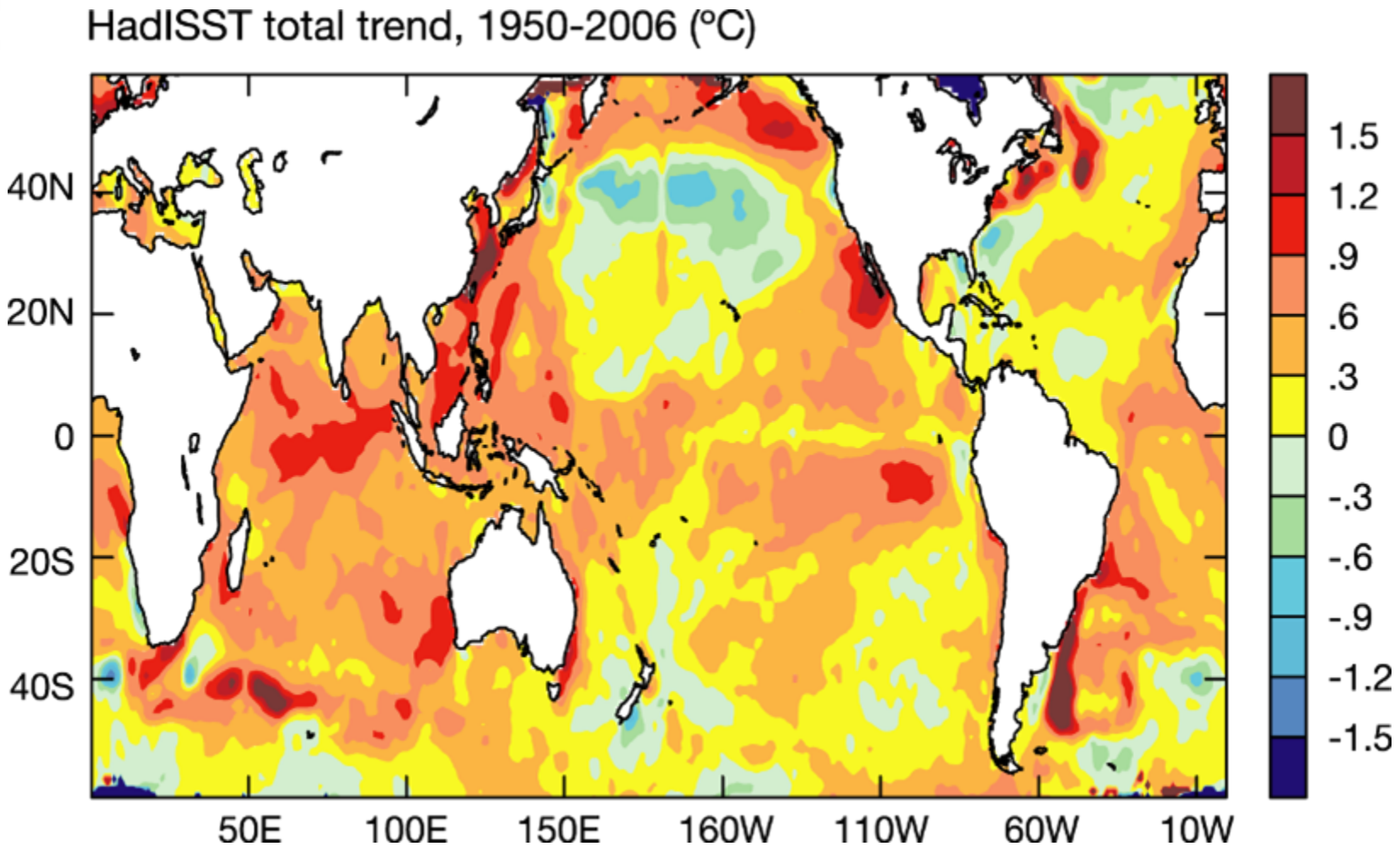
Source: NASA

Changes in mean temperature, 1950 - 2007

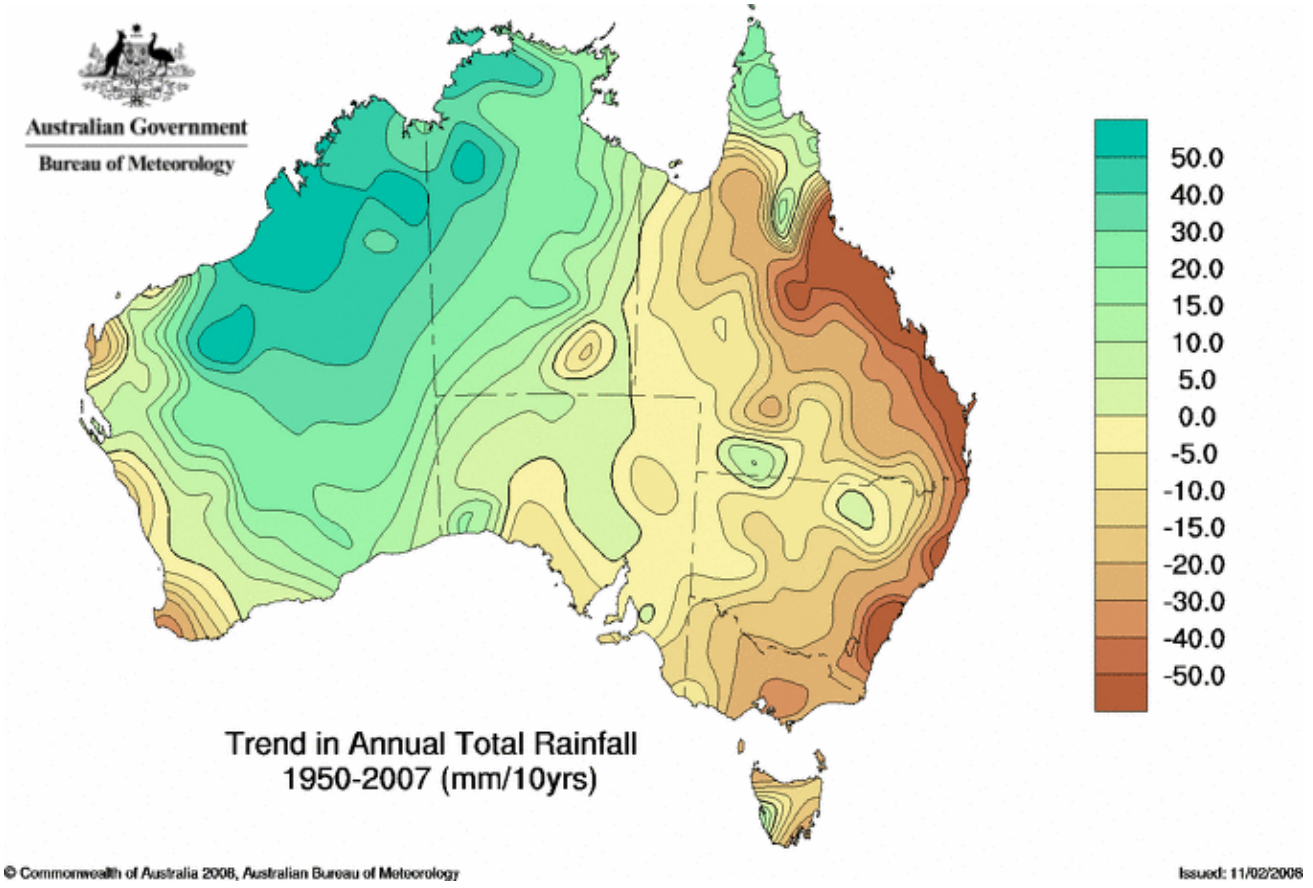


Australian average temps have risen by ~0.9°C since 1910

Observed changes – sea surface temperature



Observed changes – rainfall



Weather Bureau media release

31 October 2008

Australian Government
Bureau of Meteorology

Record dry start to spring

Melbourne has had its **driest September-October on record**, with a rainfall total of 26.0 millimetres – well below the previous record of 35.2 millimetres set in 1914.

