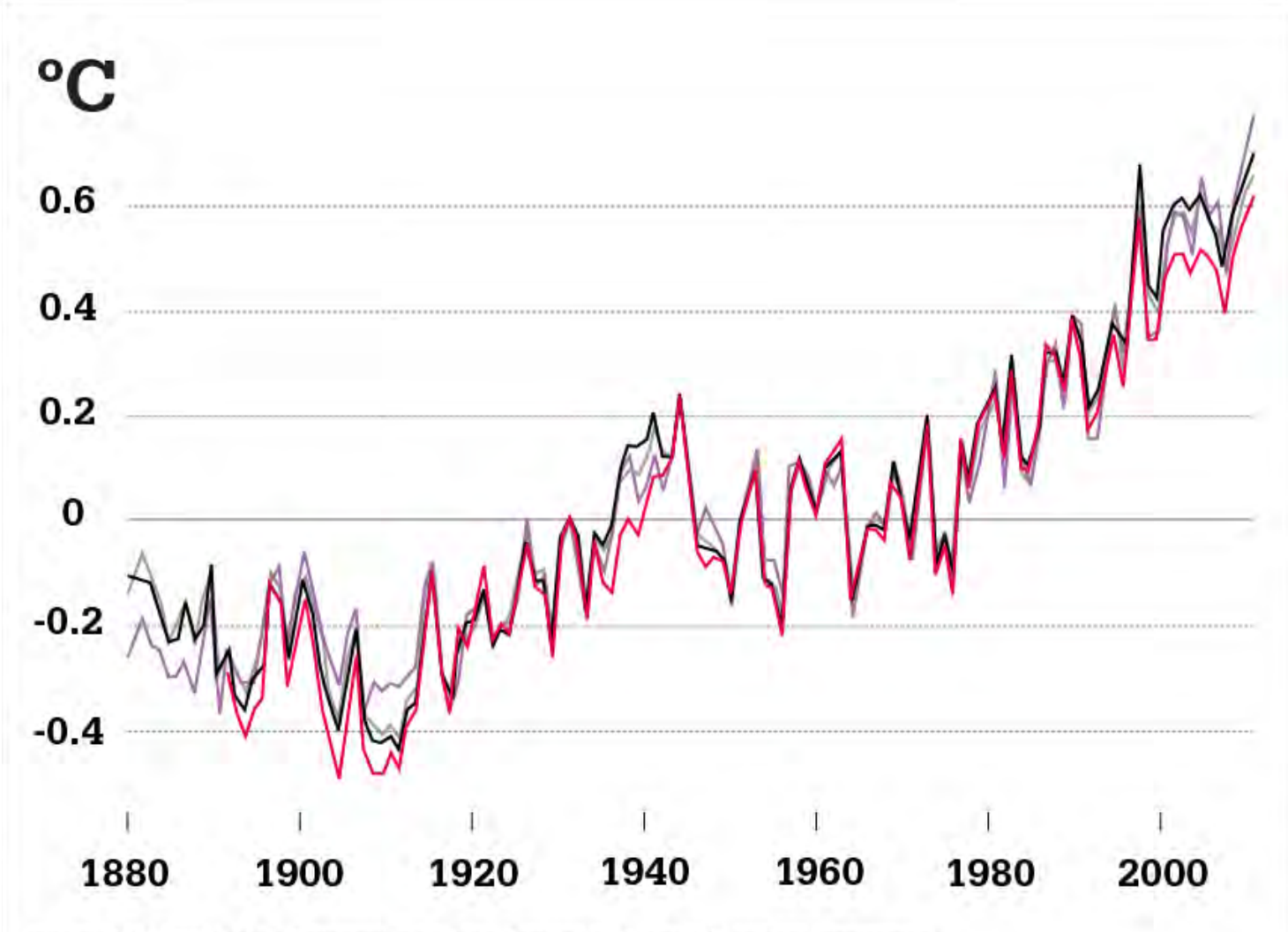
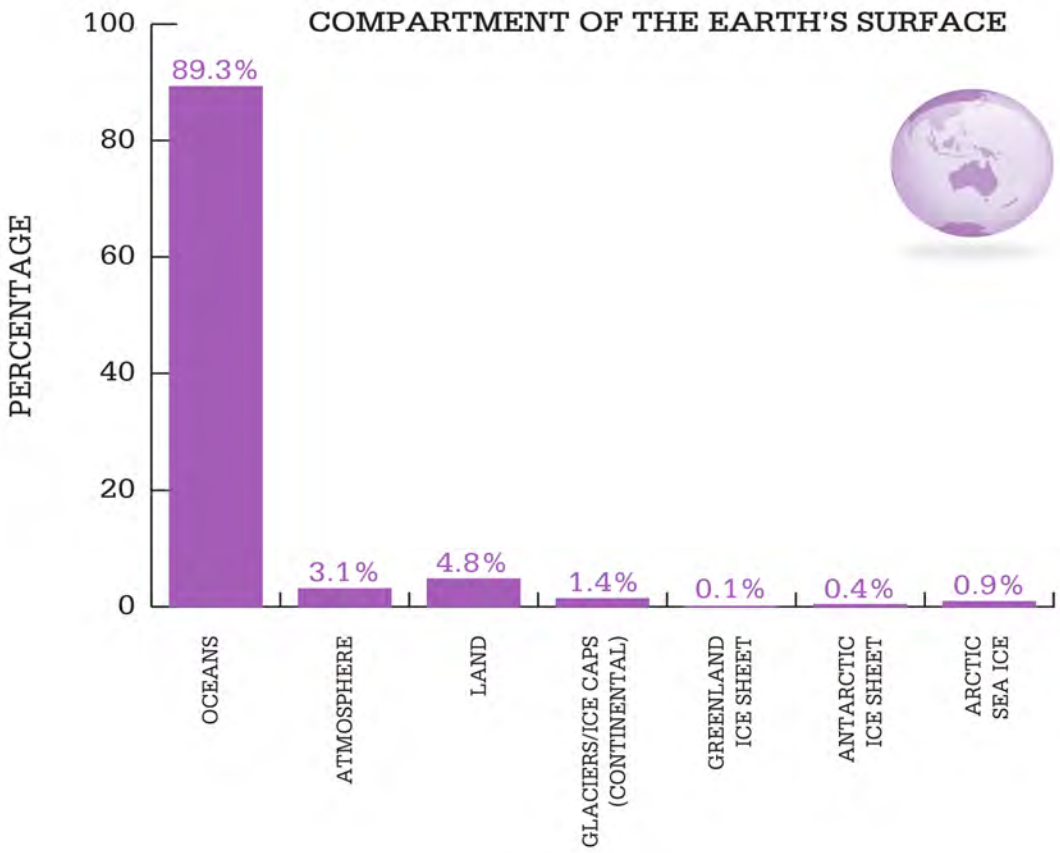
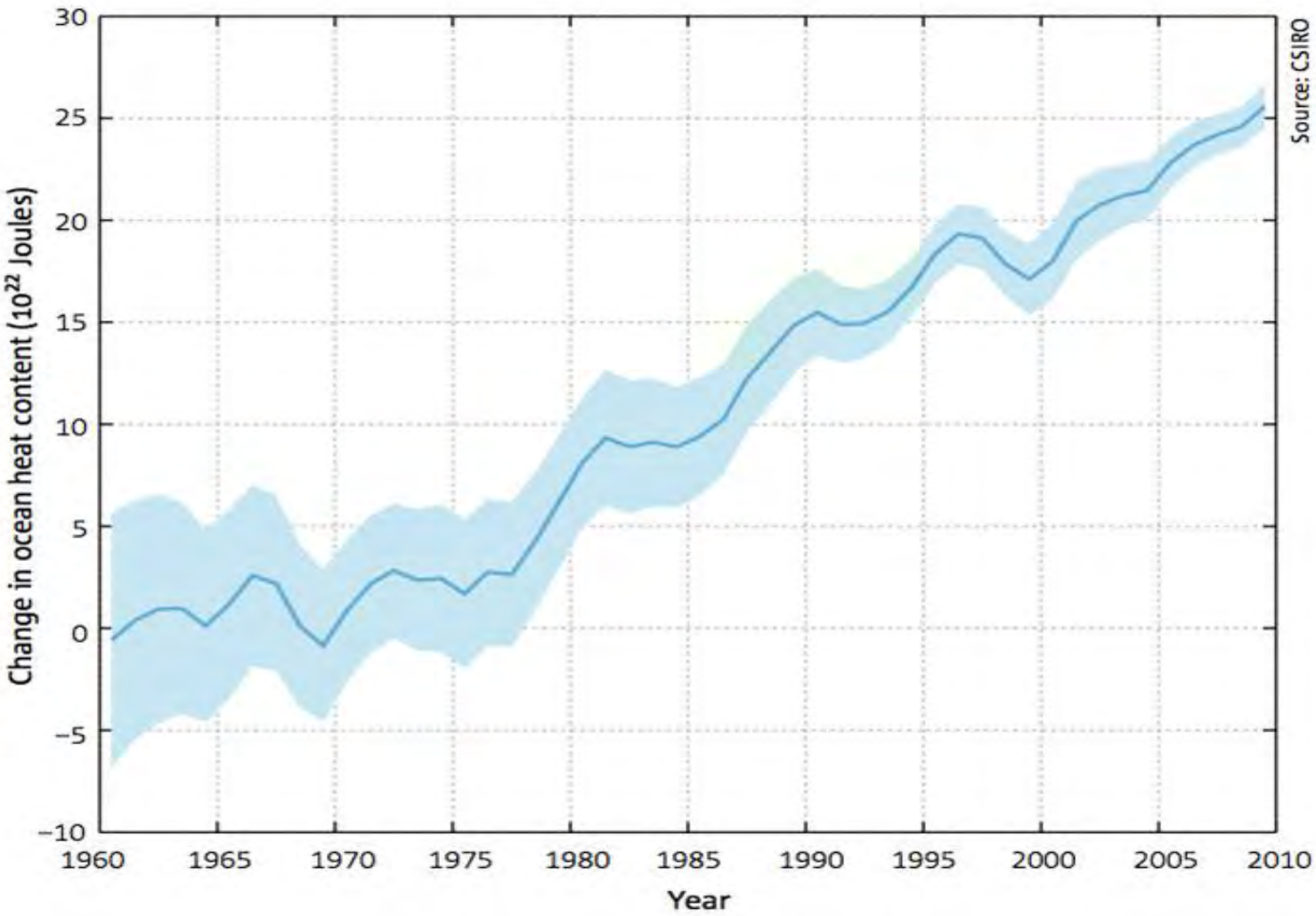
# The atmosphere is warming



