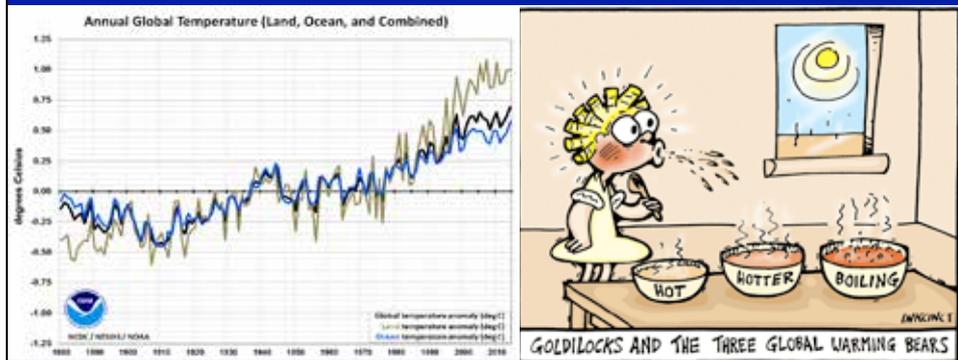


Climate change: Where are we now and where are we heading?

Professor David Karoly

School of Earth Sciences, University of Melbourne



Outline

- Different perspectives on climate change
- The latest assessment of climate change science
- Implications for greenhouse gas emission reduction targets globally and for Australia
- Challenges and opportunities for Central Victoria

References

IPCC AR5 *Climate Change 2013: The Physical Science Basis*
www.ipcc.ch

Bureau of Met & CSIRO *State of the Climate 2014*
www.bom.gov.au/state-of-the-climate/

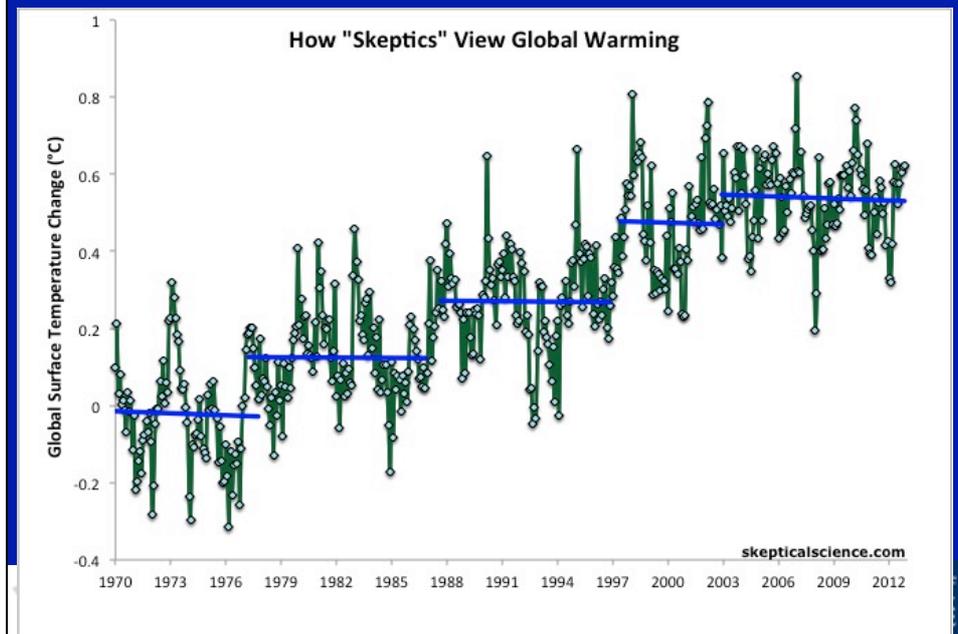
CSIRO/BoM Regional climate projections
www.climatechangeinaustralia.gov.au