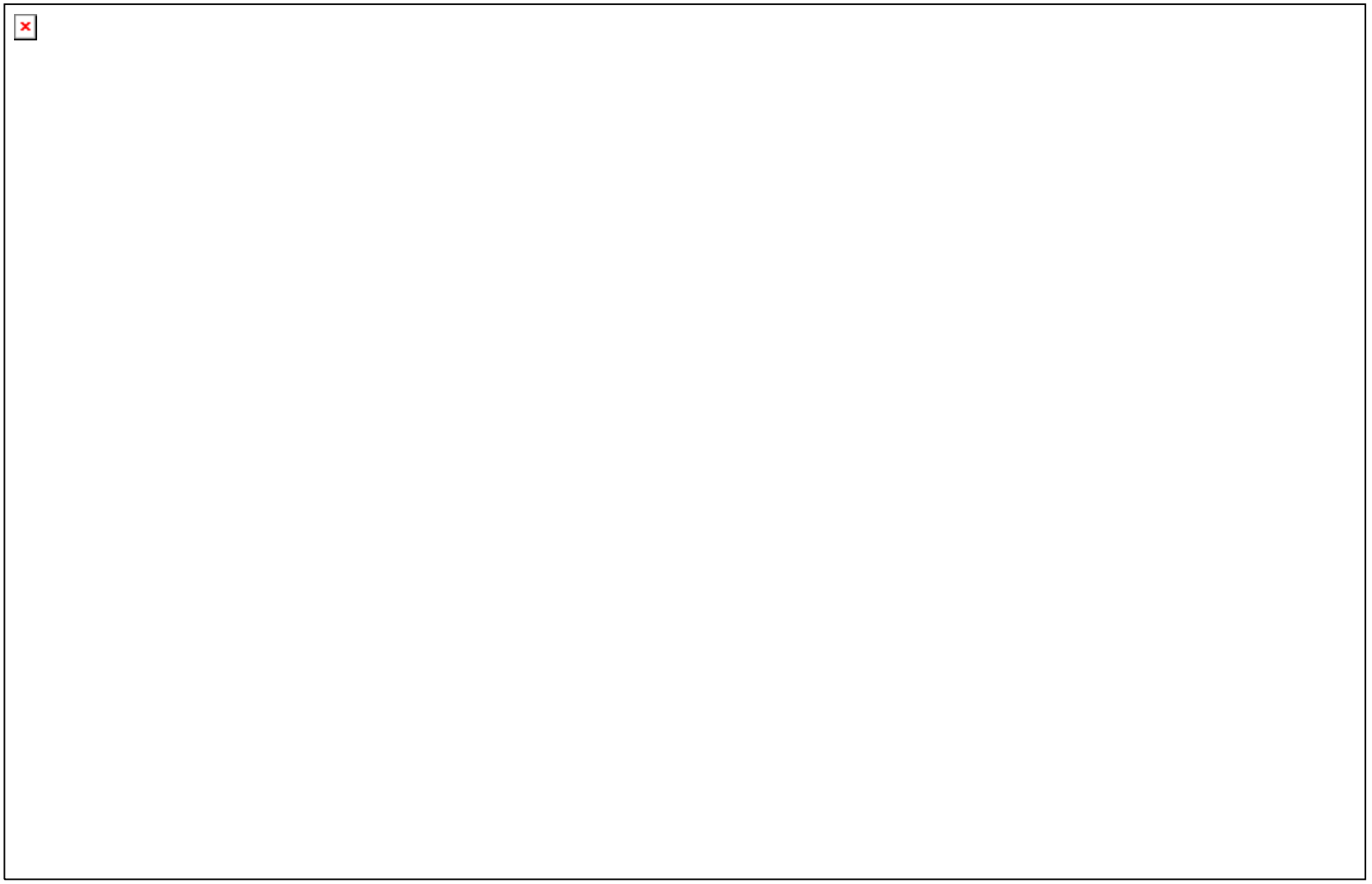
Mildura and Sale in Victoria, and Whyalla in South Australia, have also had new low rainfall records for the first two months of spring, Preliminary figures indicate that South Australia has had its driest September-October on record, with a state-wide average of 7.0 millimetres of rainfall. This compares with the previous record of 7.5 millimetres in 2006.

The dry spring start continues a very dry year in many parts of Australia. Central Australia has received little or no rain in the past two months and 2008 is on track to be the driest year on record in many places including Mount Isa and Alice Springs. Rainfall for the year to date is also near or at record low levels in much of eastern Tasmania, including Hobart, and well below average in most of South Australia and Victoria.

However, rainfall has been near normal in areas such as the south-west of Western Australia, northern New South Wales and southern Queensland.

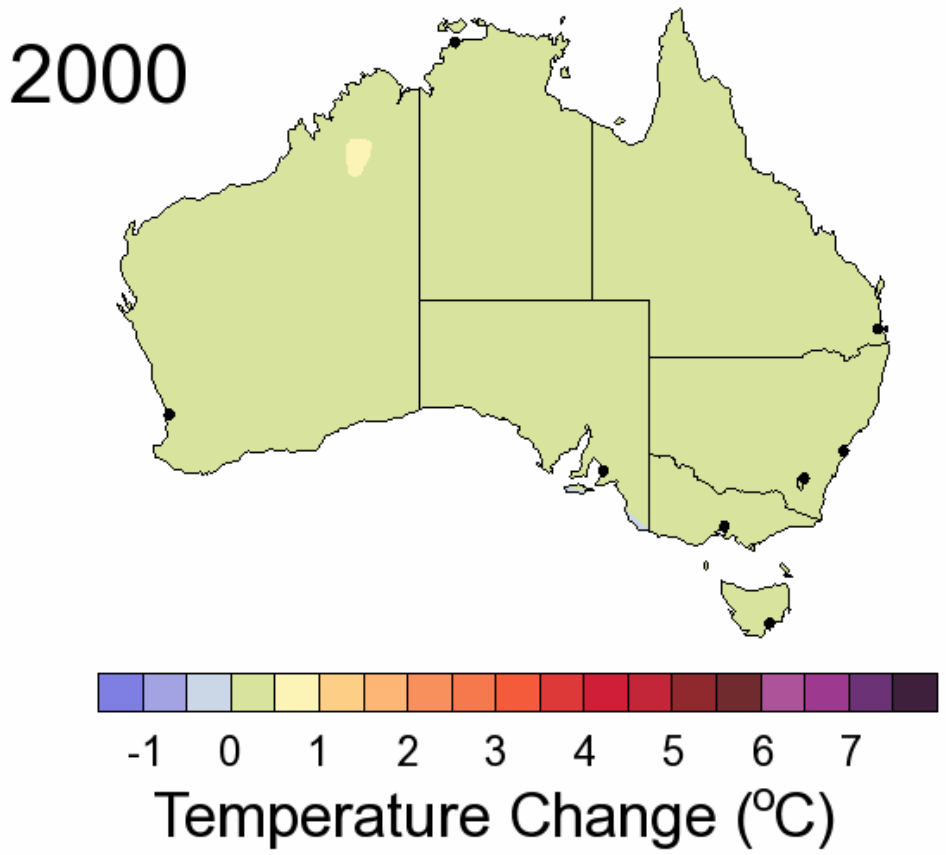
It has also been much hotter than usual in many parts of Australia with many record or near record high temperatures. Darwin equalled its hottest month on record for any month …