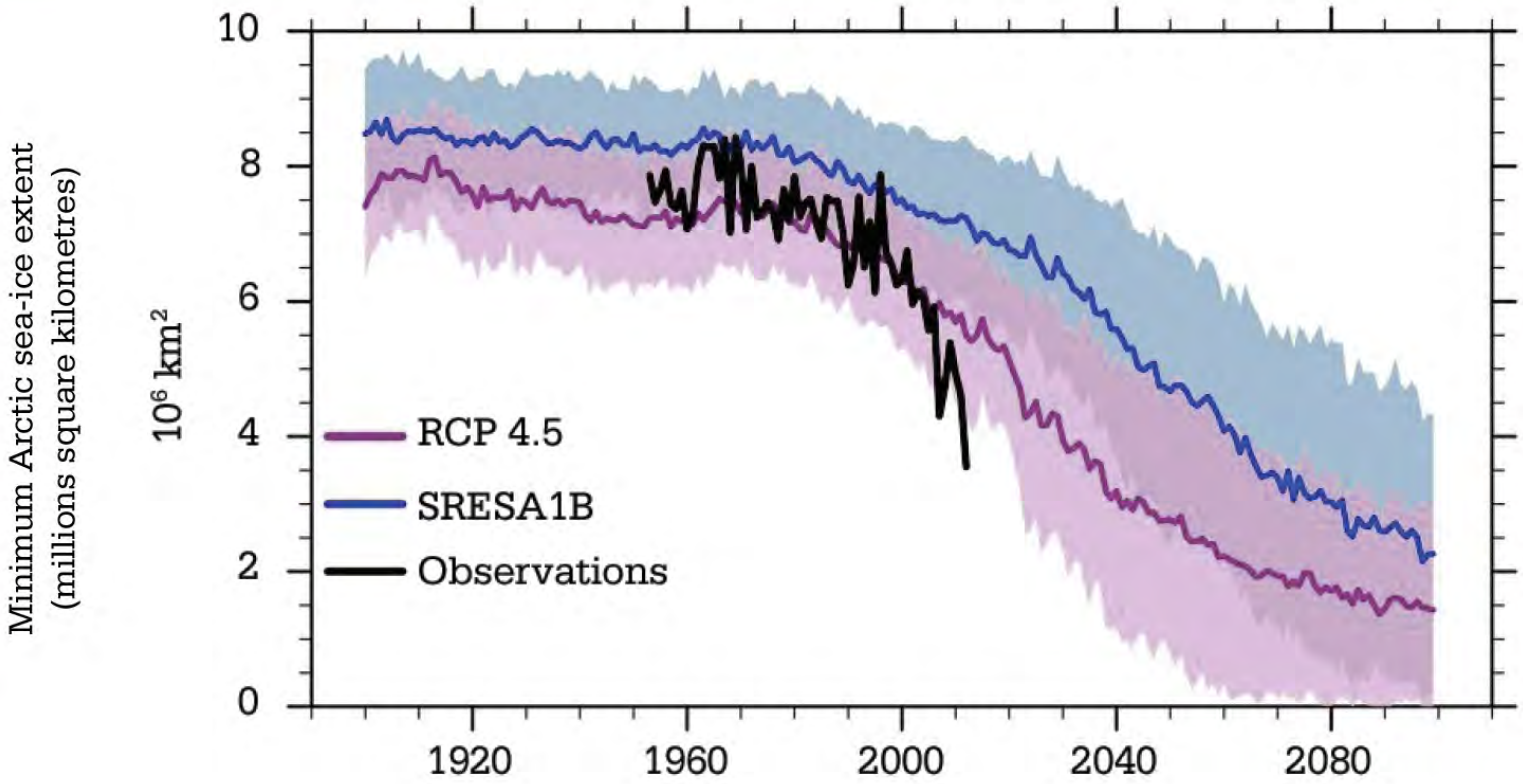
# Where does the excess heat go?



