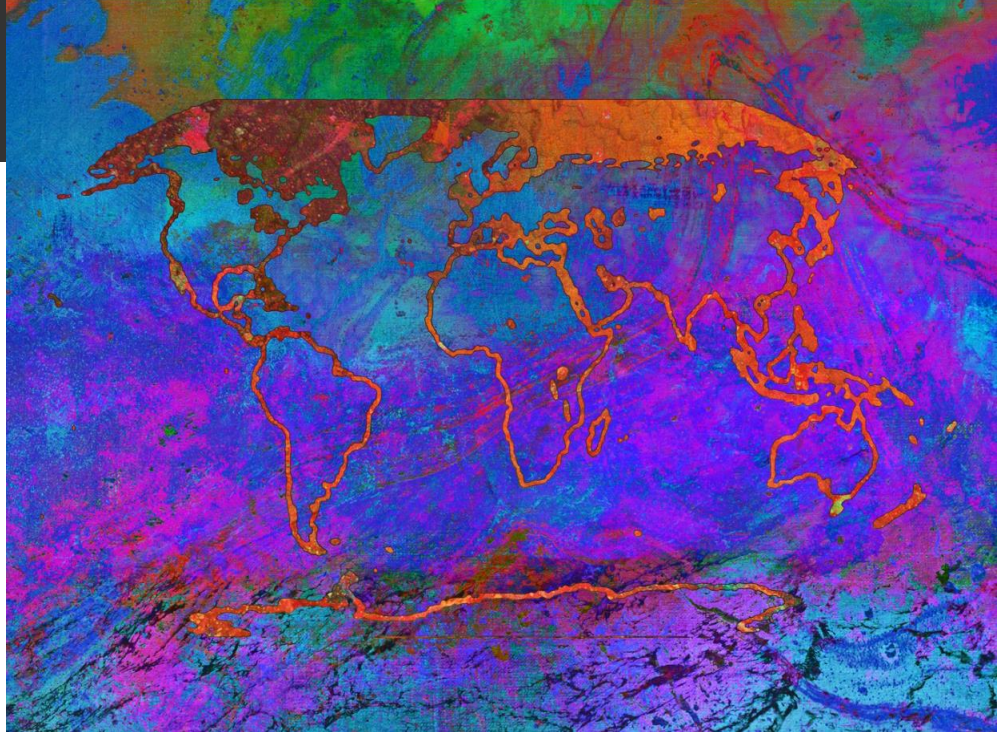




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# Global climate change science update and implications for SA coastal systems



Professor Mark Howden

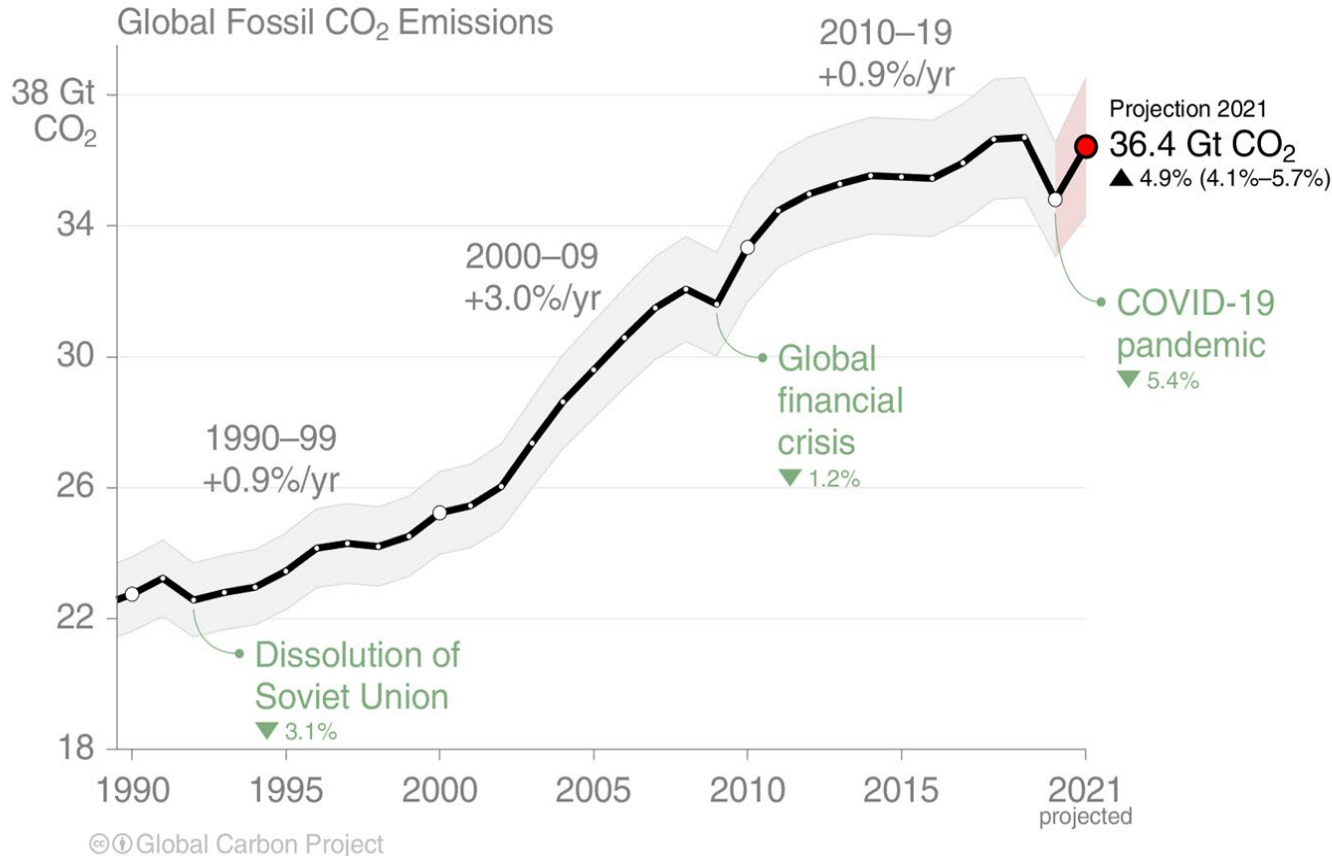
[@ProfMarkHowden](https://twitter.com/ProfMarkHowden)

