



Australian  
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# ANU Climate Update

2021: extremes  
with a glimmer of  
hope



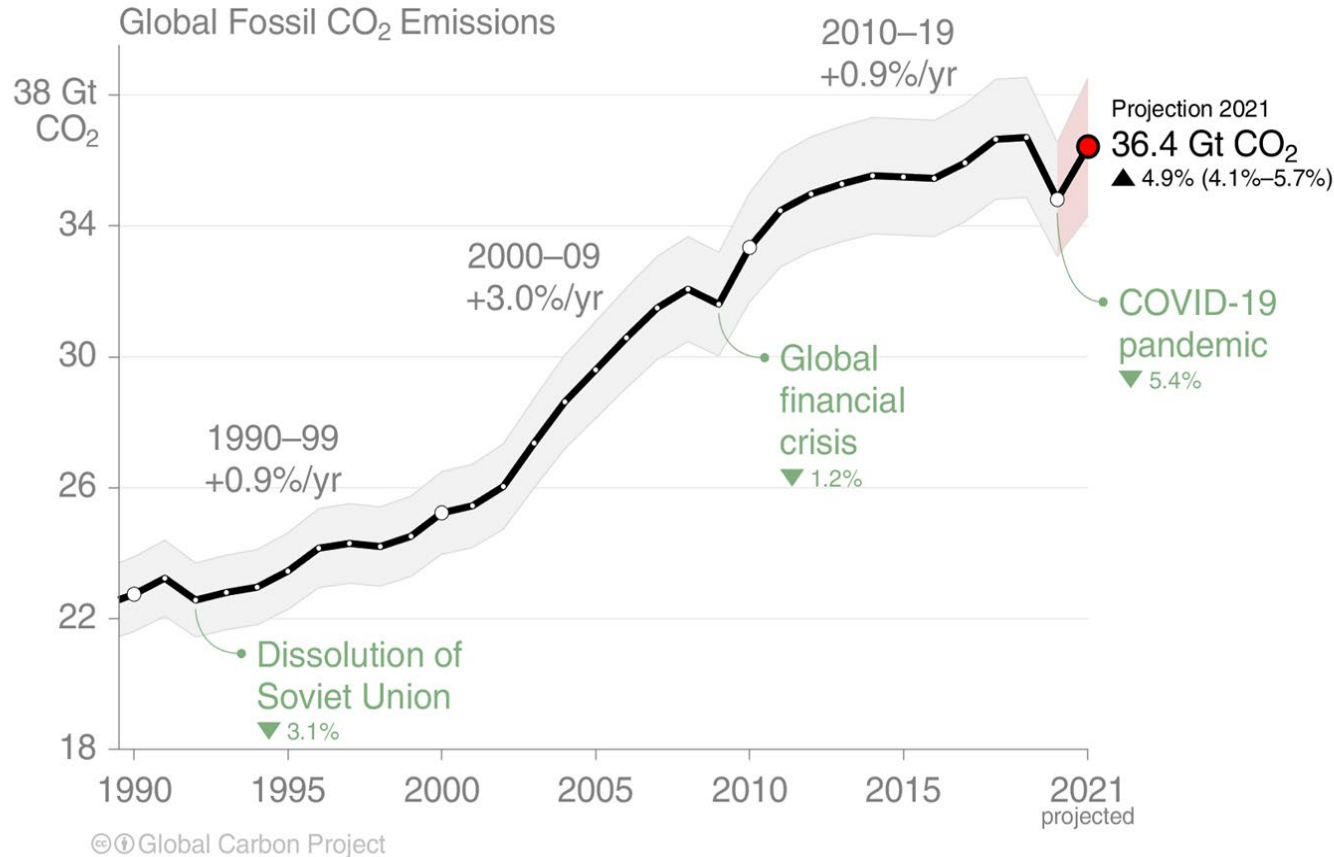
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Vice Chair, IPCC Working Group II