# The ocean is warming

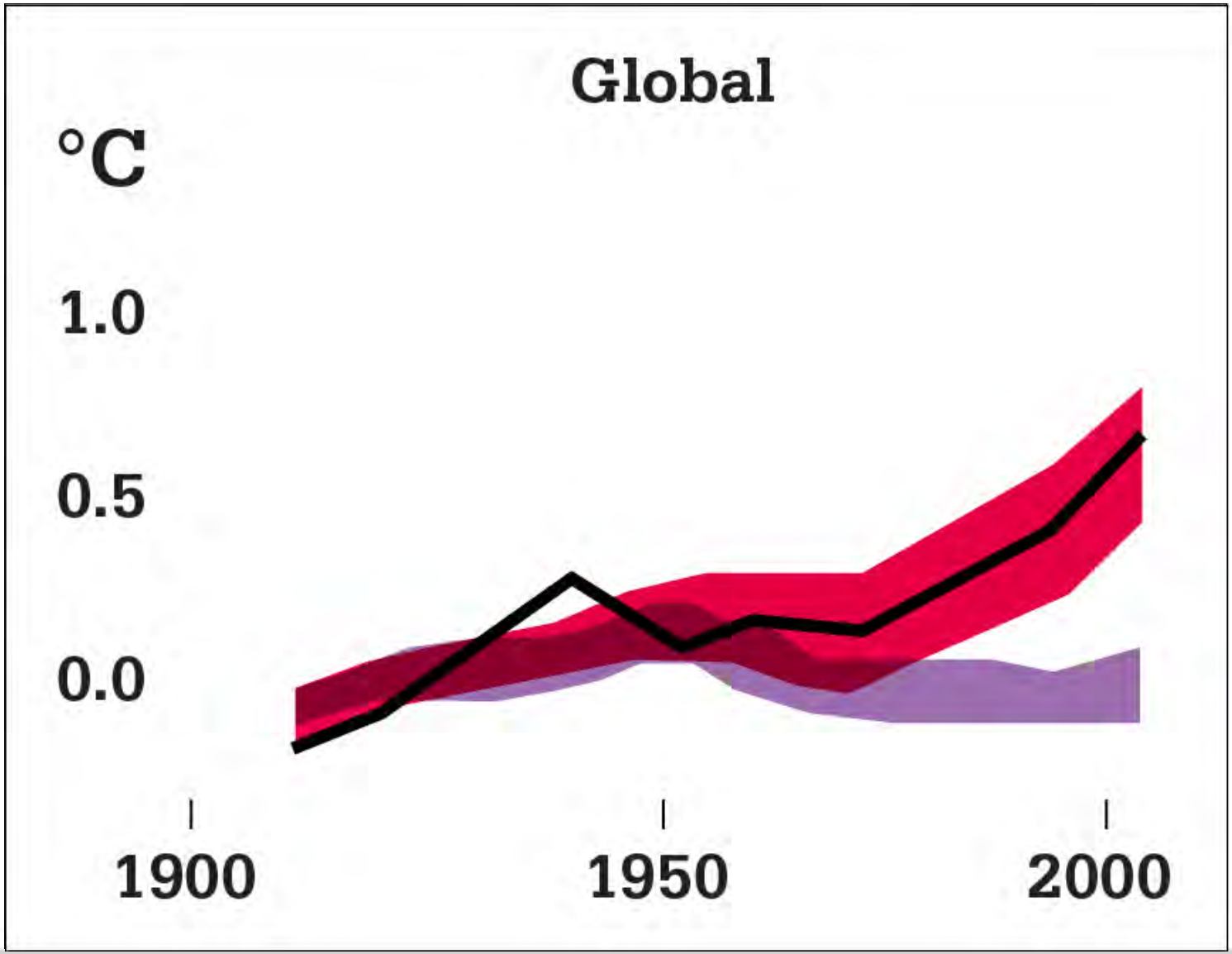


# Changes faster than predicted




**Source:** Stroeve et al. (2012) updated to include observations to 2012

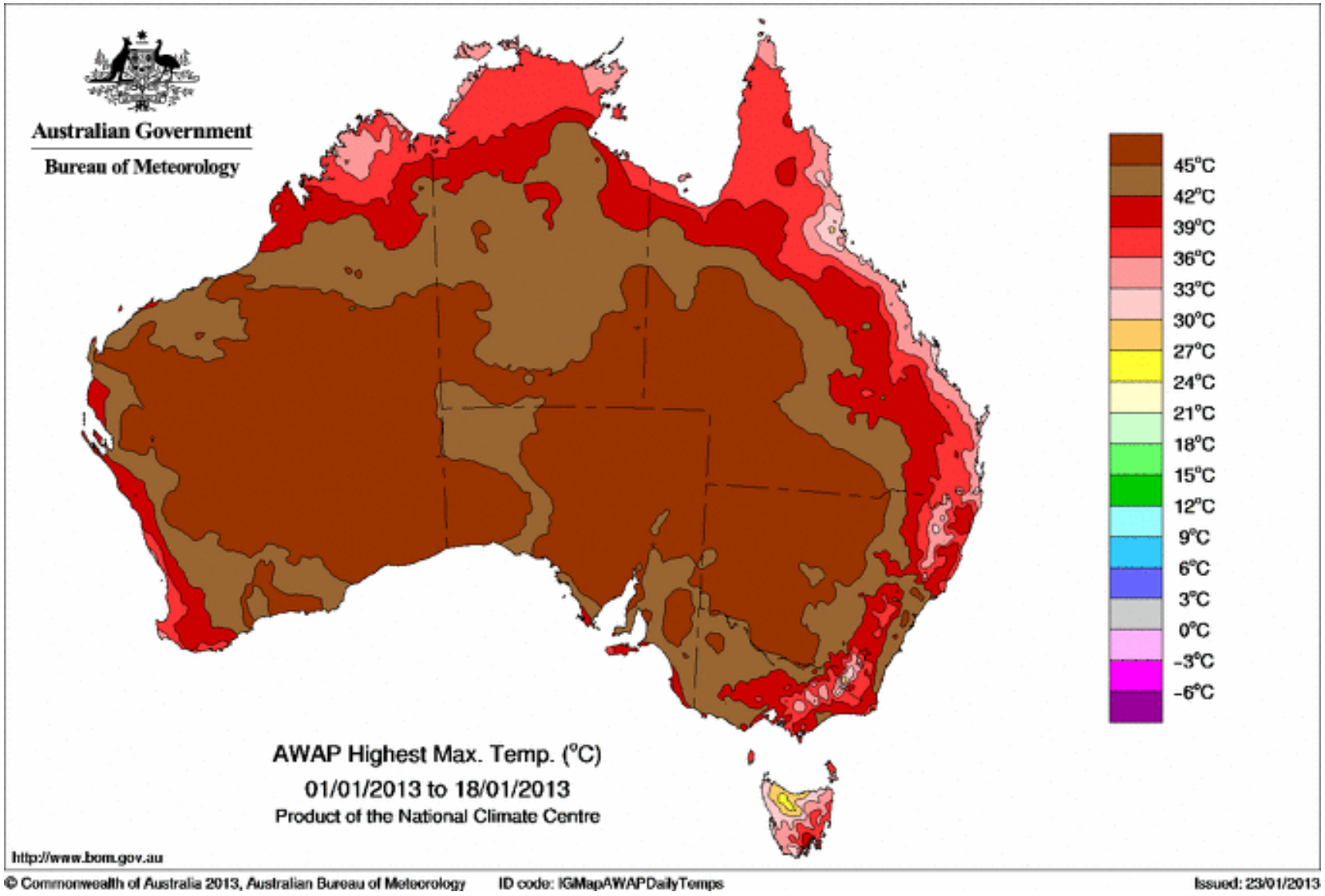
# Human activities making it warmer



# The Angry Summer – heatwaves

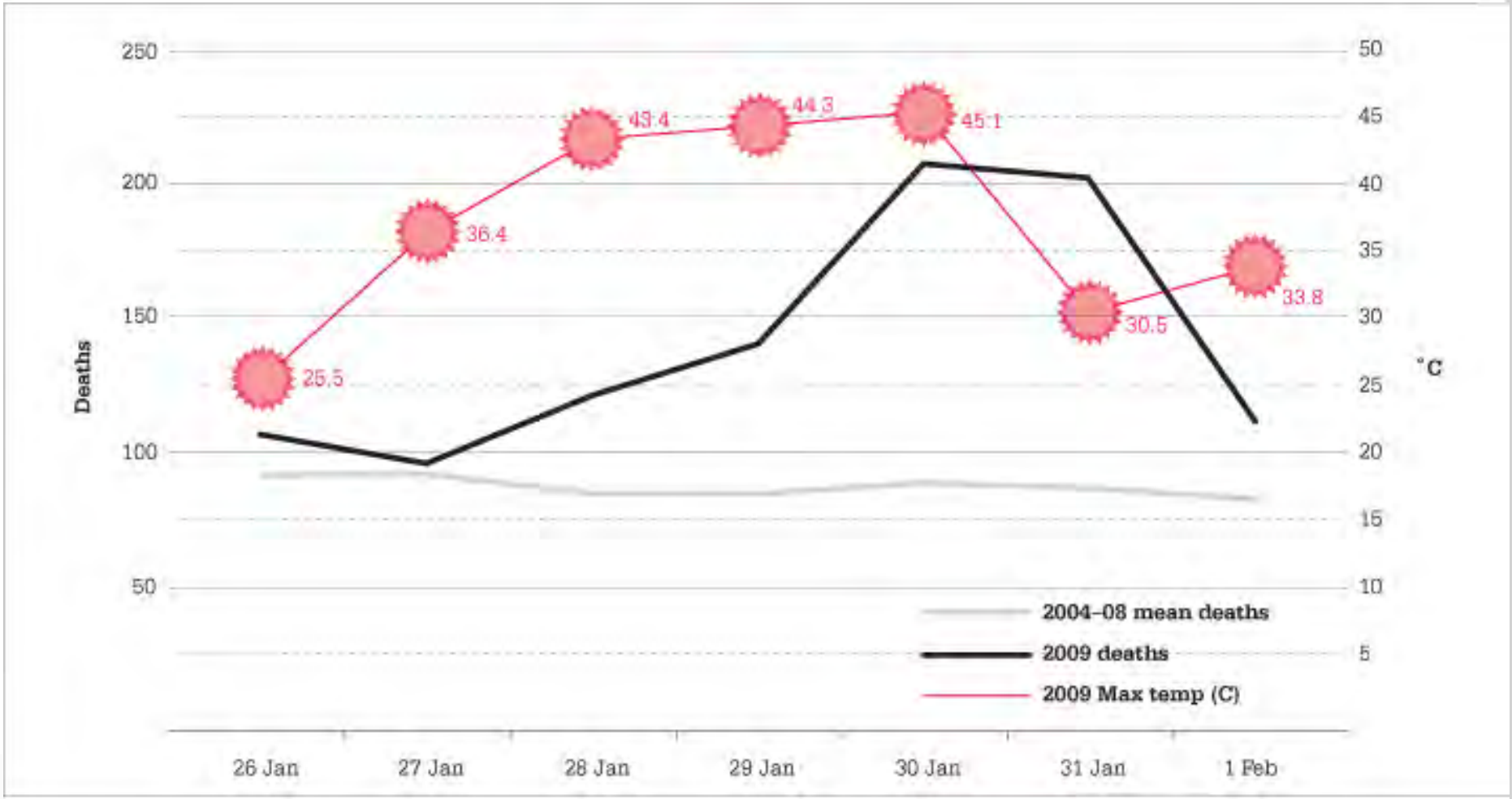
- Severe heatwave across 70% of Australia late Dec 2012 /early Jan 2013. Temperature records set in every state and territory
- Hottest ever area-averaged Australian maximum temperature, 7 January 2013: 40.30 C
- Hottest month on record for Australia – January 2013
- All-time high maximum temperatures at 44 weather stations
- Average daily maximum temperature for the whole of Australia was over 39 C for seven consecutive days (2-8 January)