ANU Institute for Climate, Energy and Disaster Solutions

Chair, ACT Climate Change Council

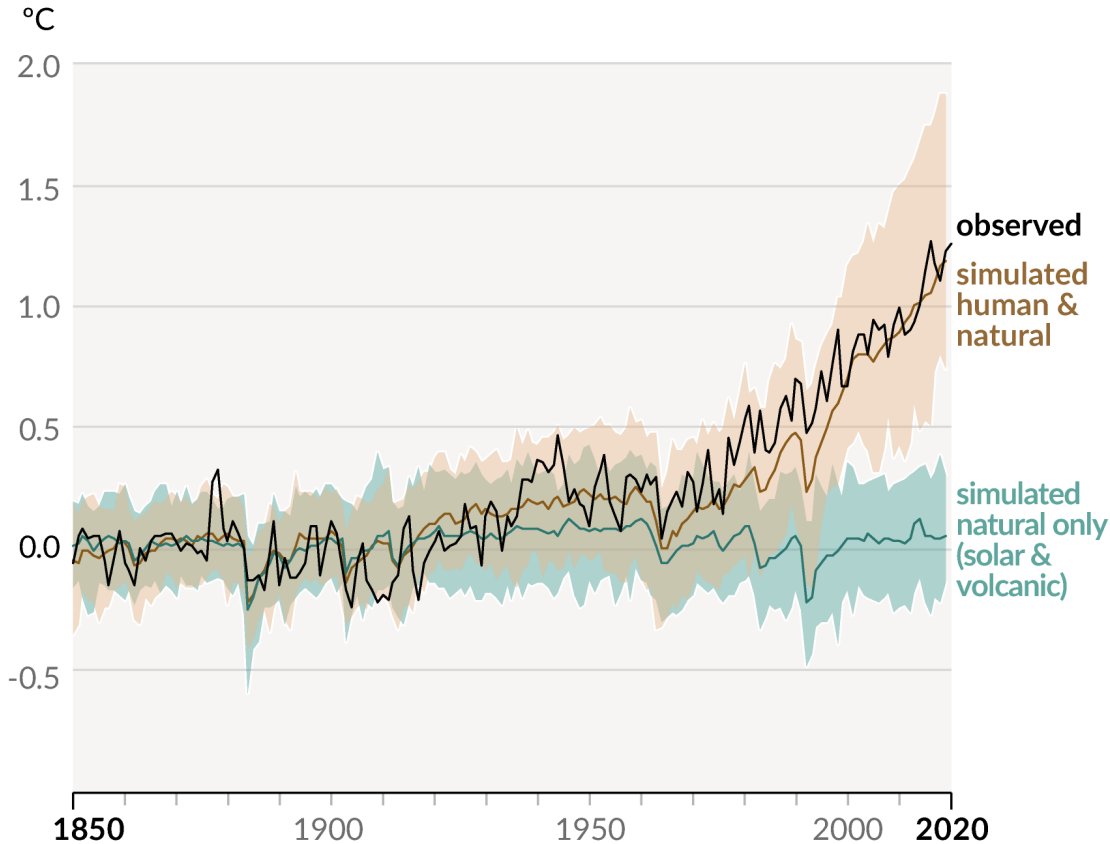
Vice Chair, IPCC Working Group II

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



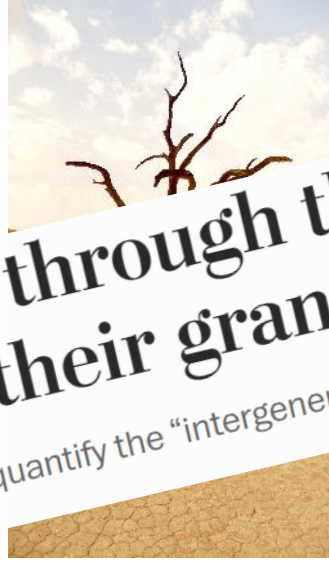
- CO<sub>2</sub> today 417ppm (pre-industrial levels were about 280ppm) highest in at least 2M years
- Record levels of methane, nitrous oxide and other GHGs

# Human influence on climate is unequivocal



- 1.1°C on a decadal scale (recent years 1.24°C)
- Would have been 1.5°C except for aerosols from air pollution which have a cooling effect
- Sea level rise, Arctic sea ice area shrinkage and glacial retreat worst in thousands of years
- Impacts on damaging extreme events

# Human influence on extremes



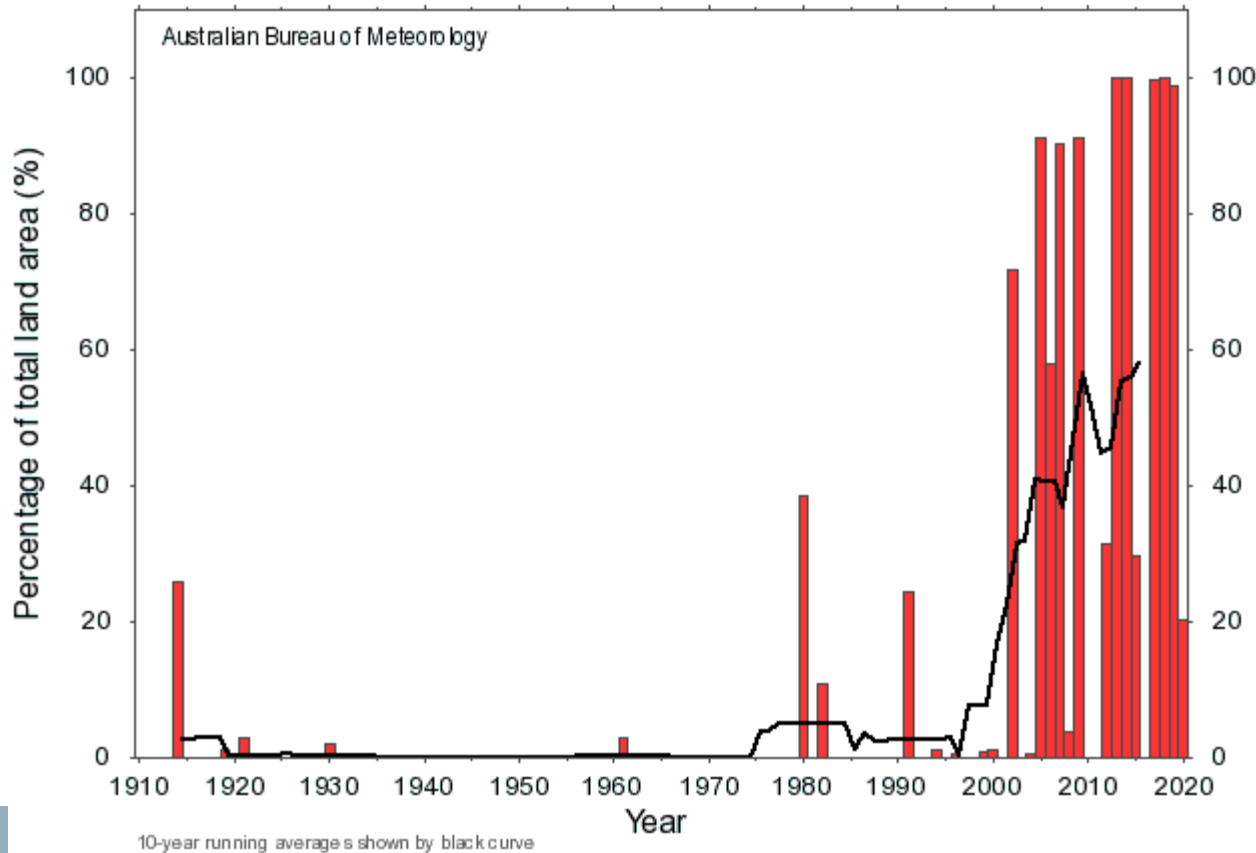
**Today's kids will live through three times as many climate disasters as their grandparents, study says**

