The A=B=C of climate change

Presented by Jim Main

Who am I?

- Grandparent
- Country lawyer
- No science qualifications
- Climate change warrior

What I'm talking about today:

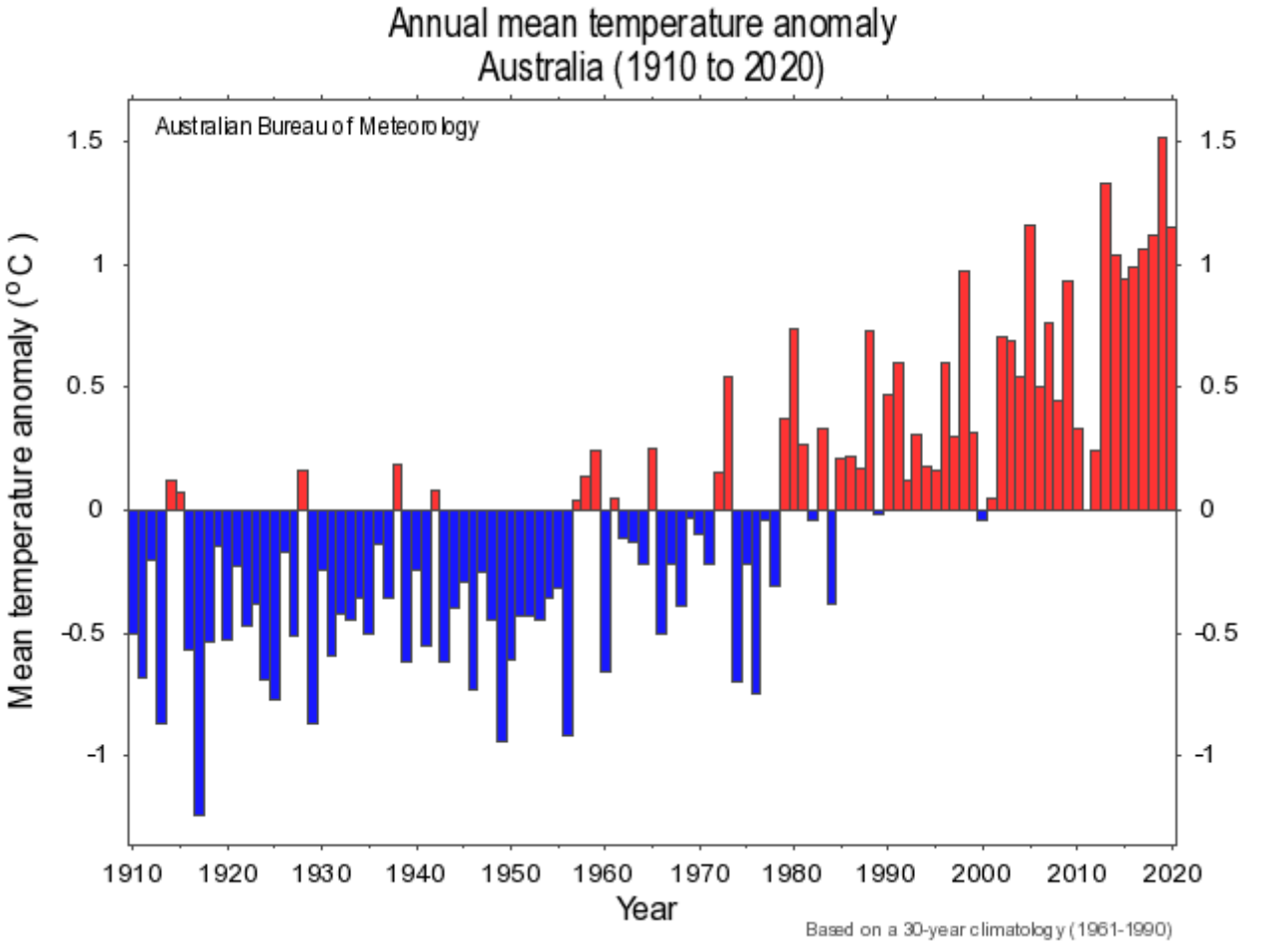
- That global warming is happening
- That greenhouse gas emissions are the cause
- That we can fix it