# Heatwaves



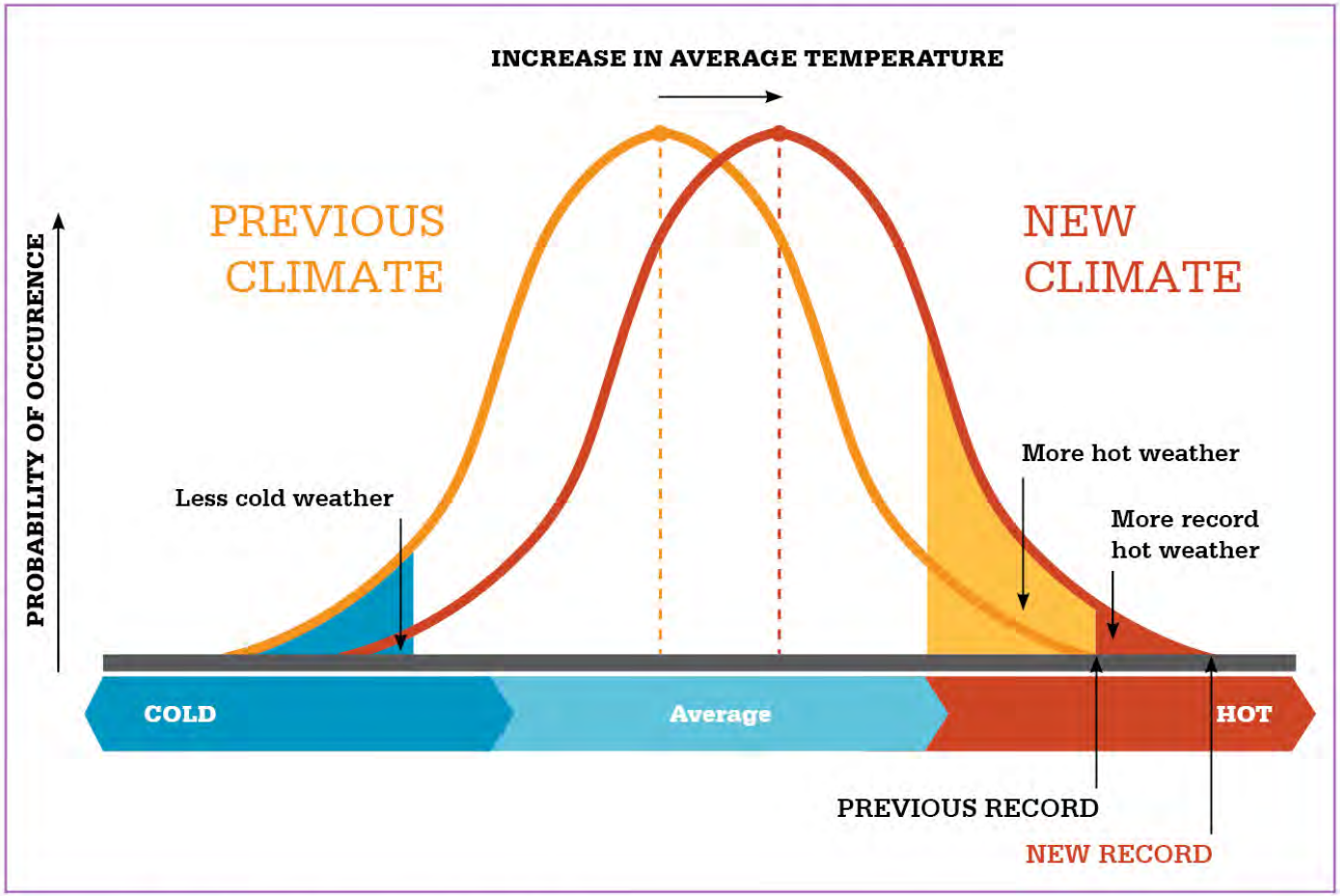

Source: Bureau of Meteorology

# Melbourne 2009 heatwave




Source: Vic DHS 2009

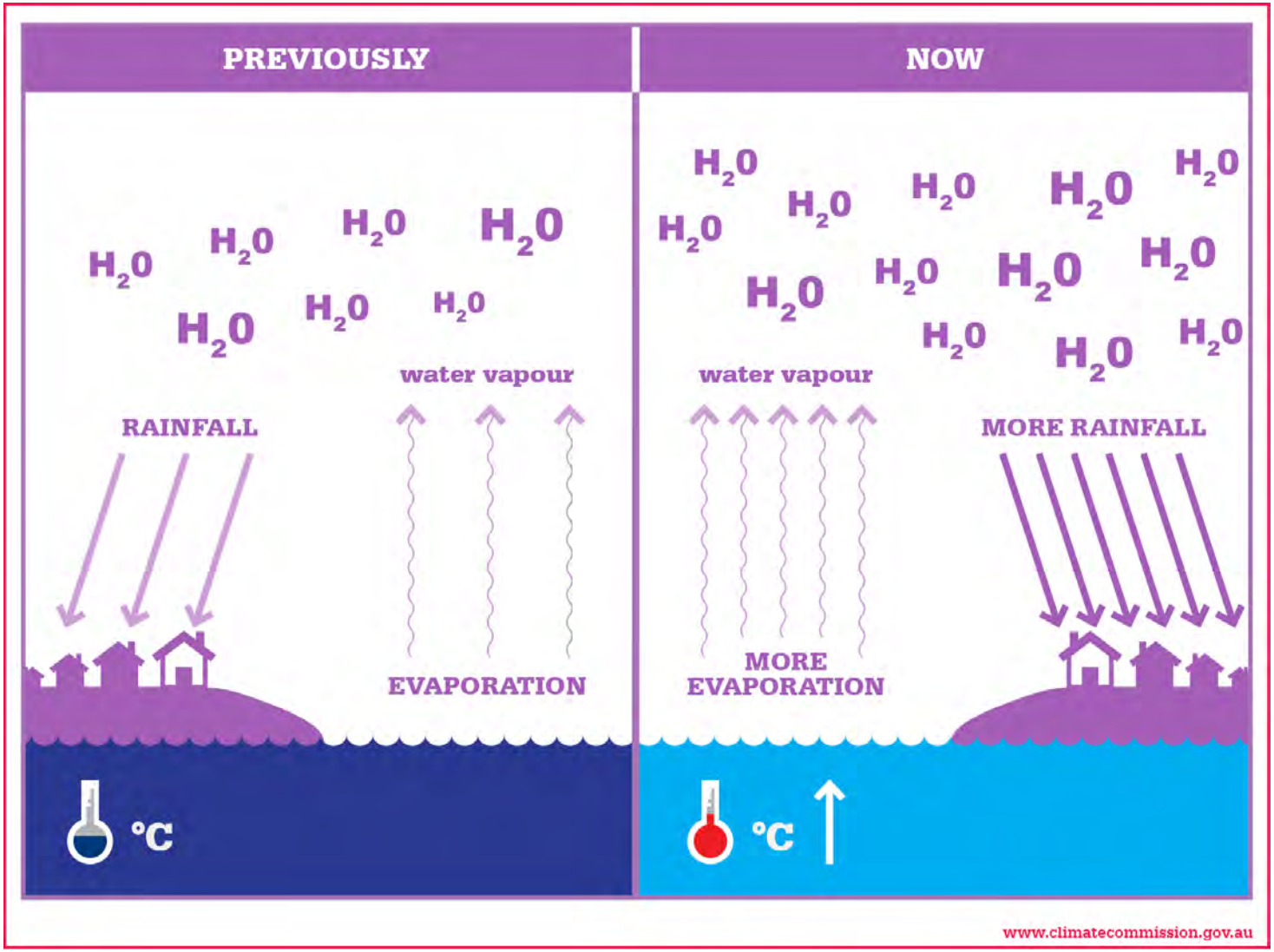
# We are living in a new climate



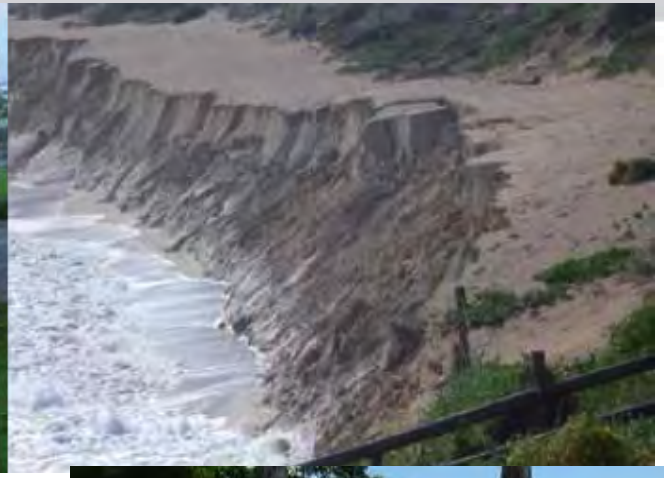

**Source:** Modified from IPCC, 2007

www.climatecommission.gov.au

# Influence of warming on the water cycle



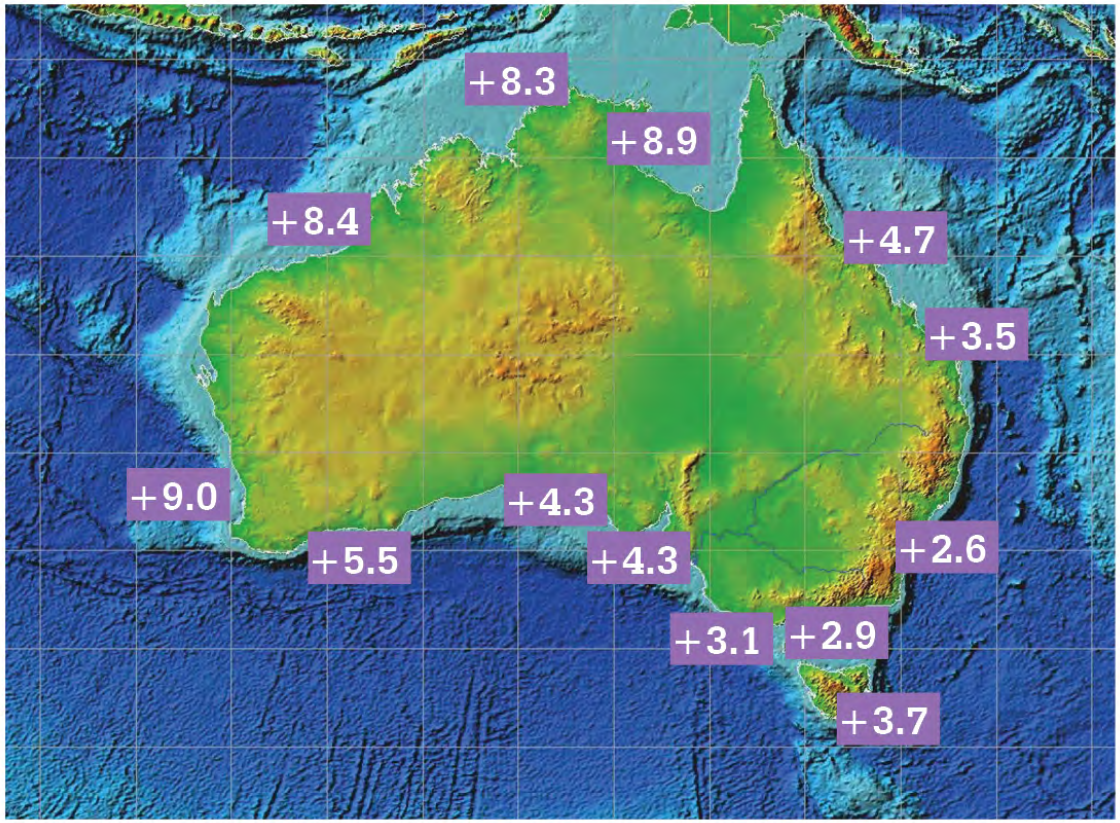
