

# Climate change frustration

## WHAT ROLE FOR THE PUBLIC SCIENTIST?

Lesley Hughes





*“It is time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here.”*



**What did we know when?**

**Why should we care?**

**Why is the message so hard?**

**How should scientists respond?**



**Jean-Baptiste Joseph Fourier**  
**1768-1830**

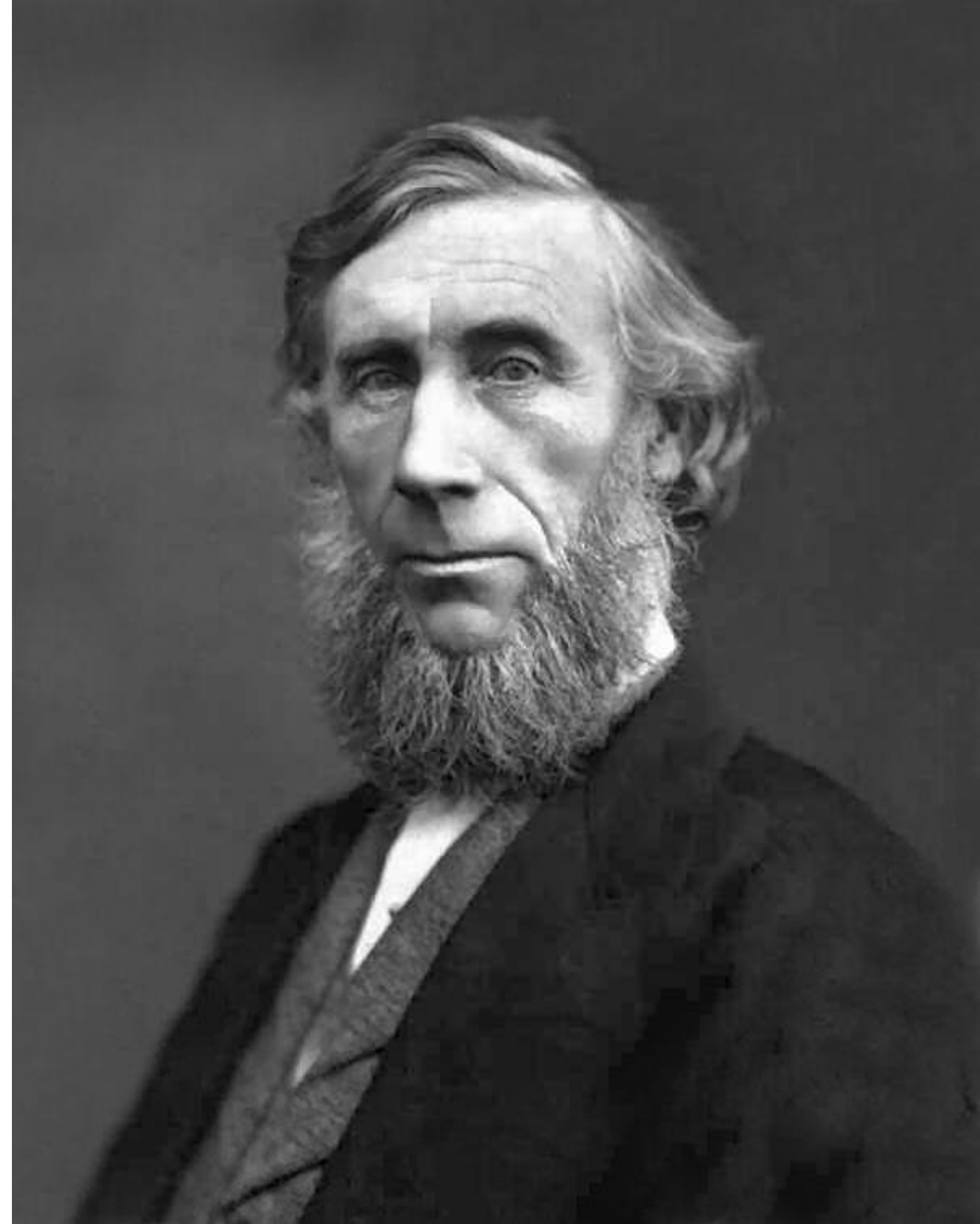
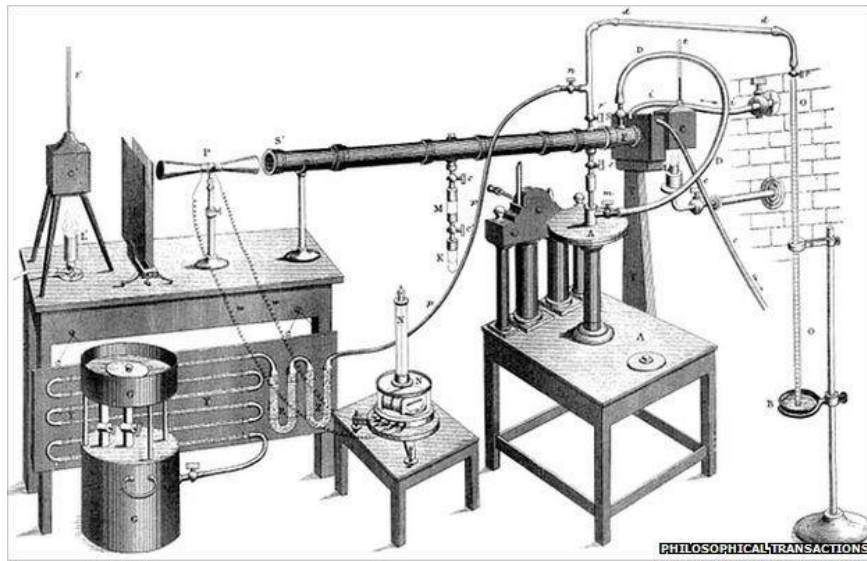
"Remarques Générales Sur  
Les Températures Du Globe  
Terrestre Et Des Espaces  
Planétaires" **(1824)**



# John Tyndall

1820-1893

**1859:** generally credited as being the first to correctly measure the relative infrared absorptive powers of nitrogen, oxygen, CO<sub>2</sub>, methane, water vapour, thus proving the Greenhouse Effect existed





# Eunice Newton Foote

## 1819-1888

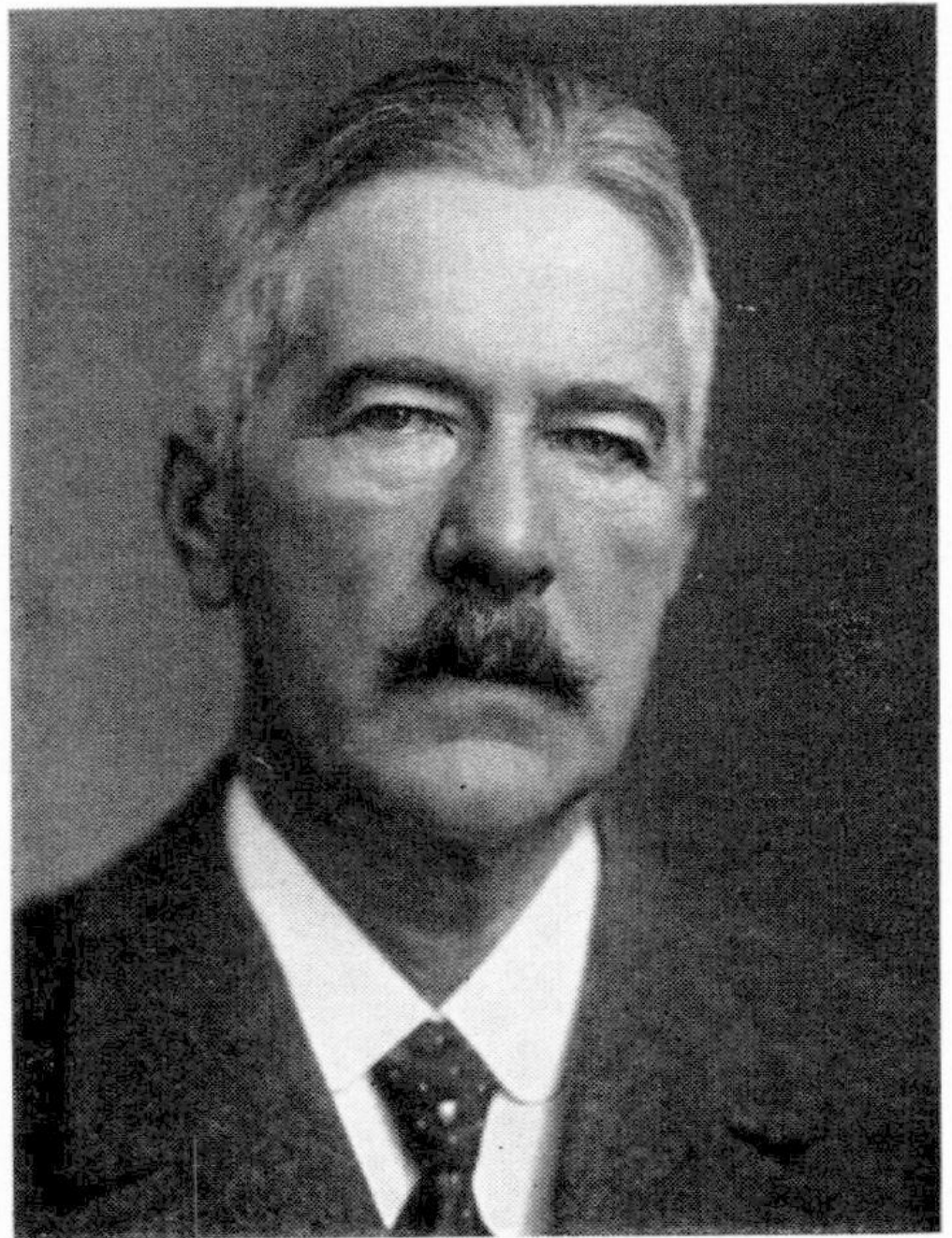
**1856:** research presented to conference that *“The highest effects of the sun’s rays I have found to be in carbonic acid gas”*



# Arvid Högbom

## 1857-1940

First to quantify sources of CO<sub>2</sub> emissions (human and natural) to understand the carbon cycle



ARVID HÖGBOM



# Svante Arrhenius

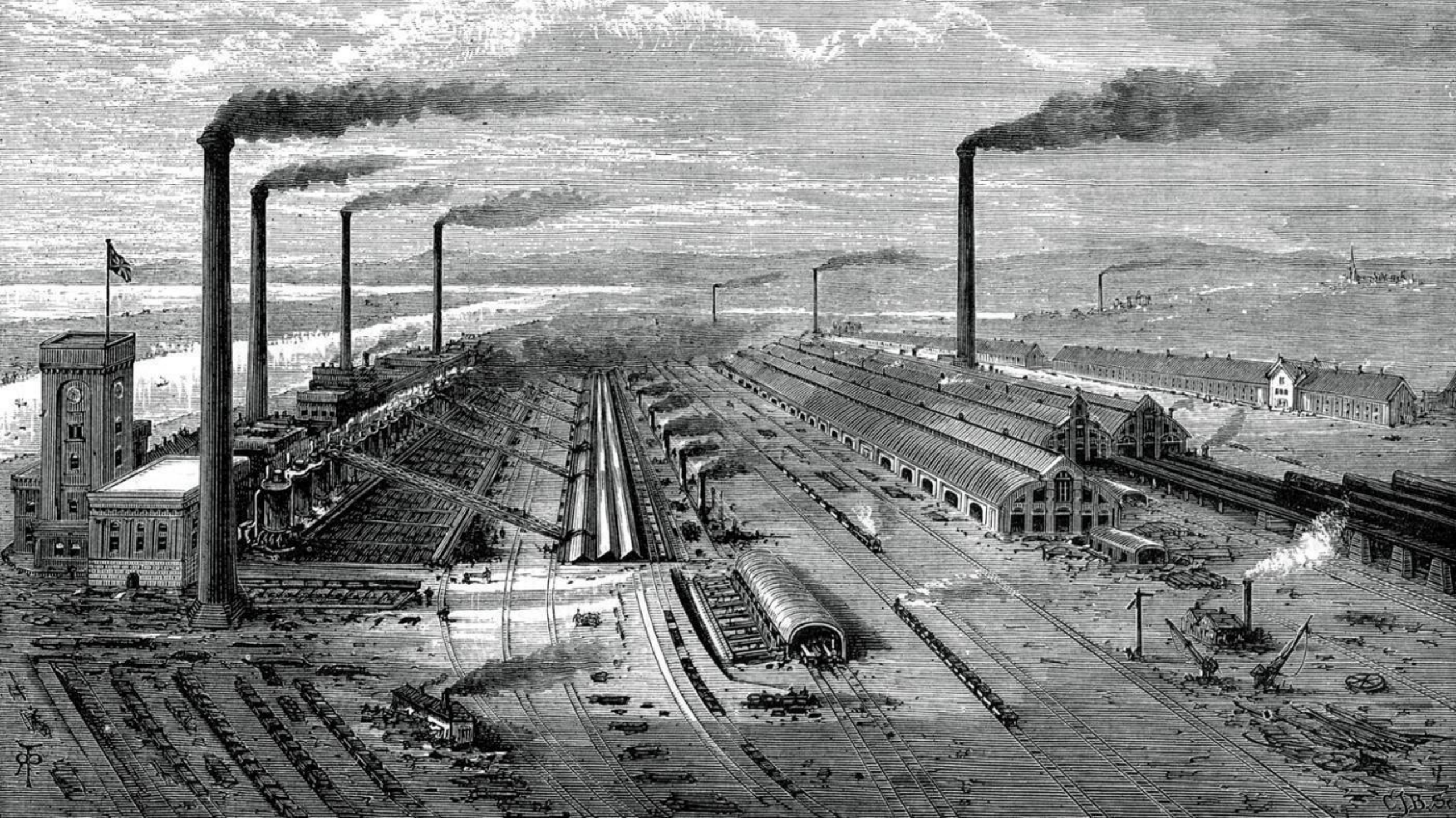
1859-1927

**1896:** realised that Högbom's calculations meant that human influences could eventually lead to a doubling of atmospheric CO<sub>2</sub> – coined term “Greenhouse Effect”

**2 x CO<sub>2</sub> ~ 5-6°C**

Predicted warming of the earth....in thousands of years





# Guy Callendar

## 1897-1964

**1938:** promoted the idea that rising CO<sub>2</sub> would promote warming (eventually known as the Callendar Effect) but thought this would be beneficial, delaying “the return of the deadly glaciers”