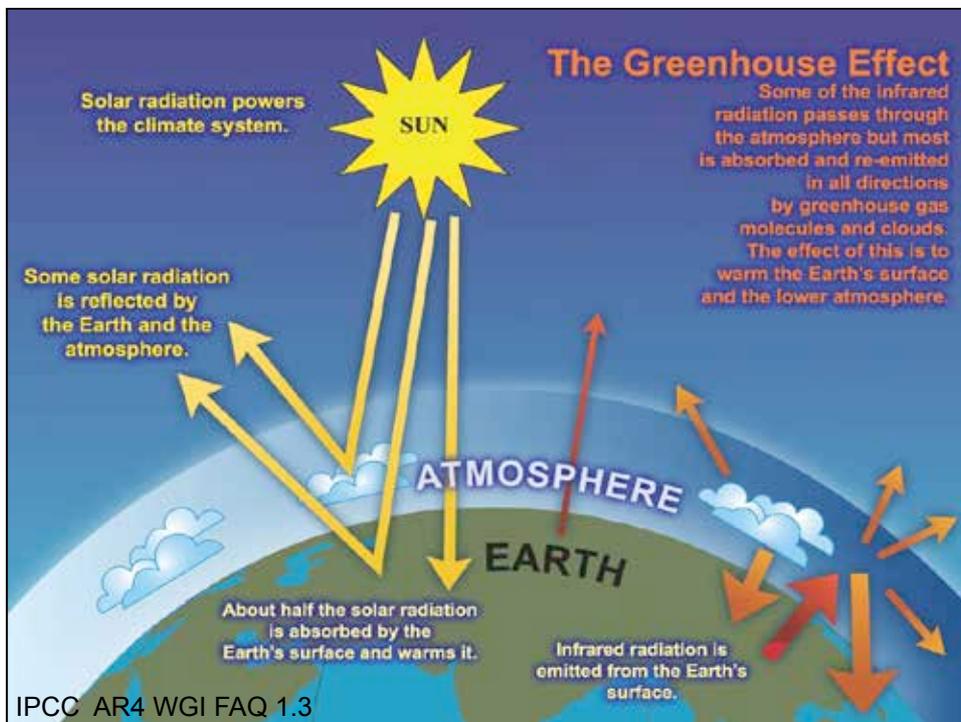
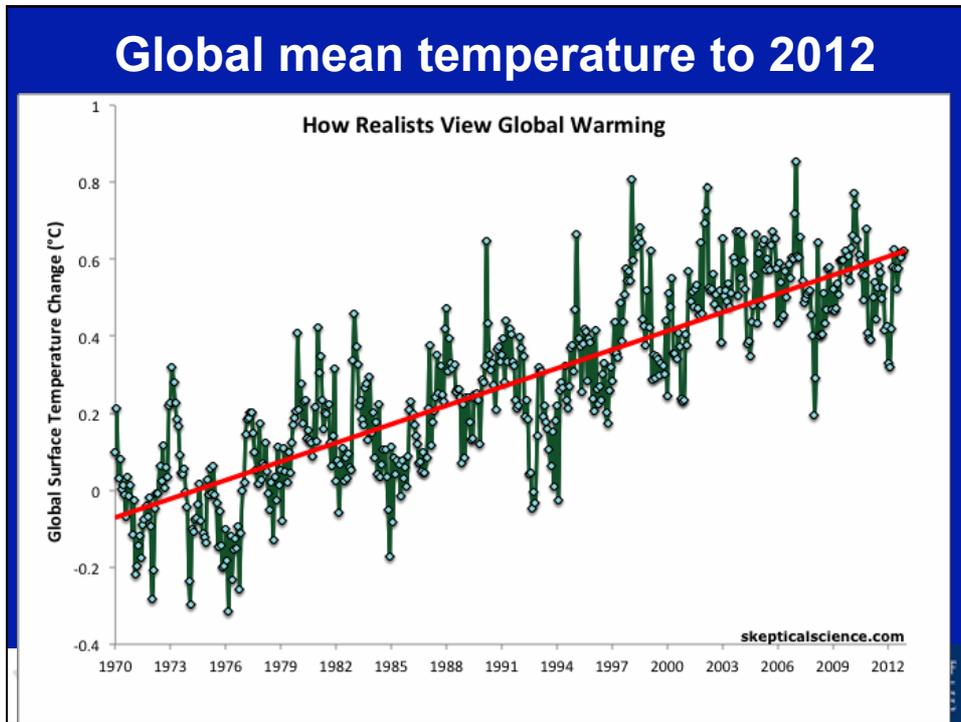
Some views from leaders