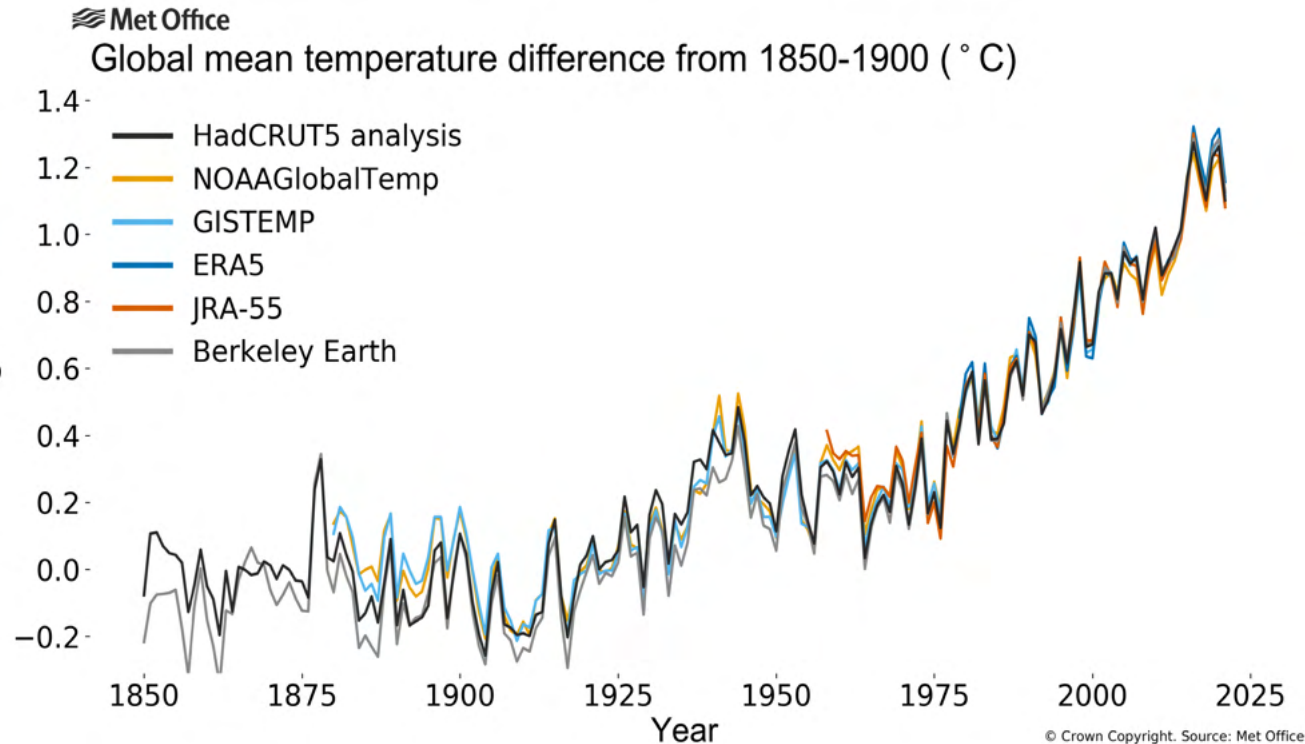
[@ProfMarkHowden](#)

# CO<sub>2</sub> emissions increasing (again)



- CO<sub>2</sub> today 418ppm (pre-industrial levels were about 280ppm) highest in at least 2M years
- Record levels of methane, nitrous oxide and other GHGs

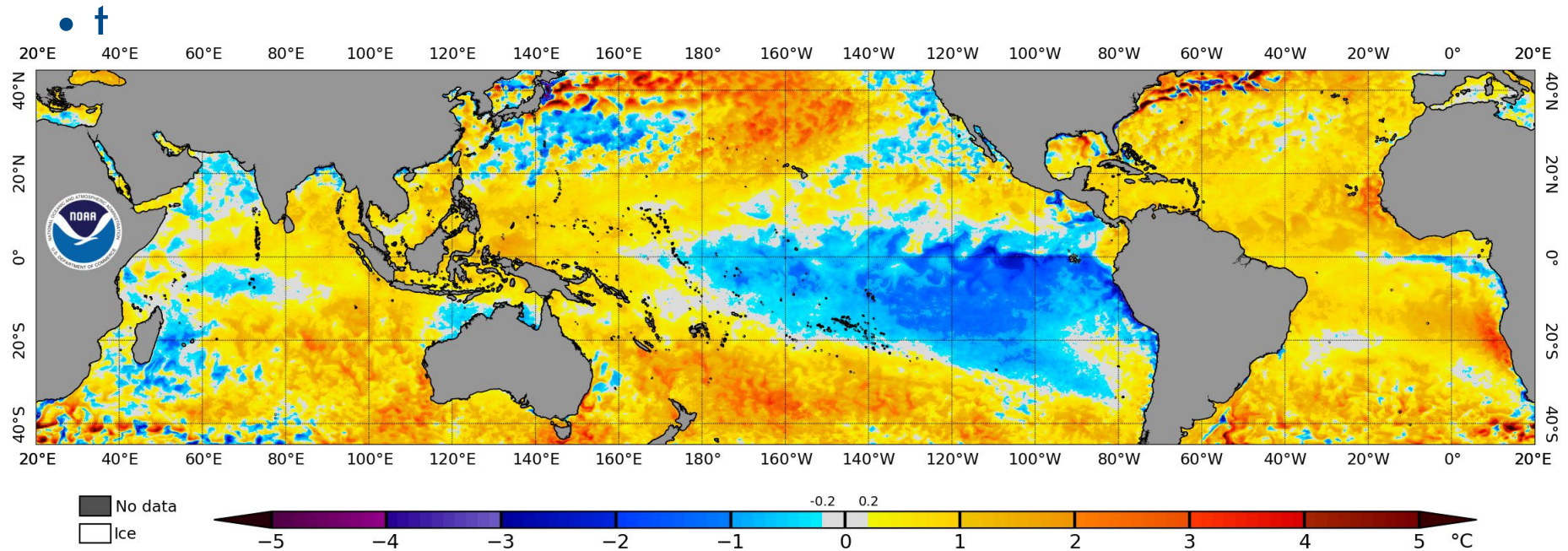
# Globally – equal hottest on record



- Fifth to seventh warmest year on record ( $1.11^{\circ}\text{C}$  above the pre-industrial average)
- 19th warmest in Australia ( $0.56^{\circ}\text{C}$  above the recent average)
- Cooled by a La Niña event