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

- More frequent
- More intense
- **Heavy rainfall**
- More frequent
- More intense
- Increased severe cyclones
- **Drought**
- Increase in some regions
- **Fire weather**
- More frequent
- **Ocean**
- Warming
- Acidifying
- Losing oxygen

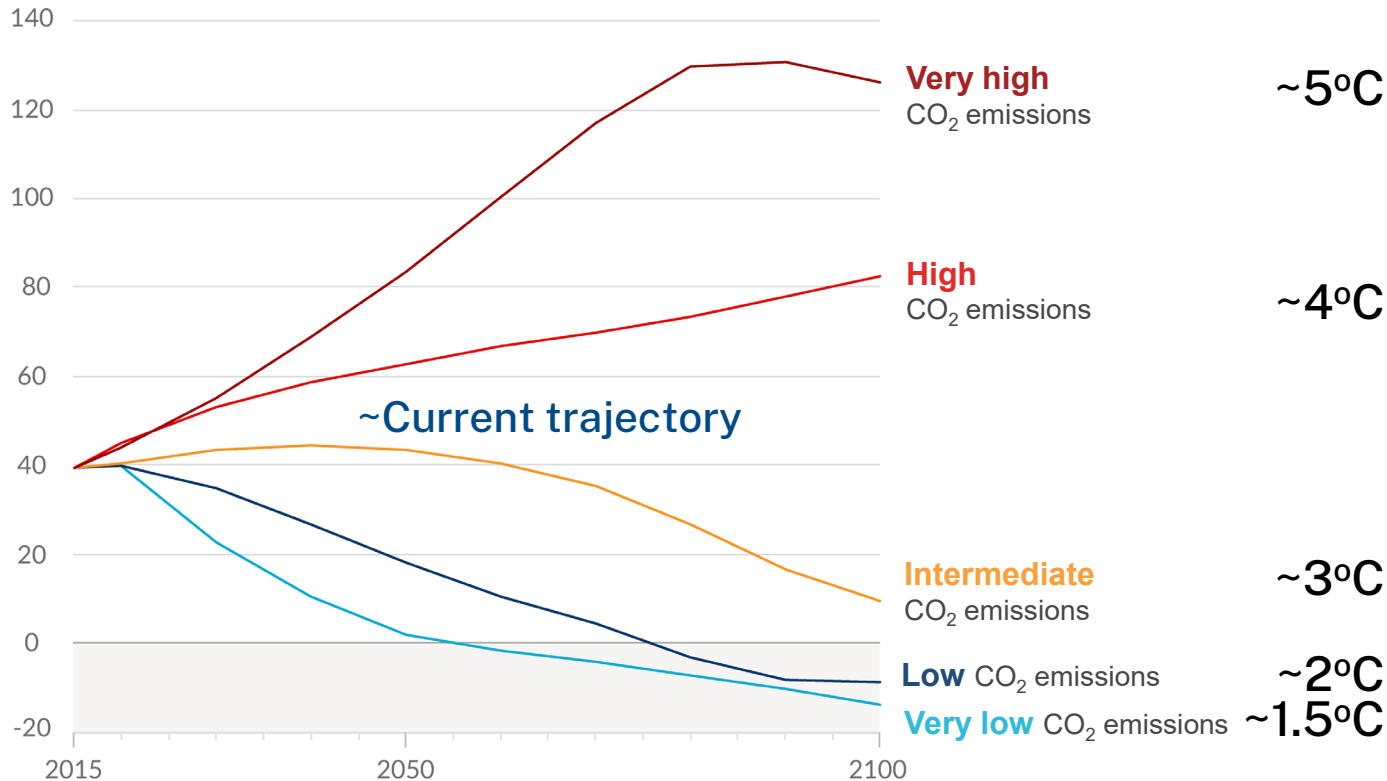
# Extremes almost everywhere, all the time

Annual maximum temperature percentage area in decile 10  
South Australia (1910 to 2020)



# Timely choices about our future

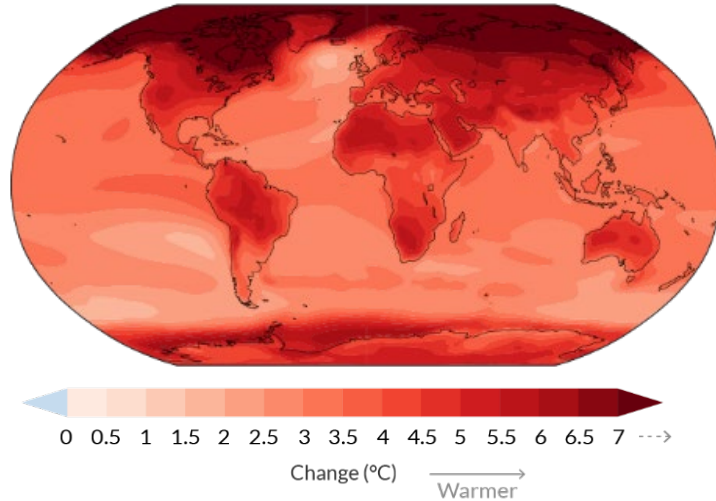
Carbon dioxide (GtCO<sub>2</sub>/yr)



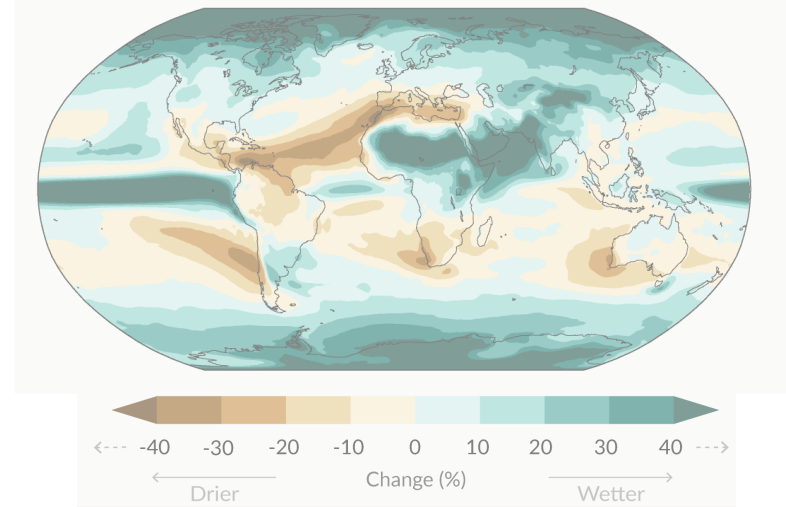
Glasgow commitments  
Paris Agreement goals