These are my sources of information

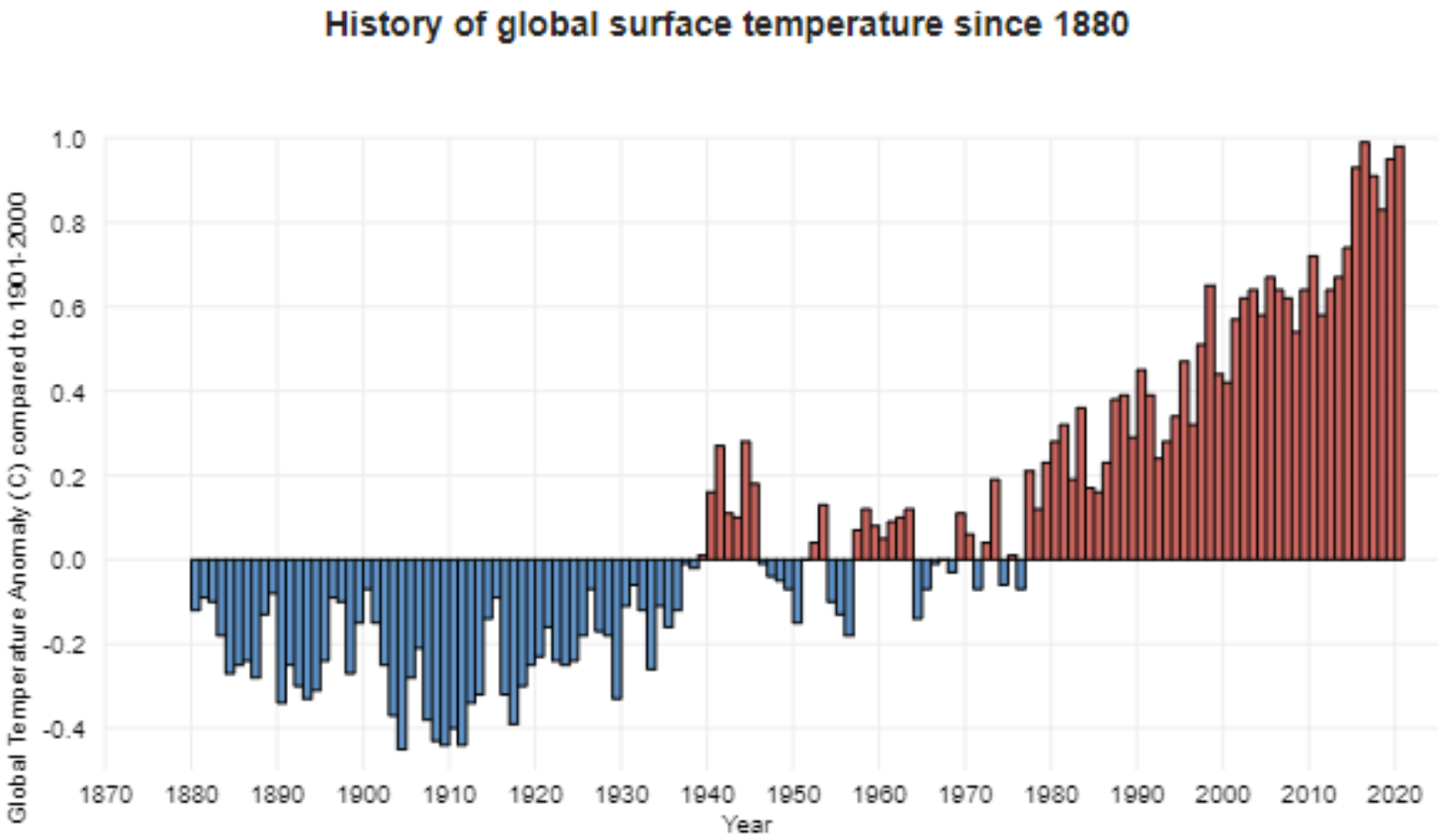
Bureau of Meteorology
University of Bern, Switzerland
CSIRO
Intergovernmental Panel for Climate Change (IPCC)
Student Energy
US National Oceanic and Atmospheric Administration (NOAA)
ERA Environmental Management Solutions
Arctic Monitoring and Assessment Programme
US Environmental Protection Agency (EPA)
Australian Academy of Science
The Global Carbon Capture and Storage Institute
NASA
US Union of Concerned Scientists
Department of the Environment and Energy
International Energy Agency (IEA)
Columbia University's Lamont-Doherty Earth Observatory
Earth Systems Science Data
Climate Council