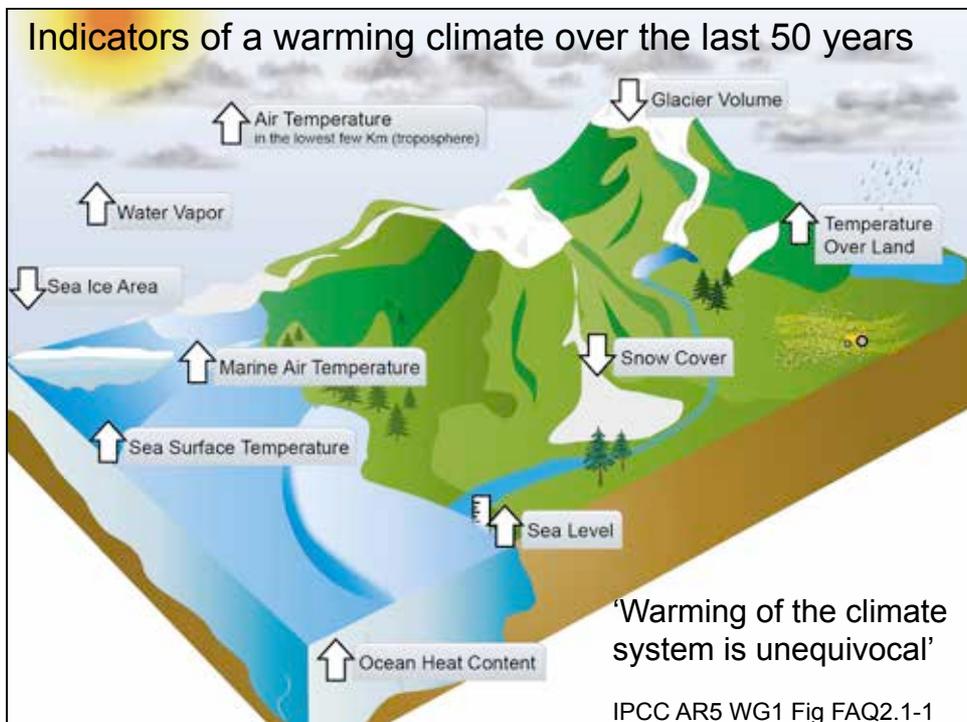
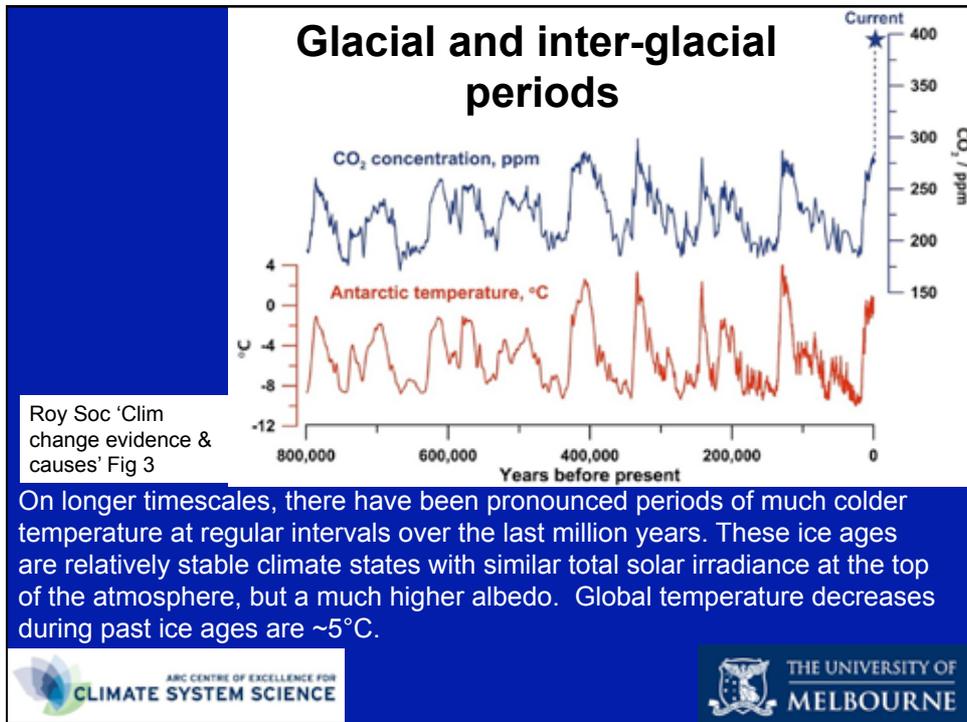
- Ban Ki Moon *“Climate change is the greatest threat facing humanity. It threatens to undo 50 years of our development work and it will impact the poor in the greatest sense.”*
- Barack Obama *“We will respond to the threat of climate change, knowing that the failure to do so would betray our children and future generations.”*
- Tony Abbott: *“Coal is good for humanity”*