# Consequences of sea-level rise



Western Australia – Perth region

Torres Strait Islands

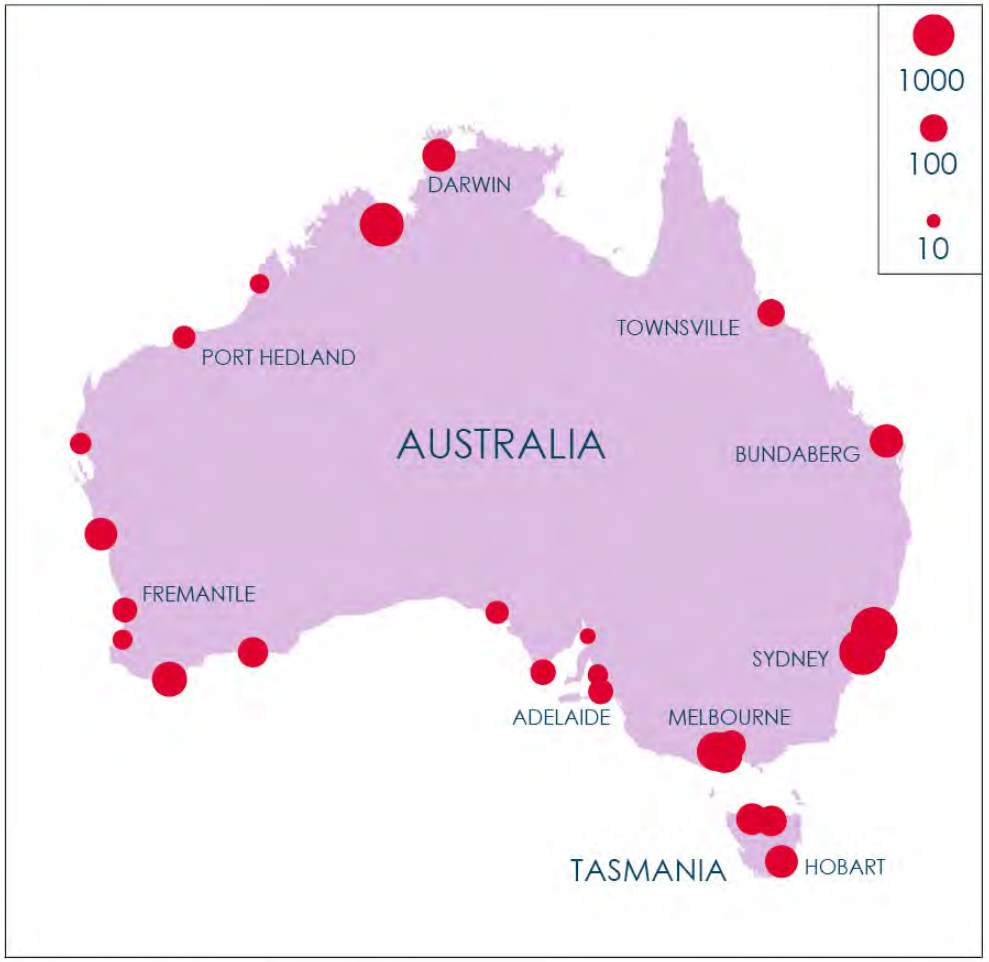
# Variation in rate of sea-level rise




**Source:** NTC, 2011

www.climatecommission.gov.au

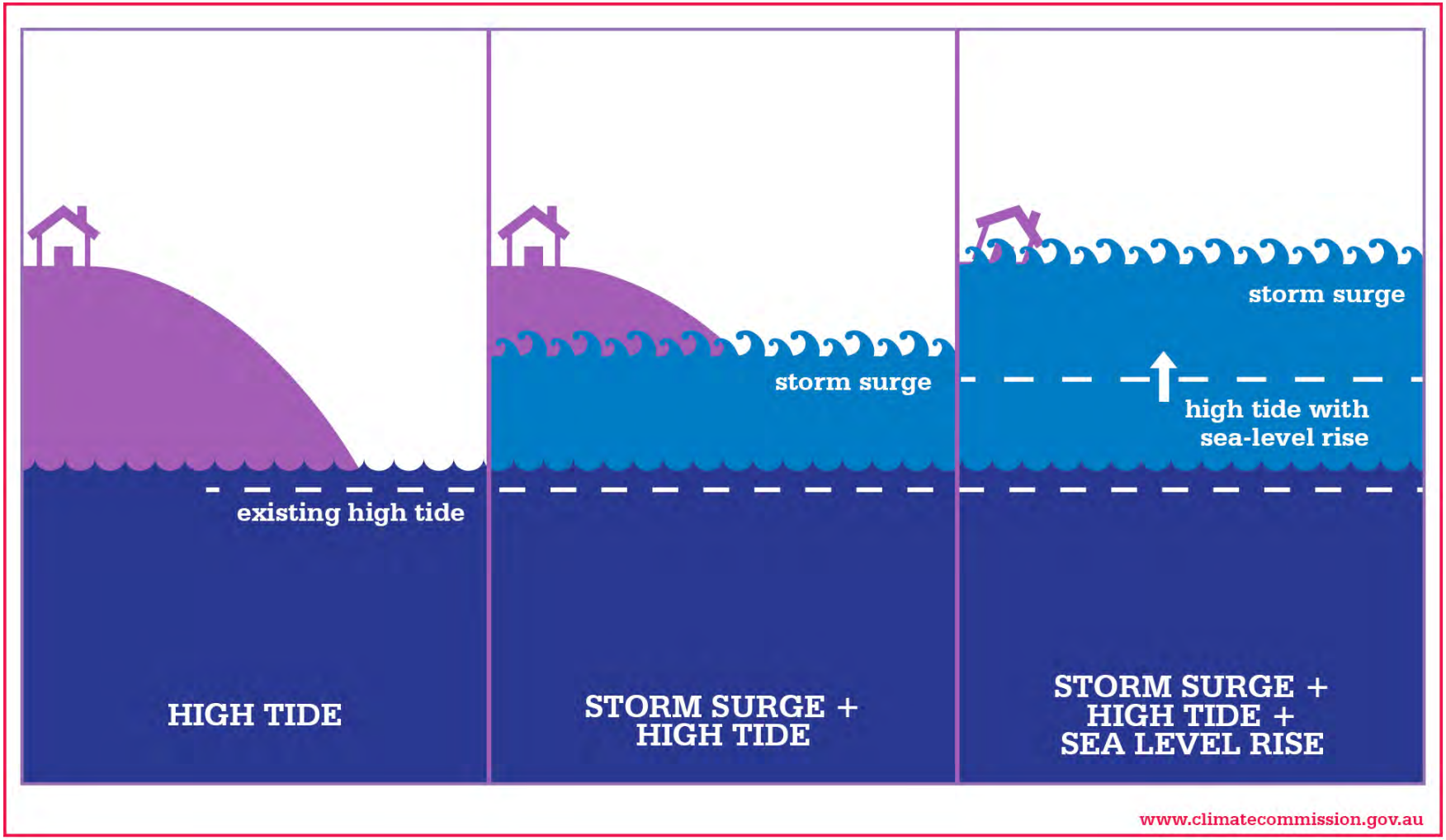
# Increased risk of coastal flooding with sea-level rise of 0.5 m




**Source:** Hunter, 2012

www.climatecommission.gov.au

