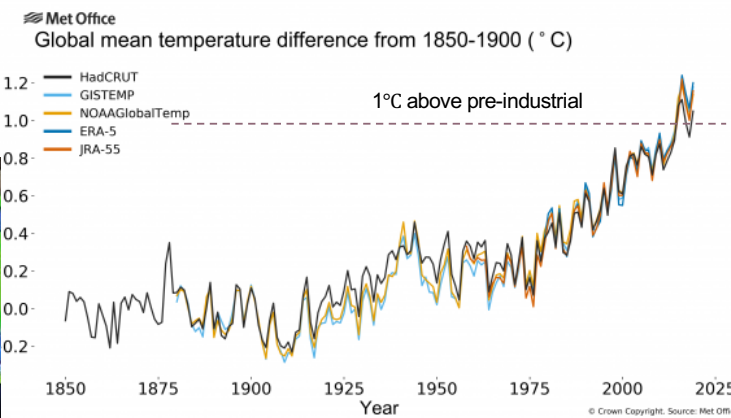


Earth Systems and Climate Change Hub
National Environmental Science Programme



Met Office
Global mean temperature difference from 1850-1900 (° C)

Legend: HadCRUT, GISTEMP, NOAA GlobalTemp, ERA-5, JRA-55

1°C above pre-industrial


Year: 1850, 1875, 1900, 1925, 1950, 1975, 2000, 2025

© Crown Copyright. Source: Met Office



Climate change science: a brief history, recent developments and projections of the future

Professor David Karoly, Earth Systems and Climate Change Hub
National Environmental Science Program, CSIRO

1



CONFRONTING CLIMATE CHANGE:
AVOIDING THE UNMANAGEABLE AND MANAGING THE UNAVOIDABLE





Scientific Expert Group Report on Climate Change and Sustainable Development.
Prepared for the 15th Session of the Commission on Sustainable Development.

Summary

- “Global climate change, driven largely by the combustion of fossil fuels and by deforestation, is a growing threat to human well-being in developing and industrialized nations alike.”
- “Significant harm from climate change is already occurring, and further damages are a certainty.”
- “The challenge now is to keep climate change from becoming a catastrophe.”

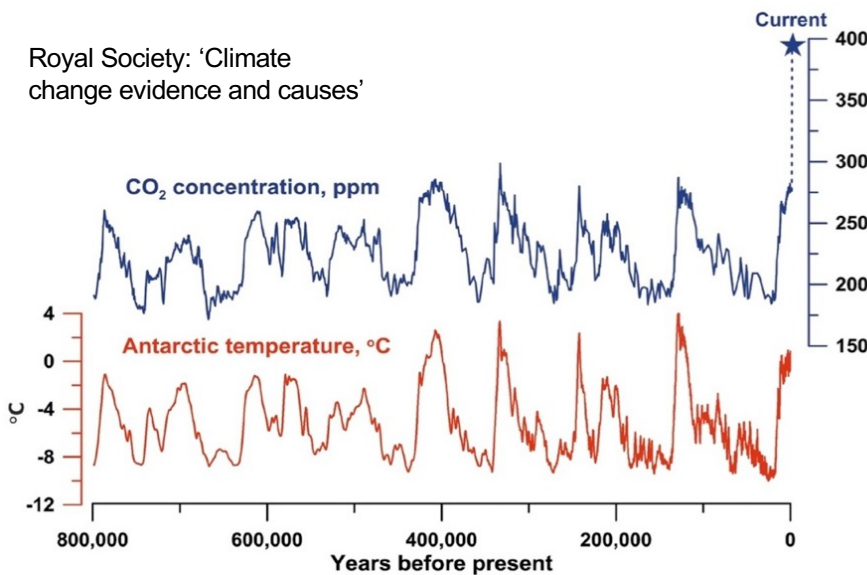
Published Feb 2007



2

Glacial and inter-glacial periods

Royal Society: 'Climate change evidence and causes'