# Cooling influence of La Niña



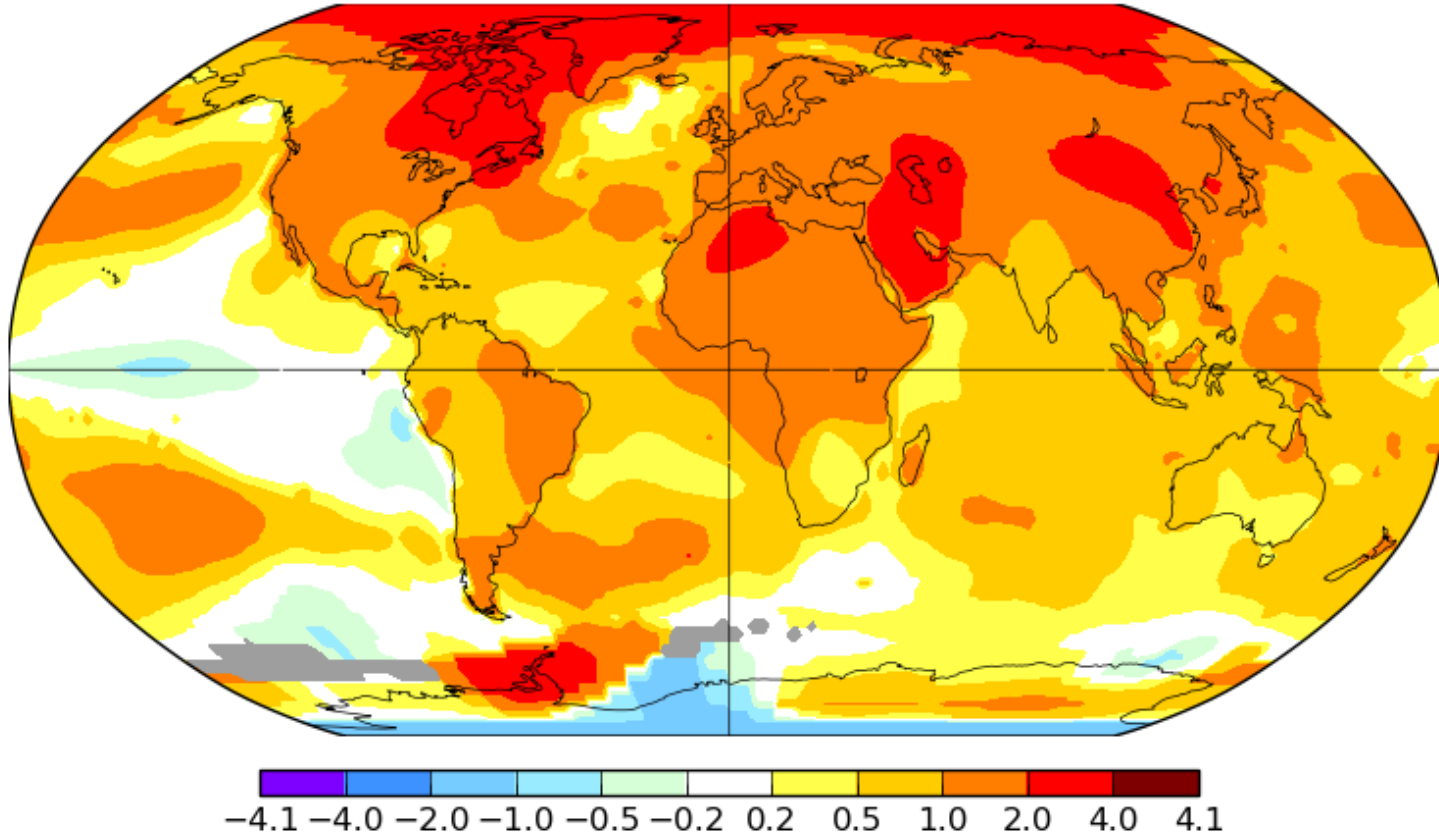


# High temperatures widespread

Annual J-D 2021

L-OTI(°C) Anomaly vs 1951-1980

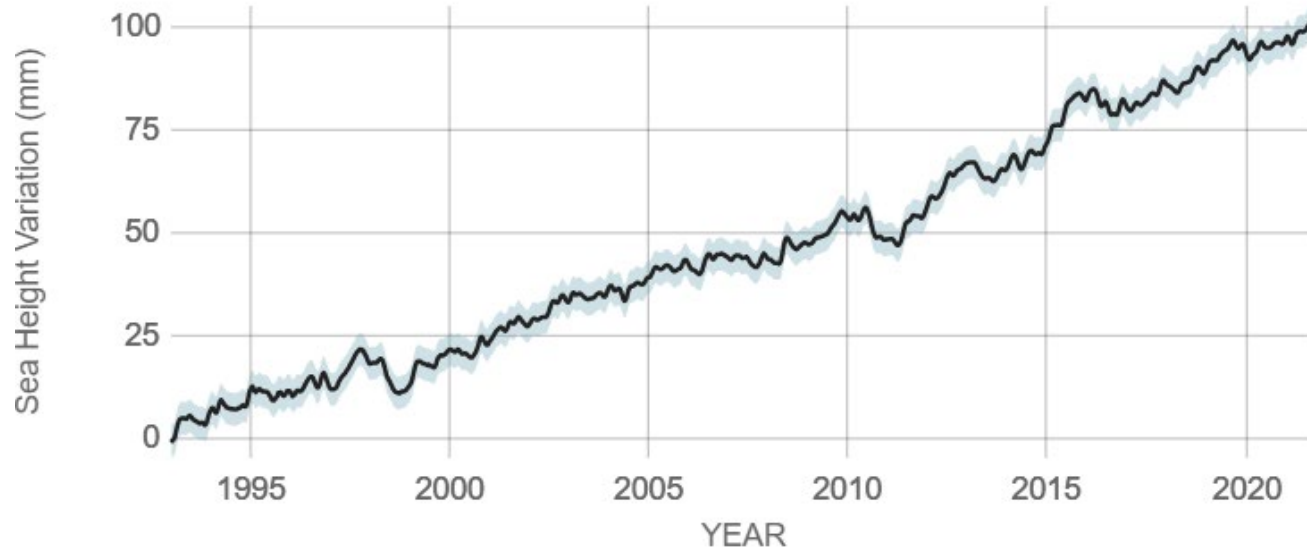
0.85







# Sea levels keep getting higher



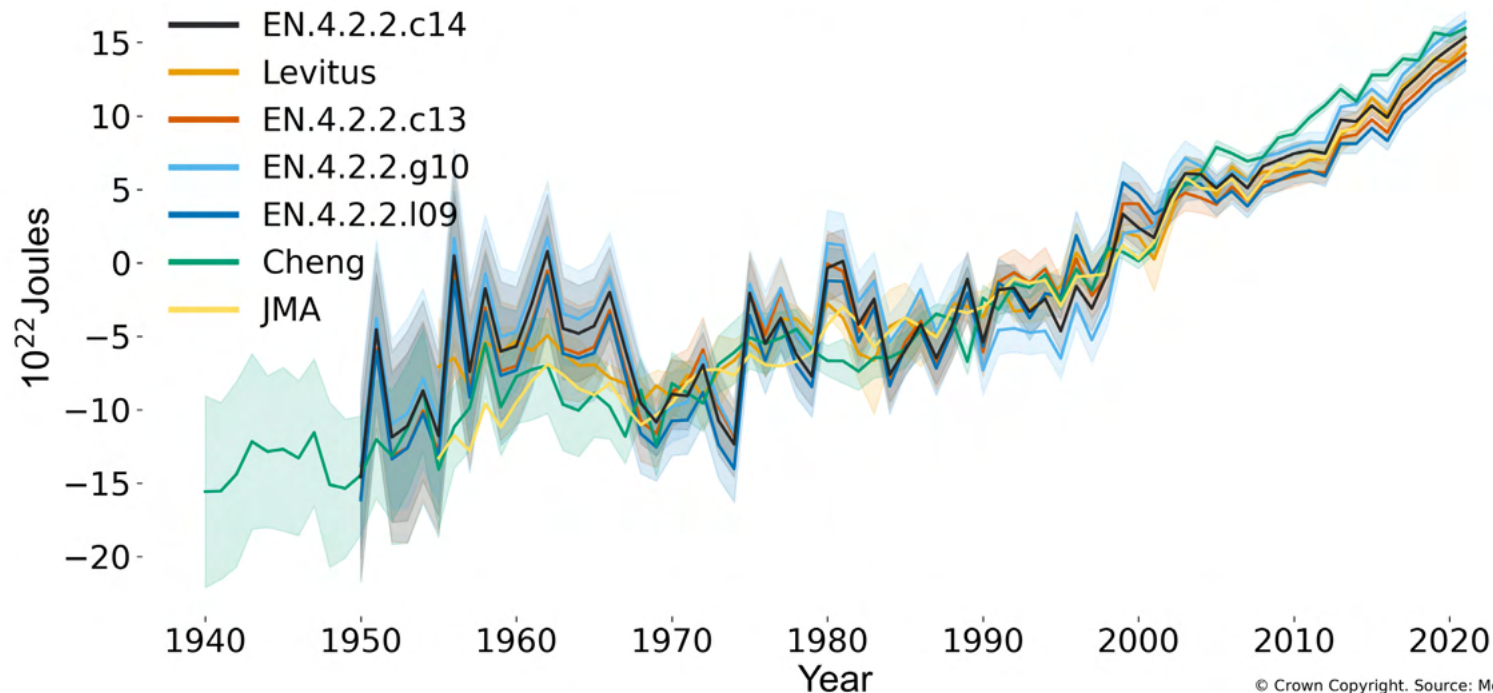
Source: [climate.nasa.gov](https://climate.nasa.gov)

- Rose by about 4.5mm last year
- Continuing the acceleration seen over the past decades