# Changed rainfall, temperature & water

## Temperature (4°C scenario)



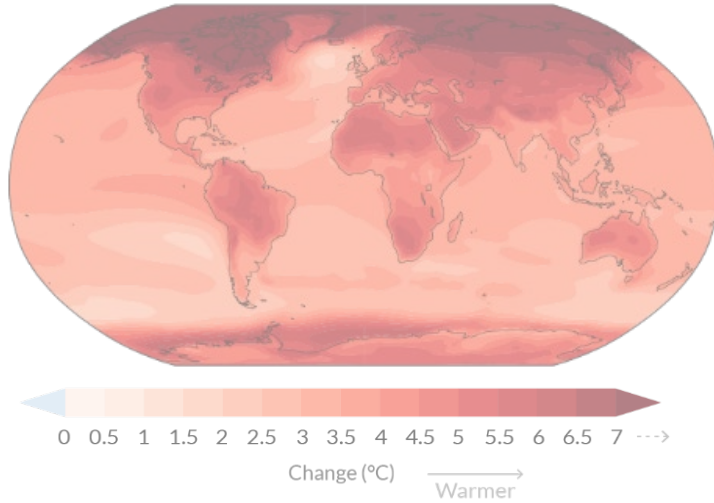
## Rainfall at 4°C



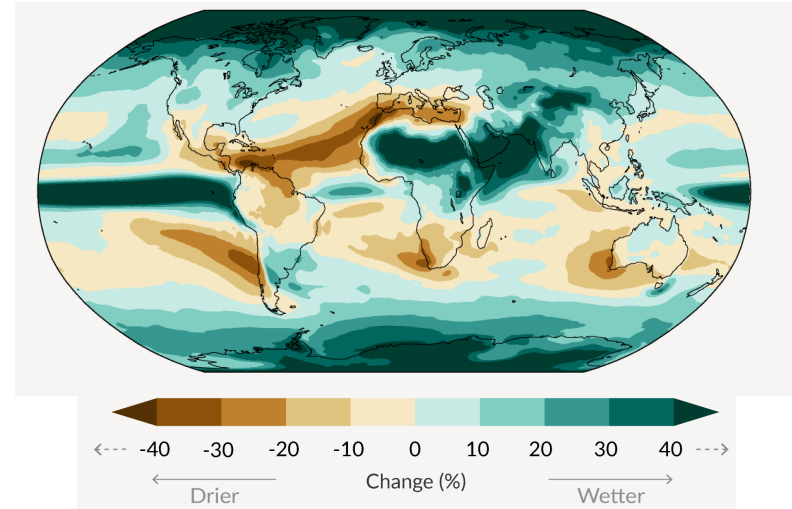
- Heat-related health issues (heat stress, vector- and food-borne disease, air pollution, mental health etc)
- Impacts on the energy system (both supply and demand) and infrastructure
- Impacts on natural systems, agriculture, water etc

# Changed rainfall, temperature & water

## Temperature (4°C scenario)



## Rainfall at 4°C

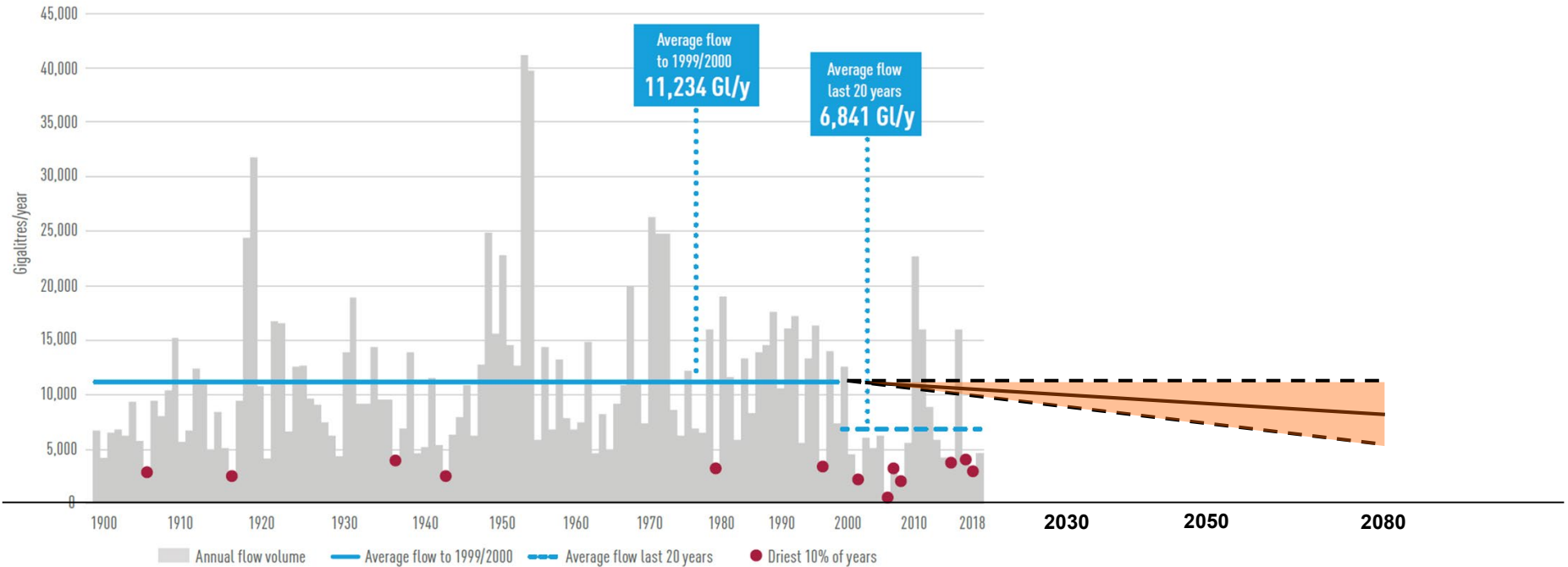


- ENSO-based rainfall variability likely to increase
- Rainfall intensity increase with implications for flooding and erosion
- Increased potential evaporation can cause drying