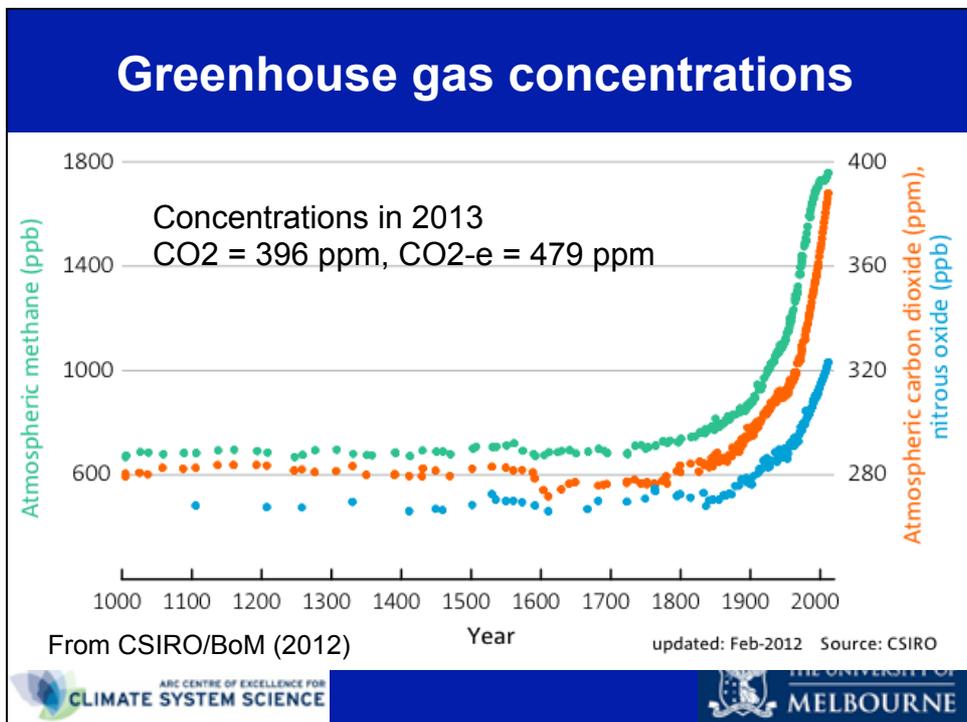
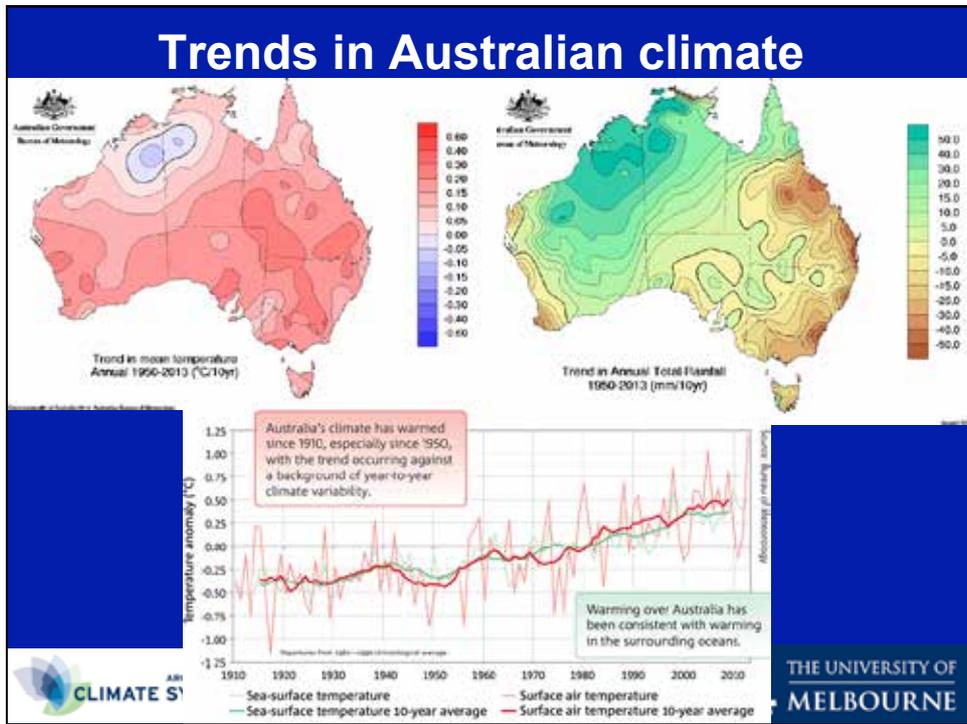