- Other changes include acidification and de-oxygenation

# Seas keep getting hotter

 Met Office

Global ocean heat content difference from 1981-2010 ( $10^{22}$  Joules)



© Crown Copyright. Source: Met Office

# A year of extreme climate events

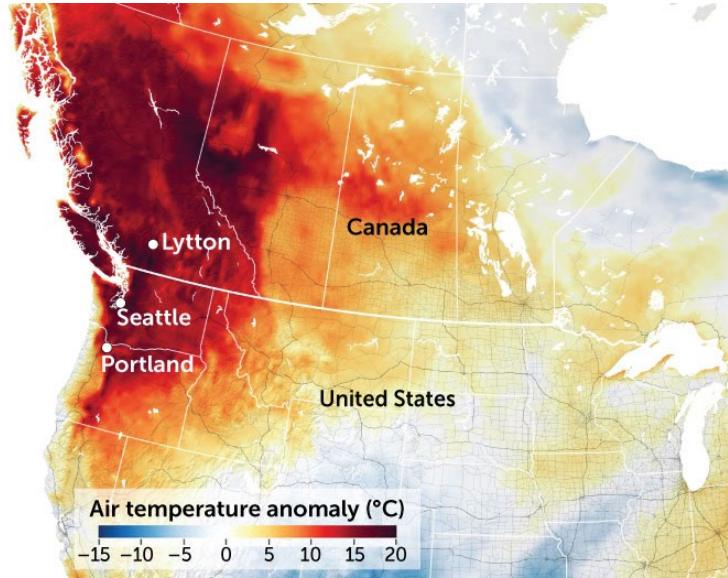
- WA heatwaves and fires (both ends of the year)
- Floods in eastern Australia (both ends of the year)