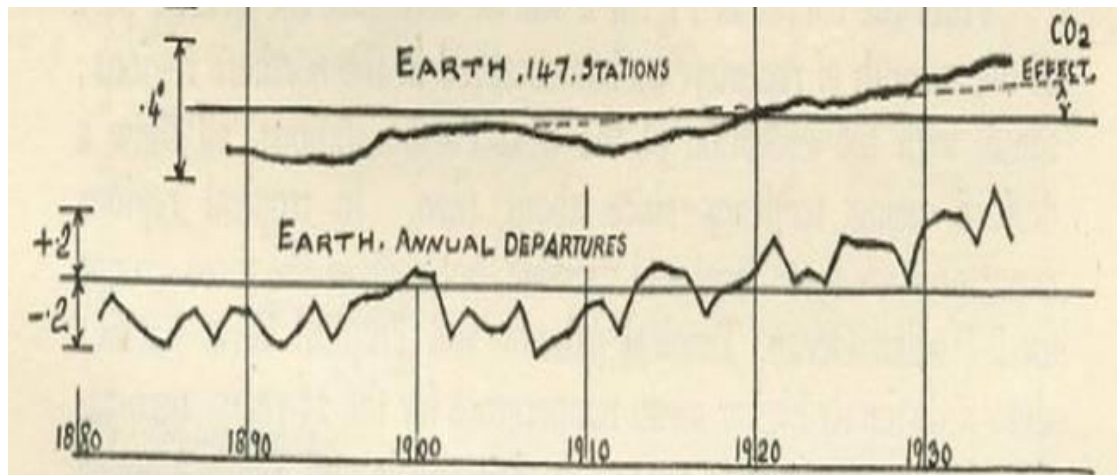
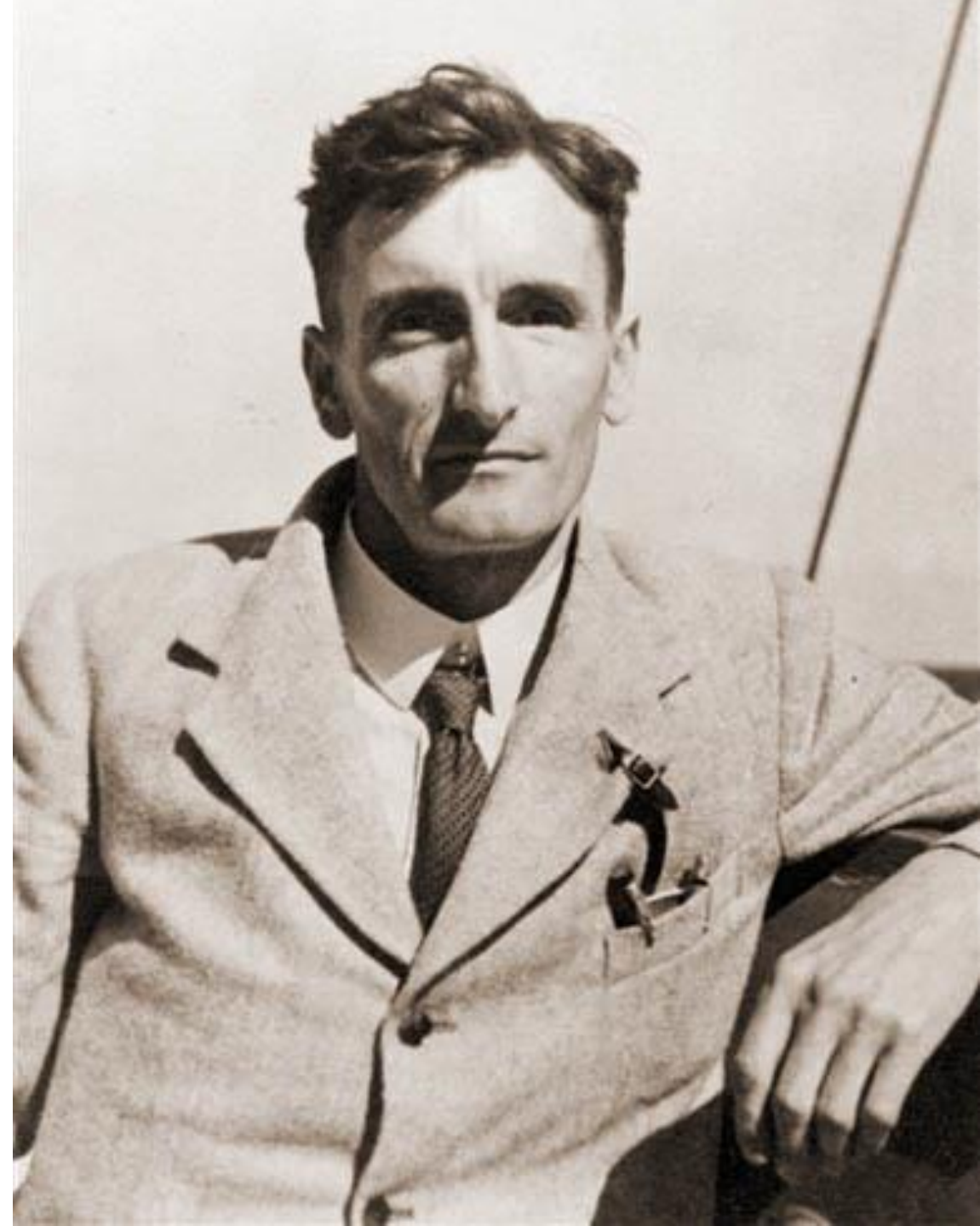
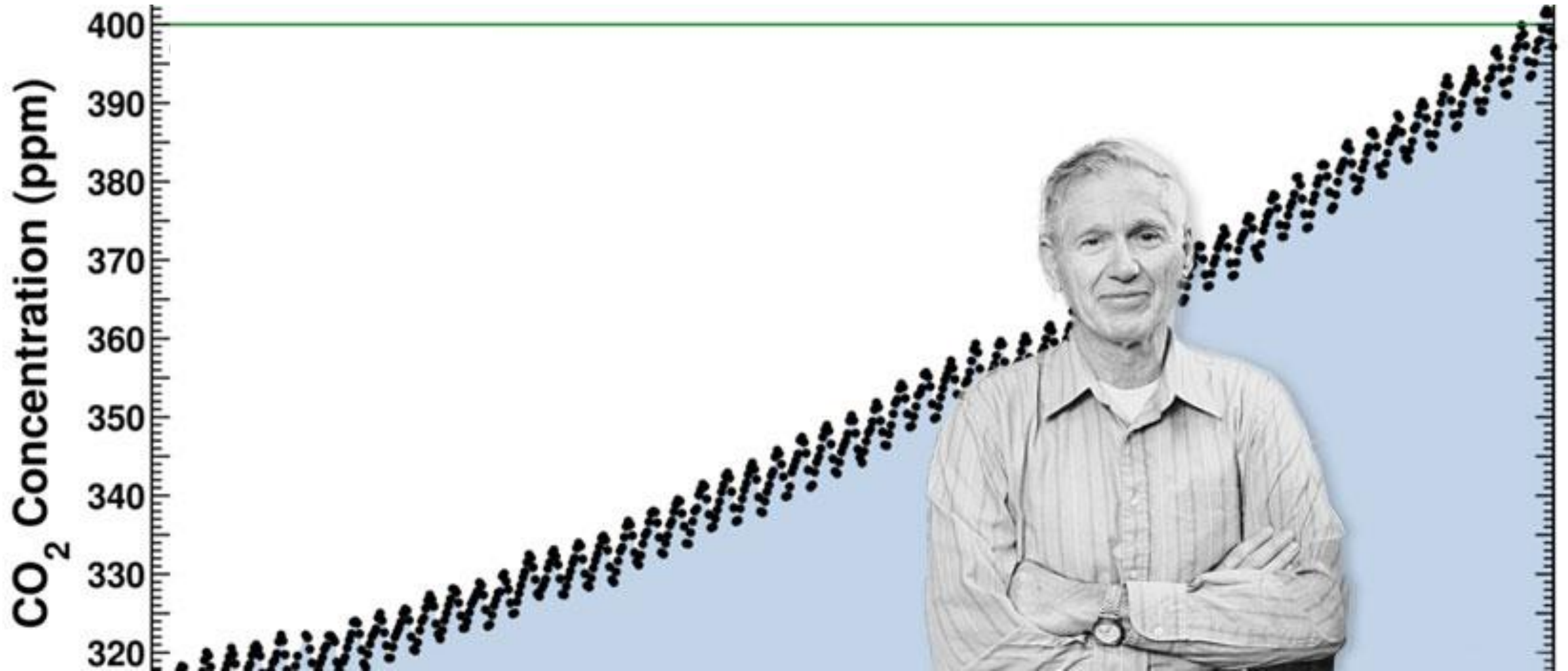


FIG. 4.—Temperature variations of the zones and of the earth. Ten-year moving departures from the mean, 1901-1930, °C.



# Charles Keeling 1928-2005





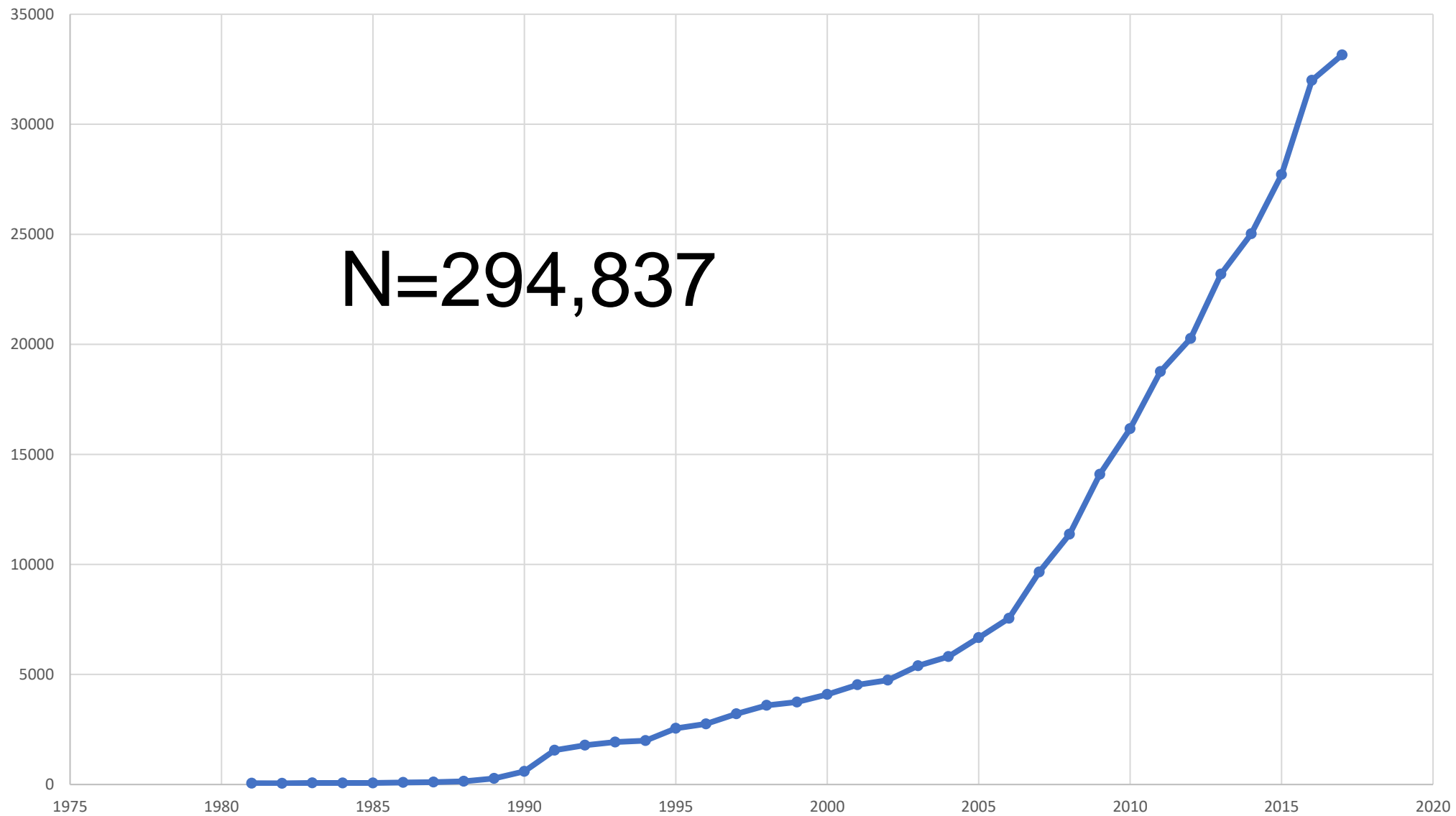
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Climatic Change: Are We on the Brink of a Pronounced Global Warming?

Author(s): Wallace S. Broecker

Source: *Science*, New Series, Vol. 189, No. 4201 (Aug. 8, 1975), pp. 460-463

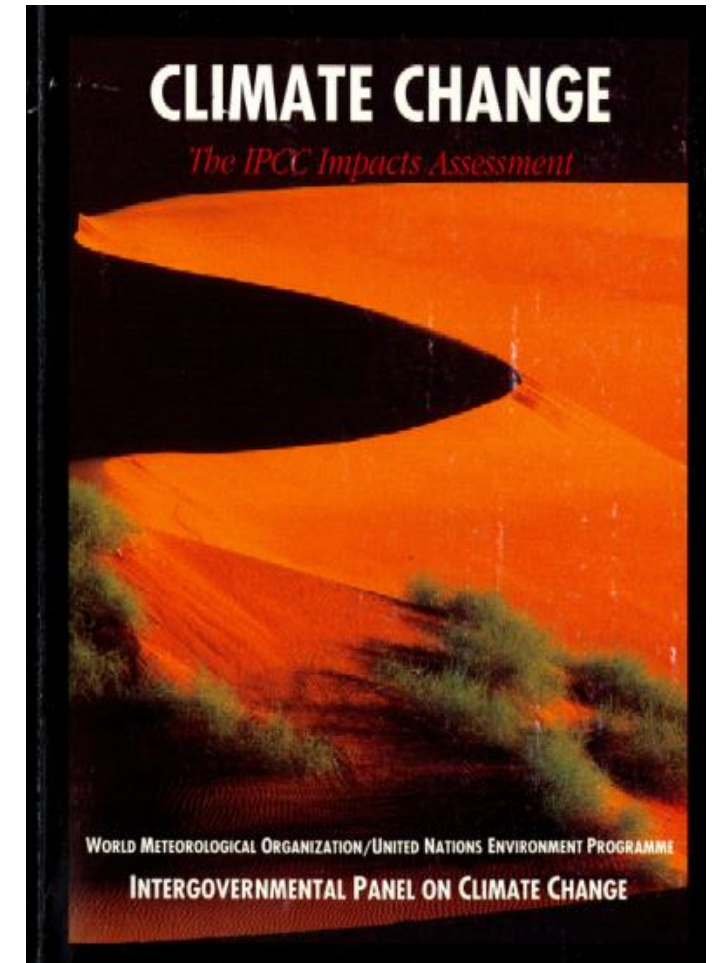
Published by: American Association for the Advancement of Science



No. papers with (global warming) or (clim\* change) in Web of Science 1981-2017

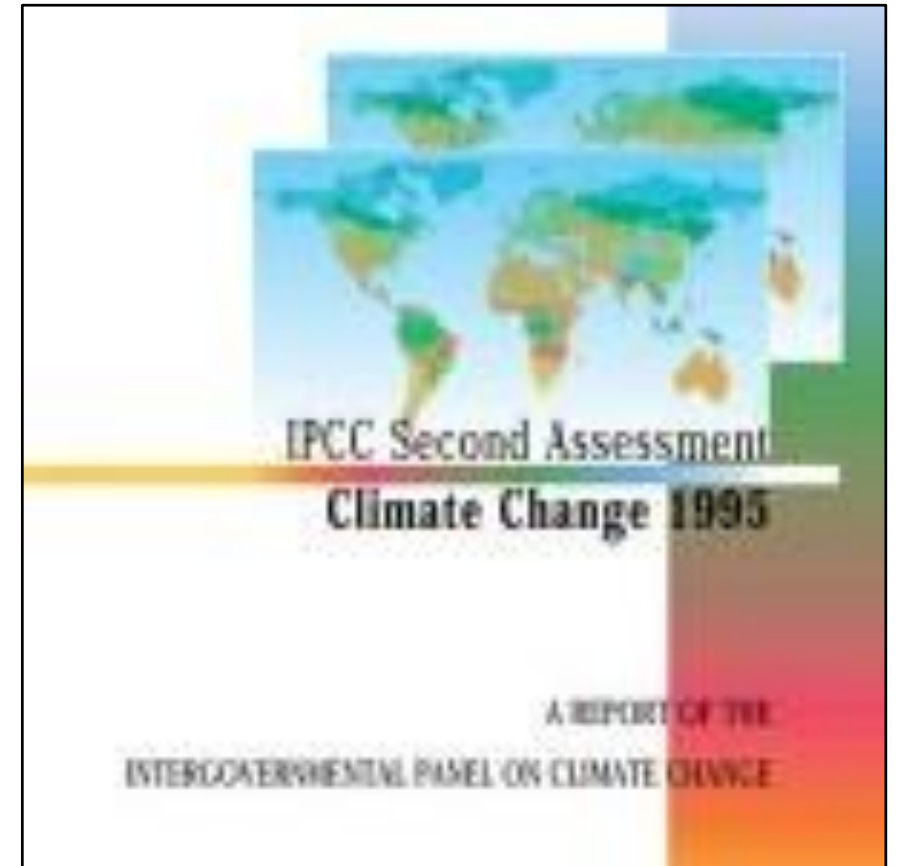
# IPCC First Assessment Report (1990)

- “...warming of the globe of  $0.3 - 0.6^{\circ}\text{C}$  has taken place over the last century”
- “Emissions resulting from **human activities** **are substantially increasing** the atmospheric concentrations of the greenhouse”



# Second Assessment Report (1995)

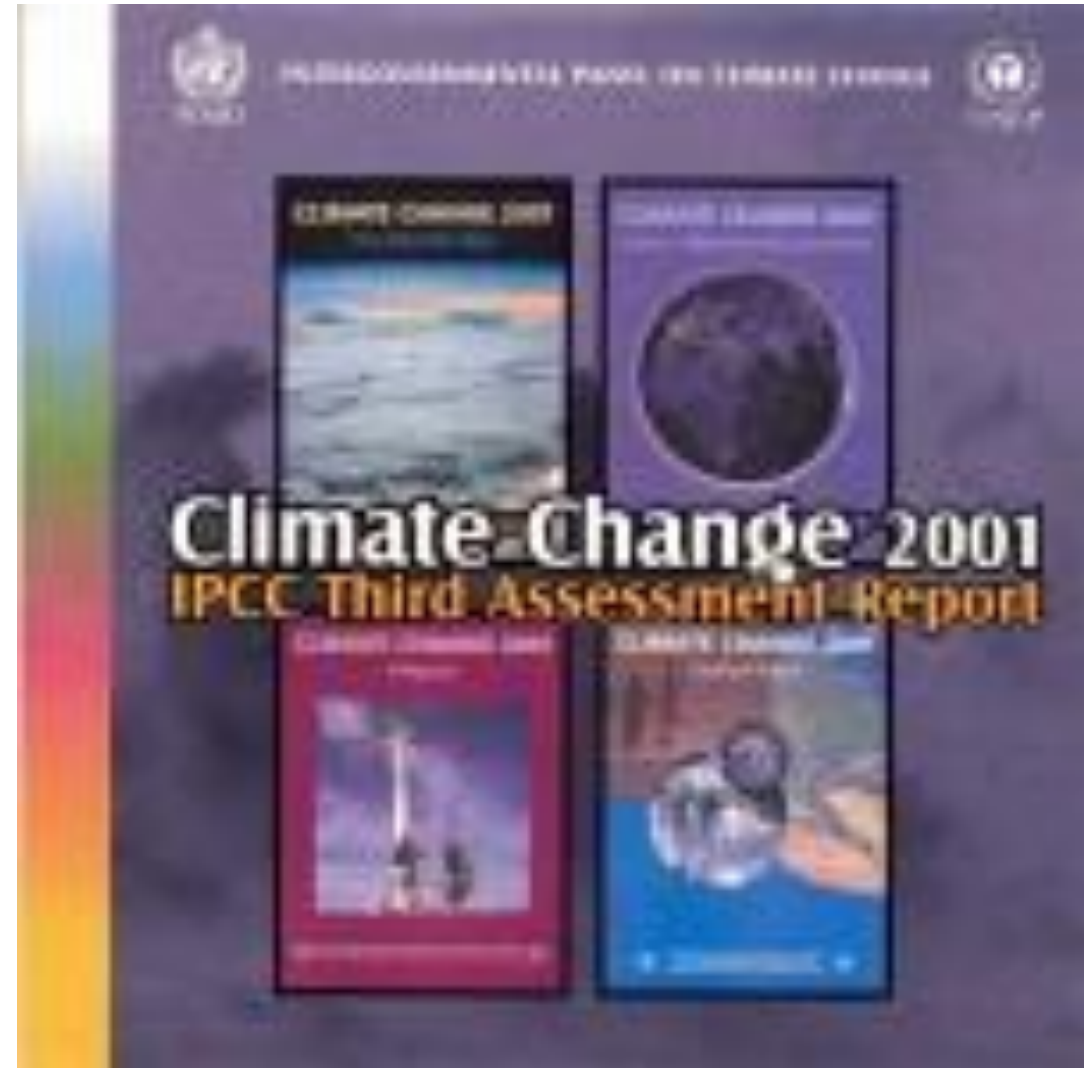
*"the observed trend in global mean temperature over the past 100 years is **unlikely to be entirely natural in origin.** ..... these results **point towards a human influence on global climate**".*