Sea level rise is accelerating



Church et al. 2008

Temperature projections to 2100

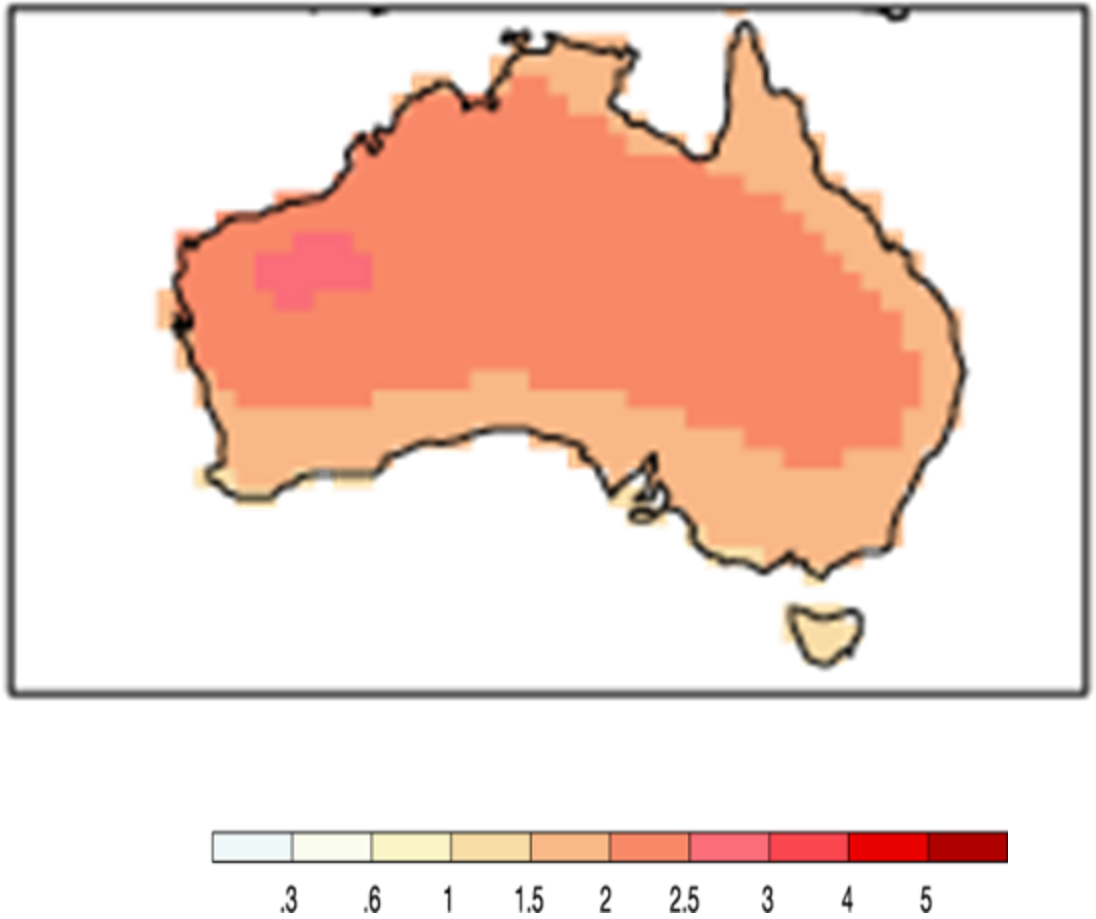


CSIRO Mark 3.5 climate model
IPCC SRES A1B emission scenario
Change relative to 1980-1999 average