# Pacific Northwest heat-dome event

- Shattering prior records – up to 49.6°C
  - accompanying wildfires, water supply, health etc issues
  - ‘virtually impossible’ without climate change influence
  - in a 2°C scenario this may occur every 5-10 years





# Wildfires

- California fires – doubled previous record area burnt
- Mediterranean, Siberia



# Texas power crisis

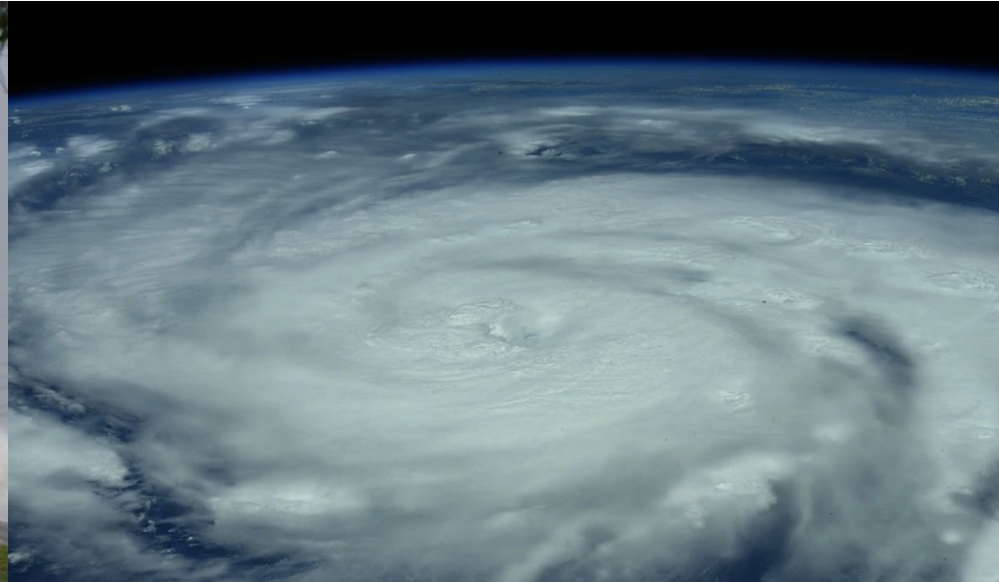
- ‘the worst energy infrastructure failure in history of Texas’, leading to shortages of water, food, and heat
- 10M people without power, up to 700 deaths
- Costliest winter event on record – up to \$195B damages exposing unadapted systems and issues with governance





# Hurricane Ida

- 114 deaths and \$75B damages
- 4<sup>th</sup> costliest hurricane in US and fifth globally
- remnants generated tornadoes and flooding





# 2021 European floods

- Devastating flooding
- 220 people killed and Euro 46B cost
- Costliest weather event in Europe to date





# Floods in Central China

- Extensive and damaging floods from ‘a years rainfall in a day’
- Estimated 400 deaths, hundreds of thousands of homes flooded, evacuation of over 800 000 people



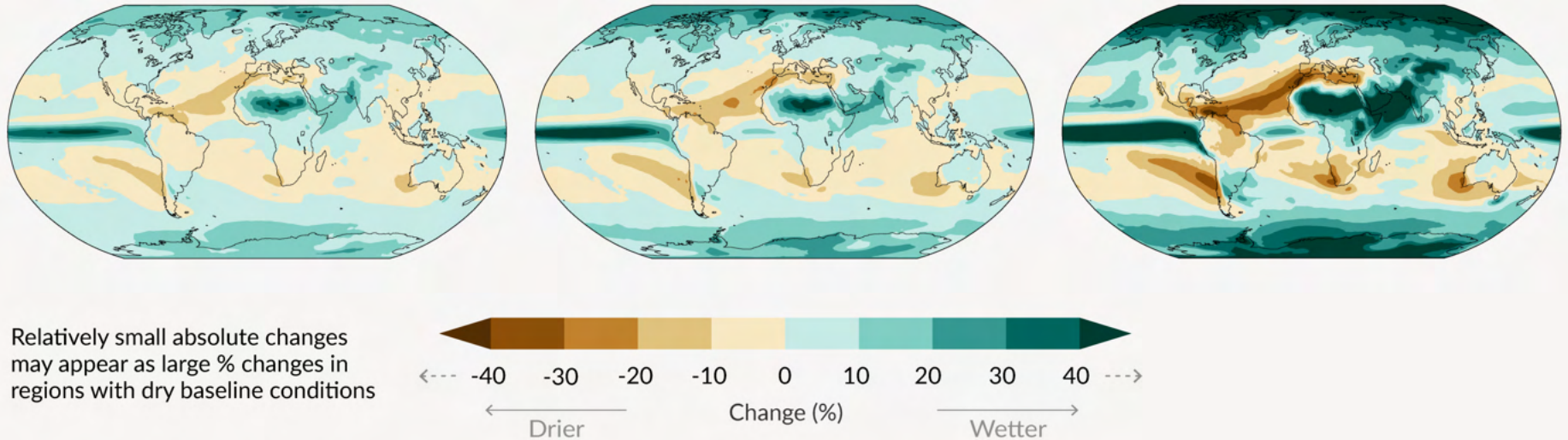
- Human influence on the global climate is unequivocal
- Widespread, rapid, intensifying and unprecedented changes in many different aspects of the climate system
- Extreme climate events more frequent and more severe
- Clear that we can choose the climate of our future via different GHG emission trajectories
  - immediate, rapid and large-scale action if we are to stick to Paris Agreement
- Both existing and projected changes mean that climate adaptation is now unavoidable and urgent