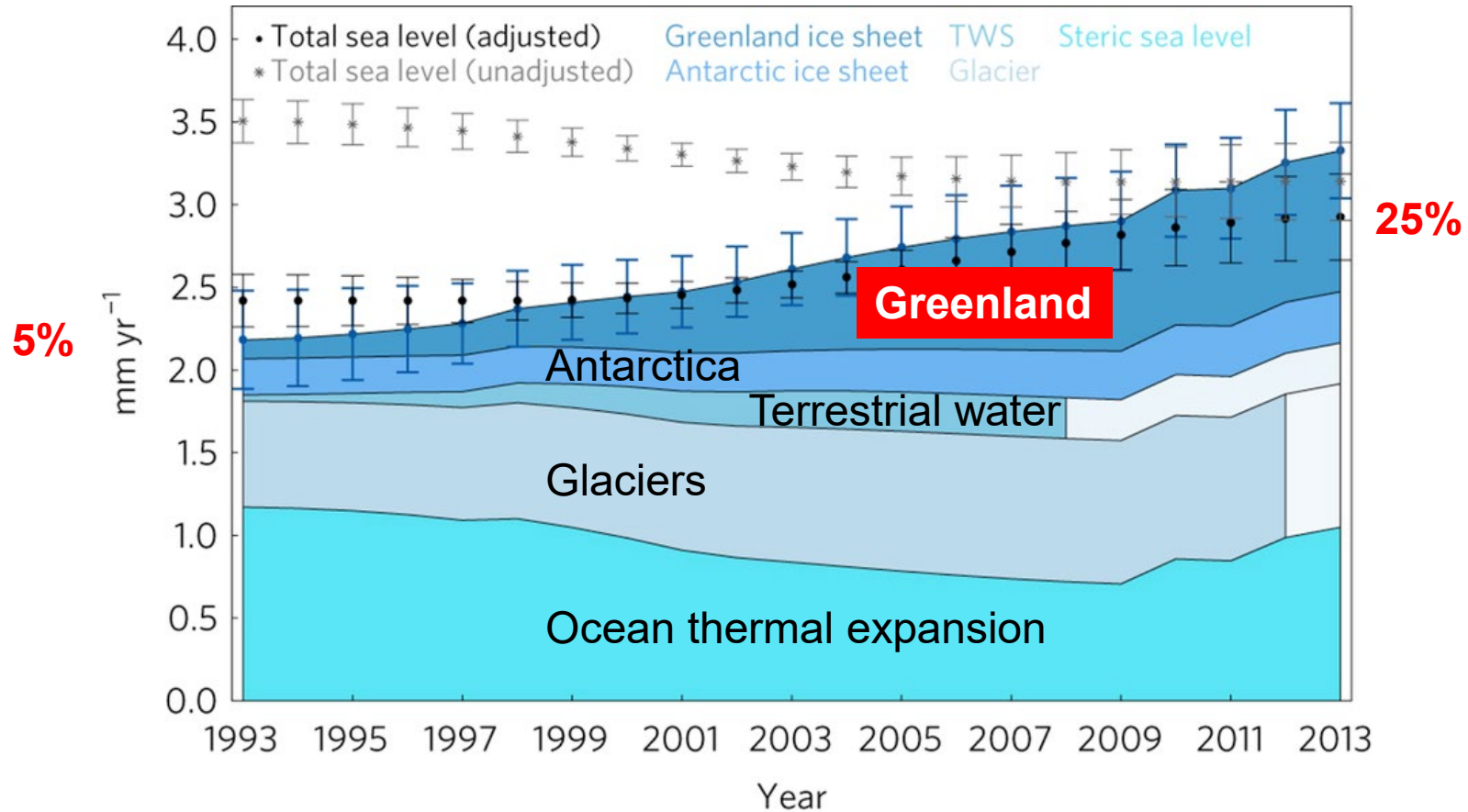
# MDB flows: historical and projected

Reduction in long-term average inflows to the River Murray

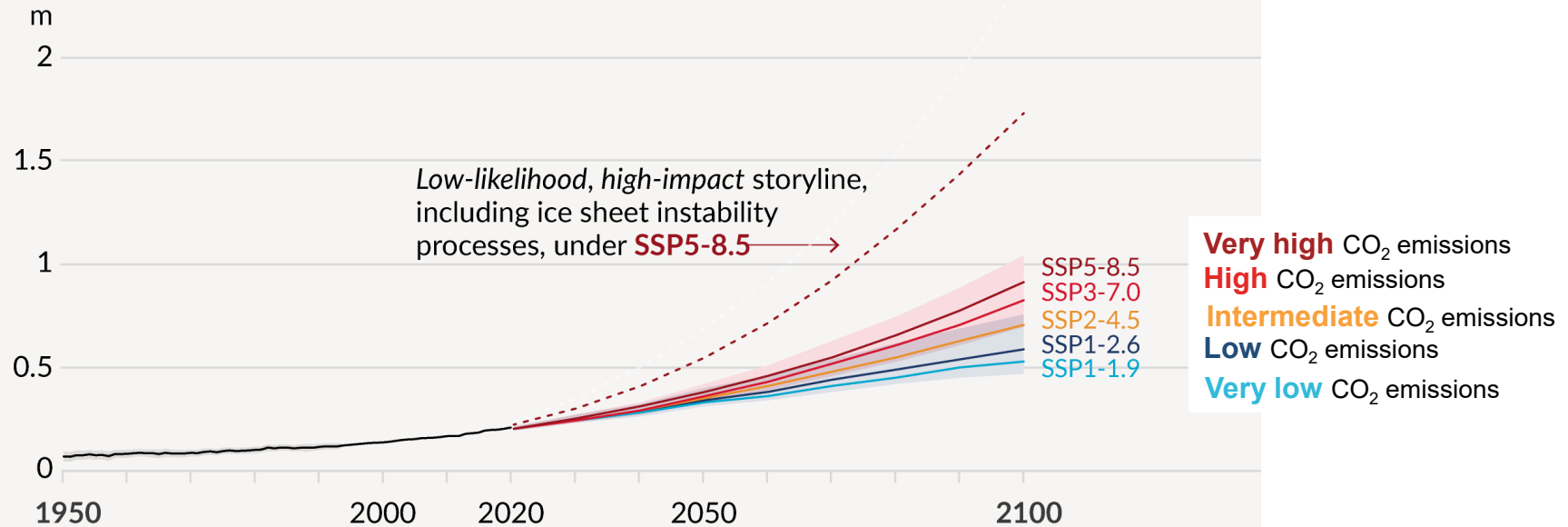




# Sea level rise: accelerating unexpectedly

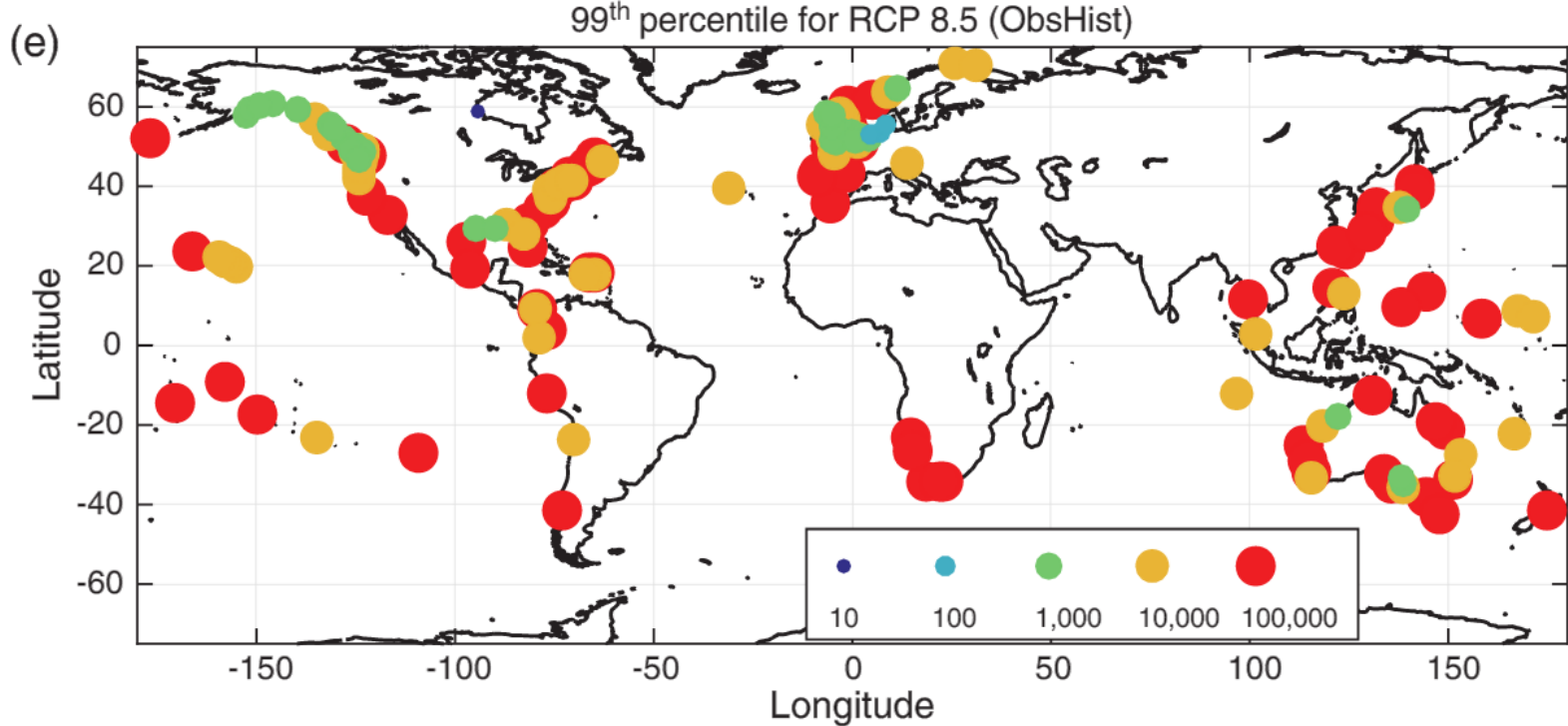


## d) Global mean sea level change relative to 1900



- Accelerating: 1901-1971 was 1.3 mm/yr; 2006-2018 was 3.7mm/yr