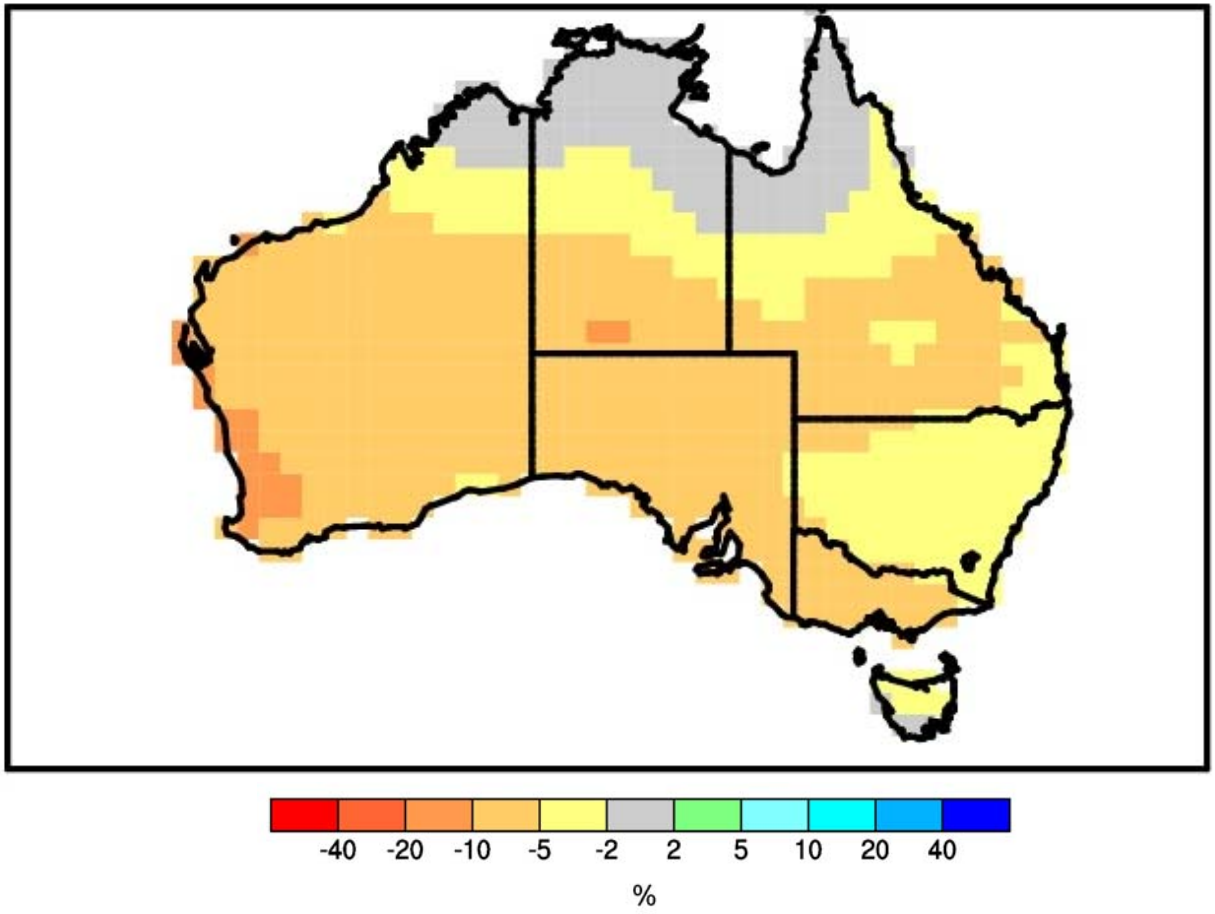
CSIRO

Change to temperature by 2050

Best estimate, high emission scenario



Changes to rainfall by 2050



Best estimate, A1B mid-range scenario

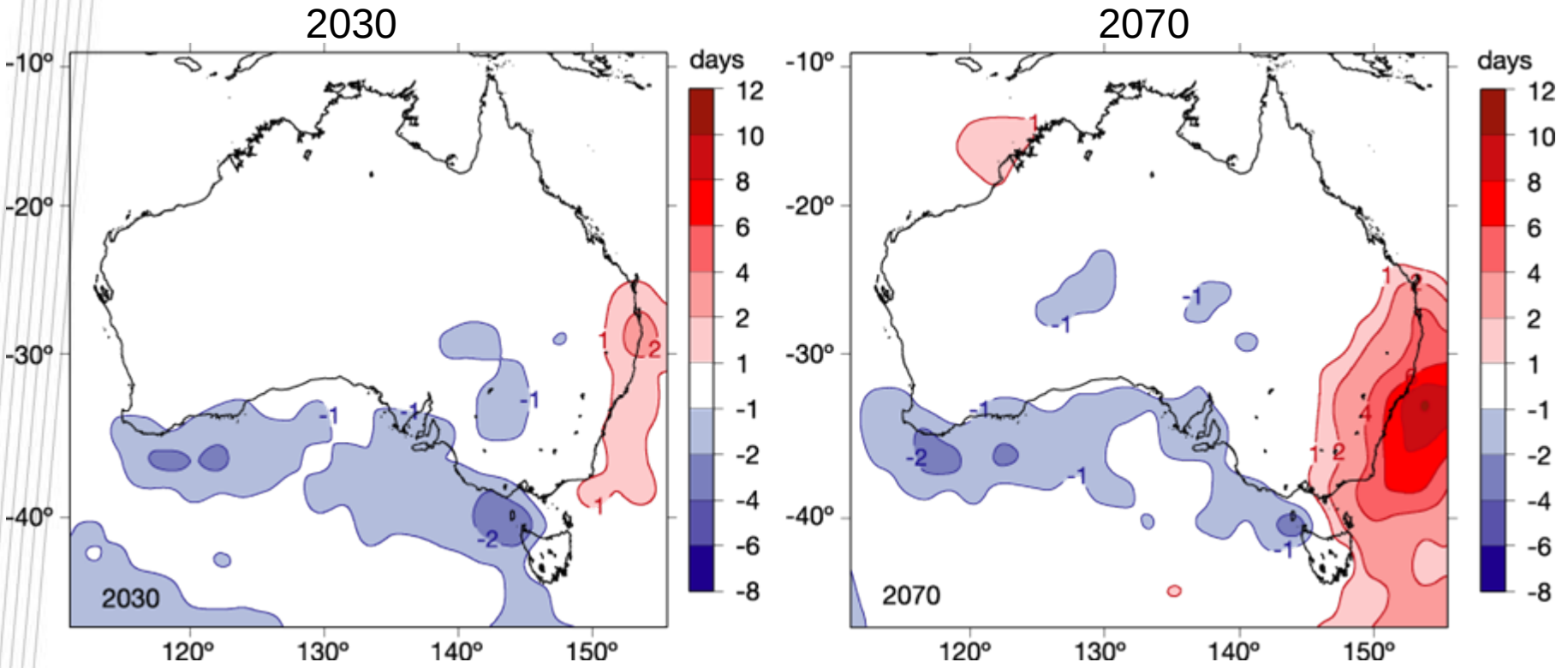
www.climatechangeinaustralia.gov.au

Comprehensive projections — other variables

- Wind speed: mainly increases
- Relative humidity: small decreases
- Solar radiation: increases in the south
- Potential evaporation: increases
- Sea surface temperature: increases, especially Tasman sea