# Changes in rainfall: spatially variable

...at 1.5°C

...at 2°C

...at 4°C



- ENSO-based rainfall variability likely to increase
- Rainfall intensity increase including that associated with cyclones
- Intensification of the mid-latitude drying trends

# COP26 and associated initiatives

- Enhanced national commitments with annual updates
- Paris 'rulebook' agreed including the global C trading market
- Loss and damage – recognition but little action
- Recognition of the core role of science
- Glasgow Leaders' Declaration on Forests and Land Use
- International Sustainability Standards Board
- Methane Pledge – now 111 countries signed up
- Clydebank Declaration for green shipping corridors
- Ongoing discussion of Carbon Border-Adjustment Mechanisms

# Energy transition is accelerating

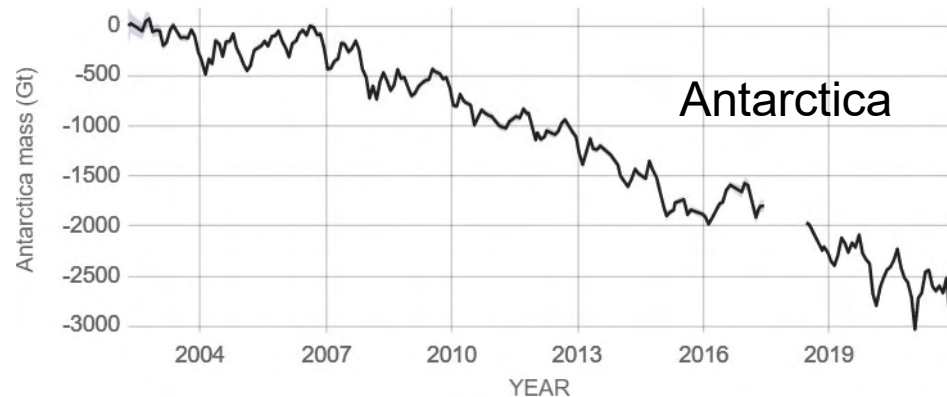
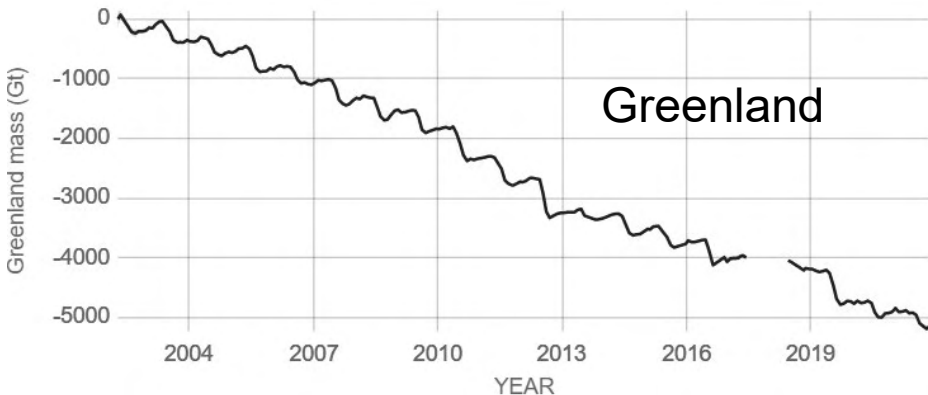
- Renewables are 'cheapest electricity in history'
- 290GW of renewables – beating 260GW record last year
- Global Energy Alliance – deliver clean energy to 1B people
- 1 in 10 new passenger vehicles globally are re-chargeable
  - in Australia it is 2.4%
- IEA report: to meet net-zero by 2050, no investment or exploitation of new oil and gas and no new coal power stations

**Australian power prices now 'among lowest in the world' as renewable energy drives costs down**



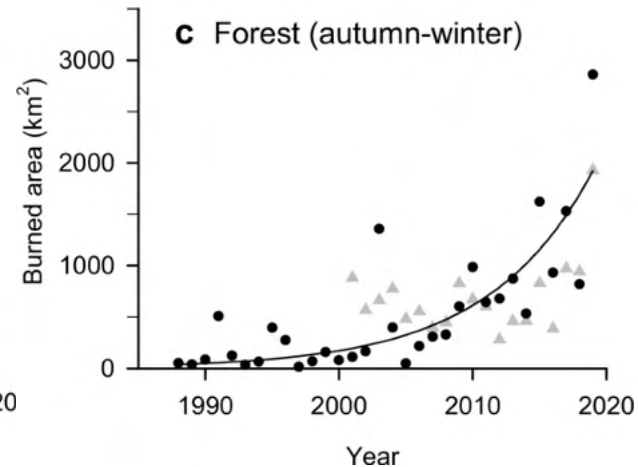
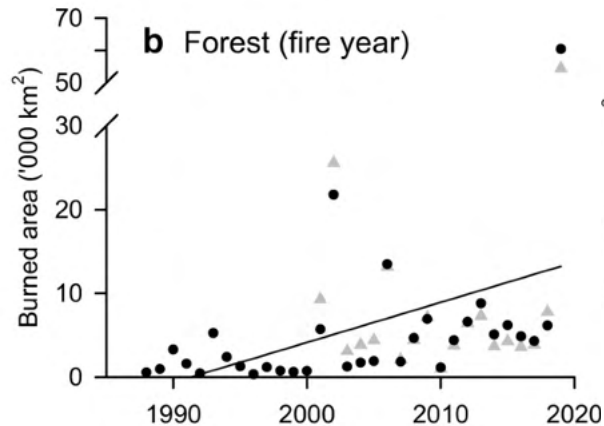
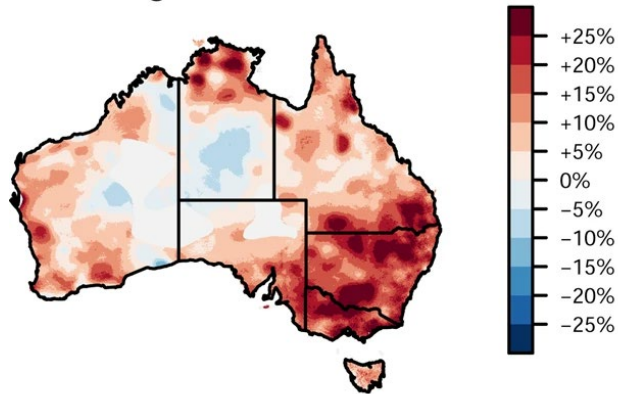
# Cryosphere disruption