# Third Assessment Report (2001)

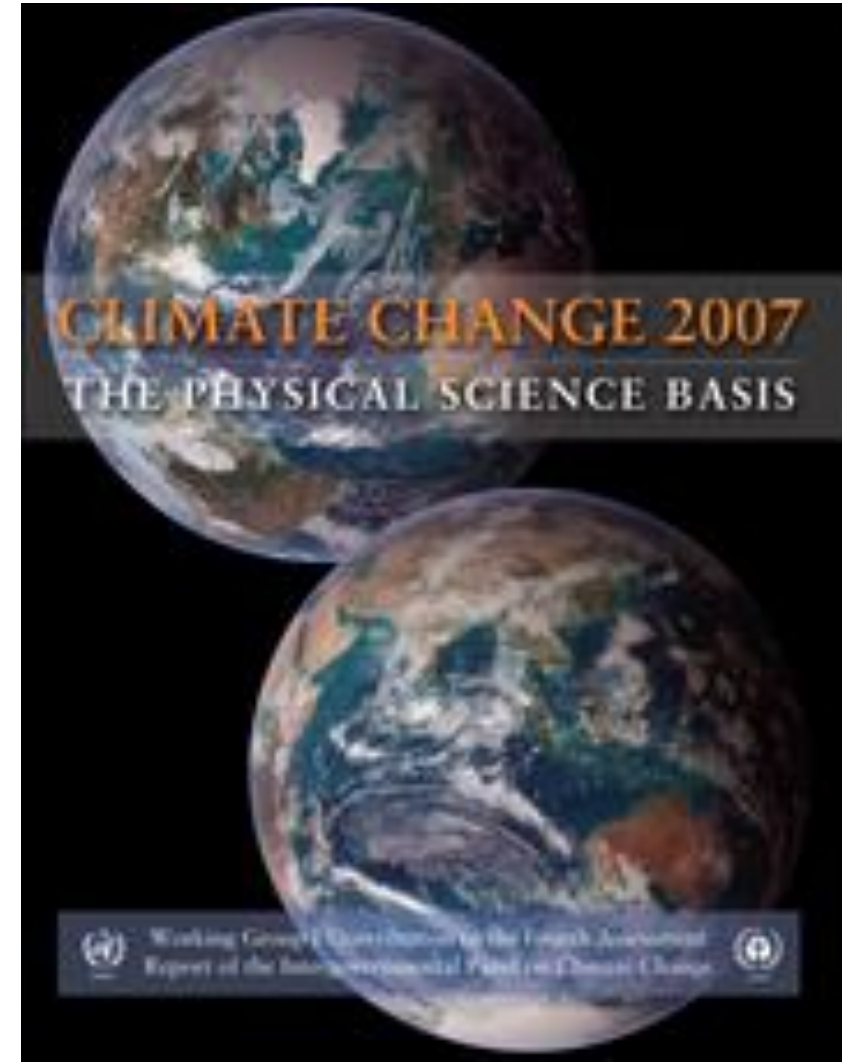
*“New and strong evidence that most of the warming observed over the last 50 **years is attributed to human activities**”*



# Fourth Assessment Report (2007)

*“Warming of the climate system is **unequivocal**”*

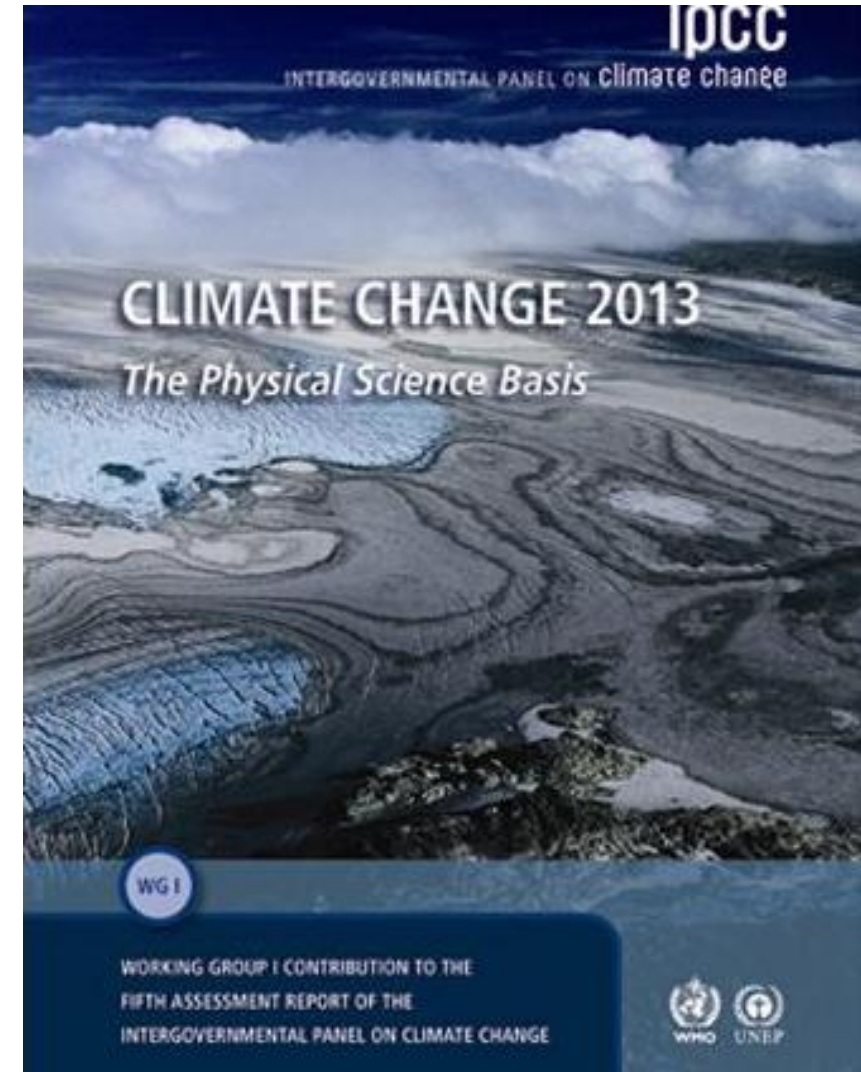
*“Most of the observed increase in global average temperatures since the mid-20th century **is very likely** due to the observed increase in anthropogenic greenhouse gas concentrations.”*



# Fifth Assessment Report (2013)

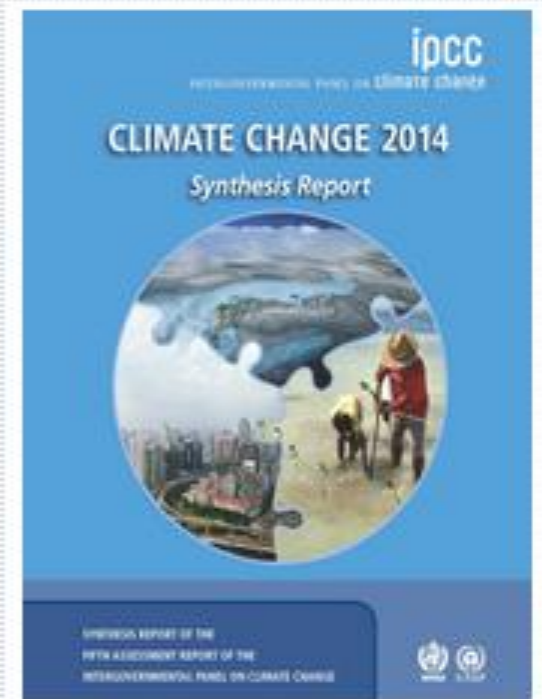
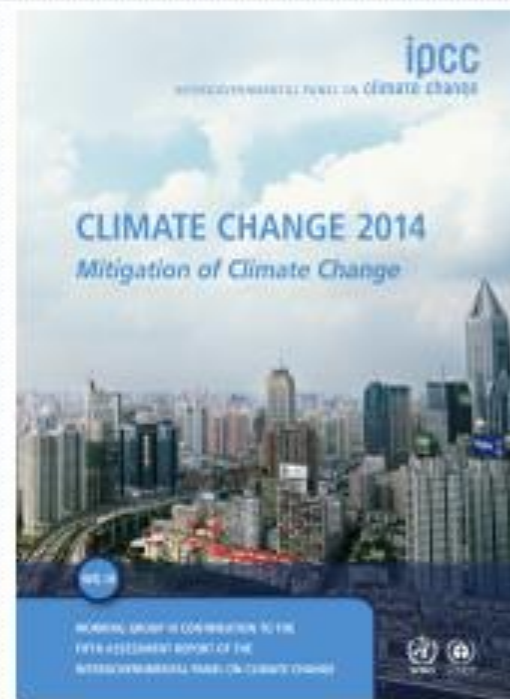
*“Warming of the climate system is **unequivocal**, and since the 1950s, many of the observed changes are **unprecedented** over decades to millennia”*

*“**Human influence on the climate system is clear**. It is **extremely likely** (95-100% probability) that human influence was the dominant cause of global warming between 1951-2010”*



# ...most scrutinised report in history?

- 3 Working Group Reports + Synthesis report
- ~2500 pages
- 4 drafts
- 800 authors (from 3000 nominations)
- 142,631 comments



**Why should we care?**



alarmist

ə'la:mɪst/

*noun*

**1.1.** someone who exaggerates a danger and so causes needless worry or panic

*adjective*

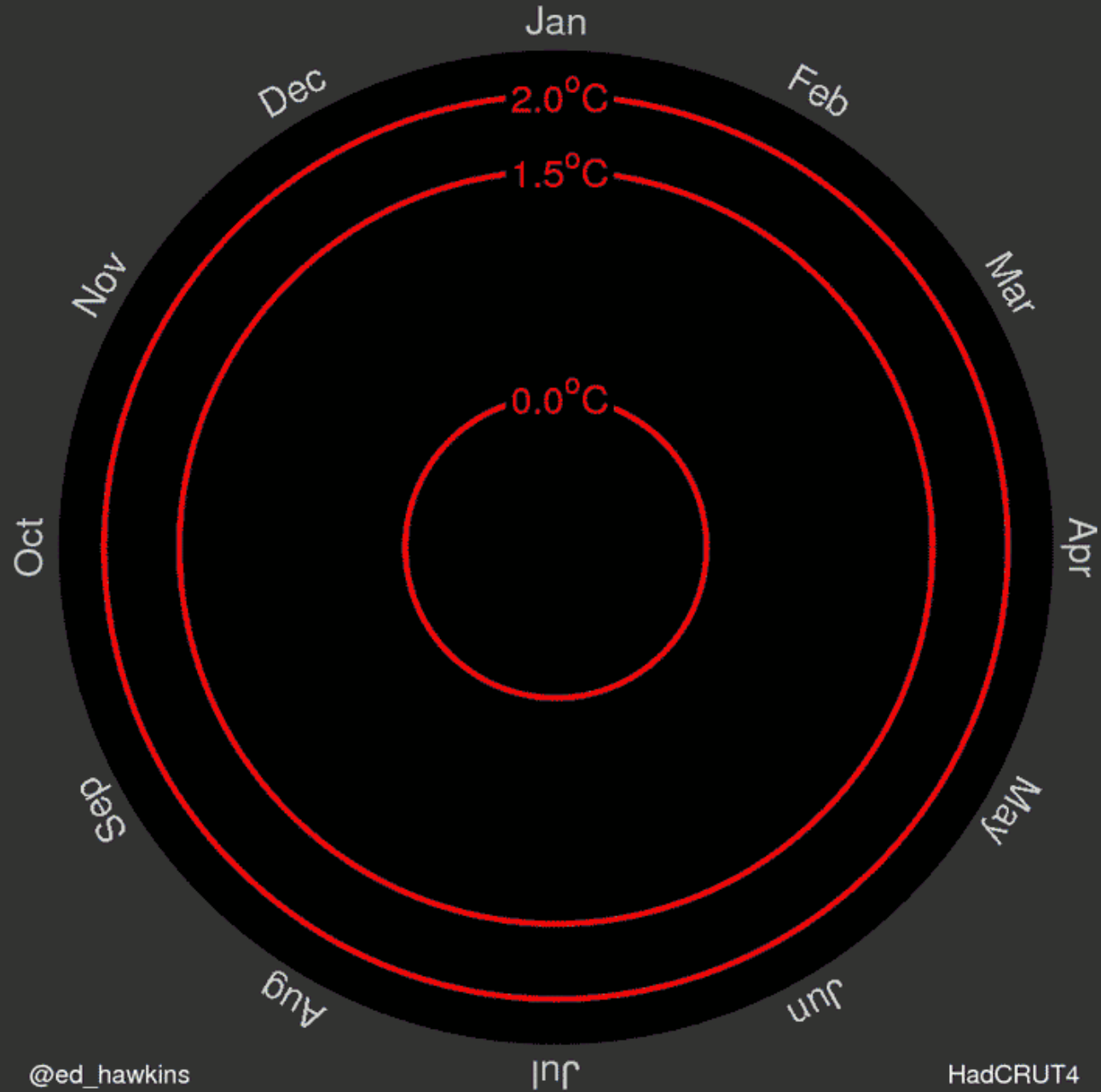
**2.2** Creating needless alarm or panic



**Climate changing 170 times faster (70s to 2016) than in previous 7000 years**



# Global temperature change (1850–2016)

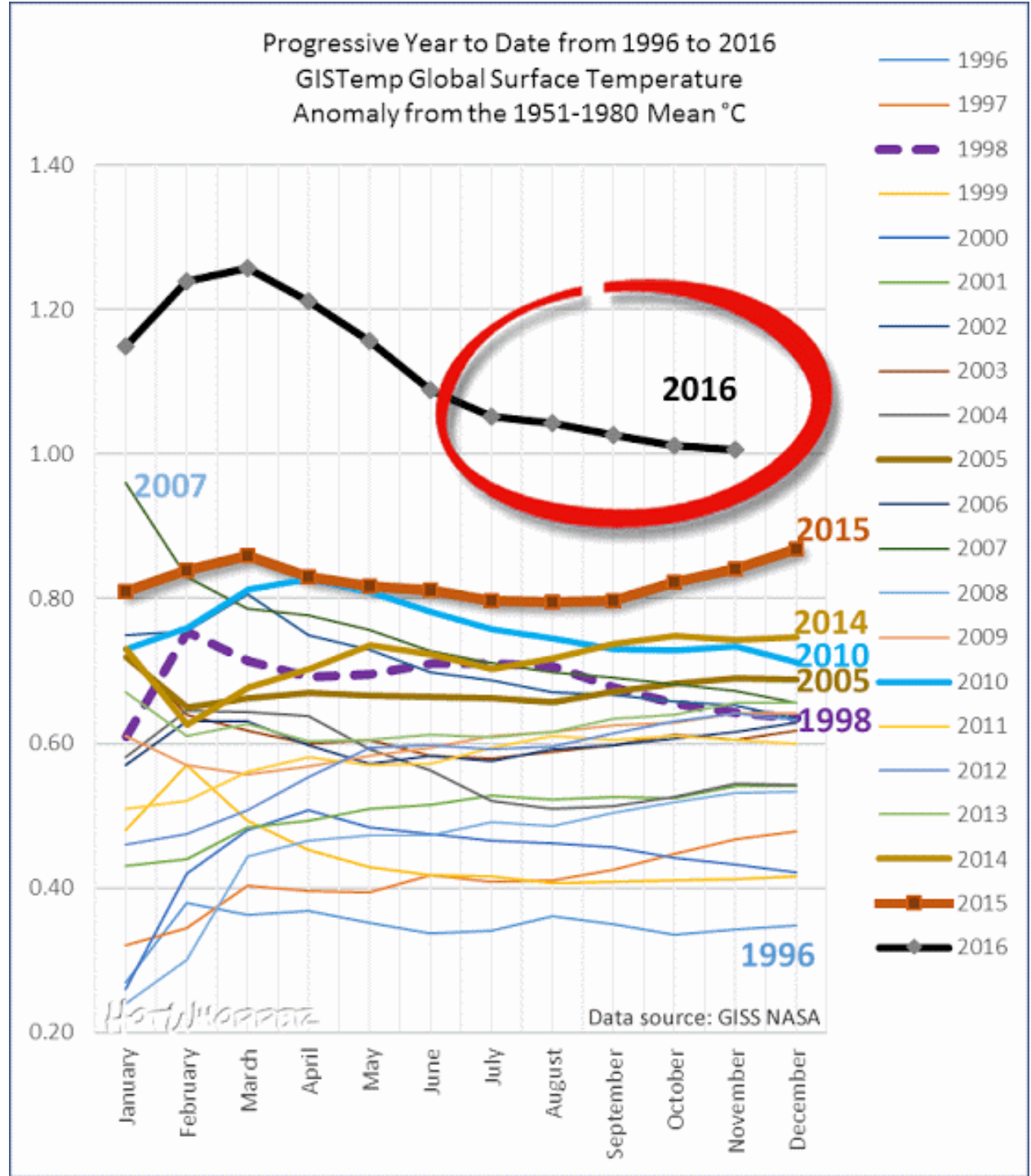


<http://www.climate-lab-book.ac.uk/2016/spiralling-global-temperatures/>



# 2016: another record year

- 2017 third warmest year in history
- Warmest non El Niño year
- 16 of the 17 warmest years occurred since 2000



**Glaciers are retreating**





1941



1950



2004

- **Himalaya-Hindu Kush mountain range & Tibetan Plateau**
- **Source of 10 major river systems, providing water for > 1.3 billion people – nearly 20% of world population**
- **Warming 2X global average, 500 glaciers already gone**