www.climatechangeinaustralia.gov.au

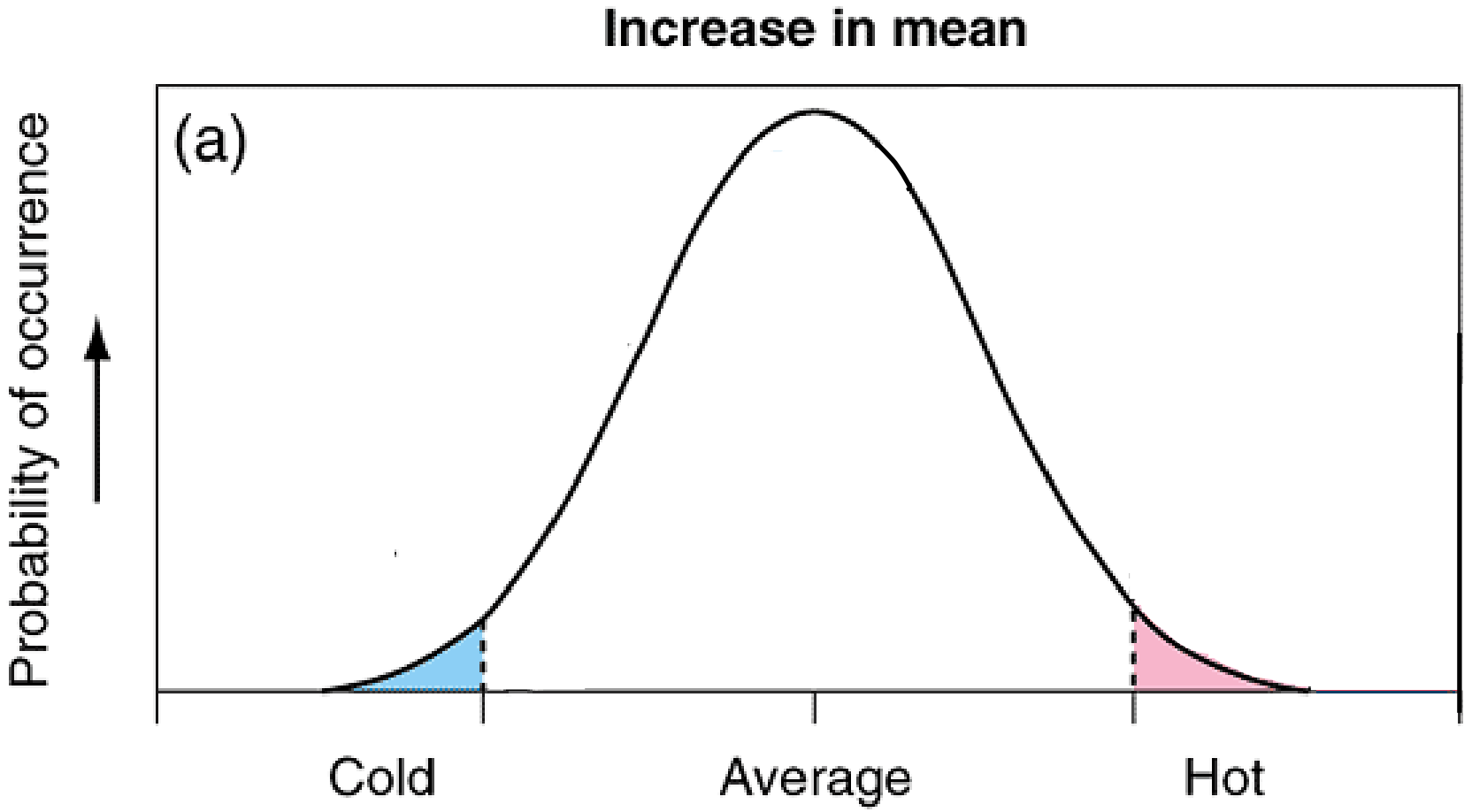
Australia's future climate: hail



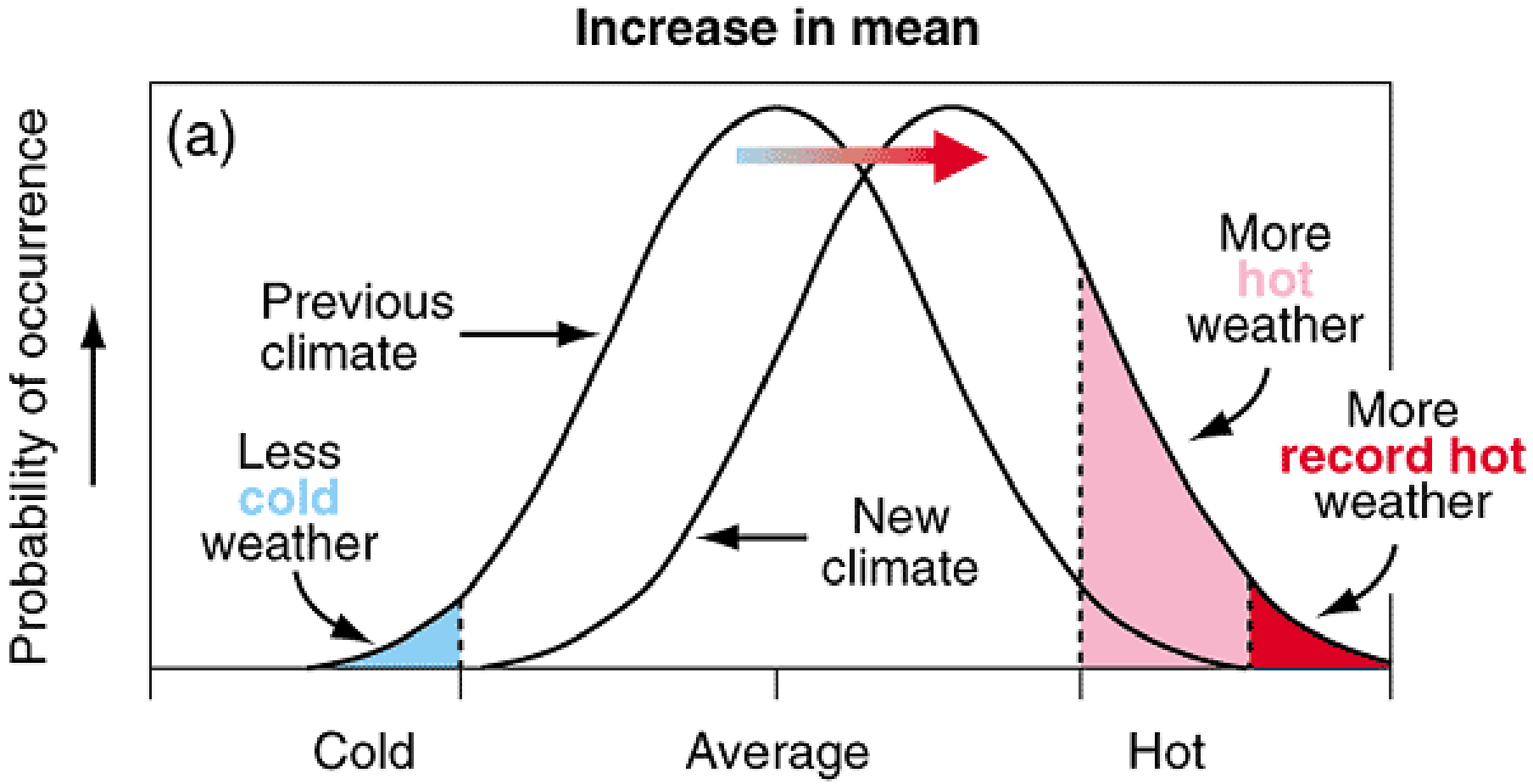
Red indicates increase.
Blue indicates decrease.

A2 (high) emissions scenario

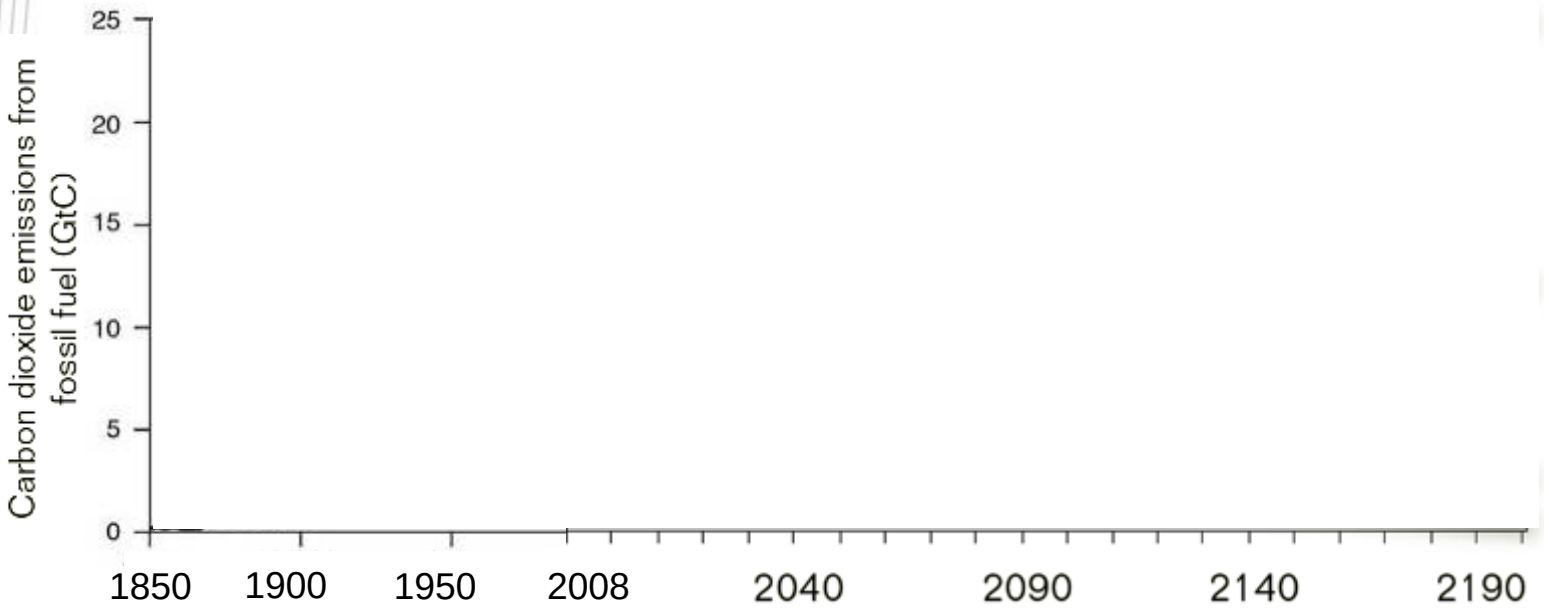
Why small increases in means can lead to large increases in extremes