- Increasing concerns about icesheet stability
- First rainfall recorded on highest point of Greenland
- Atlantic overturning circulation is at its weakest in at least 1600 years



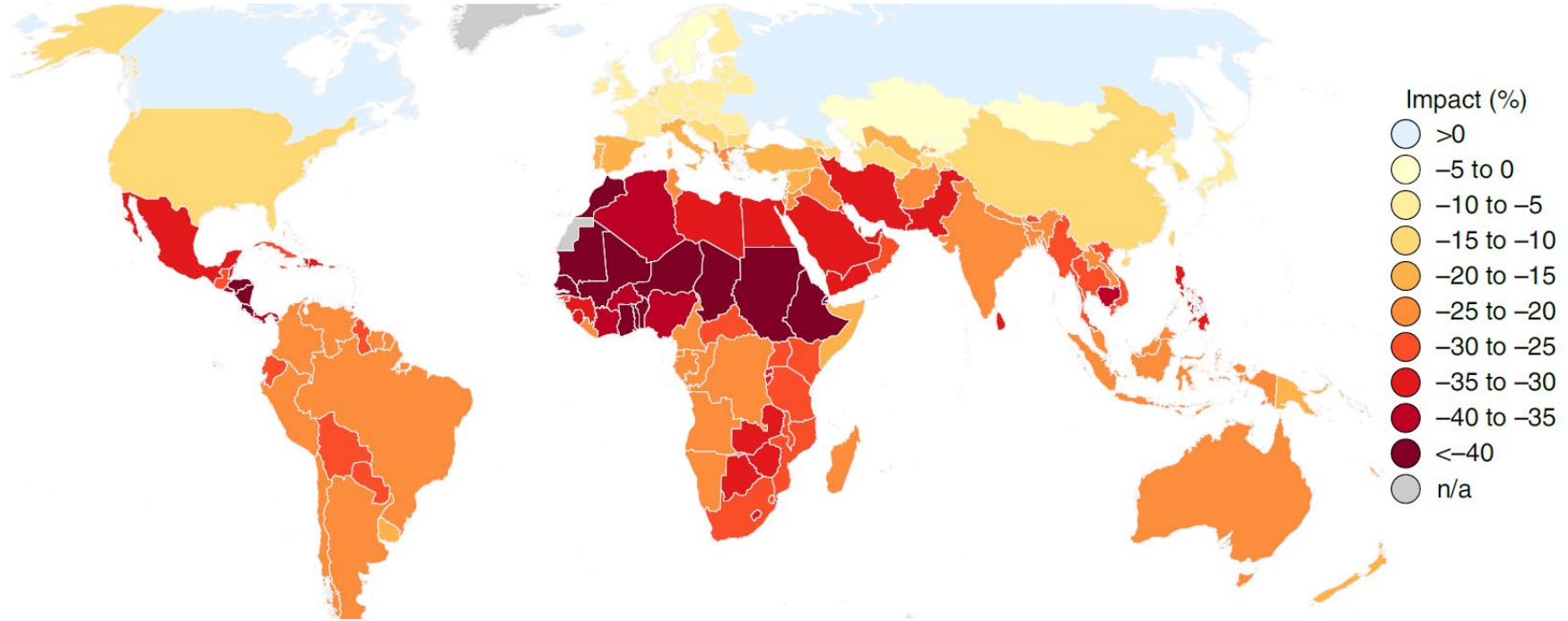
# Fire risk is increasing

a) Change in mean FFDI



**Increased ENSO sea surface temperature variability  
under four IPCC emission scenarios**

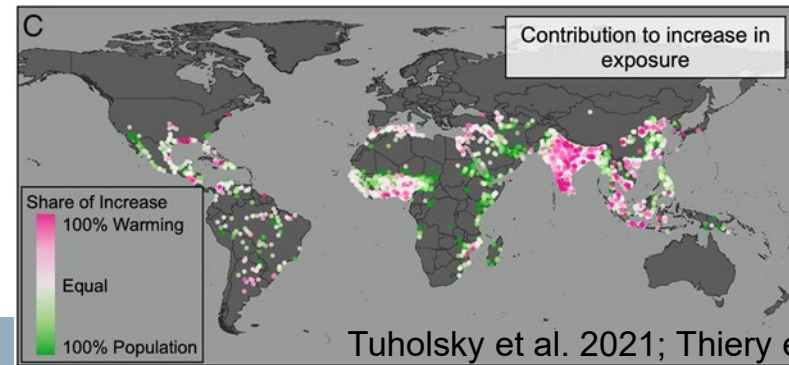
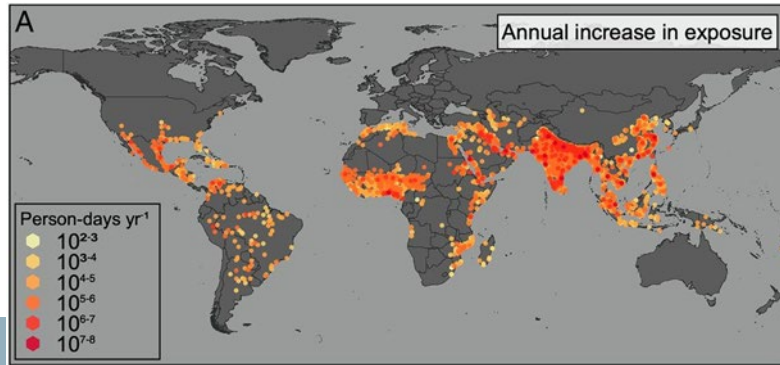
# Climate changes drag back global ag productivity



- Potential global average agricultural productivity reduced by 21%

# Urban heat exposure

- Globally, since 1983, urban exposure increased nearly 200%, affecting 1.7 billion people
- Total urban warming elevated exposure rates 52% above population growth alone
- Locally-tailored adaptations and early warning systems are needed to reduce harm





# Urban heat exposure

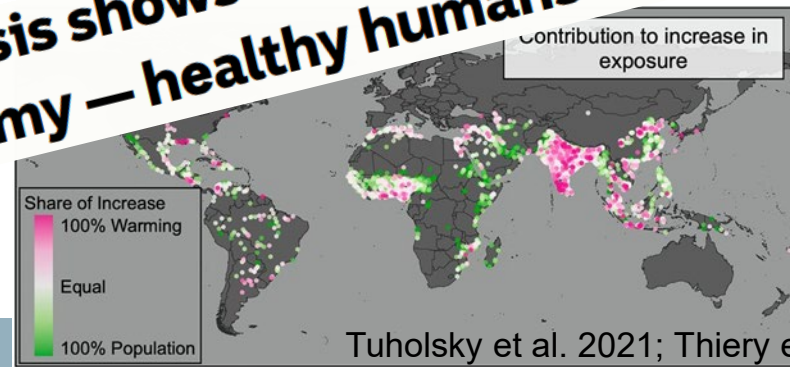
- Globally, since 1983, urban exposure increased, affecting 1.7 billion people
- Total urban warming equivalent to 1.7°C for the population

Today's kids will live through three times as many climate disasters as their grandparents, study says

Published in the journal Science, the findings quantify the "intergenerational inequality" of climate change.

Many systems are

COVID supply chain crisis shows what's really at the heart of the economy — healthy humans







# Just when you needed a swim ...

## Climate crisis pushing great white sharks into new waters





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# Courts