# Influence of sea-level on coastal flooding

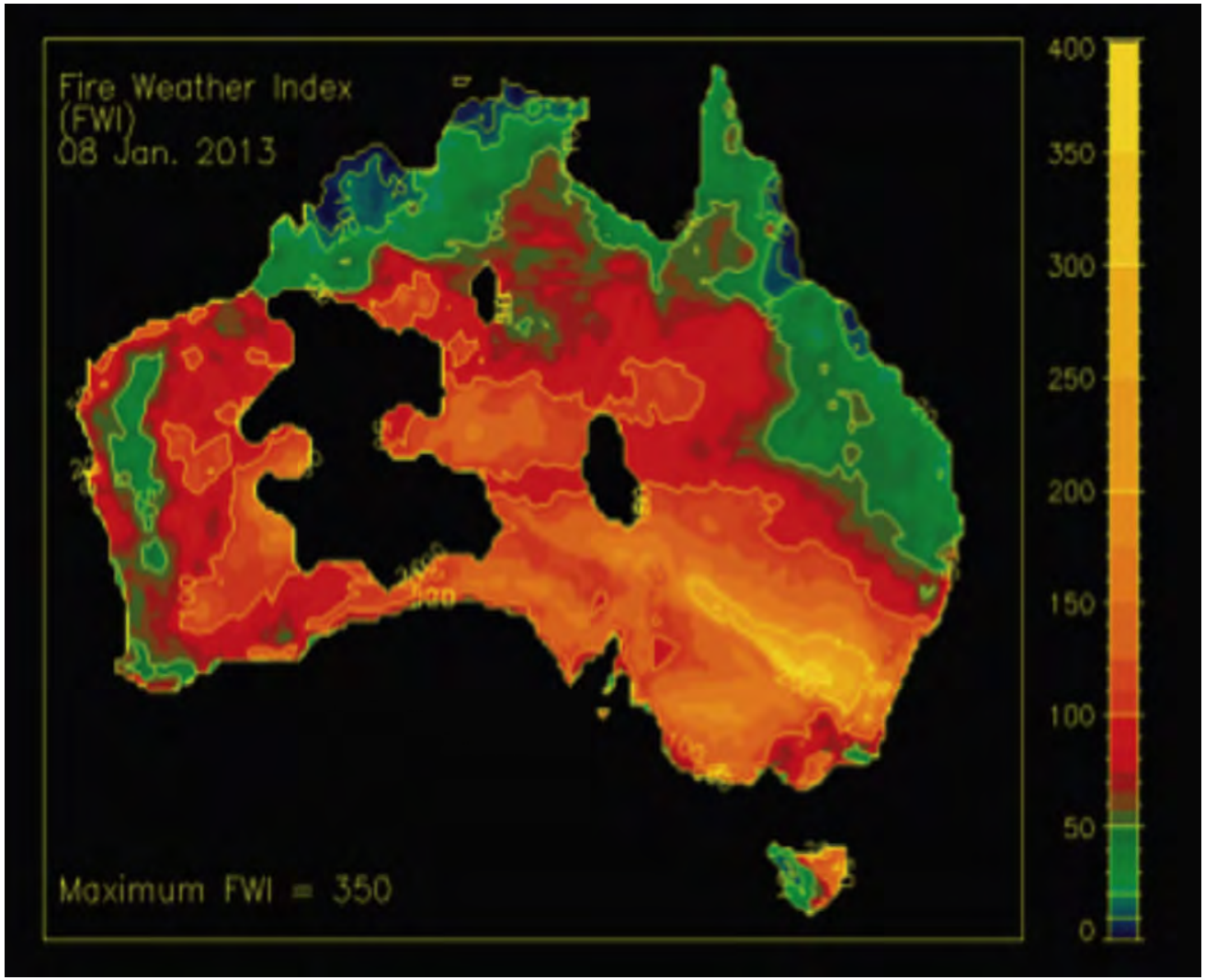


# Heavy rainfall and flooding

# Queensland 2010/11 floods

- December 2010 was Queensland's wettest December on record
- Floods broke river height records at over 100 observation stations
- 78% of the state was declared a disaster zone
- Economic cost estimated to be in excess of $5 billion
- 300,000 homes and businesses lost power in Brisbane and Ipswich