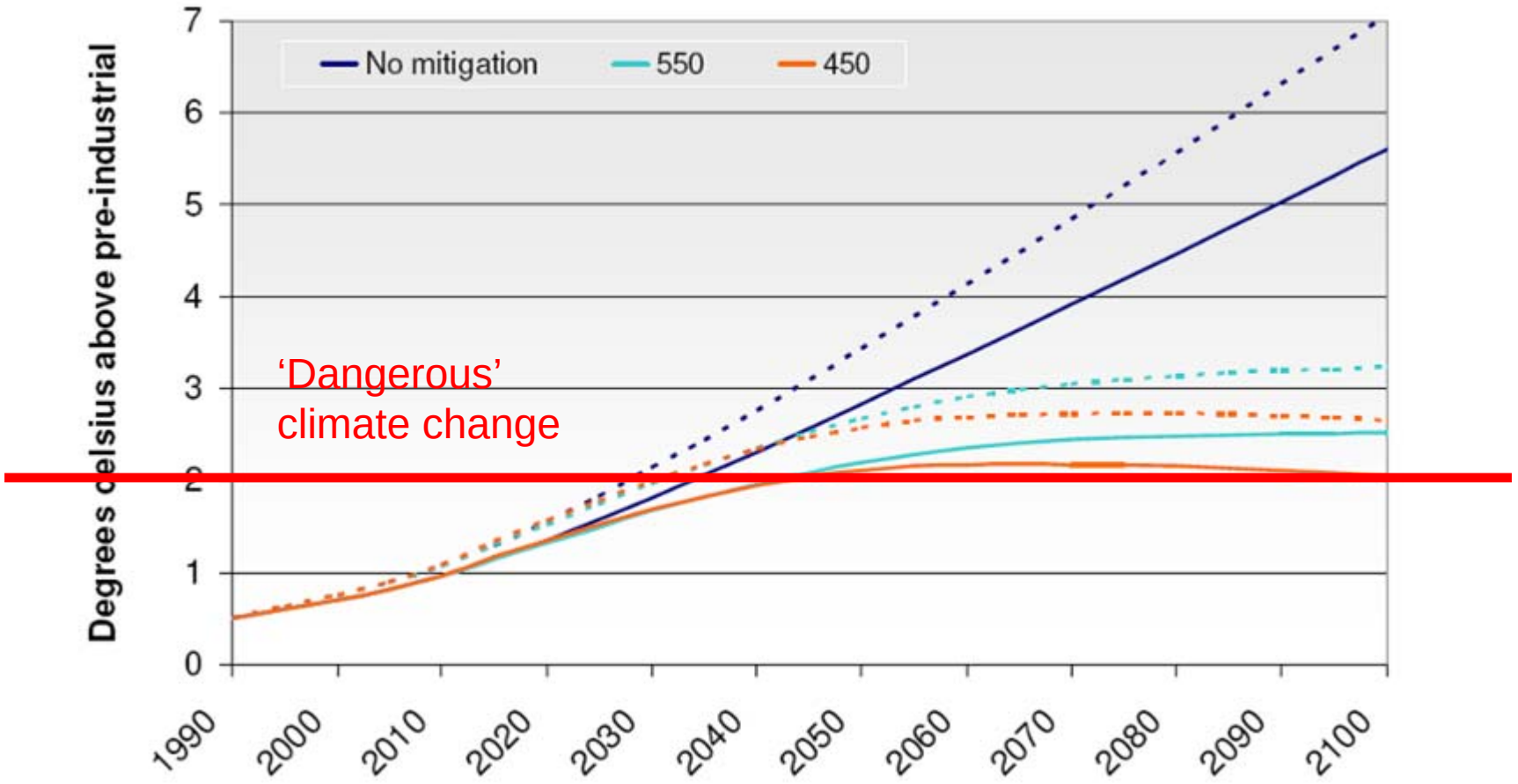
Why small increases in means can lead to large increases in extremes



Carbon dioxide emissions: Garnaut report



Temp increases above pre-industrial levels under various scenarios



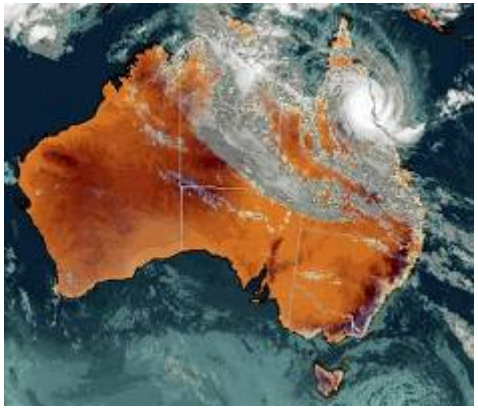
Impacts of climate change

Australia already experiencing impacts from recent climate change.