**States and cities scramble to sue oil companies over climate change**

**German climate change law violates rights, court rules**

**Class action to stop planned coal mine extension filed by climate action-focused Australian teenagers**

**Australian Government sued by 23-year-old Melbourne student over financial risks of climate change**

**Companies warned that 'greenwashing' could have legal consequences**

**Dutch supreme court upholds landmark ruling demanding climate action**

**Philippines: Landmark decision by Human Rights Commission paves way for climate litigation**

# Investors and banks

Shell faces shareholder rebellion over fossil fuel production

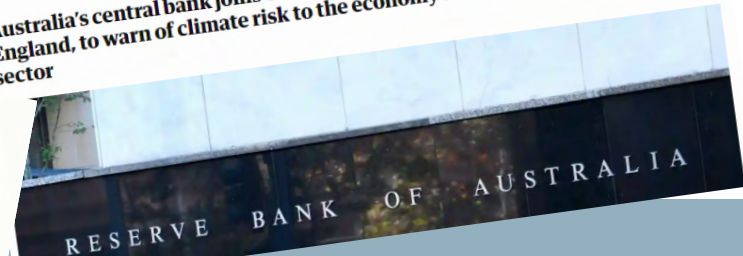
**BlackRock Unveils Climate Funds Targeting the Toughest ESG Clients**

**Super trustees must diversify climate risk or divest:**  
Noel Hutley

Reserve Bank warns of 25% GDP loss by 2100 unless action taken on climate change

Australia's central bank joins 60 others, including the Bank of England, to warn of climate risk to the economy and financial sector

ExxonMobil and Chevron suffer shareholder rebellions over climate





# Regulators

**APRA releases guidance on managing the financial risks of climate change**

**APRA warns banks will face lawsuits if they fail to account for climate risks**

*ASIC Signals Increasing Expectations for Climate Change Disclosures*

‘reiterating ASIC's expectation that disclosing and managing climate change risk is a key responsibility of directors. Serious disclosure failures could lead to enforcement action’

**Rest Super agrees to align portfolio to climate goals**



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# Thankyou

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Vice Chair, IPCC Working Group II



Every half a degree matters  
Every year matters  
Every choice matters

*Howden and Colvin 2018*