Global mean temperature to 2012



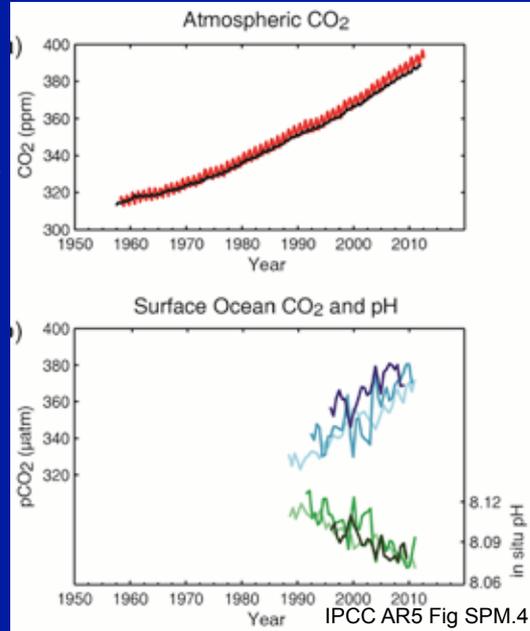






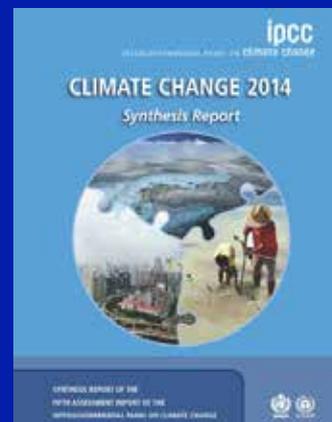
Observed changes

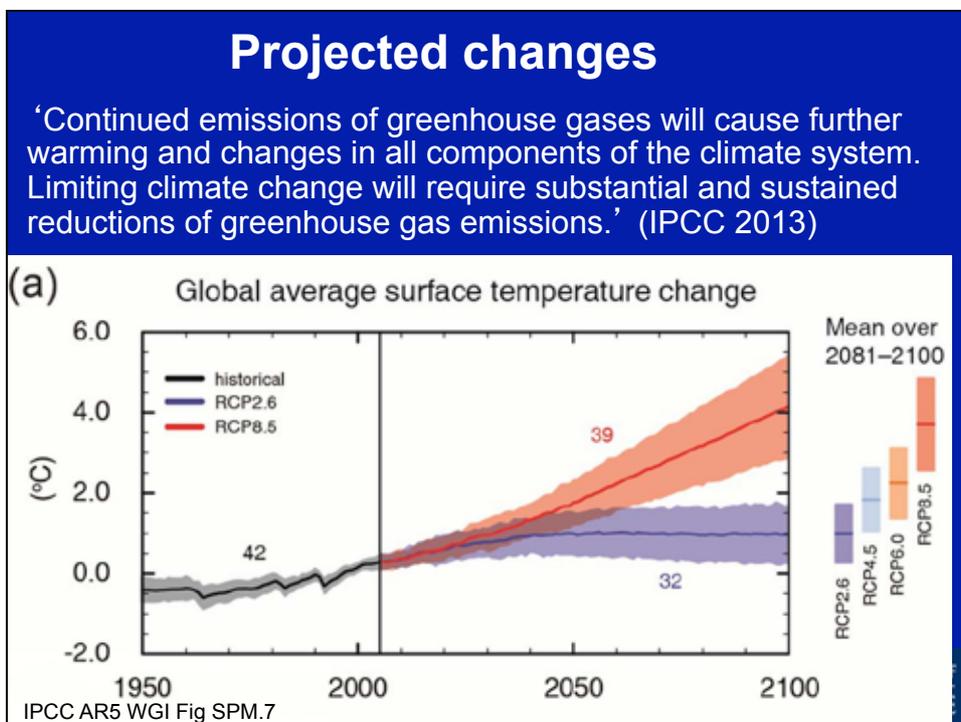
'The atmospheric concentrations of carbon dioxide (CO₂), methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. CO₂ concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification' (IPCC 2013)



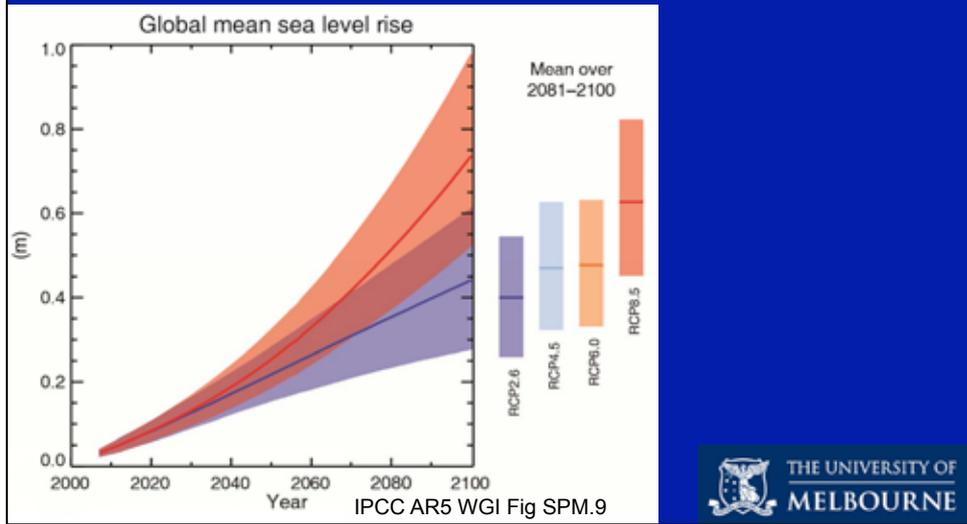
IPCC AR5 Synthesis Report 2014

- 'Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.'
- 'Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.'

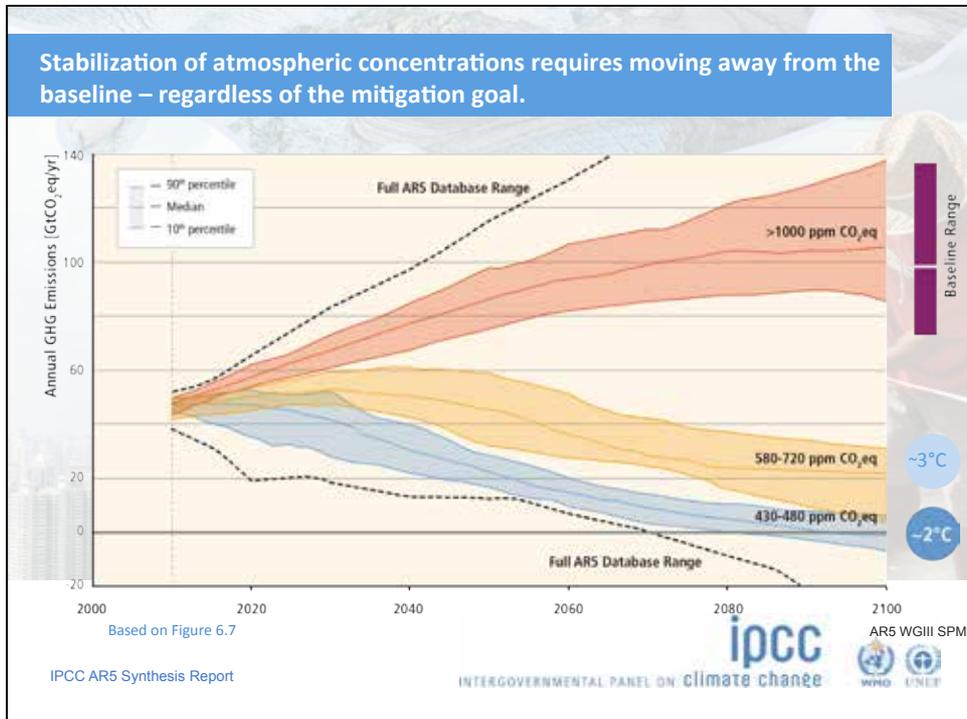




‘Global mean sea level will continue to rise during the 21st century. Under all RCP scenarios the rate of sea level rise will *very likely* exceed that observed during 1971–2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets.’ (IPCC 2013)