**Polar ice is melting**



1984 - 2016





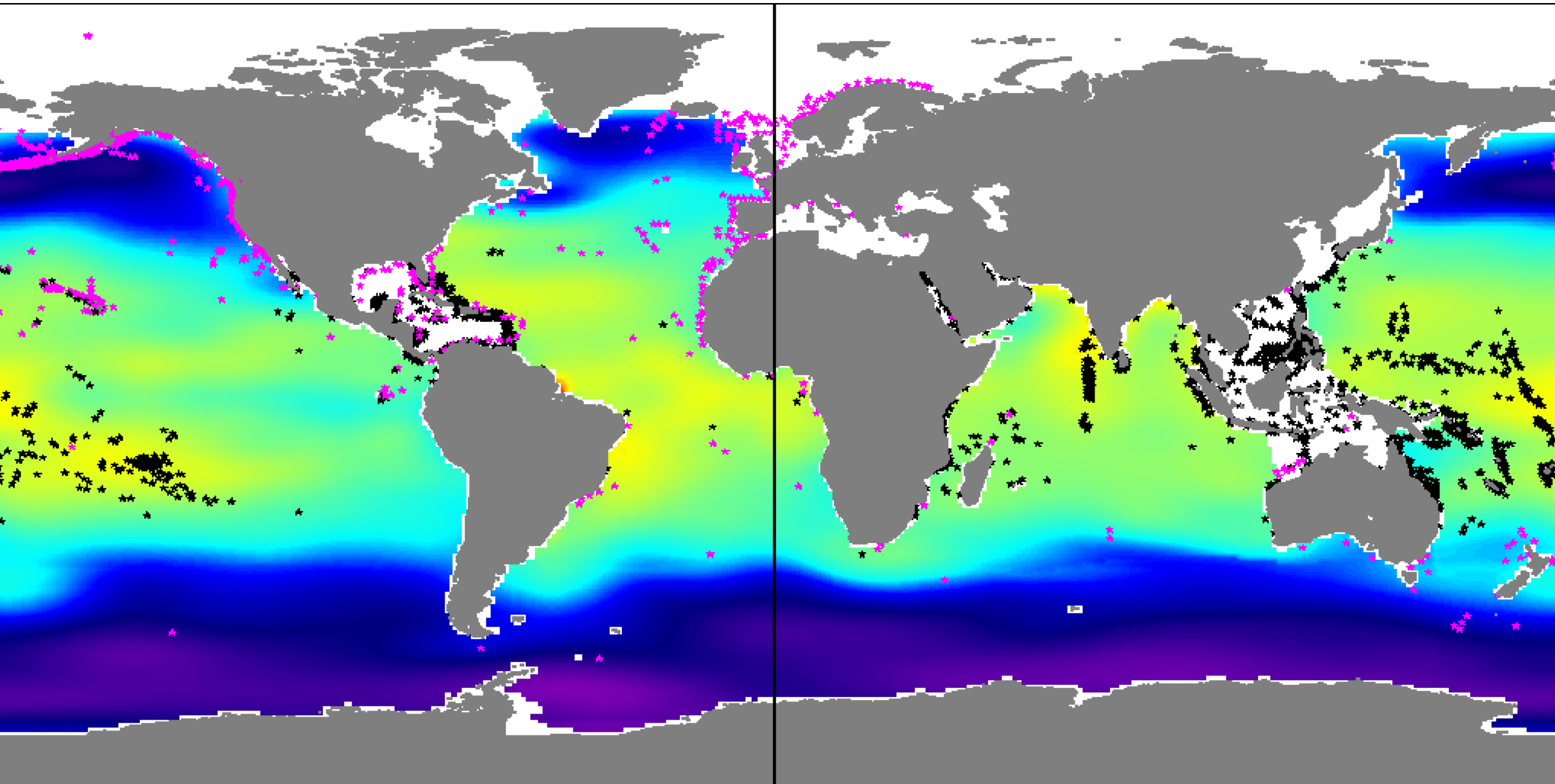
**Sea level rise is accelerating**

**Pace has tripled since 1990s**



- 
- A photograph showing a coastal cliffside. In the foreground, a steep, eroded sand cliff drops down to a beach. Several people are walking along the top edge of the cliff. In the background, a city skyline with various high-rise buildings is visible under an overcast sky. The beach in the foreground is sandy and has some debris scattered on it.
- **50% Australian coastline vulnerable to recession by 2100**
  - **In Sydney, 1-in-100 year flood could occur every day by 2100**
  - **For 110cm m slr: >\$200 billion assets at risk**

# Oceans 30% more acidic than pre-industrial





# Coral reefs are bleaching

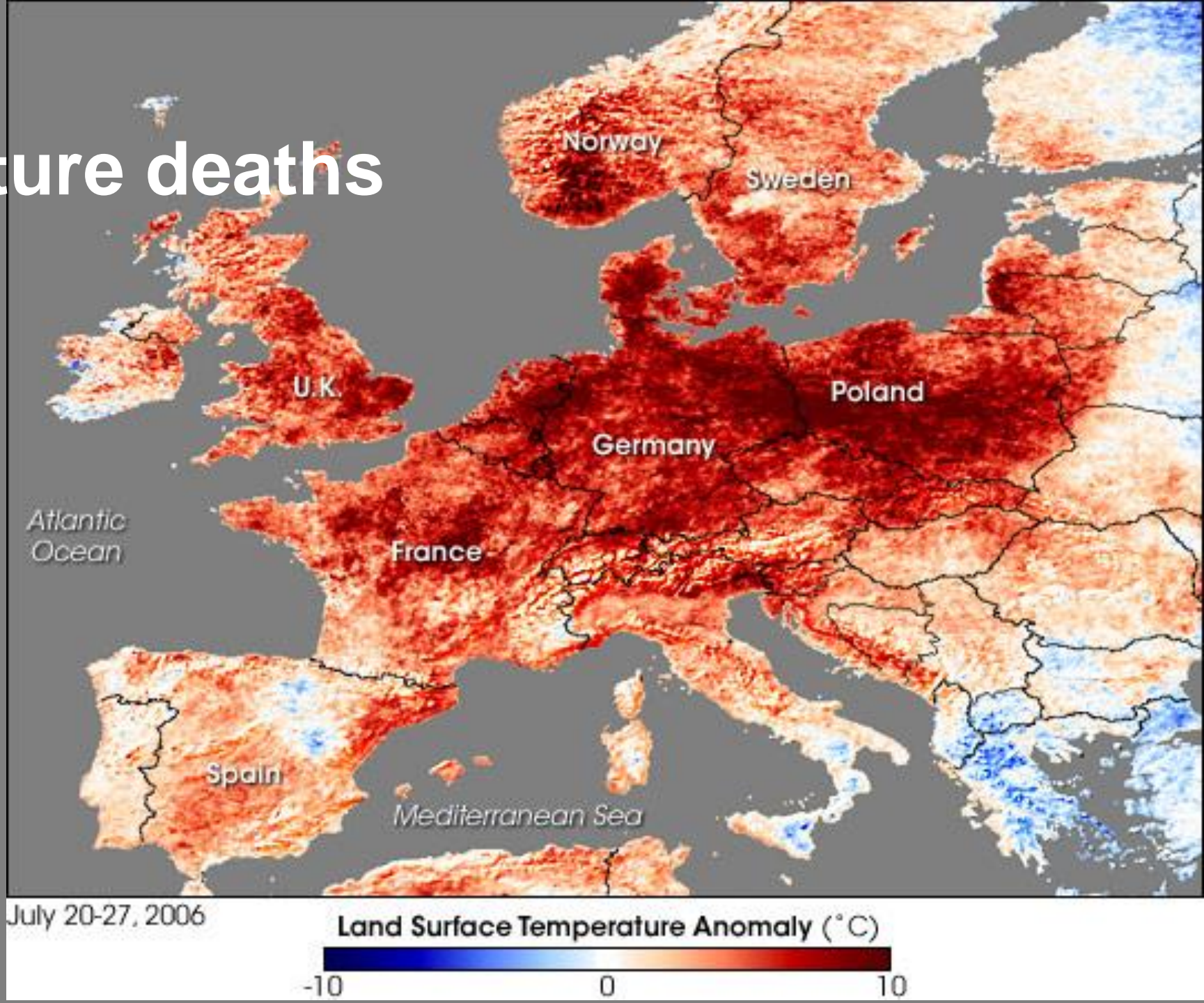


- **2016-17: catastrophic bleaching on Great Barrier Reef**
- **93% individual reefs affected**
- **50% mortality of bleached coral**