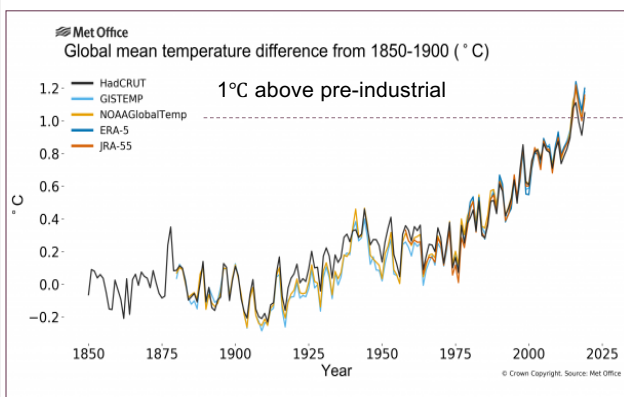
2019 CO₂ 410ppm

Regular ice ages and warmer interglacial periods are due to variations in the Earth's orbit around the Sun. Associated changes in CO₂ amplify the warming. Global average temperatures varied by about 5°C.

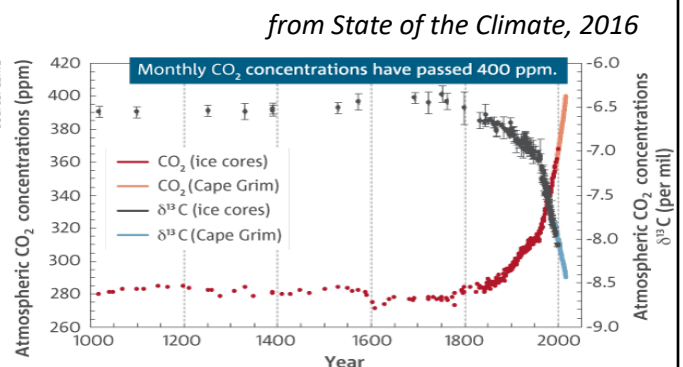


3

Observed global climate change



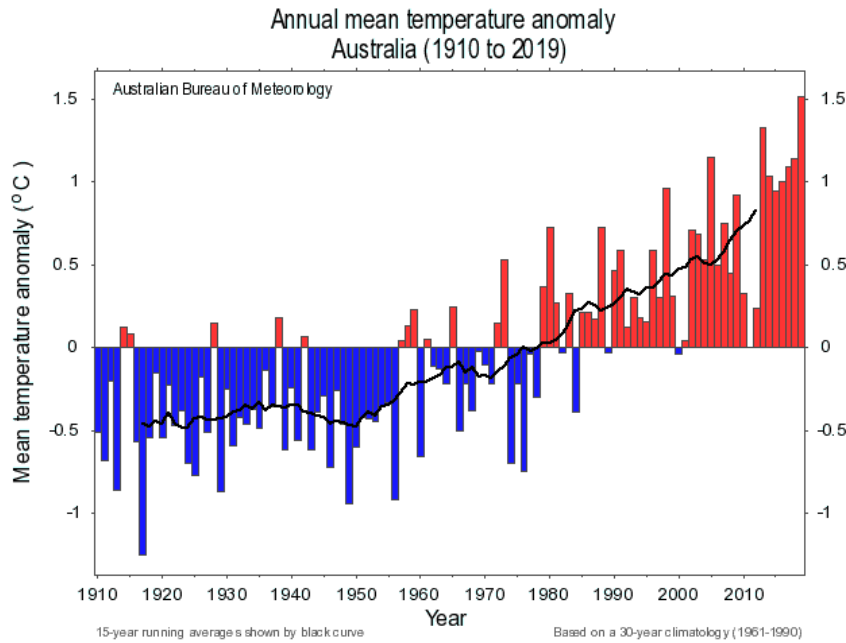
from WMO, 2020



The decrease in the ratio of the carbon-13 isotope ($\delta^{13}\text{C}$) that accompanies increasing CO₂ trends show that the sources are fossil fuel and land-use change.