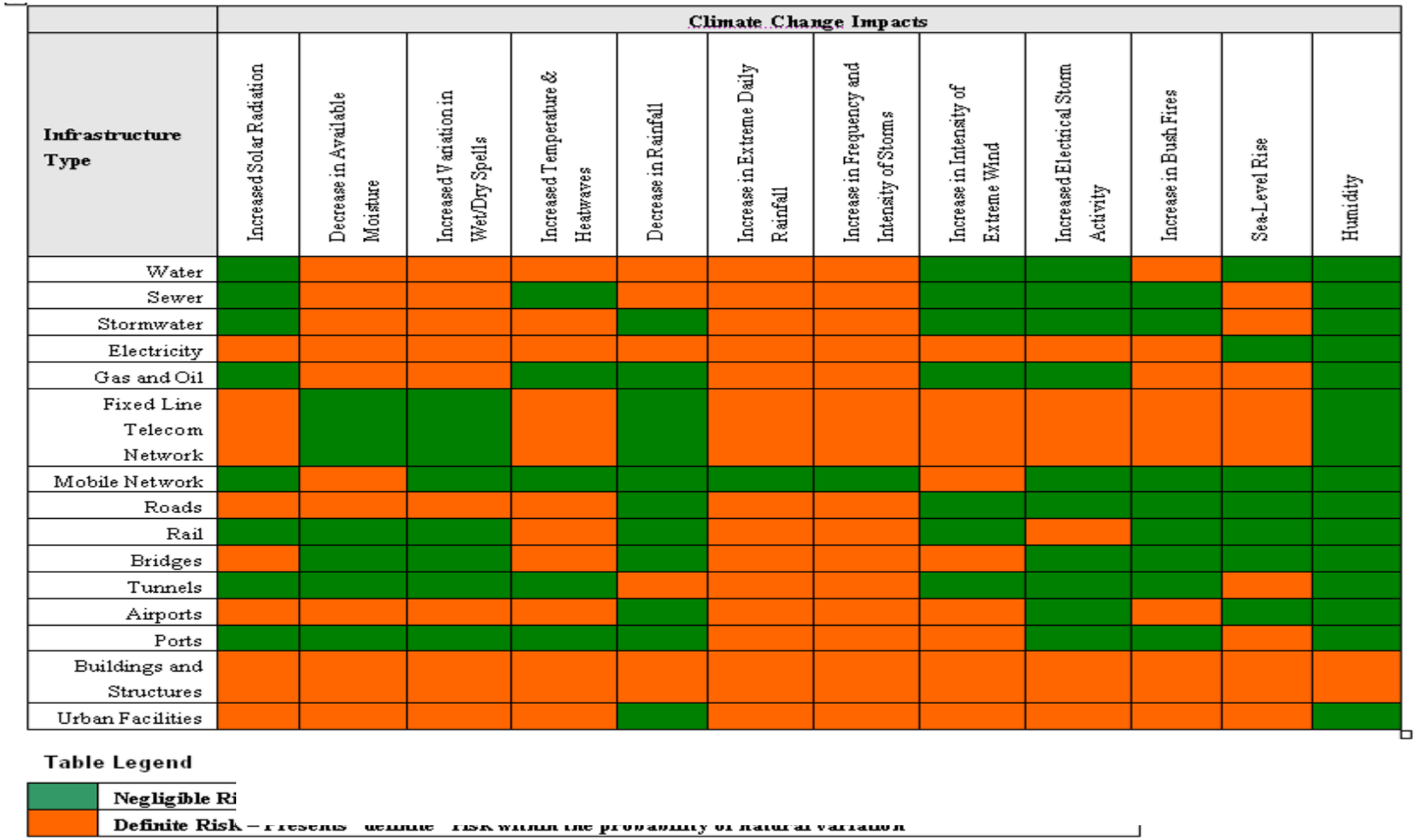
- Increasing stresses on water supply and agriculture, changed natural ecosystems and reduced seasonal snow cover

Ongoing vulnerability to extreme events.

- Substantial economic losses caused by droughts, floods, fire, tropical cyclones and hail



Infrastructure sensitivity



Infrastructure Type	Climate Change Impacts											
	Increased Solar Radiation	Decrease in Available Moisture	Increased Variation in Wet/Dry Spells	Increased Temperature & Heatwaves	Decrease in Rainfall	Increase in Extreme Daily Rainfall	Increase in Frequency and Intensity of Storms	Increase in Intensity of Extreme Wind	Increased Electrical Storm Activity	Increase in Bush Fires	Sea-Level Rise	Humidity
Water												
Sewer												
Stormwater												
Electricity												
Gas and Oil												
Fixed Line Telecom Network												
Mobile Network												
Roads												
Rail												
Bridges												
Tunnels												
Airports												
Ports												
Buildings and Structures												
Urban Facilities												

Table Legend

	Negligible Ri
	Definite Risk – Presents "definite" risk within the probability of natural variation

Water infrastructure – main risks

- More **extreme daily rainfall events** would affect capacity and maintenance of storm water, drainage and sewer infrastructure.
- Increased risk of major **bushfires** in the catchments of dams and reservoirs will threaten water quality and availability.
- Increased **ground movement** and changes in **groundwater** could accelerate degradation of materials and structural integrity of water supply, sewer and stormwater pipelines.
- **Lower rainfall** is likely to lead to water shortages, exacerbated by higher temperatures and increased demand from a growing population.

Building infrastructure – main risks

- Buildings affected by increased frequency and intensity of **extreme rainfall and wind**.
- Coastal buildings and facilities at risk from **storm surges** worsened by higher sea level.
- Increases in **bushfire** frequency and intensity pose threats to buildings and structures.
- **Drier conditions** would lead to increased ground movement and changes in groundwater.
- **Higher temperatures and more solar radiation** could amplify degradation of materials.

Coastal communities (80% of population)

- More intense storms and cyclones, leading to increased coastal flooding, storm surges and wind damage
- Sea-level rise likely to exacerbate ocean storm surge damage
- High vulnerability in the Torres Strait Islands

Plumbing

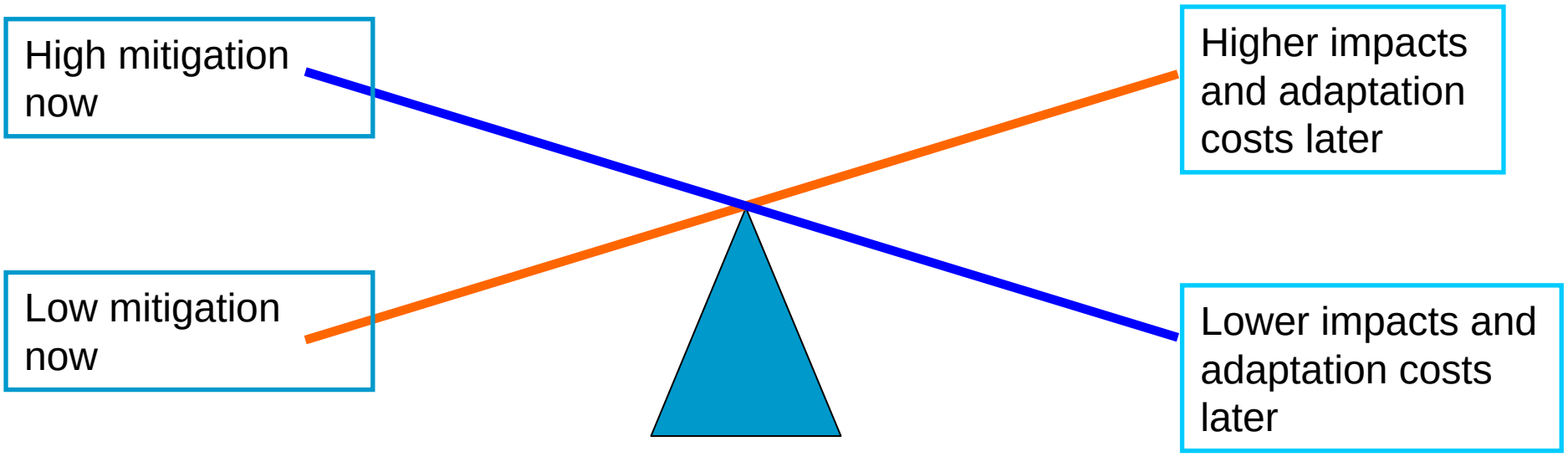
Buildings

- Demand for larger gutters and storm water pipes for drainage to cope with more extreme weather (i.e. bigger storms)
- Water conservation: greater demand for rainwater tanks, water recycling pipes, automatic garden watering systems, aquifer recharge
- Greater demand for swimming pools, air conditioners and evaporative coolers
- Greater demand for solar hot-water heaters and other alternative energy options such as geothermal, heat pumps
- Demand for higher energy- and water-efficient appliances
- Less demand for gas heaters for space heating in winter