- **\$7 billion**
- **>60,000 jobs**



# Europe: 2003 70,000 premature deaths



**Russia: 2010**  
**56,000 premature deaths**

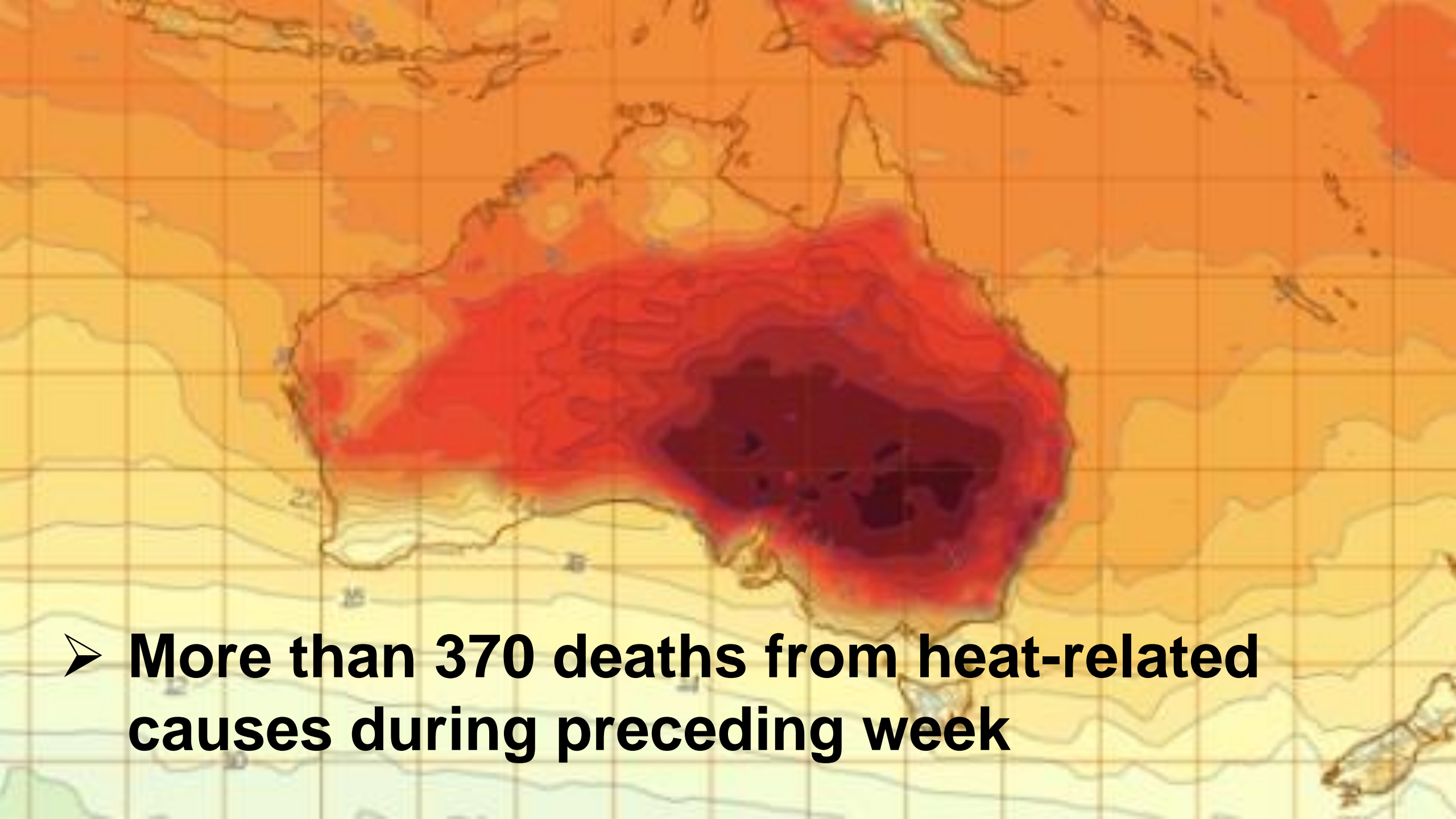






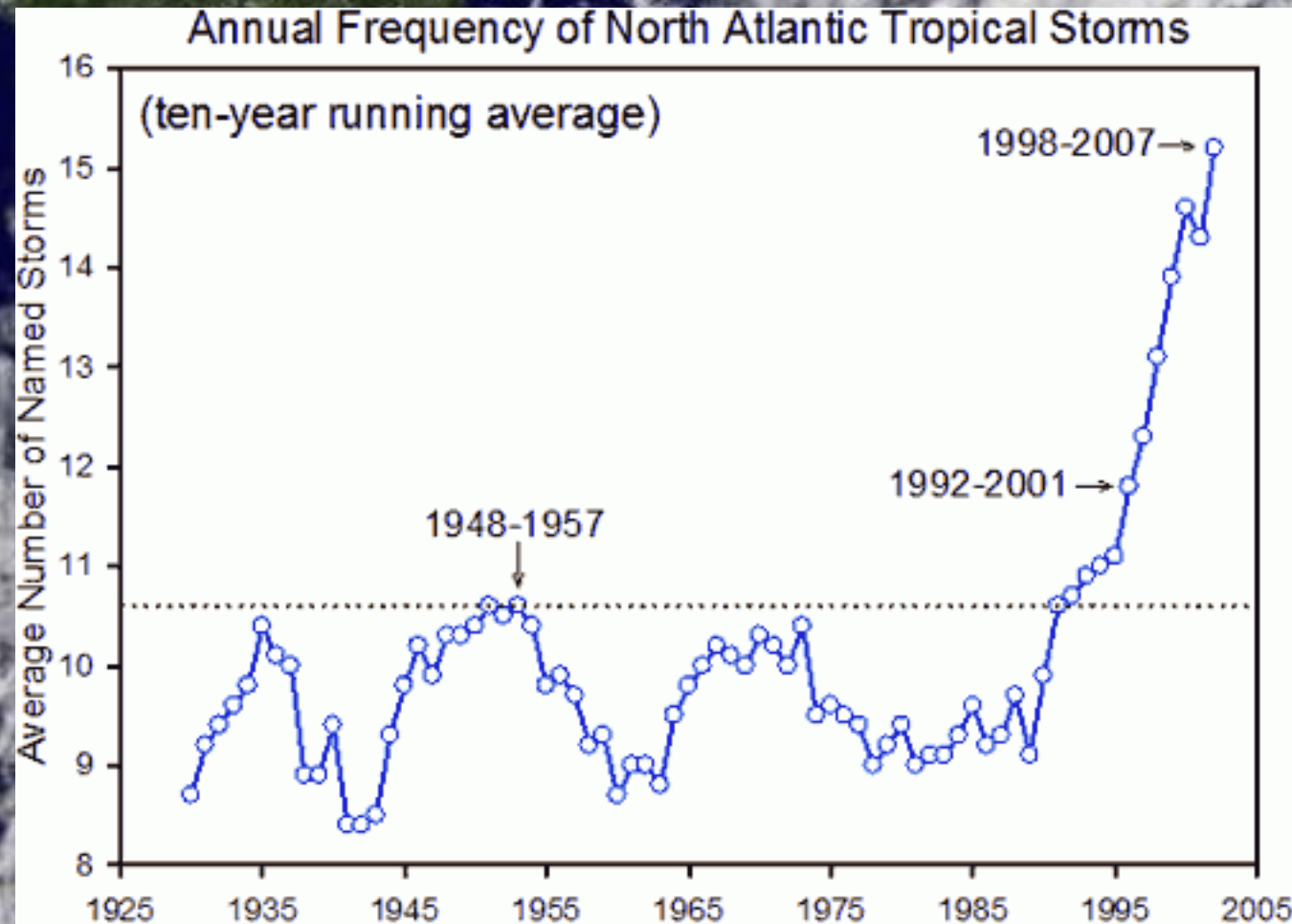
**Black Saturday 2009: 173 deaths**





➤ **More than 370 deaths from heat-related causes during preceding week**

# North Atlantic hurricanes increasing



**2007-2016: 46% increase in weather-related disasters**

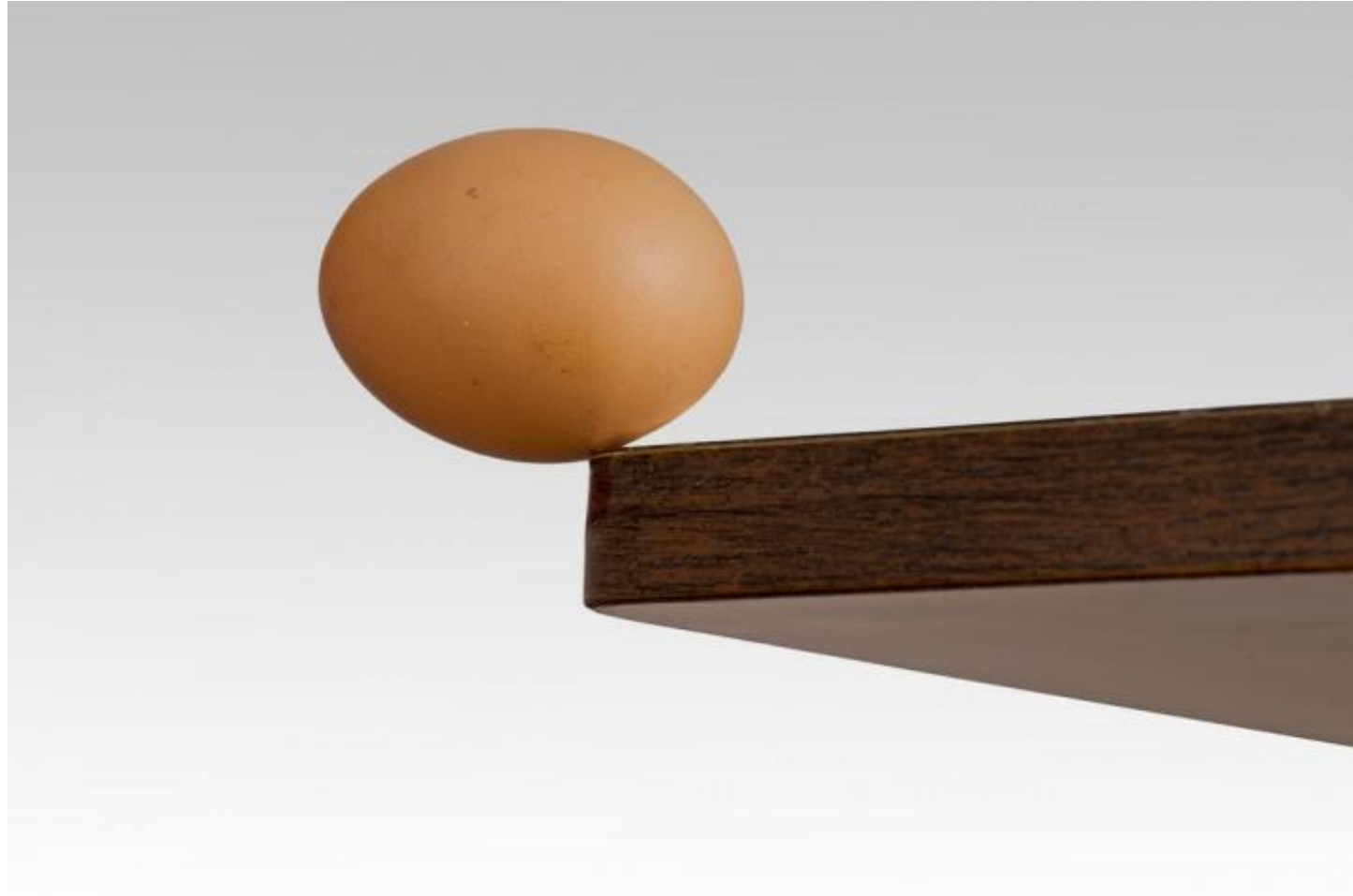
**2015: 19 million people displaced**



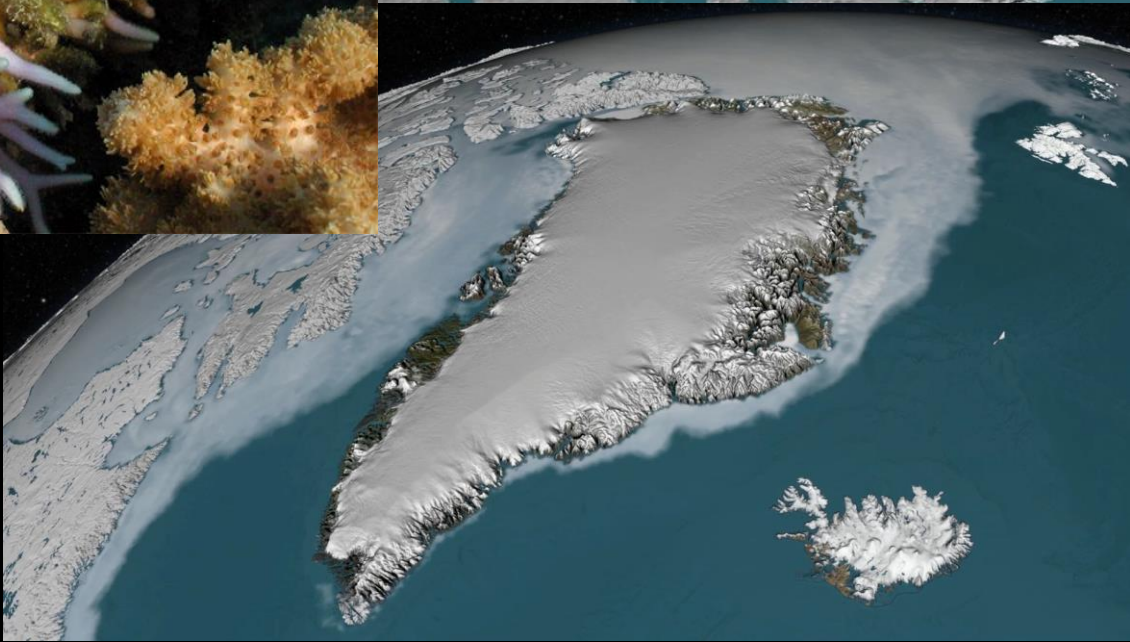
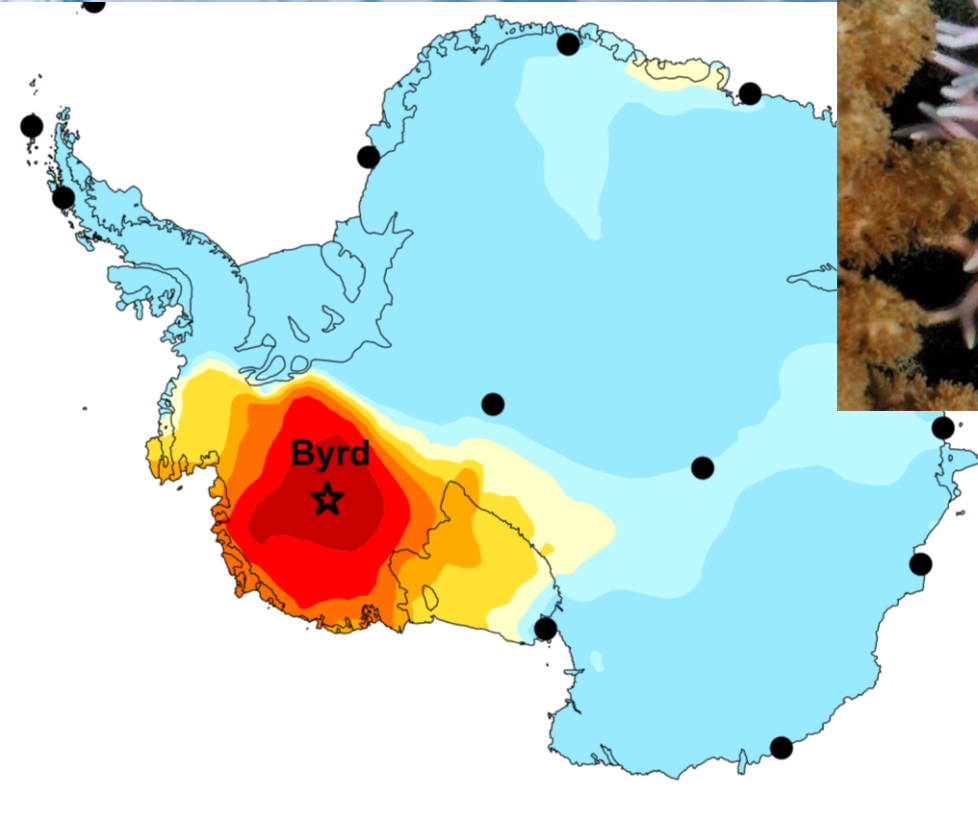
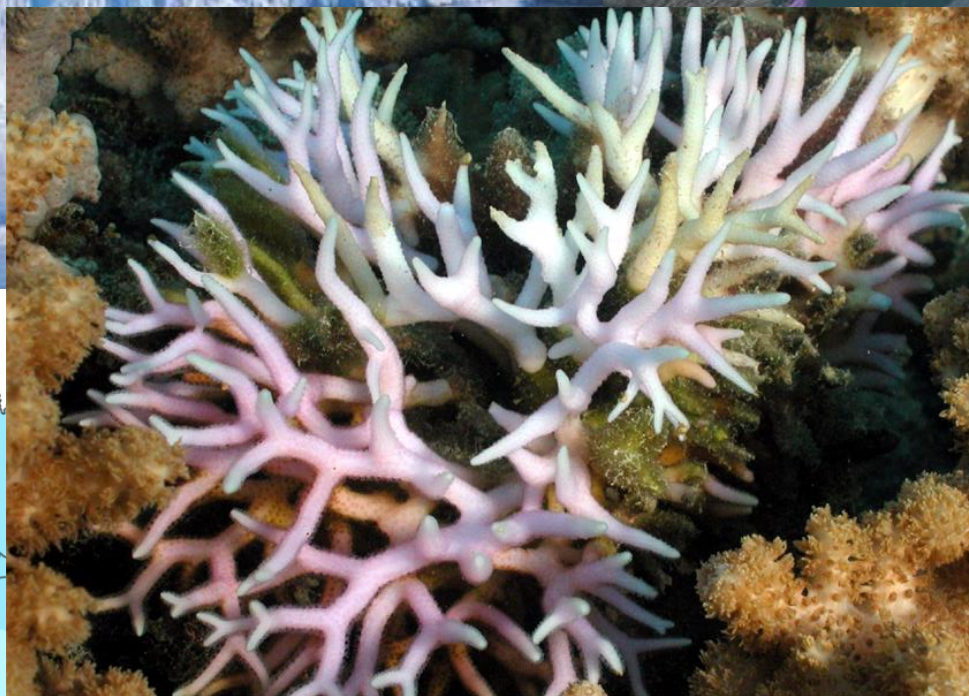
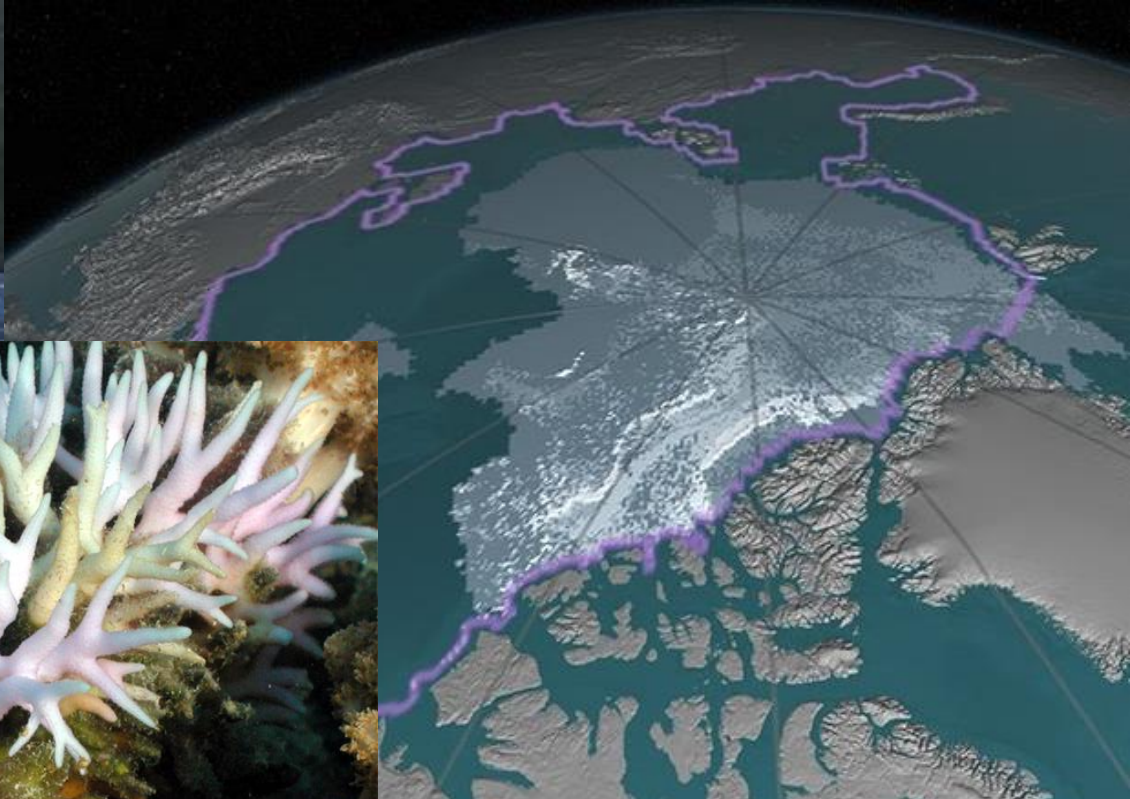
# Tipping point

*noun*

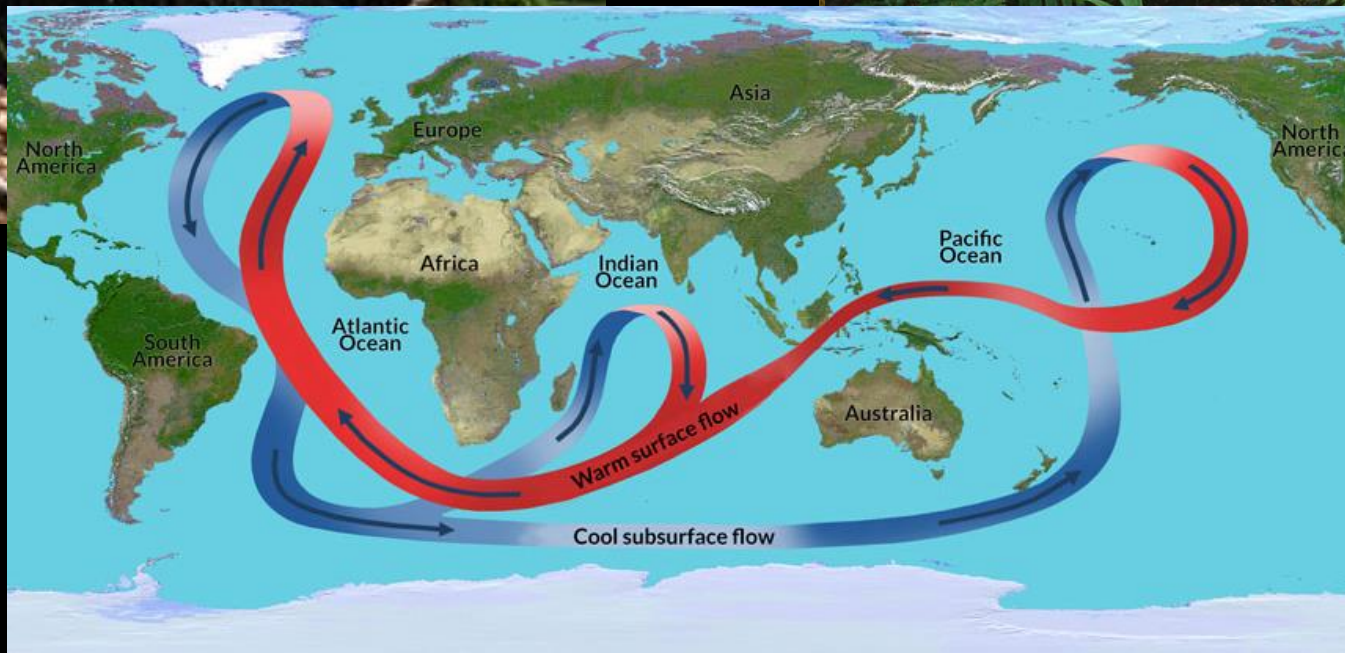
the point at which a series of small changes or incidents becomes significant enough to cause larger, more important changes



1-3°C



3-5°C





4°C

Submergence of land currently occupied by 470-760 million people



Beyond 5°C





**“What is the difference between a 2° and 4°C world?”**

**“Human civilisation”**

A close-up, high-angle shot of a roulette wheel. The wheel is partially visible, showing numbers 28, 12, 35, 3, 2, 32, 15, 19, 4, 21, and 2. A golden roulette ball is in motion, and a white roulette ball is also visible. The wheel is set on a dark, polished surface. A semi-transparent white text box is overlaid on the center of the image.

**So what are our chances?**

# **Carbon budget**

**= quantity of greenhouse gas emissions that can be emitted in total over a specified time for a specified amount of warming**

**2015**

**2°C**



**1.5°C**



**2015**

**2°C**



**1.5°C**



**71% spent**

**~ 20 years emissions  
left**

**2015**

**2°C**



**71% spent**

**~ 20 years emissions  
left**

**1.5°C**



**95% spent**

**~ 3 years emissions  
left**



**2015**

**2°C**



**71% spent**

**~ 20 years emissions  
left**

**1.5°C**



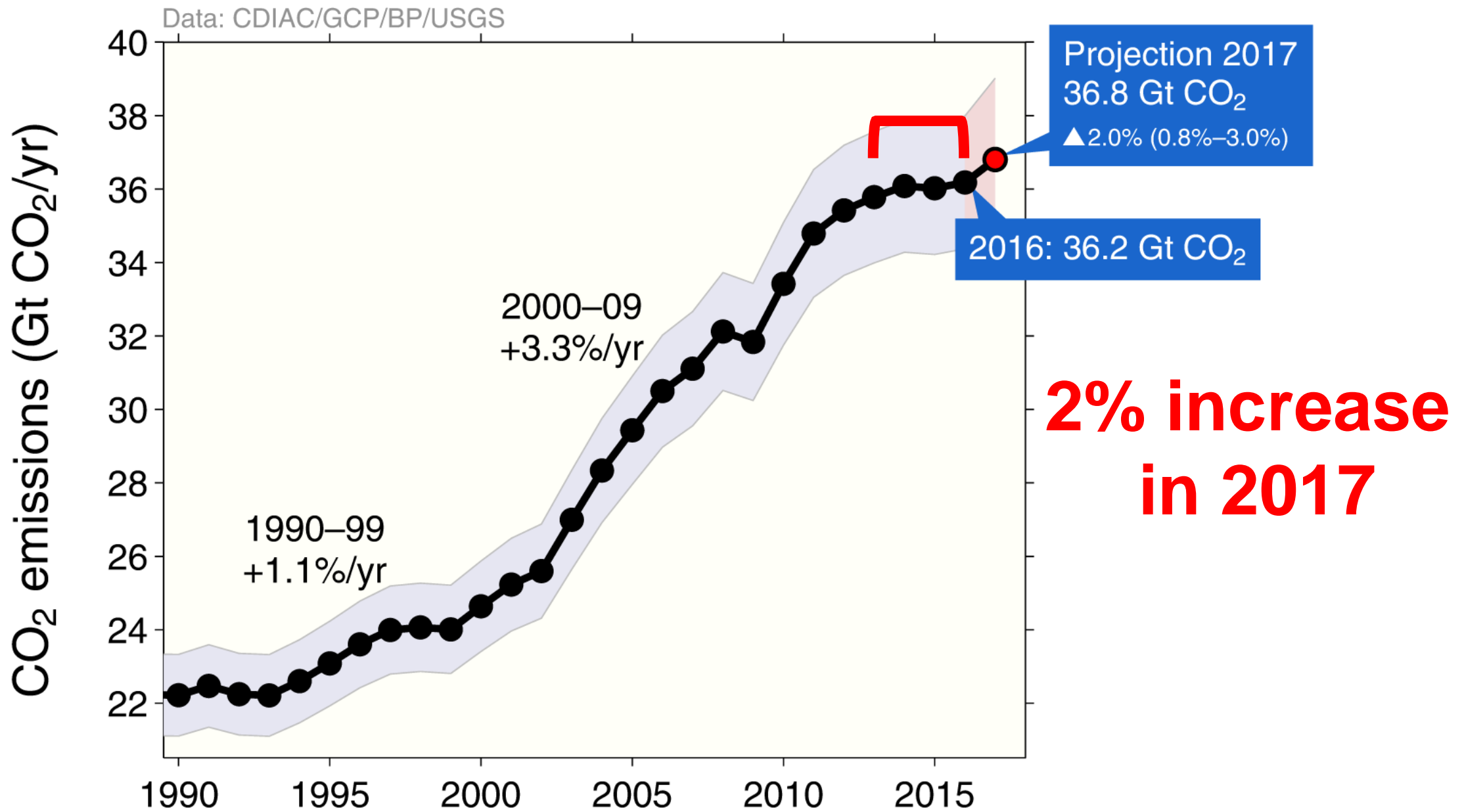
**95% spent**

**~ 3 years emissions  
left**

A large yellow excavator is positioned in the center of a vast coal mine. The excavator's arm is extended, and it appears to be working on a large pile of dark coal. The mine's walls are composed of dark, layered rock, and the overall scene is dimly lit, emphasizing the scale and depth of the excavation. The excavator is the only piece of machinery visible in the frame, highlighting the isolation of the work environment.