- Can't rule out increases of 5m by year 2150

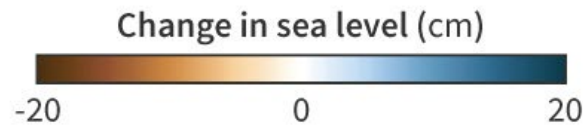
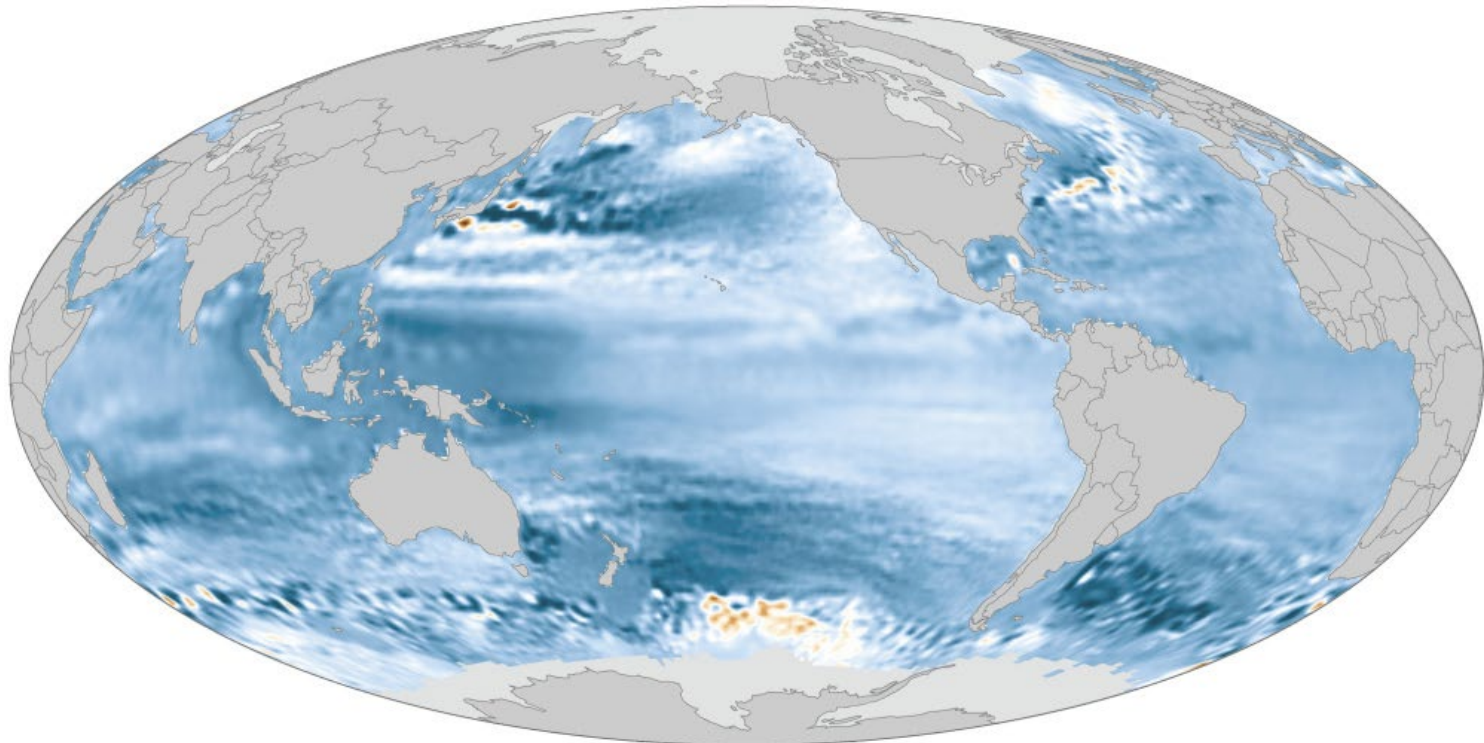
# Increased risk of extreme sea level events



- 10,000x means that a current once-a-century flooding level is reached every few days at normal high tide



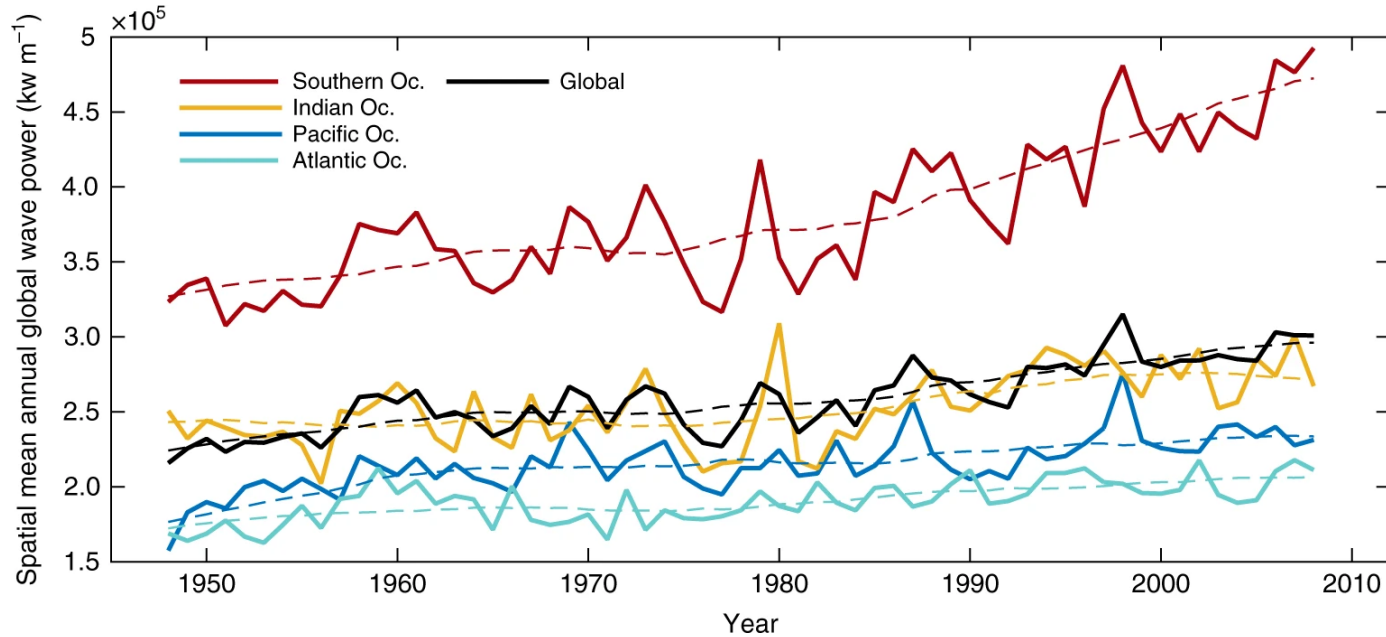
# Global sea level rise varies spatially