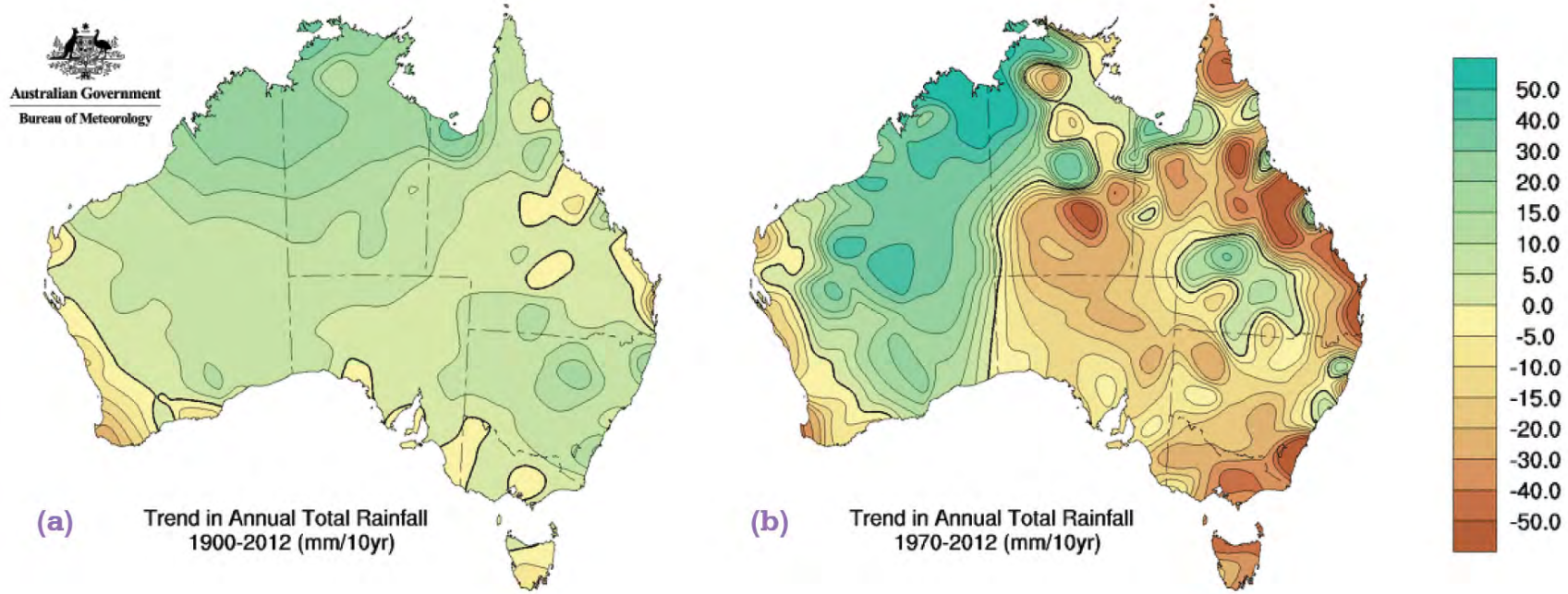
# Fire Weather Index, 8 Jan 2013



# Bushfires and Climate Change

- Climate change exacerbates bushfire conditions by increasing the frequency of very hot days.
- Between 1973 and 2010 the Forest Fire Danger Index increased significantly at 16 of 38 weather stations across Australia, mostly in the southeast. None of the stations showed a significant decrease.
- Projected increases in hot days across Australia, and in dry conditions in the southwest and southeast, will very likely lead to more days with extreme fire danger in those regions.

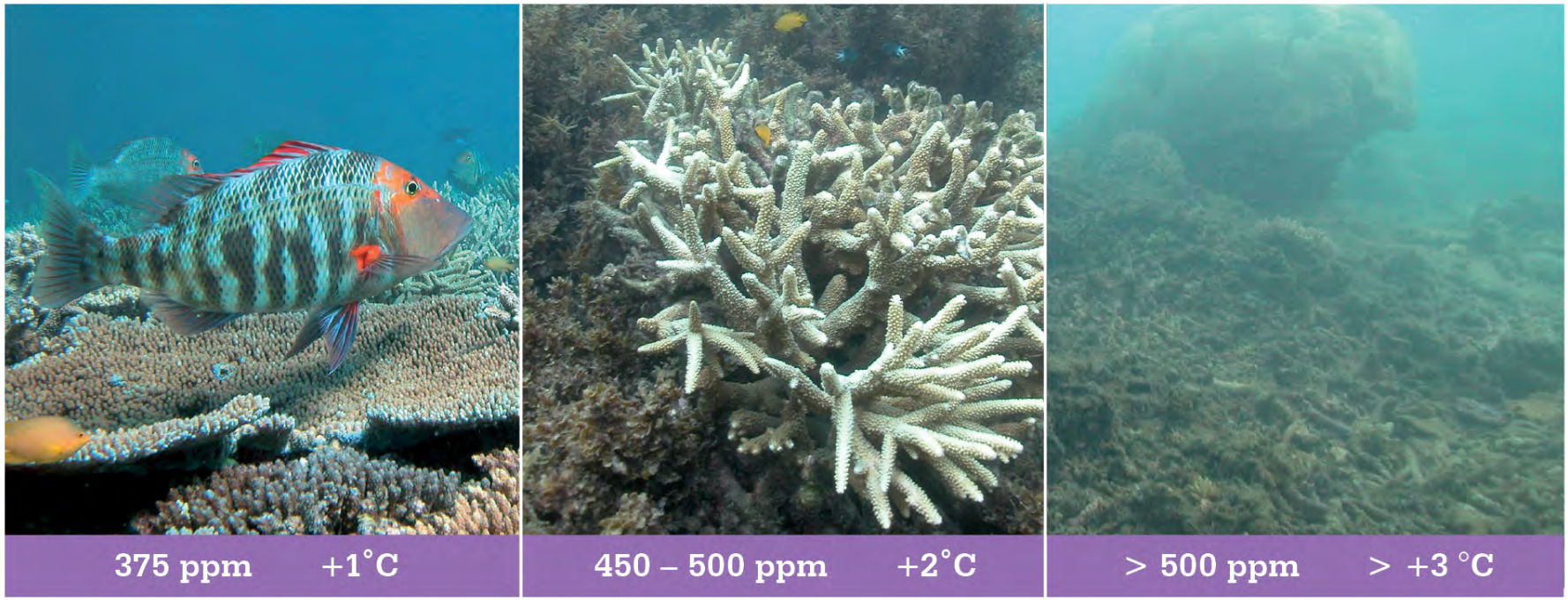
# With changing rainfall patterns




**Source:** BoM, 2013c

www.climatecommission.gov.au

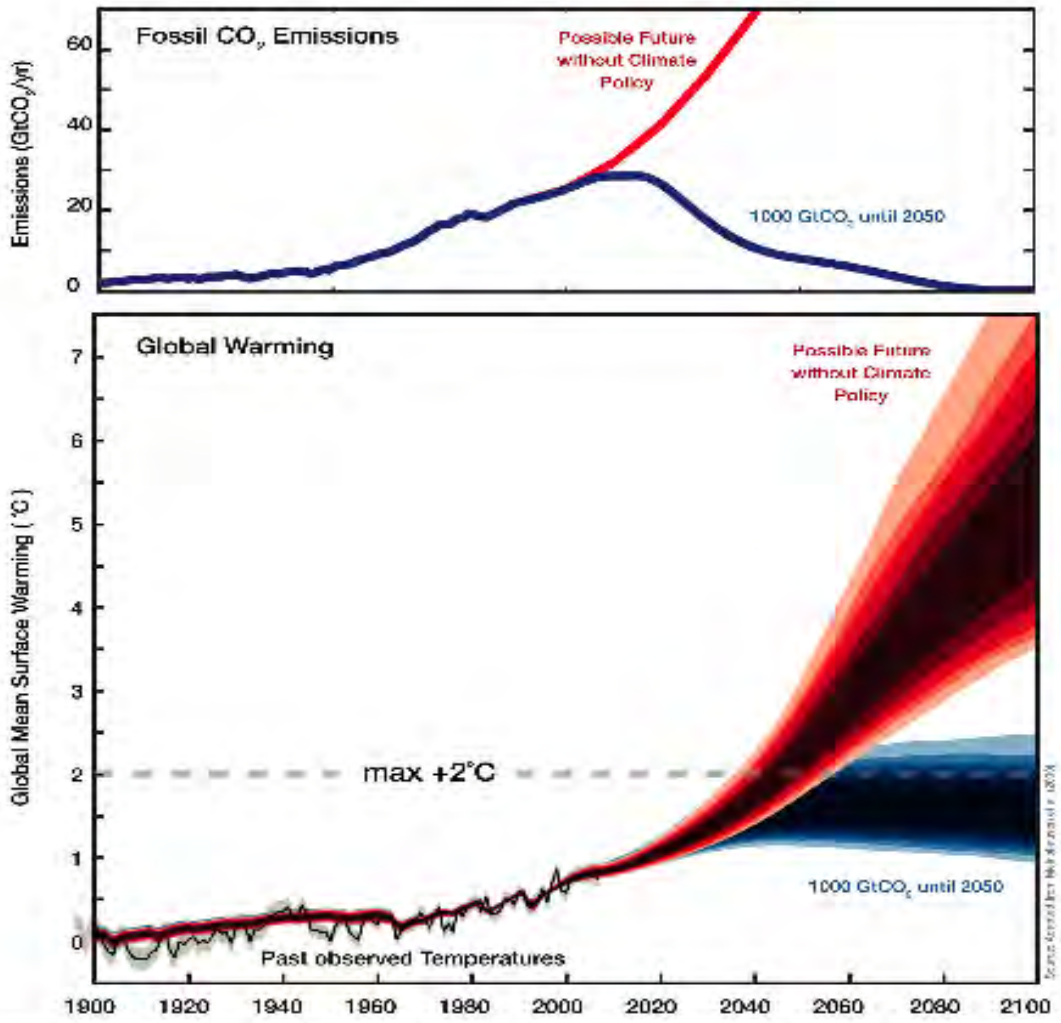
# Coral reef states under increasing $CO_2$ and T