Working conditions

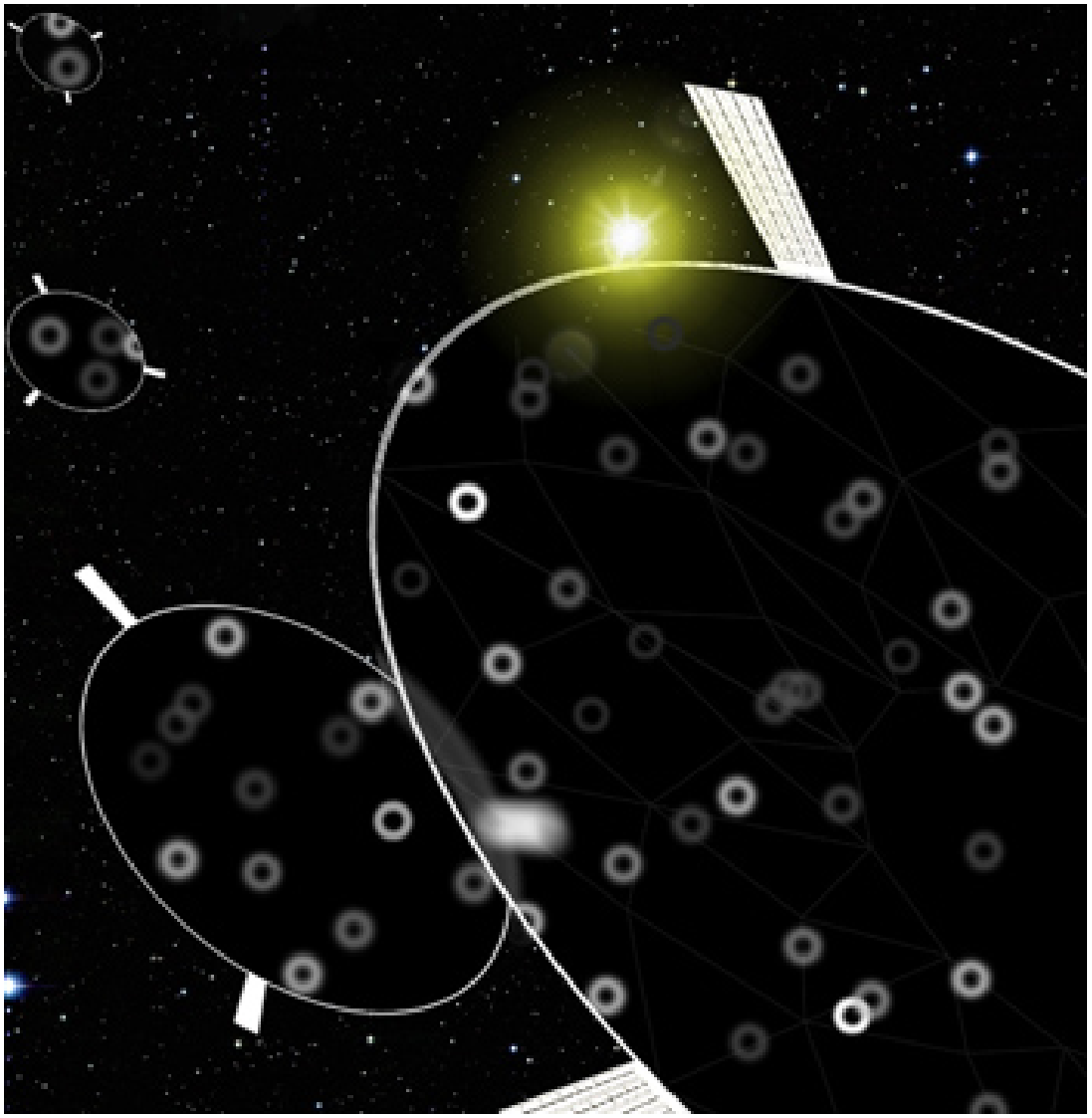
- Greater personal exposure to hot weather and sun (less cloud with drier conditions)
- Less time lost due to rain (fewer rainy days)

Adaptation-mitigation see-saw



Adaptation can ‘buy time’ for mitigation to work

Big ideas!



16 trillion sunlight-refracting shades

Border Mail
01/10/2008
Page: 18
Letters
Region: Albury-Wodonga VIC
Circulation: 25499
Type: Regional
Size: 44.06 sq.cms
MTWTFS-

Drought trigger clear as day

WHEN I was a kid we never had drought after drought.

Then we started with daylight saving. We started with a little bit, but now we have six months of the year daylight saving.

It has just become too much for the environment to cope with.

It is so logical, for six months of the year we have an extra hour each day of that hot afternoon sun.

I read somewhere that scientific studies had shown there is a lot less moisture in the atmosphere which means we get less rain.

I believe this one hour extra sun is slowly evaporating all the moisture out of everything.

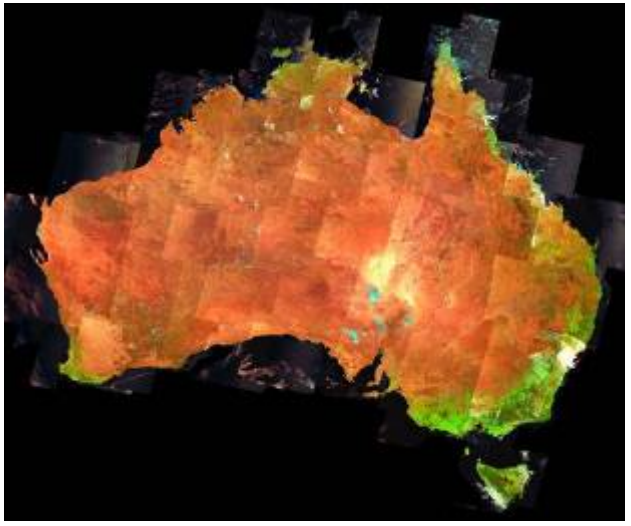
Why can't the Government get the CSIRO to do studies on this, or better still, get rid of daylight savings.

They have to do something before it is too late.

— CHRIS HILL,
Albury

Conclusions

- Climate change is with us now. Its pace may be quickening.
- There is extensive information on how Australia's climate is likely to change in future. www.climatechangeinaustralia.gov.au
- We need to **adapt** to the inevitable changes that will occur and **mitigate** (reduce) emissions to buy time and lessen the impacts.
- Start planning now.



Paul Holper
CSIRO Marine and Atmospheric Research

Ph: +61 3 9239 4661
Email: paul.holper@csiro.au
Web: www.cmar.csiro.au

www.greenhouse2009.com

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