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



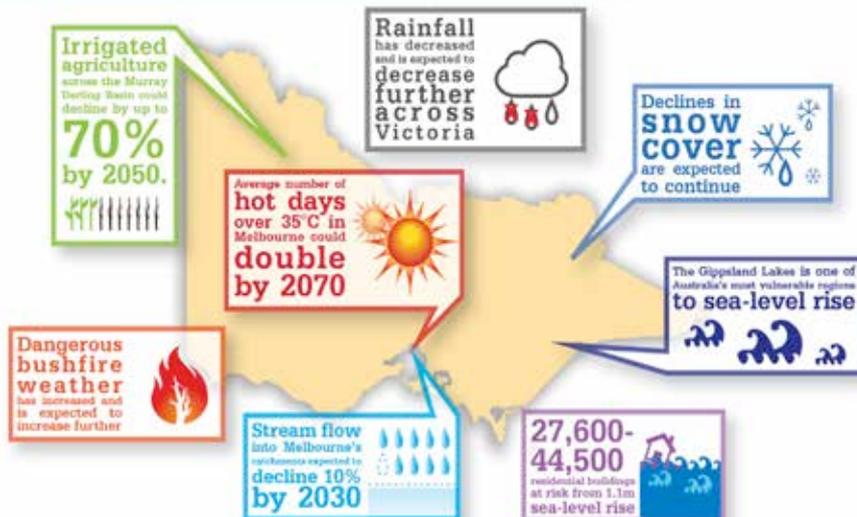
Future climate change in Goulburn Broken

	Present day	2070 low emissions	2070 high emissions
Ann mean temp	13.9°C	1.5°C (1.0 to 2.0°C)	2.8°C (1.9 to 3.9°C)
Summer rainfall	200mm	-2% (-17 to +14%)	-4% (-29 to +28%)
Winter rainfall	251mm	-7% (-17 to +3%)	-12% (-30 to +6%)
Benalla: frost days	46	28	17
Benalla: days over 35C	14	24	37

From www.climatechange.vic.gov.au/regional-projections

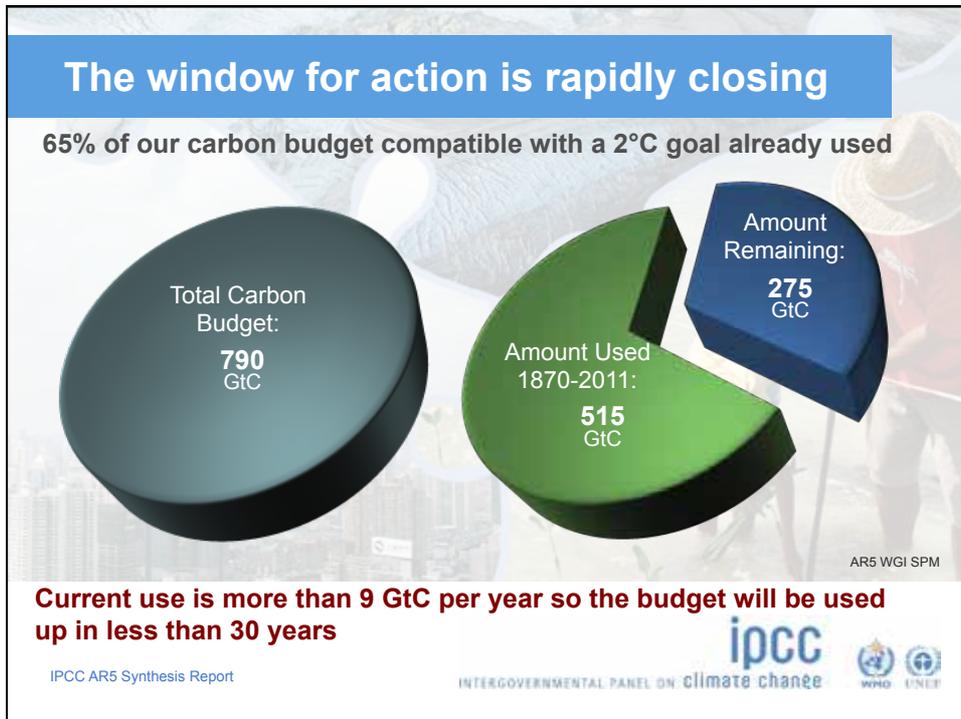


CLIMATE CHANGE RISKS TO VICTORIA



Find out more: www.climatecommission.gov.au





Limiting Temperature Increase to 2°C

-  Measures exist to achieve the substantial emissions reductions required to limit likely warming to 2°C
-  A combination of adaptation and substantial, sustained reductions in greenhouse gas emissions can limit climate change risks
-  Implementing reductions in greenhouse gas emissions poses substantial technological, economic, social, and institutional challenges
-  But delaying mitigation will substantially increase the challenges associated with limiting warming to 2°C