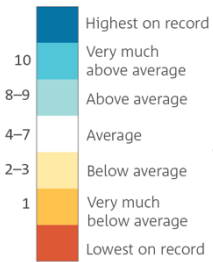
4

Observed Australian climate change



5

Rainfall decile ranges



Rainfall during April to October has been very low over parts of southern Australia in recent decades.

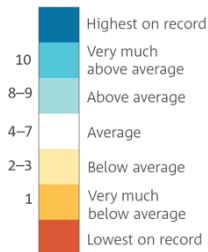
April-Oct rain deciles 2000-2019

from State of the Climate 2020

Observed Australian rainfall changes

Oct-April rain deciles 2000-2020

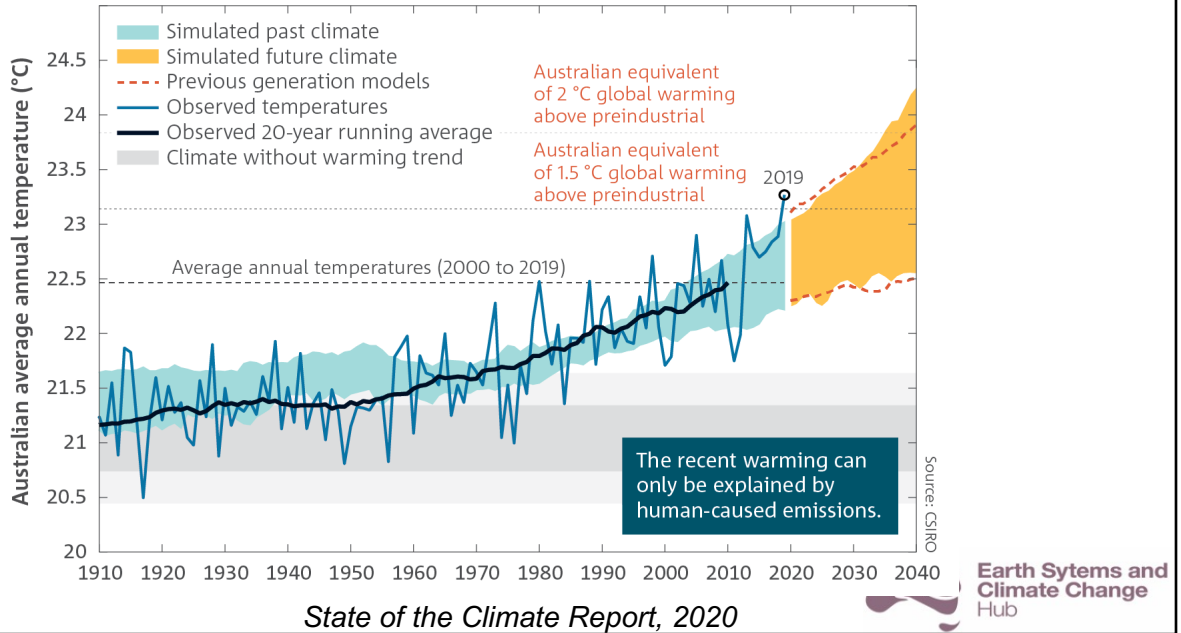
Rainfall decile ranges



Rainfall during the northern wet season has been very much above average for the last two decades.