**Source:** modified from Hoegh-Guldberg et al., 2007

www.climatecommission.gov.au

# The carbon maths: future pathways




Meinshausen et al. 2009

# Overspend in the carbon budget

# The fossil fuel equation

- The remaining global budget for $CO_2$ emissions from fossil fuel combustion is about 600 billion tonnes if we are to stay within the 2$^{o}$C limit.

- The world's indicated fossil fuel reserves (coal, oil and gas), if all were burnt, would emit nearly 3,000 billion tonnes of $CO_2$ (IEA, 2012).

- This means that we can burn only about 20% of the world's known fossil fuel reserves. Most will have to stay in the ground.

- Australia's coal reserves represent about 51 billion tonnes of $CO_2$ emissions, about one twelfth of the world's allowable budget.

# Key Messages

- The evidence for climate change is overwhelming and clear. It is beyond reasonable doubt that the burning of fossil fuels is the primary cause.

- We are already seeing the social, economic and environmental impacts of a changing climate, especially extreme events. The risks rise as climate shifts further.

- To stabilise the climate at a manageable level, most of the world's fossil fuel reserves must stay in the ground.

- This is the critical decade. Decisions we make from now to 2020 will determine the severity of climate change our children and grandchildren experience.

generation foundation

# Stranded Carbon Assets

## Why and How Carbon Risks Should Be Incorporated in Investment Analysis

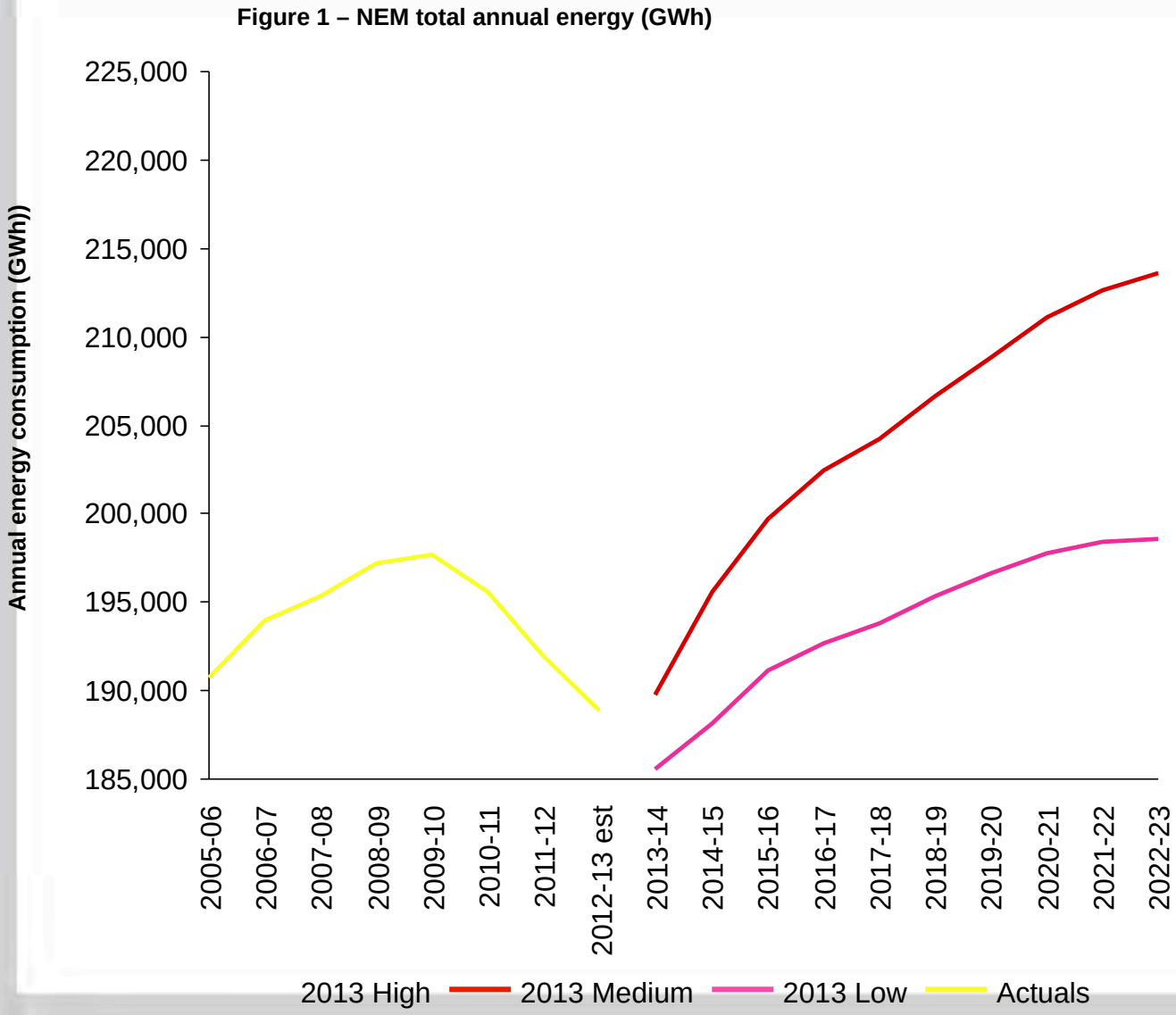
October 30, 2013

# One driver of change:

Average life expectancy in northern China has been cut by an average of 5.5 years as a result of diseases caused by GHG emissions related to smog.

In September 2013, China announced that it will ban the construction of any new coal plants in three key industrial regions – Beijing, Shanghai and Guangzhou – with particularly heavy air pollution.24

# AEMO: Load fall by 5% since FY09
# - Residential and commercial (~40% of total) consumption down 7.5% in the past 5 years.




**Closures & withdrawals equivalent to 5% of installed capacity**

# Speed of change

**Clean, Zero Cost Fuel sources growing fast**

**Australia:**
**Solar 3,000 installations 2007, now over 1 million**
**First wind farm is S Aust 2003. Now 26% of generation**

**Germany:**
**25gw solar, 32gw wind = 60% renewables on some days.**
**Highly reliable grid.**

**China:**
**$53 billion investment in solar & wind in 2013**

# Final Thoughts

**Bandwidth of price tolerance for fossil fuels  is narrowing**

**Solar cost down 80% is last 4 years. No need for subsidies**

**Wind cost declining at 4% p.a.**

**Best-selling car in Norway right now: Tesla S**

**WMO data for 2012 shows rate on increase in emissions declinied by at least one third: The transition is happening far faster than  anyone imagined.**

# Terrestrial biodiversity?

For SPREP countries, climate change is just 1 stressor among many.

Captive breeding, translocation , fenced areas essential.

AWC – 6 fenced areas in Australia :100 sq km +

NZ: Maungatatauri 34 sq km.

# Maungatatauri NZ