NOAA Climate.gov  
Data: UHSLC

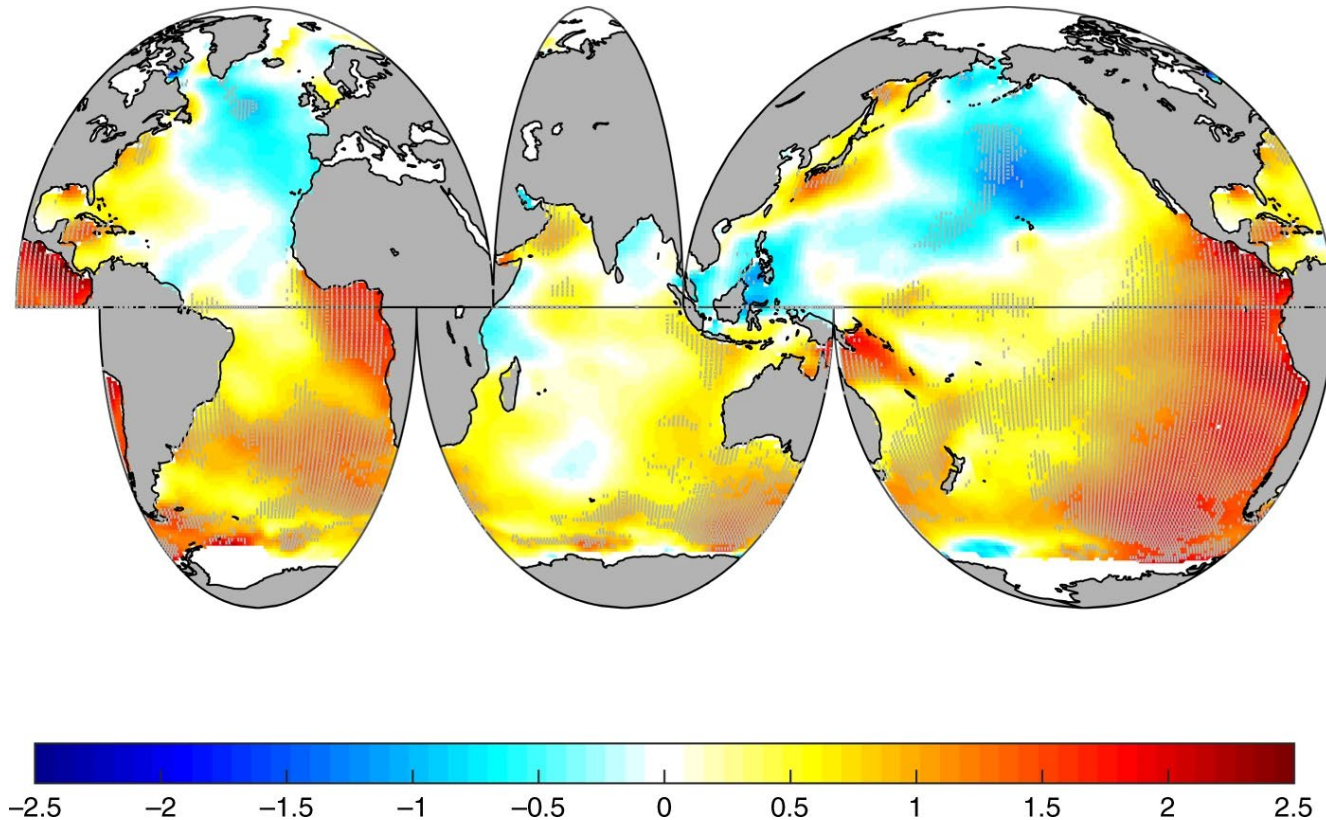


# Climate change is increasing wave energy



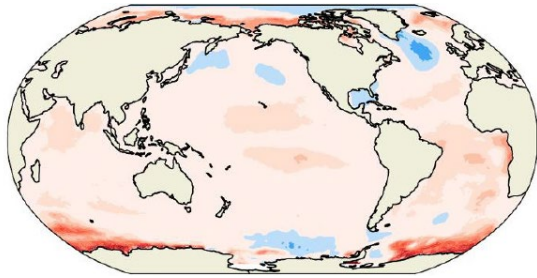


# Climate change is increasing wave energy

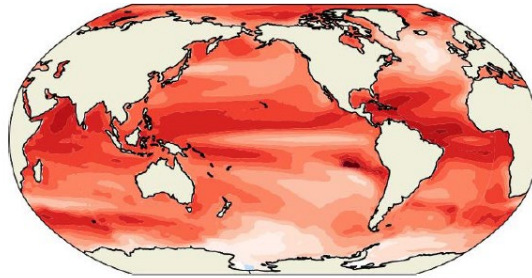


# Marine heatwave changes

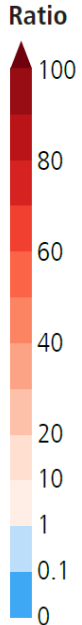
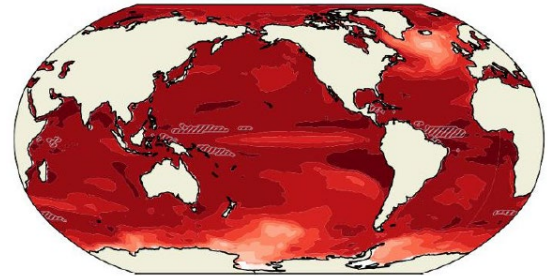
Observed  
1985-2014