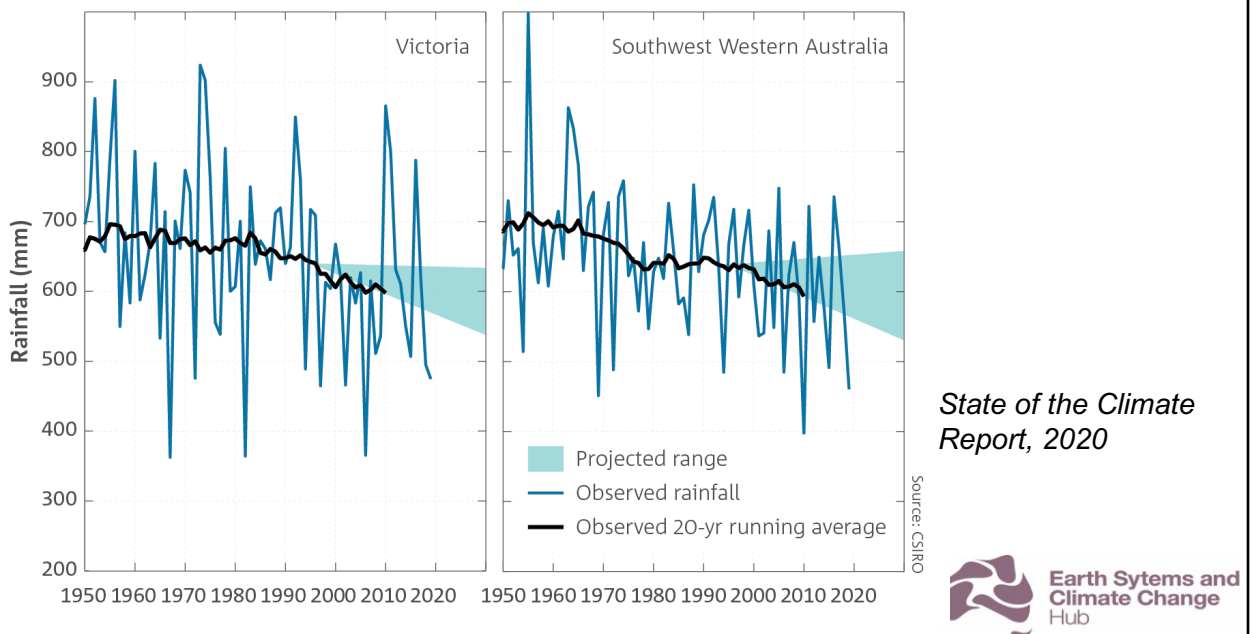
6

Observed and simulated Australia-wide temperatures



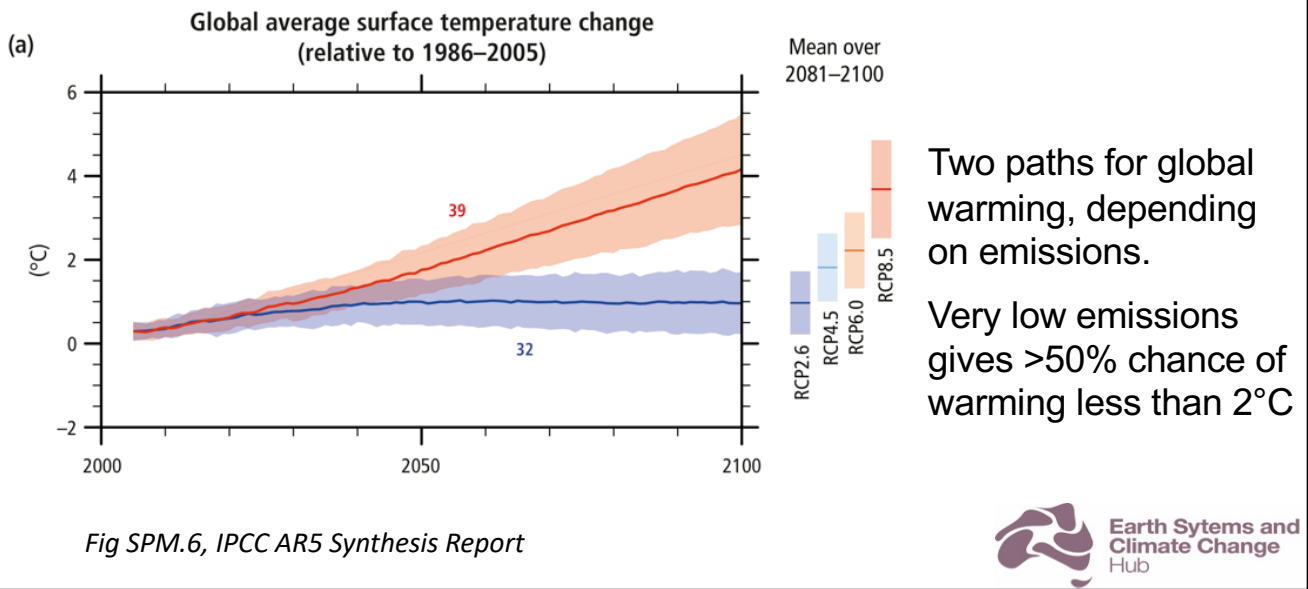
7

Observed and projected rainfall change

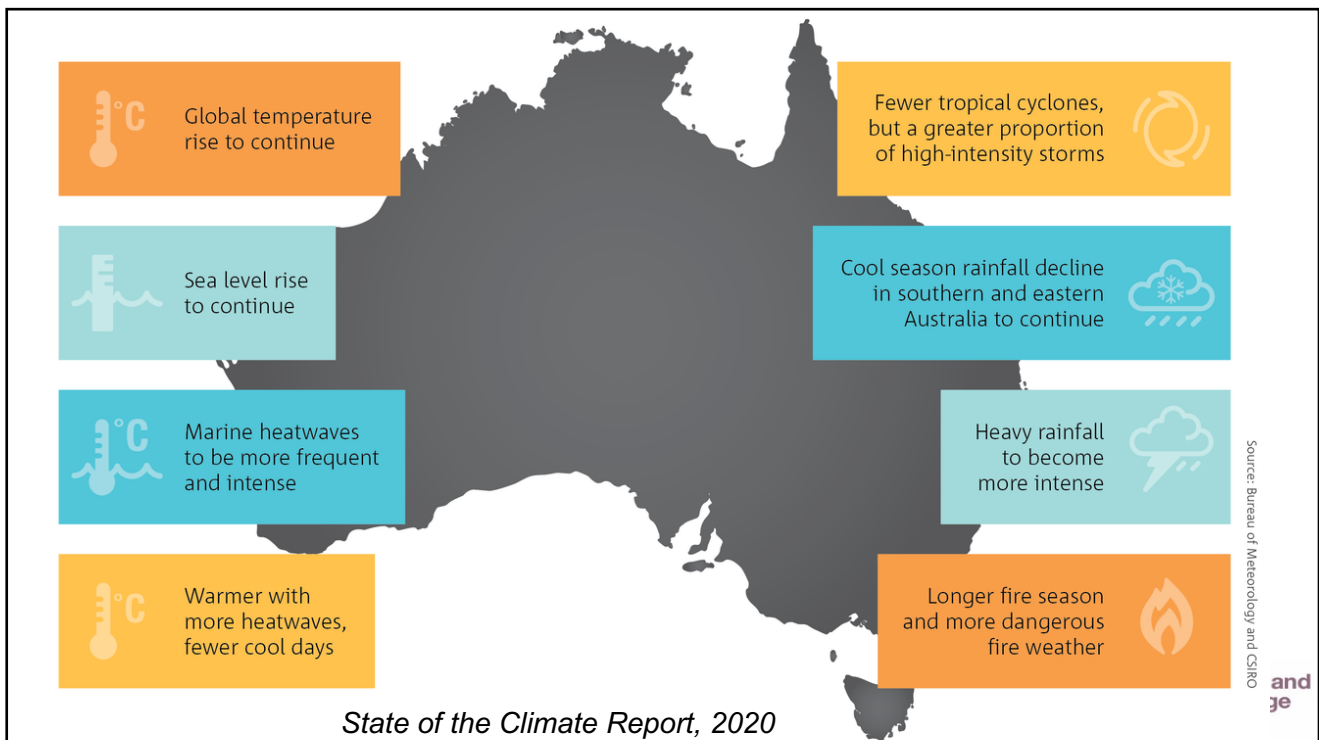