# Unburnable coal

**>90% Australia's known extractable coal reserves must stay in ground**



## The Emissions Gap Report 2017

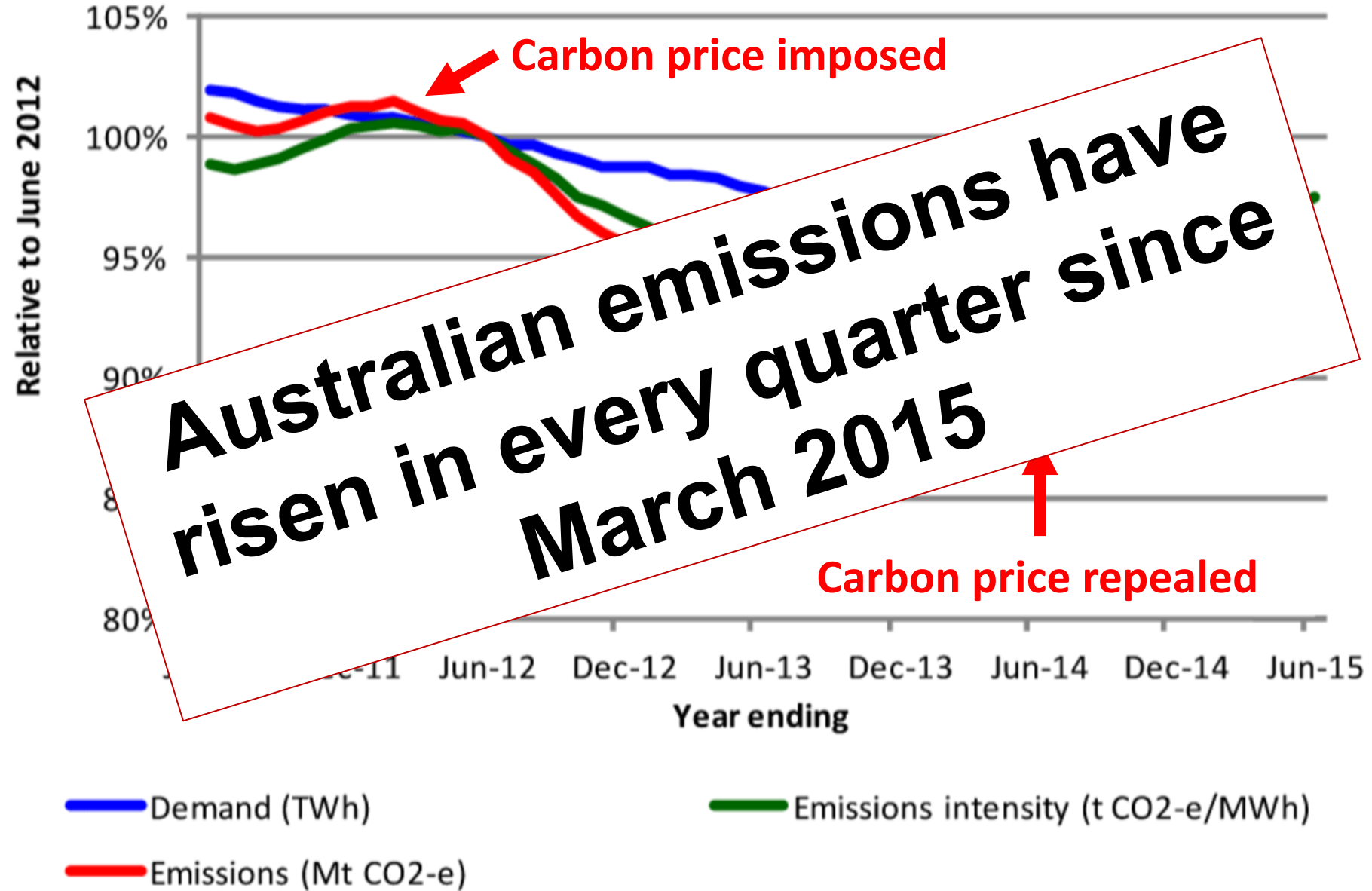
A UNEP Synthesis Report



# Emissions Gap Report 2017

- highest CO<sub>2</sub> or at least 5 million years
- Last time CO<sub>2</sub> was this high, sea levels ~20m higher than present and global temperatures 2-3°C higher
- Paris pledges only **one third** of what is needed for 2°C target

# Carbon pricing



# Australia's commitment

26-28% reduction on 2005, by 2030

*(Climate Change Authority recommended 40-60% target)*

Climate Action Tracker estimates Australia on track to **increase** emissions 27% on 2005 by 2030

***“Australia stands out as having the largest relative gap between current policy projections for 2030 and the INDC target”***

# CCPI 2017 • Overall Results



Rank	Country	Score**	
1*			
2			
3			
4	▲ France	66.17	
5	▲ Sweden	66.15	
6	▼ United Kingdom	66.10	
7	▲ Cyprus	64.28	
8	▲ Morocco	63.28	
9	▲ Luxembourg	62.86	
10	▲ Malta	62.51	
11	▲ Portugal	62.47	
12	▼ Belgium	62.08	
13	▼ Denmark	61.87	
14	▲ Switzerland	61.66	
15	▼ Latvia	61.20	
16	▲ Italy	60.72	
17	▲ Croatia	60.66	
18	▼ Romania	60.33	
19	▲ Lithuania	59.75	
20	▲ India	59.08	
21	▼ Ireland	59.02	
22	▼ Indonesia	58.86	
23	▼ Egypt	58.75	
24	▲ Czech Republic	58.52	
25	▲ Greece	58.29	
26	▼ Slovak Republic	57.69	
27	▲ Netherlands	57.10	
28	▼ Mexico	57.02	
29	▼ Germany	56.58	
30	▲ Slovenia	56.55	
31	▼ Finland	56.28	

Rank	Country	Score**	
32	▲ South Africa	56.17	
33	▼ Spain	56.14	
34	▼ Hungary	55.05	
35	▼ Poland	53.68	
36	▲ Argentina	53.15	
37	▲ Bulgaria	53.06	
38	▼ Norway	52.90	
39	▼ Iceland	52.55	
40	▲ Brazil	52.46	
41	▲ Austria	52.00	
42	▲ Thailand	51.91	
43	▼ United States	51.04	
44	▼ Malaysia	50.96	
45	▲ Ukraine	50.88	
46	▼ New Zealand	50.48	
47	▼ Algeria	48.46	
48	- China	47.49	
49	▼ Belarus	46.86	
50	- Estonia	46.04	
51	- Turkey	45.54	
52	- Chinese Taipei	44.76	
53	- Russian Federation	44.30	
54	- Singapore	43.97	
55	▲ Canada	43.06	
56	▼ Islamic Rep. of Iran	43.05	
57	- Australia	40.66	
58	▲ Korea	38.11	
59	▲ Kazakhstan	36.87	
60	▼ Japan	35.93	
61	- Saudi Arabia	25.45	

### Index Categories

- Emissions Level (30% weighting)
- Development of Emissions (30% weighting)
- Renewable Energies (10% weighting)
- Efficiency (10% weighting)
- Climate Policy (20% weighting)

### Rating

- Very good
- Good
- Moderate
- Poor
- Very poor



**Australia**

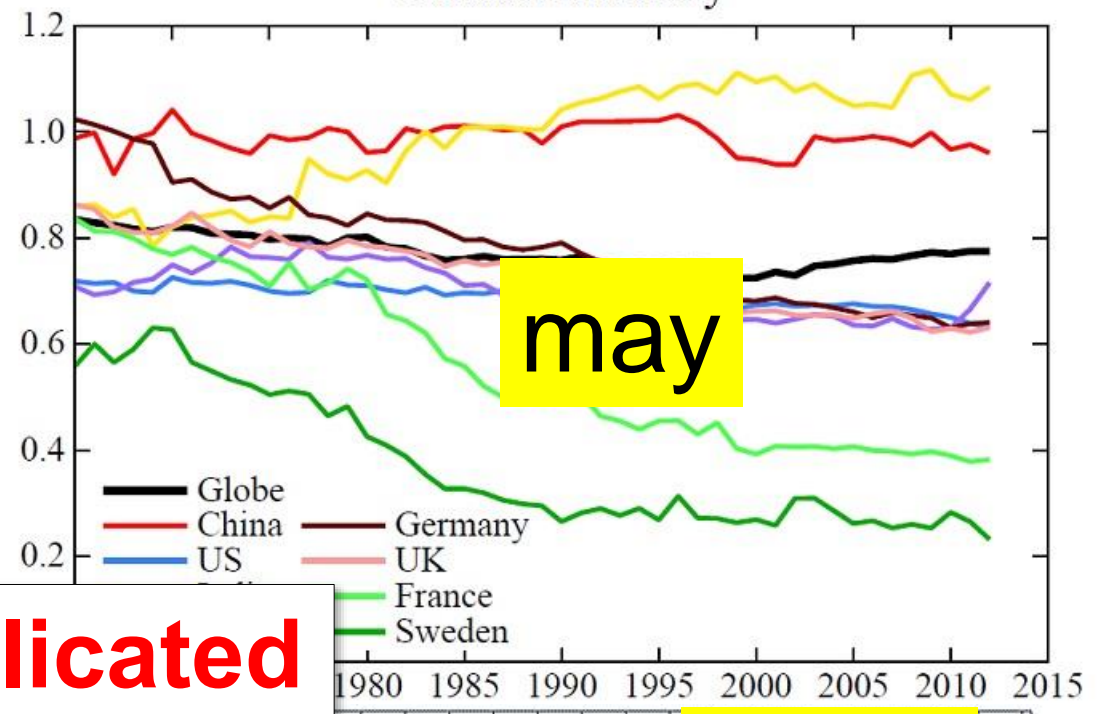
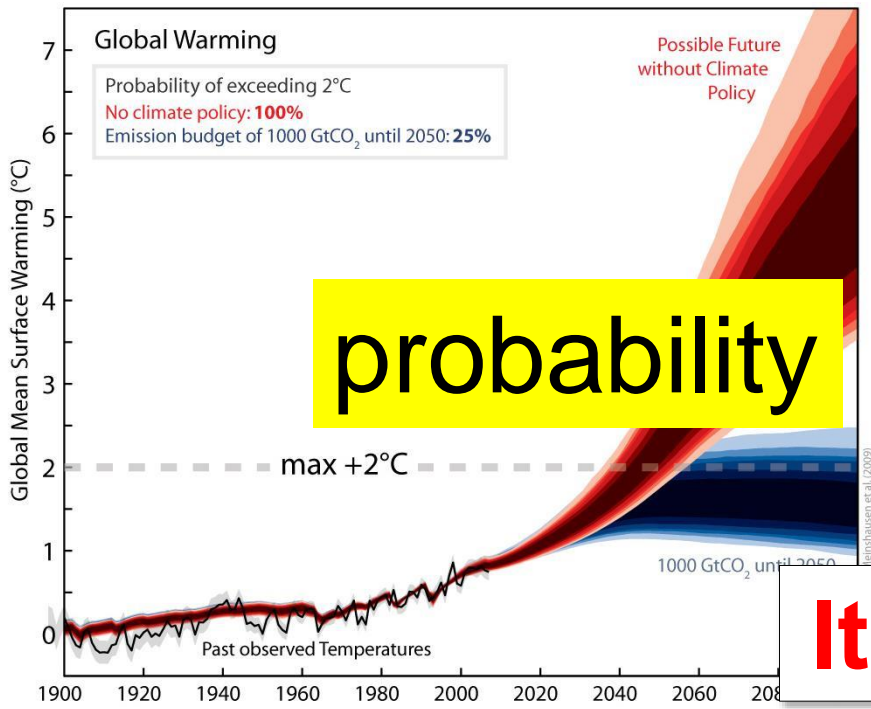
\* None of the countries achieved positions one to three. No country is doing enough to prevent dangerous climate change.  
 \*\* rounded

comparison with previous year © Germanwatch 2016

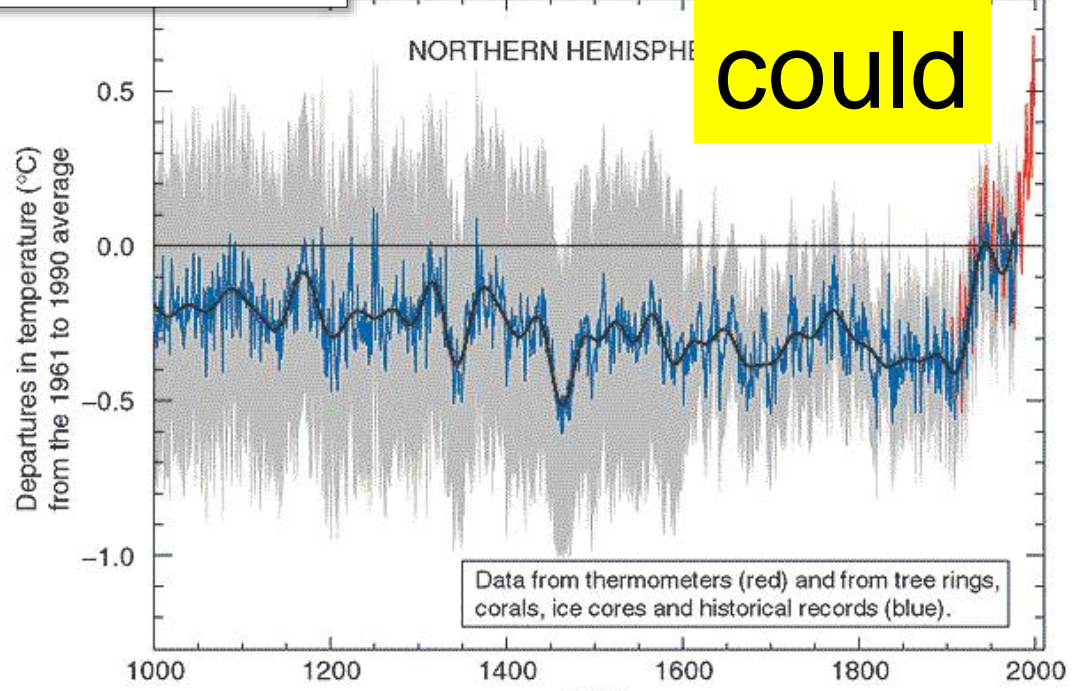
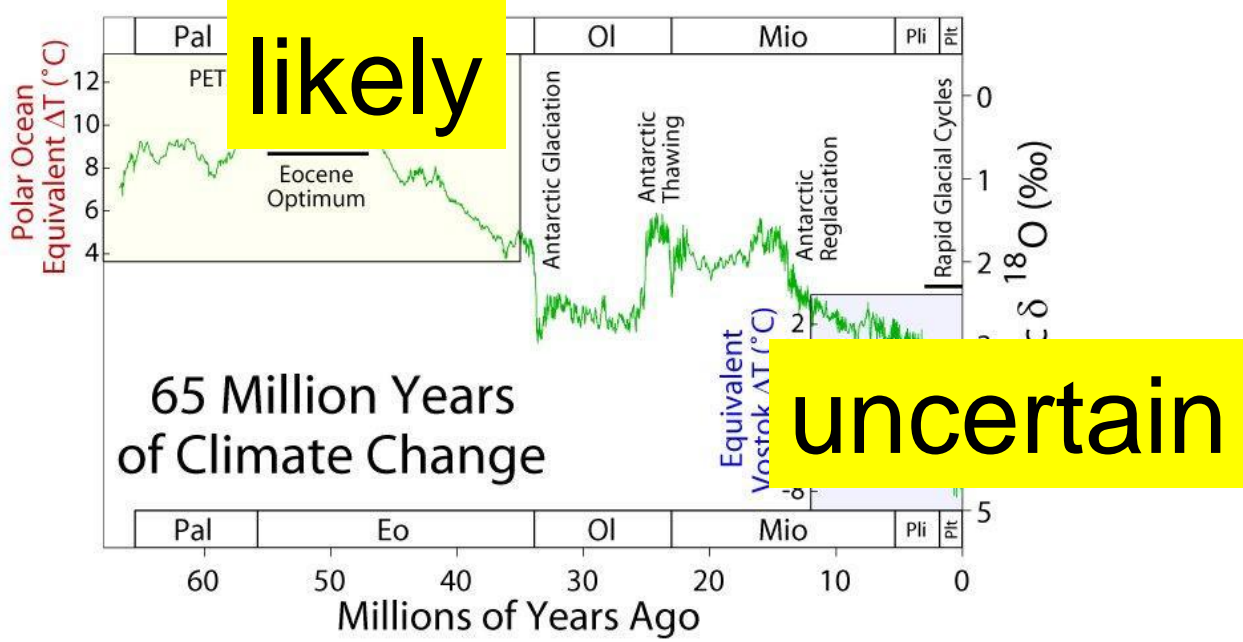
A photograph of five industrial smokestacks of varying heights and colors (grey and dark brown) against a blue, cloudy sky. The tallest stack in the center is emitting a thick plume of white smoke that drifts to the right. The other stacks also emit smaller amounts of smoke. The overall scene is dimly lit, suggesting dawn or dusk.

**Why is the message so hard?**





It's complicated





**It's scary**



**It's sad**

**Often presented as “only”  
an environmental problem**



An aerial photograph of a city skyline, likely New York City, viewed from a high vantage point over a large body of water. The buildings are densely packed and reflect the golden light of the sun. The water is a deep blue, and the sky is a pale, hazy blue. A white rectangular box with a black border is superimposed over the center of the image, containing red text.

**It can seem like a long way off....**



**.....or happening to someone else**



**The tap keeps running after you turn it off**



**There are loud & powerful voices,  
ideology, and \$\$\$ arrayed against**





# THE AUSTRALIAN



WWW.THEAUSTRALIAN.COM.AU

**BUSINESS REVIEW 2018**  
**THE BIG SHORT**  
The 100 best against Aussie banks

**EXCLUSIVE Q&A**  
**SPY FILES**  
The CIA's strategy on Bill Hare for Gareth Evans & Kim Deacon

**SPORT 2018**  
**In a world of Payne**  
Shelbourne Cup winner marked to inspire after fall

## AFP suspected Wilkie of leaking 'top secret' security document

**ANALYSIS**  
Labor's Foreign Minister Andrew Wilkie is suspected of leaking a 'top secret' security document to the AFP, according to a report by the Australian Security Intelligence Organisation (ASIO). The report, which was obtained by The Australian, says that Wilkie was seen talking to an ASIO officer in a public place in Canberra in late 2017. The officer is believed to be a senior ASIO official who is responsible for monitoring the security of the government's communications. The report also says that Wilkie was seen talking to a number of other people, including members of the media, in the same period. The ASIO has not commented on the report.