AR5 WGI SPM, AR5 WGII SPM, AR5 WGIII SPM

IPCC AR5 Synthesis Report

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WHO UNEP

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

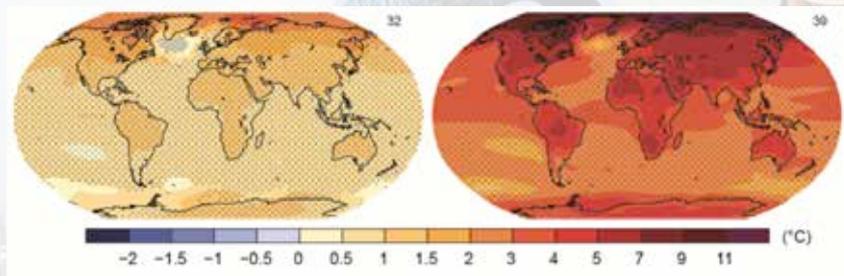
IPCC AR5 Synthesis Report



The Choices We Make Will Create Different Outcomes

With substantial mitigation

Without additional mitigation

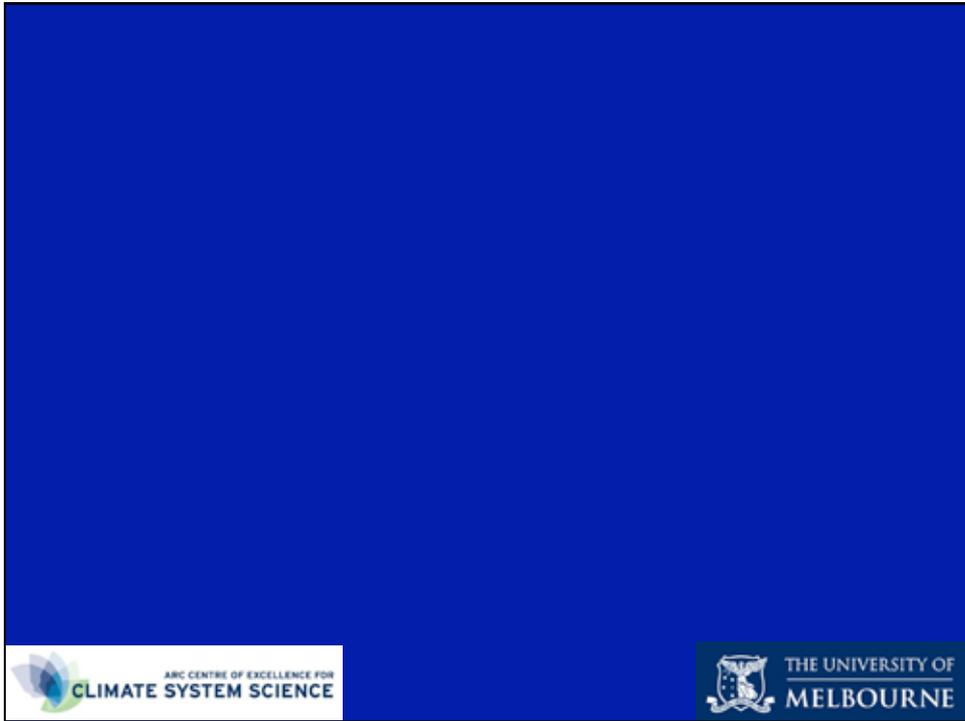


Change in average surface temperature (1986–2005 to 2081–2100)

AR5 WGI SPM

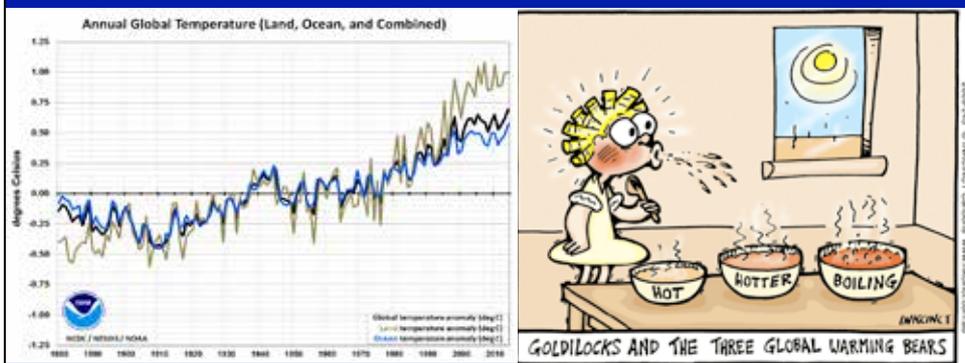
IPCC AR5 Synthesis Report





Climate change: What can we do about it?