8

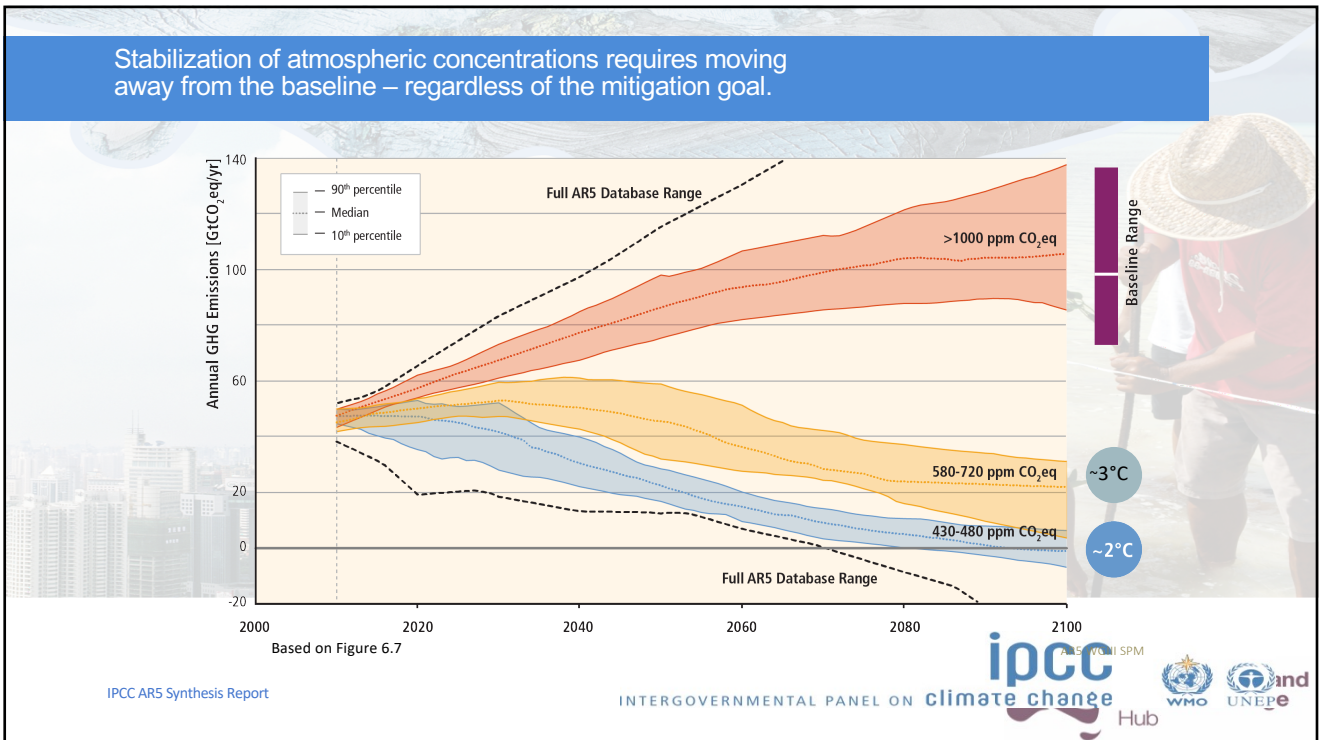
Projected climate change



9







10



11

Mitigation Measures

-  **More efficient use of energy**
-  **Greater use of low-carbon and no-carbon energy**
 - Many of these technologies exist today
-  **Improved carbon sinks**
 - Reduced deforestation and improved forest management and planting of new forests
 - Bio-energy with carbon capture and storage
-  **Lifestyle and behavioural changes**