Foreign Minister Andrew Wilkie, who worked at the ASIO.

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# Herald Sun

BY ANDREW BOLT

## THIS IS A SAD DAY

FOR THE FREE SPEECH

WHY SILENCING ME DOES NOTHING FOR RACIAL HARMONY

WOMEN AND

**(Some of) the media continues to focus on the false debate**





**There are other important concerns**



A world map is shown in the background, rendered in a red-to-yellow color gradient. The map is centered on the Atlantic Ocean, with North and South America on the left and Europe and Africa on the right. A white rectangular text box is overlaid in the center of the map.

**Tragedy of the commons problem  
like no other**

## Survey 2017

**2,660** Australians across the country including 600 each in QLD, NSW and VIC, and 400 each in SA & WA

71%

of Australians accept that  
climate change is taking  
place.

66%

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of Australians have a high level of concern about climate change.

# 87%

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of Australians do not want our country to step back from the Paris Agreement, with 61% wanting us to “work harder” with other countries to achieve its objectives.

# 72%

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of Australians think governments should implement a plan for the orderly closure of coal-fired power stations to replace them with clean energy.



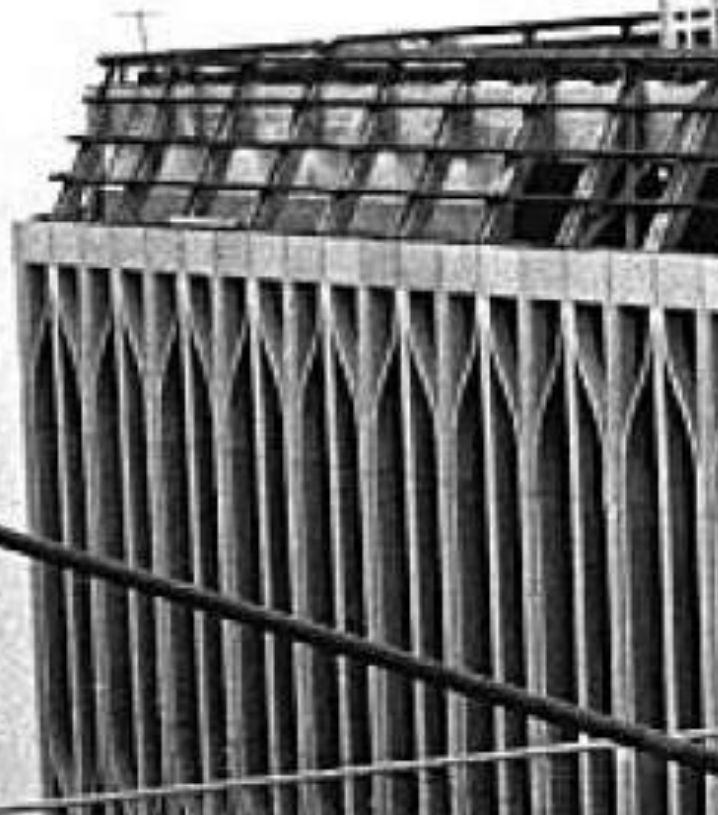
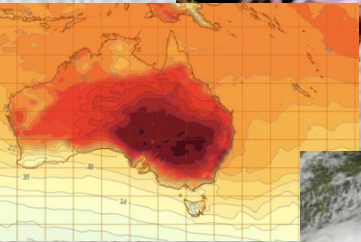
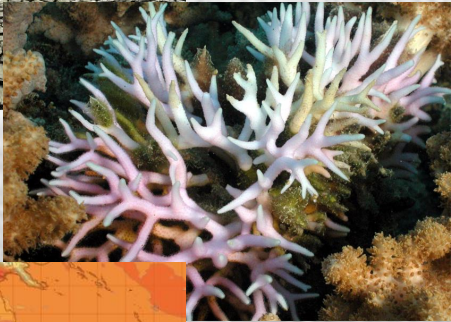
# 96%

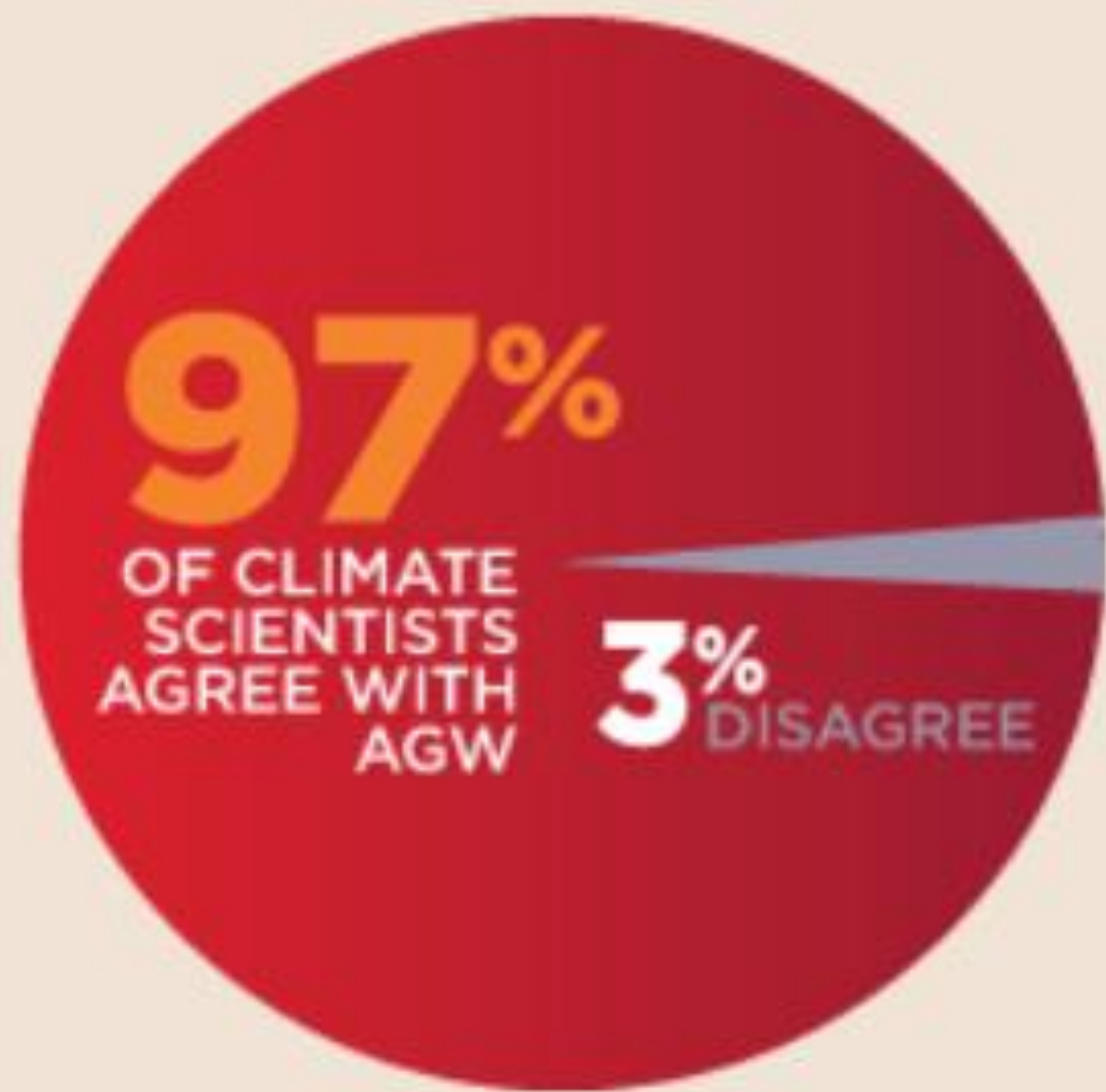
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of Australians want our primary source of energy to come from renewables (58% want an energy supply based on renewables supported by storage technologies, 38% prefer renewables supported by fossil fuels).

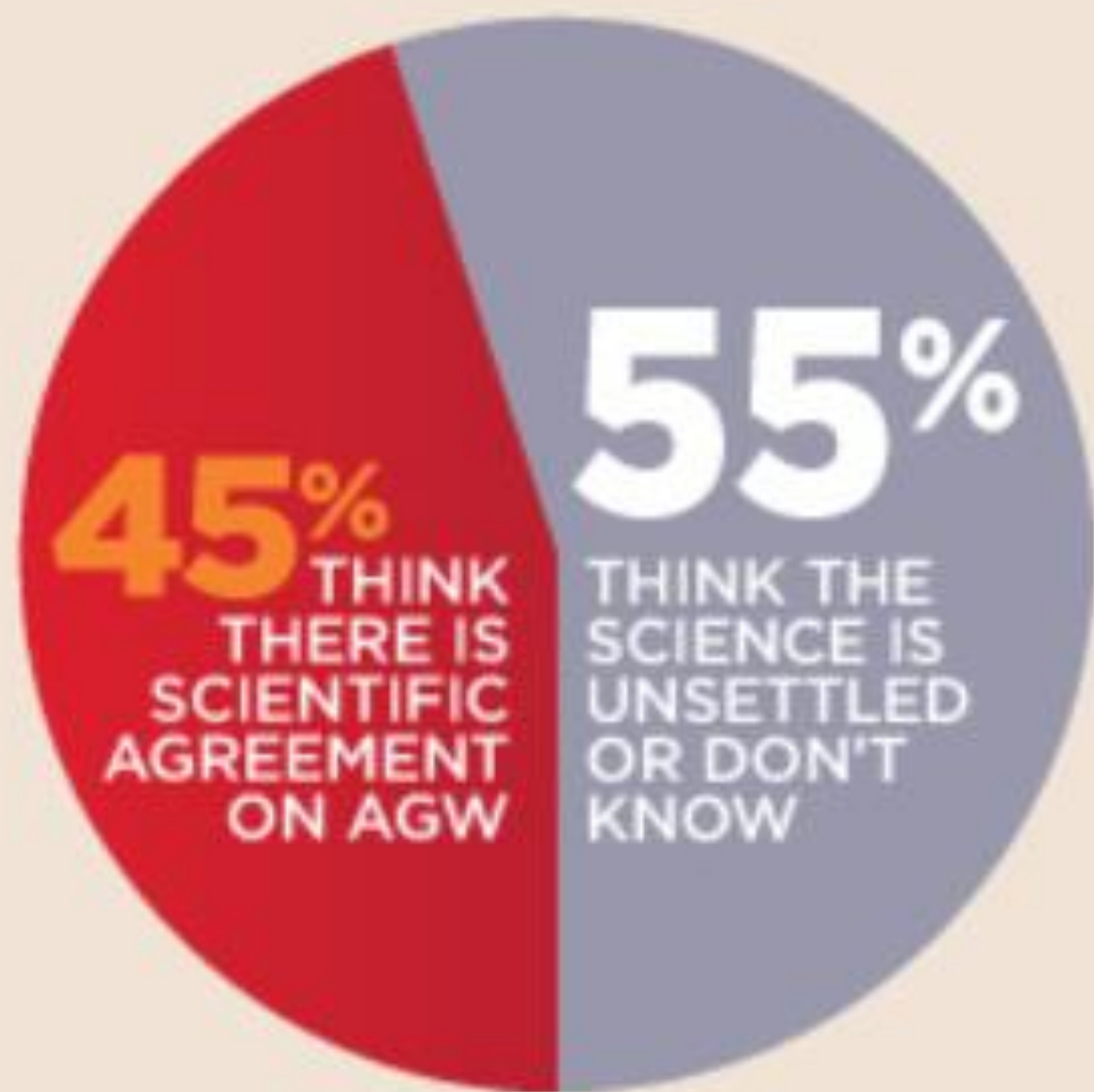


**How should scientists respond?**

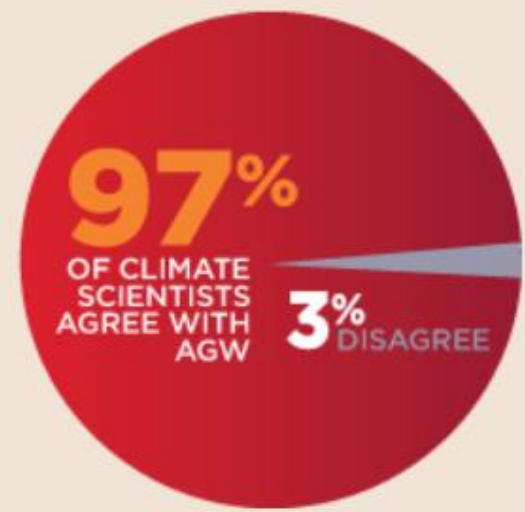




**THE SCIENCE**



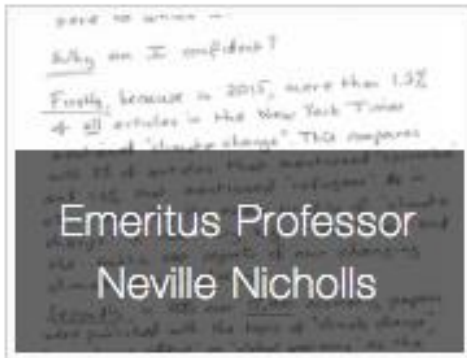
**THE PUBLIC**



THE SCIENCE

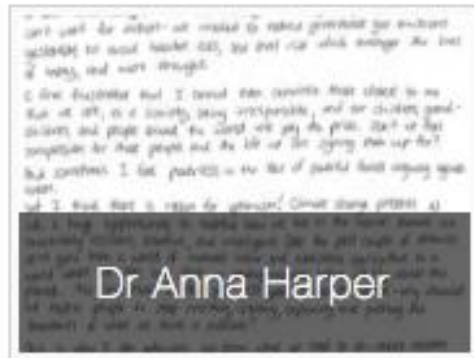
# Is this how you feel?

<http://www.isthis-how-you-feel.com/this-is-how-scientists-feel.html>



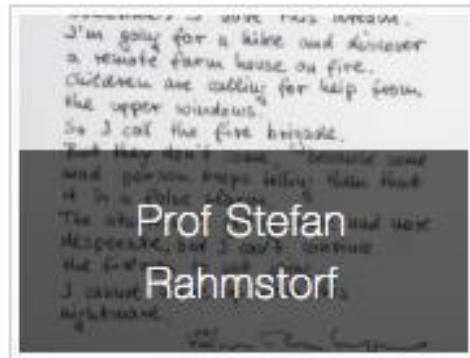
Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Emeritus Professor  
Neville Nicholls



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Anna Harper



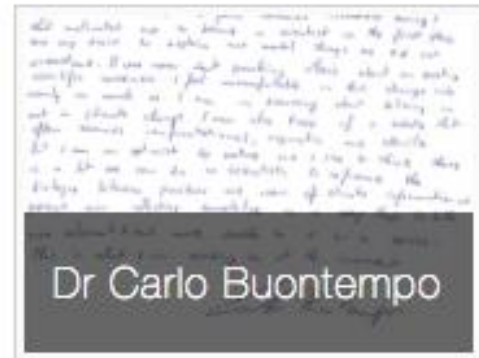
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Prof Stefan  
Rahmstorf



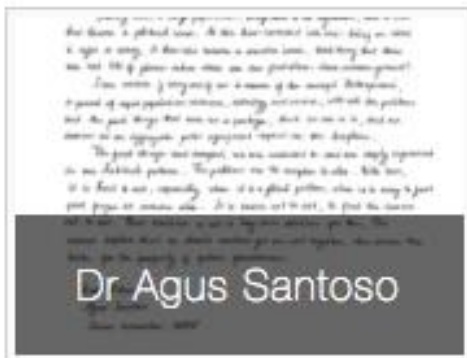
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Dr Jessica Carilli



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Carlo Buontempo



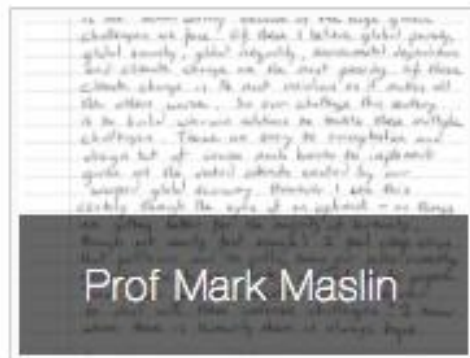
Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Agus Santoso



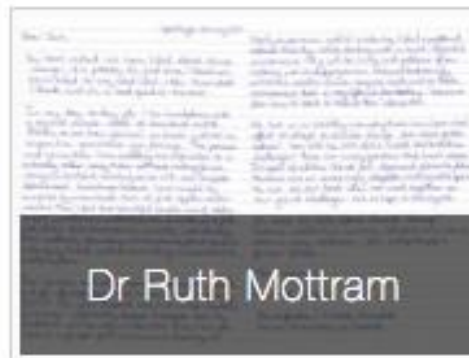
Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Prof Donald J  
Wuebbles



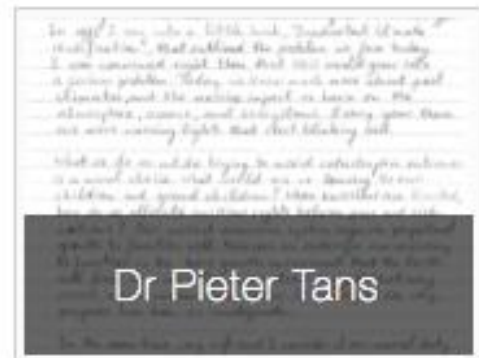
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Prof Mark Maslin



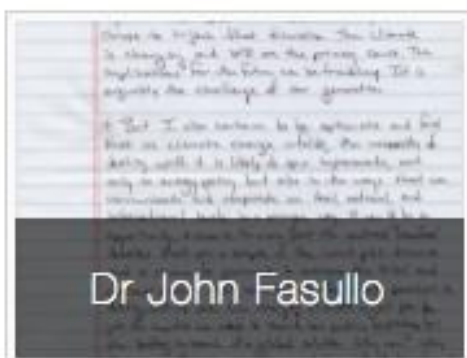
Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Ruth Mottram



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Pieter Tans



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr John Fasullo



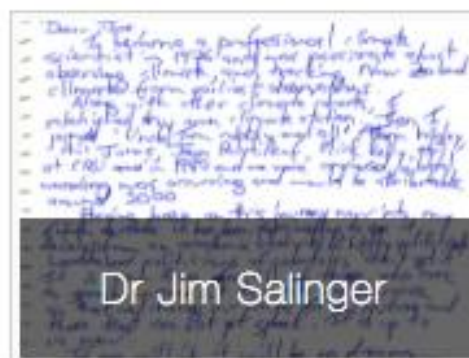
Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Prof Richard  
Somerville



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Prof Peter  
deMenocal



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Jim Salinger



Handwritten note on lined paper. The text is partially obscured by a black bar at the bottom.