Professor David Karoly
School of Earth Sciences, University of Melbourne



Impacts on the community

- Human health – more heat stress, infectious diseases
- Natural disasters – more severe weather, bushfires and coastal flooding
- Water resources – Reduced stream flow, reduced water for irrigation
- Agriculture – southward shift in growing regions, impacts from heat waves, some benefits from higher CO₂
- Coasts – risks from sea level rise and storm surges



Limiting Temperature Increase to 2°C



Measures exist to achieve the substantial emissions reductions required to limit likely warming to 2°C



A combination of adaptation and substantial, sustained reductions in greenhouse gas emissions can limit climate change risks



Implementing reductions in greenhouse gas emissions poses substantial technological, economic, social, and institutional challenges

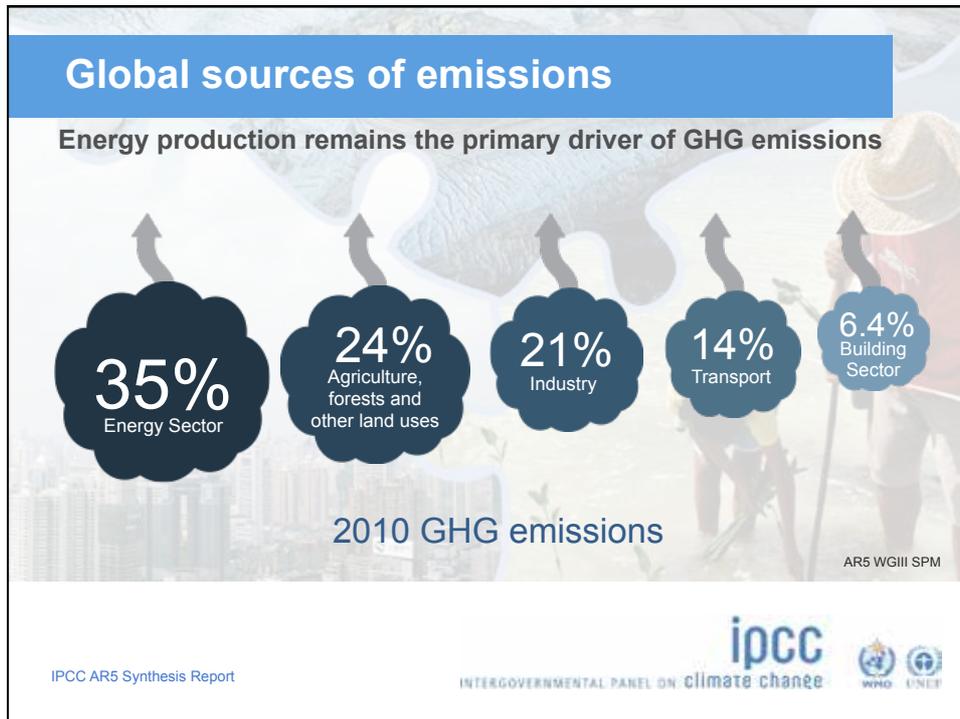


But delaying mitigation will substantially increase the challenges associated with limiting warming to 2°C

AR5 WGI SPM, AR5 WGII SPM, AR5 WGIII SPM

IPCC AR5 Synthesis Report





Opportunities to achieve 2°C?

- Transform the global energy system
 - Shift to low carbon energy (solar, wind, nuclear?, carbon capture and storage - CCS) (new industries, new jobs)
 - Massive improvement in energy efficiency (save money)
 - Electrification of transport and heating/cooling systems
- Phase out use of fossil fuels, except with CCS
- Abatement of emissions from agriculture and industry (higher production)
- End deforestation and increase biological storage of carbon (increase in soil fertility)

Adapting to a changing climate

- Reduce impacts of increased heat stress
 - improved building design, better insulation, more shade
 - Improved urban design, more trees
- Changes in farming practices
 - Changes in crops and livestock varieties
 - Changes in cropping to use less water and increase soil carbon
 - Plant more trees to increase shade and capture carbon
- Improve water use efficiency
 - Increased water recycling
 - Increased local water capture



Ambitious Mitigation Is Affordable

- Economic growth reduced by ~ 0.06% per year (BAU growth 1.6 - 3%)
- This translates into delayed and not forgone growth
- Estimated cost does not account for the benefits of reduced climate change
- Unmitigated climate change would create increasing risks to economic growth

AR5 WG1 SPM, AR5 WGII SPM

IPCC AR5 Synthesis Report



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

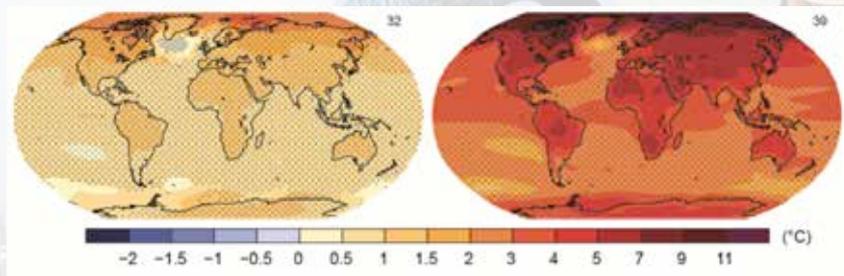
IPCC AR5 Synthesis Report



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

IPCC AR5 Synthesis Report