Low  
2081-2100



Very High  
2081-2100

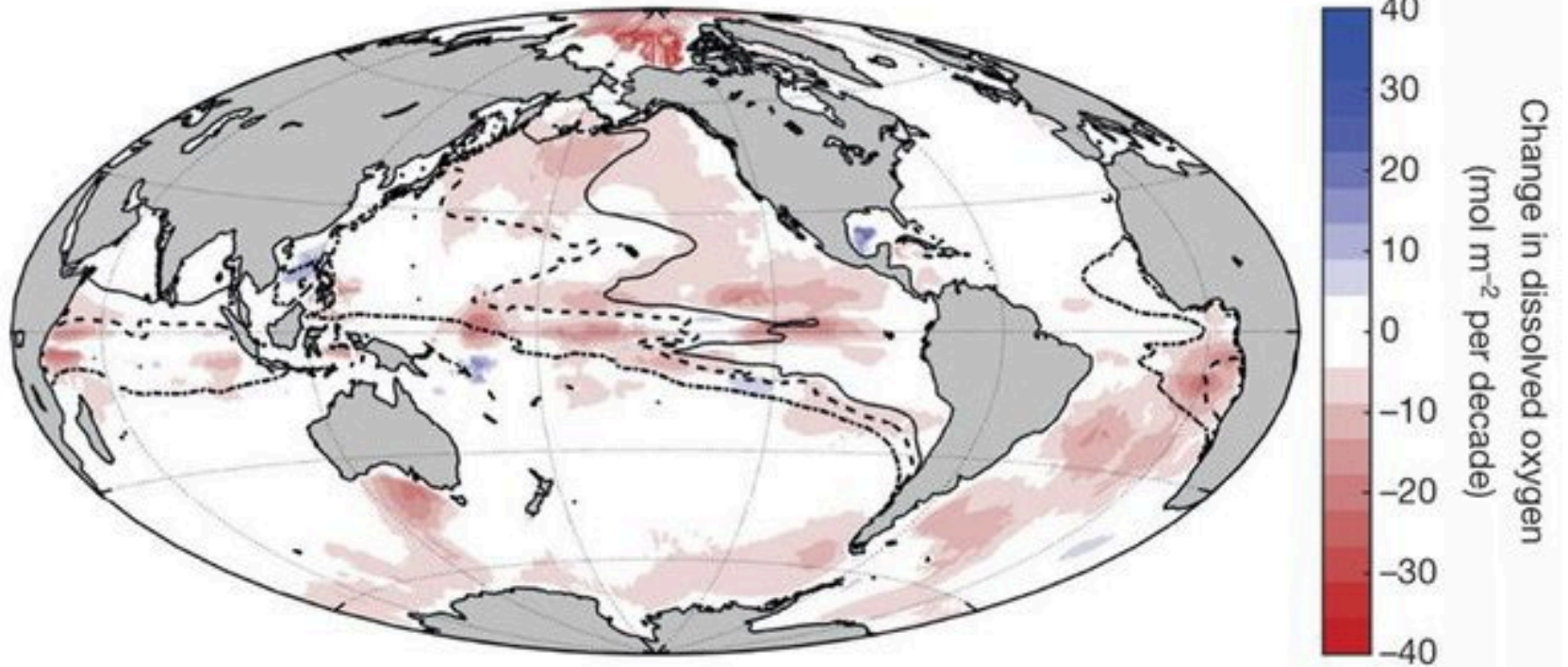


- Human influence on 84-90% of the marine heatwaves since 2006

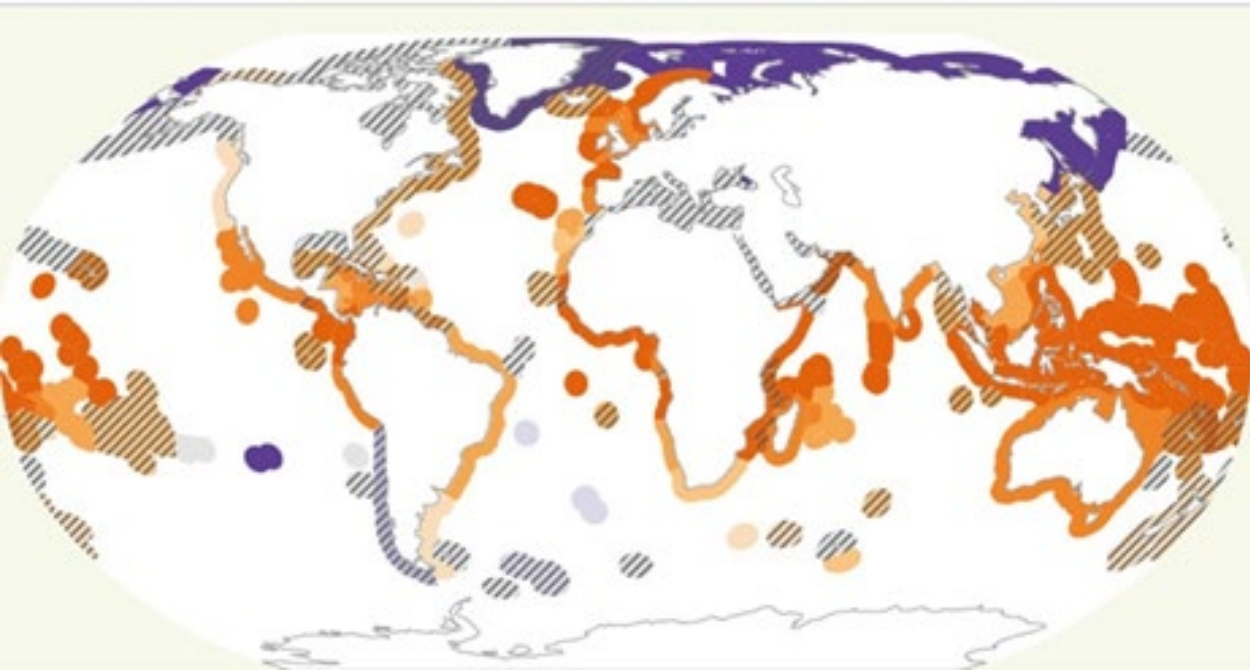




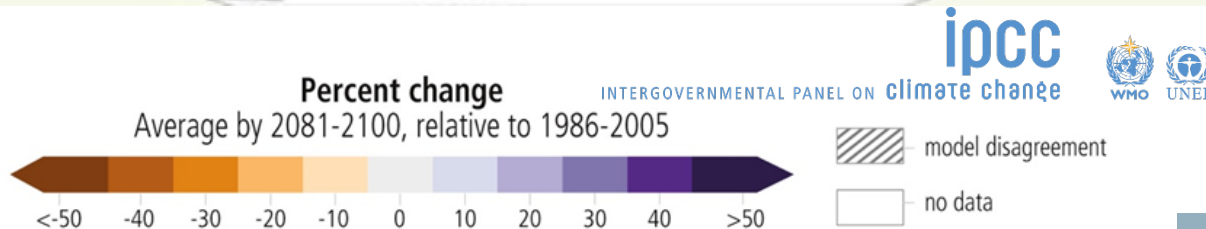
# Declining oxygen levels and alkalinity



# Marine systems and fishery productivity



- Warming and in particular marine heatwaves, acidification, declining oxygen, stratification all impact negatively on marine system productivity





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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*