Dr Helen McGregor

angry

furious

frustrated

nobody's listening

*discouraged*

overwhelmed

dismayed

perplexed

powerless

desperate

*depressed*

sad

nightmare

outraged

scared

angry

furious

frustrated

hope

nobody's listening

*discouraged*

overwhelmed

optimistic

powerless

dismayed

perplexed

desperate

unwilling to give up

*depressed*

sad

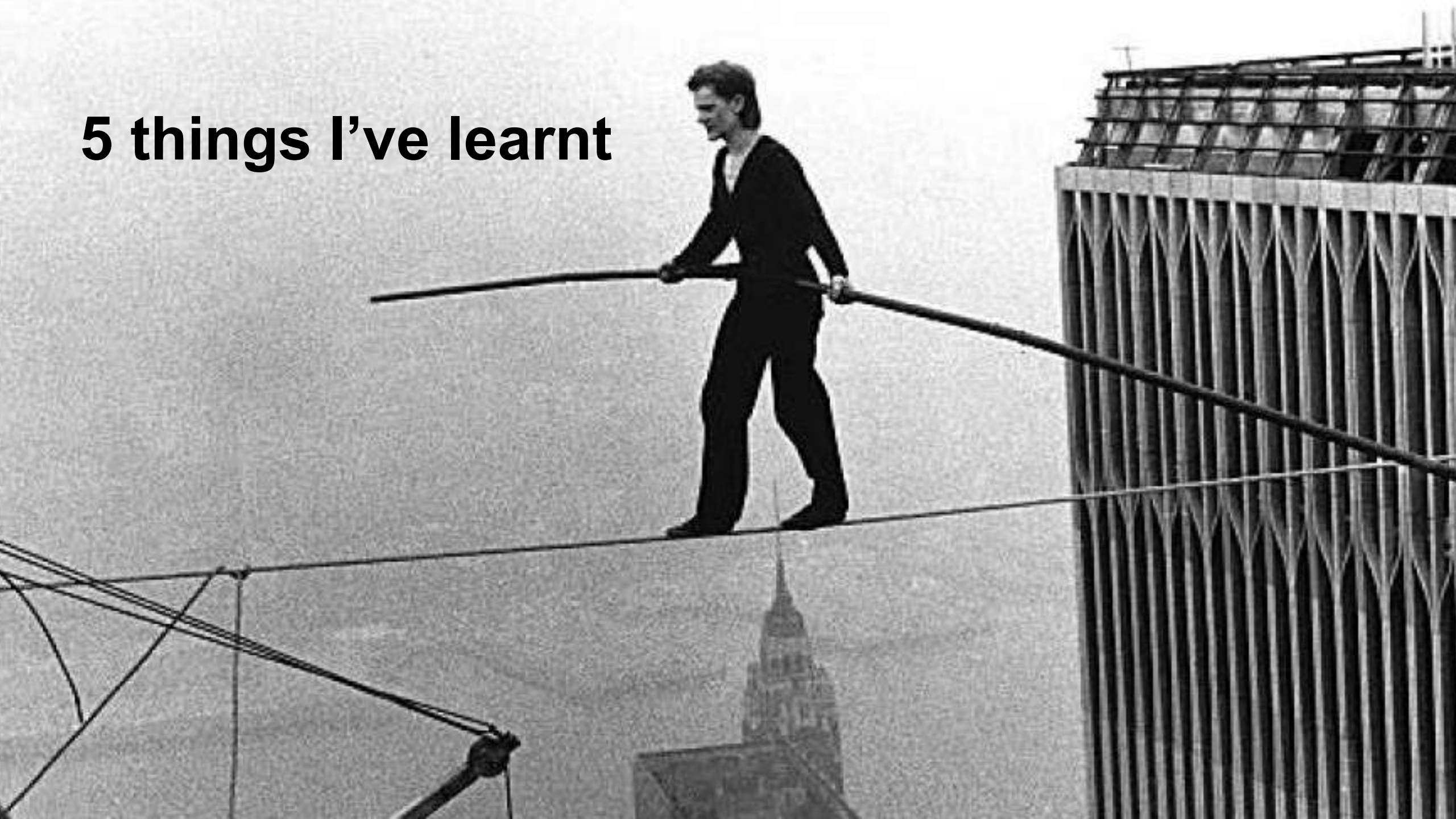
nightmare

outraged

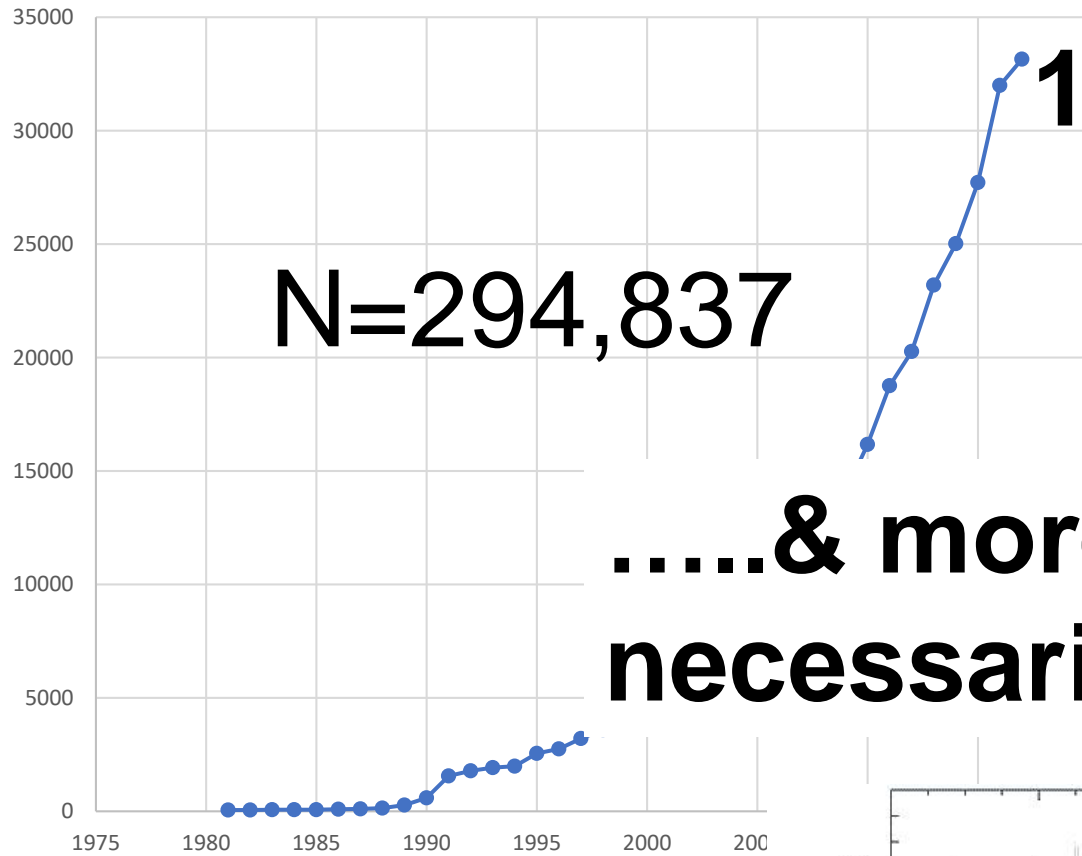
scared



# 5 things I've learnt

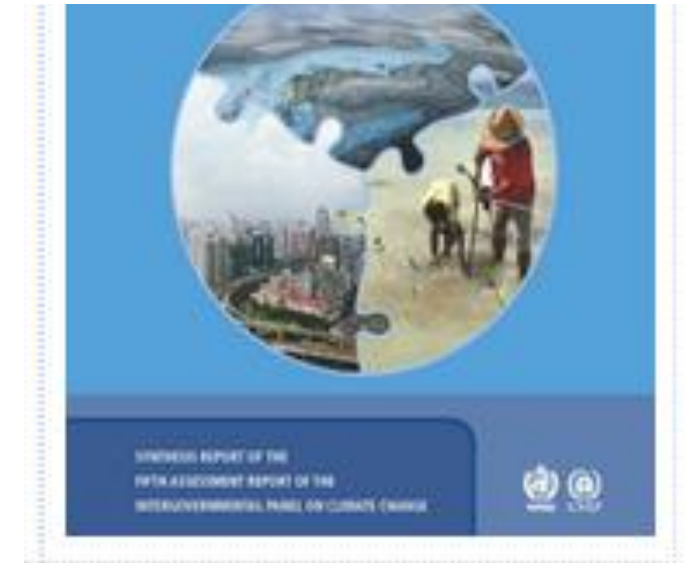
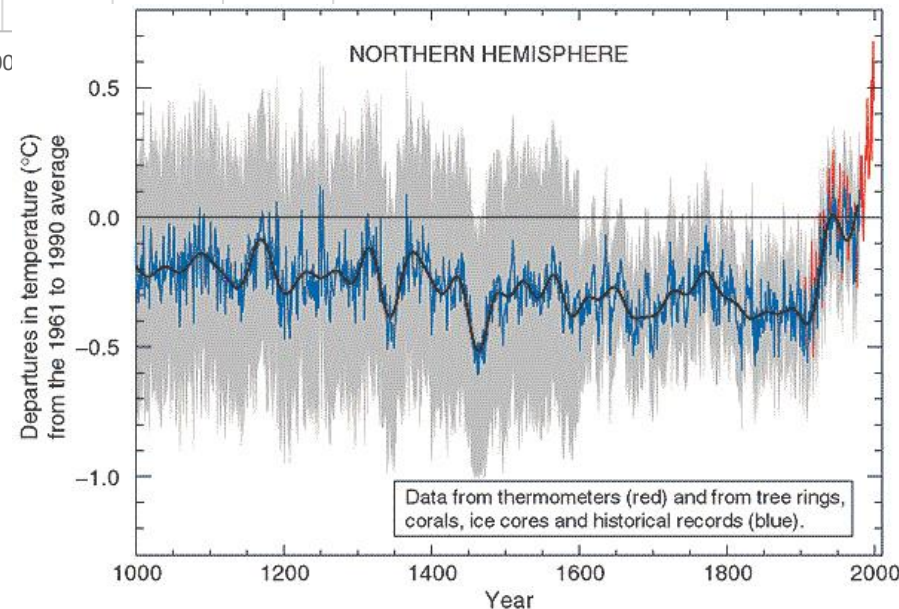


N=294,837



**1. More information doesn't necessarily mean more understanding**

**.....& more understanding doesn't necessarily mean more action**



## **2. Need to continually search for more meaningful (local) narratives**



## **2. Need to continually search for more meaningful (local) narratives**



**3. advocacy .....is not a dirty word**  
'advəkəsi/

***Noun***

**public support for or recommendation  
of a particular cause or policy**

NEWS ▶ TOP STORIES

# Finkel supports Labor's 50% renewables target

Updated: 9:43 am, Monday, 20 November 2017



# 4. Need to overwhelm the negative with the positive.....



BUSINESS INSIDER

SCIENCE

## At least 40% of the world's power will come from renewable sources by 2040 – here are the companies leading the charge

Jeremy Berke 5h 31,258



FACEBOOK



LINKEDIN



TWITTER



A tower of Abengoa solar plant at "Solucar" solar park is pictured in Sanlucar la Mayor, near the Andalusian capital of Seville, southern Spain November 13, 2015.

REUTERS/Marcelo del Pozo

....and emphasise the achievable



## California's big utilities to reach 50% renewable energy in 2020

PG&E, SDG&E and SCE are expecting to meet the state's ambitious 50% target 10 years early, with contract prices for utility-scale solar projects falling to below \$30/megawatt-hour (MWh).

NOVEMBER 14, 2017 CHRISTIAN ROSELUND

COST AND PRICES

MARKETS

POLICY

UTILITY-SCALE PV

CALIFORNIA



## 5. We cannot be effective alone

2013

WE REALLY HAVE  
CHECKED AND WE'RE  
NOT MAKING THIS UP.



"NOISE SO DEAF"





# WENTWORTH GROUP

OF CONCERNED SCIENTISTS

---





We've crowd-funded \$969,000  
\* in a week!

Let's raise  
\$1 MILLION

for people-powered science information



GIGA-WHAT?  
EXPLAINING  
AUSTRALIA'S  
RENEWABLE  
ENERGY  
TARGET

LAGGING BEHIND:  
AUSTRALIA AND  
THE GLOBAL  
RESPONSE TO  
CLIMATE CHANGE

THE US-CHINA  
ANNOUNCEMENT  
CLIMATE CHANGE  
AND CLEAN ENERGY  
COOPERATION:  
WHAT'S THE BIG



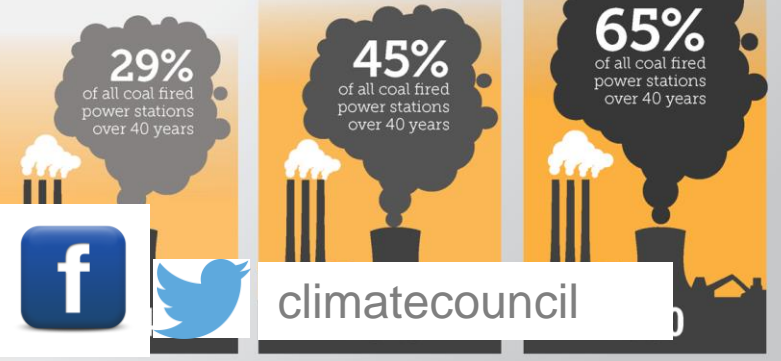
COUNTING  
THE COSTS:  
CLIMATE  
CHANGE  
AND COASTAL  
FLOODING



CLIMATE  
COUNCIL

Become a weekly or monthly donor at  
[climatecouncil.org.au](http://climatecouncil.org.au)

BY 2030 **65%** OF AUSTRALIA'S  
COAL-FIRED POWER STATIONS WILL  
BE OVER **40 YEARS OLD**

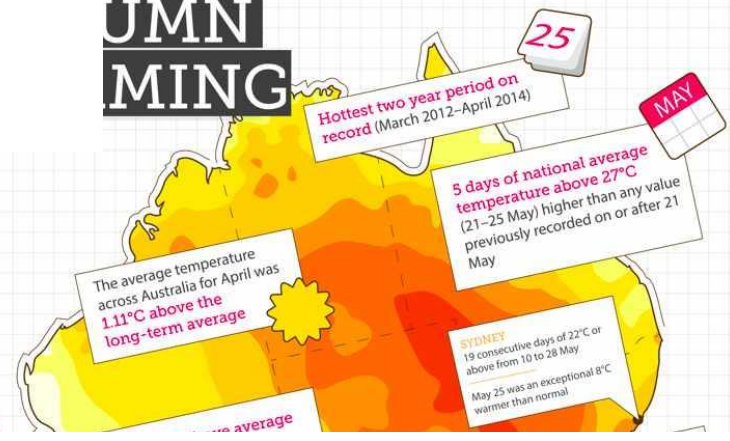


climatecouncil

CLIMATE  
COUNCIL:  
JOINT  
STATEMENT  
ON THE  
HEALTH  
EFFECTS  
OF COAL IN  
AUSTRALIA

BE PREPARED:  
CLIMATE  
CHANGE  
AND THE  
NSW  
BUSHFIRE  
THREAT

NORMAL  
SUMMER  
WINTER



[www.climatecouncil.org.au](http://www.climatecouncil.org.au)

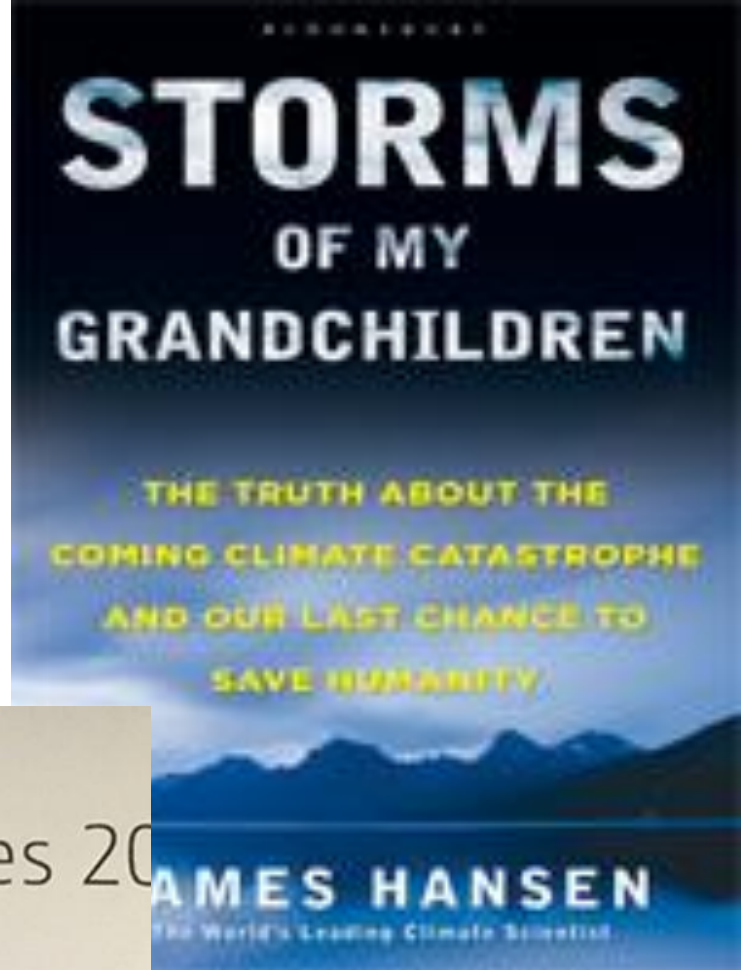
[www.facebook.com/climatecouncil](https://www.facebook.com/climatecouncil)

Source: Data from AEMO 2011, AEMO 2012 and power plant operator websites



1988

2015



**activist**  
'aktivist/

***noun***

**a person who  
campaigns to bring  
about political or  
social change.**







WE ARE THE ONES

WE HAVE BEEN

WAITING FOR!

12.12.15