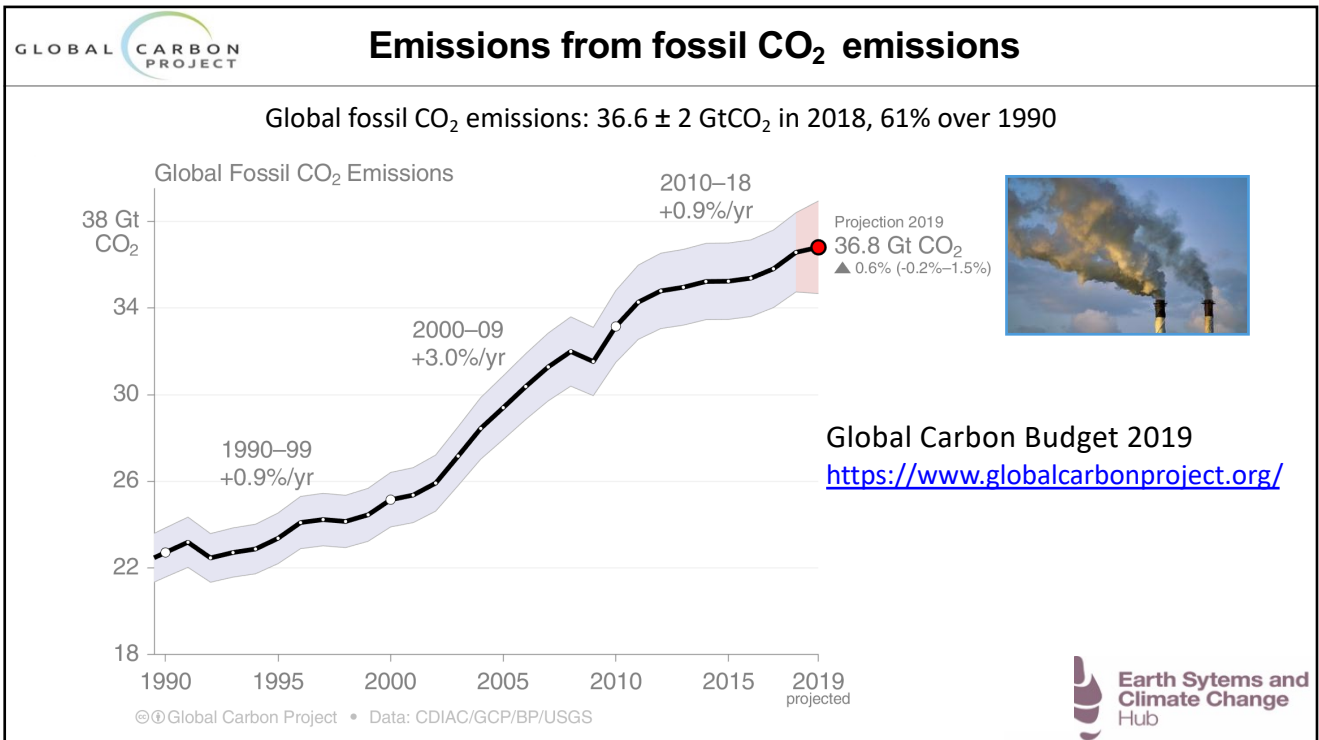
ARS WGIII SPM

ipcc
INTERGOVERNMENTAL PANEL ON climate change
Hub

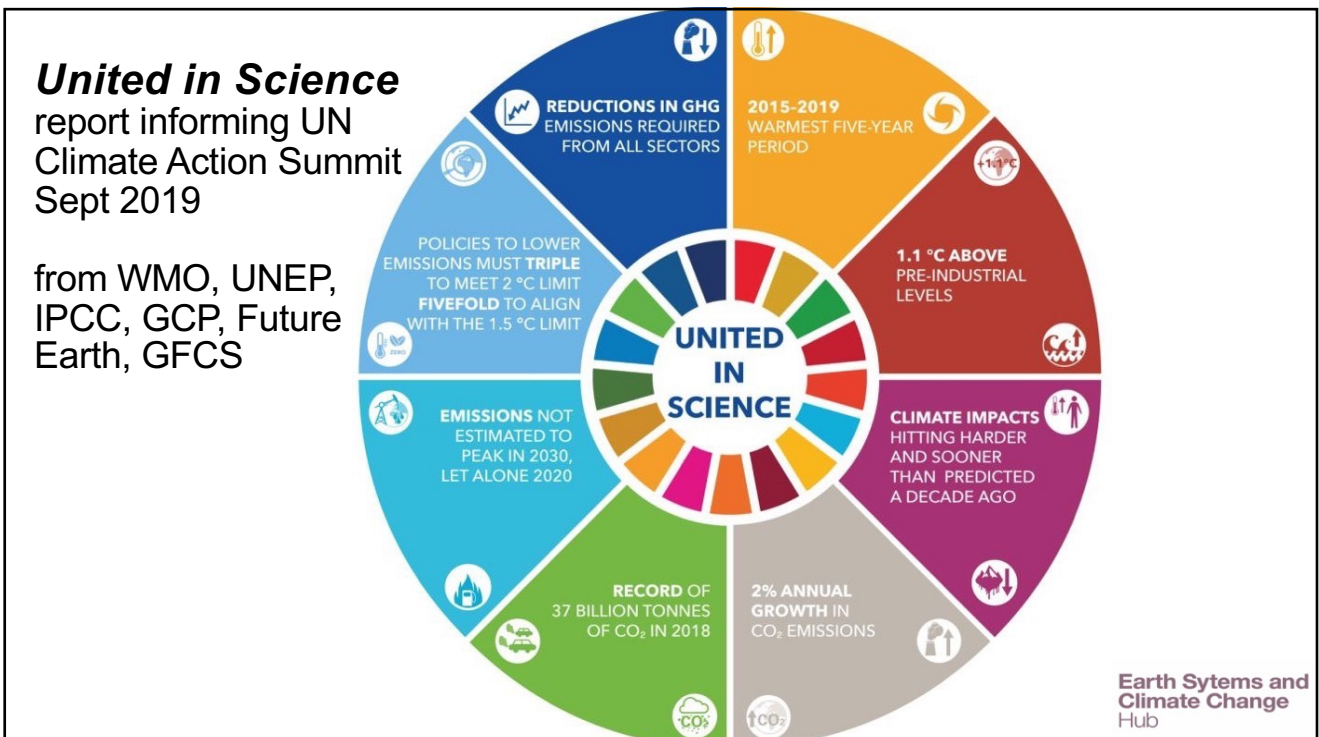
WMO and UNEP

IPCC AR5 Synthesis Report

12



13



14

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

ipcc
INTERGOVERNMENTAL PANEL ON climate change
Hub



15

References

- Scientific Expert Group on Climate Change (SEG), 2007 *Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable*
http://www.globalproblems-globalsolutions-files.org/unf_website/PDF/climate%20change_avoid_unmanagable_manage_unavoidable.pdf
- Aust Academy of Science *The science of climate change: Questions and answers 2015* <https://www.science.org.au/climatechange>
- CSIRO & Bur of Met State of the Climate 2020
<https://www.csiro.au/en/Showcase/state-of-the-climate>
- Global Carbon Project Carbon Budget 2019 www.globalcarbonproject.org/
- UN *United in Science*, 'Synthesis report latest climate science' UN Climate Action Summit, 2019
<https://www.ipcc.ch/2019/09/22/united-in-science-report-climate-summit/>

Earth Sytems and
Climate Change
Hub



16



National Environmental Science Programme



FOR MORE INFORMATION
Prof David Karoly
David.Karoly@csiro.au

www.nespclimate.com.au

The Earth Systems and Climate Change Hub is funded by the Australian Government's National Environmental Science Program, with co-investment from the following partner agencies