Firstly, global warming is happening

It’s getting hotter in Australia

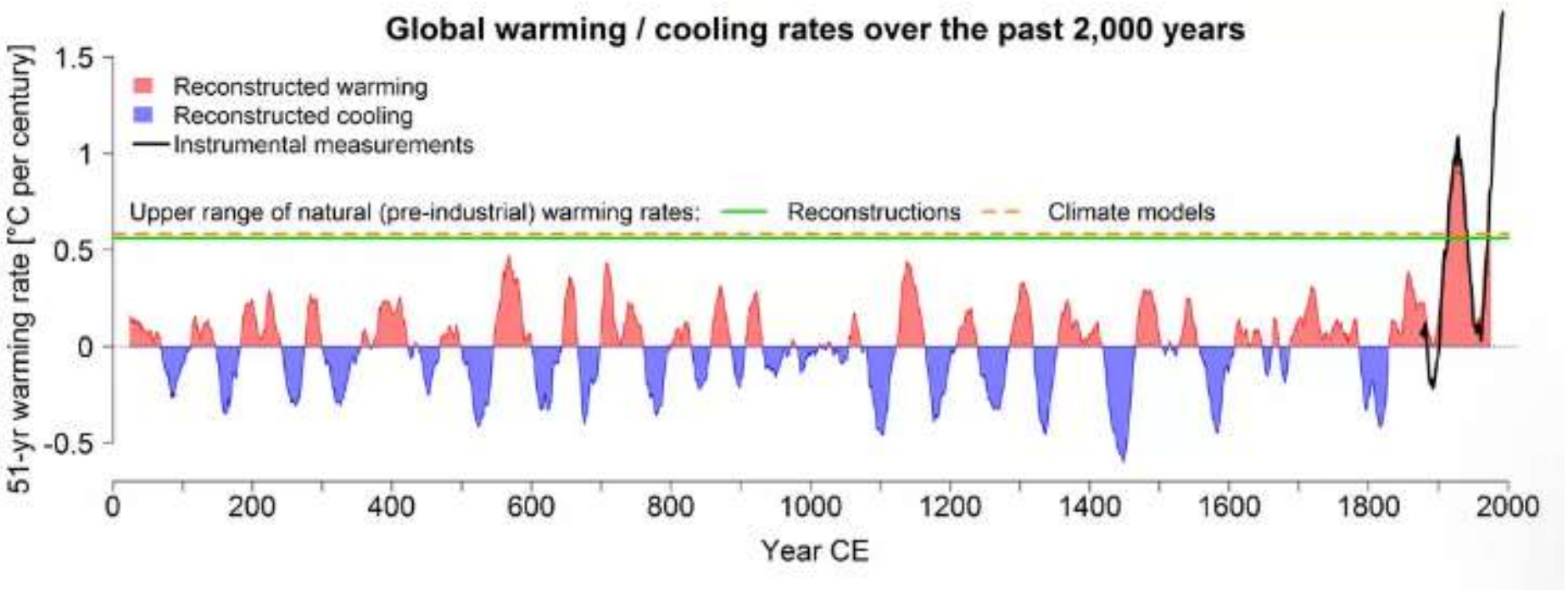


The whole world is getting hotter



NASA

It hasn’t been so hot for at least 2,000 years



Bern University

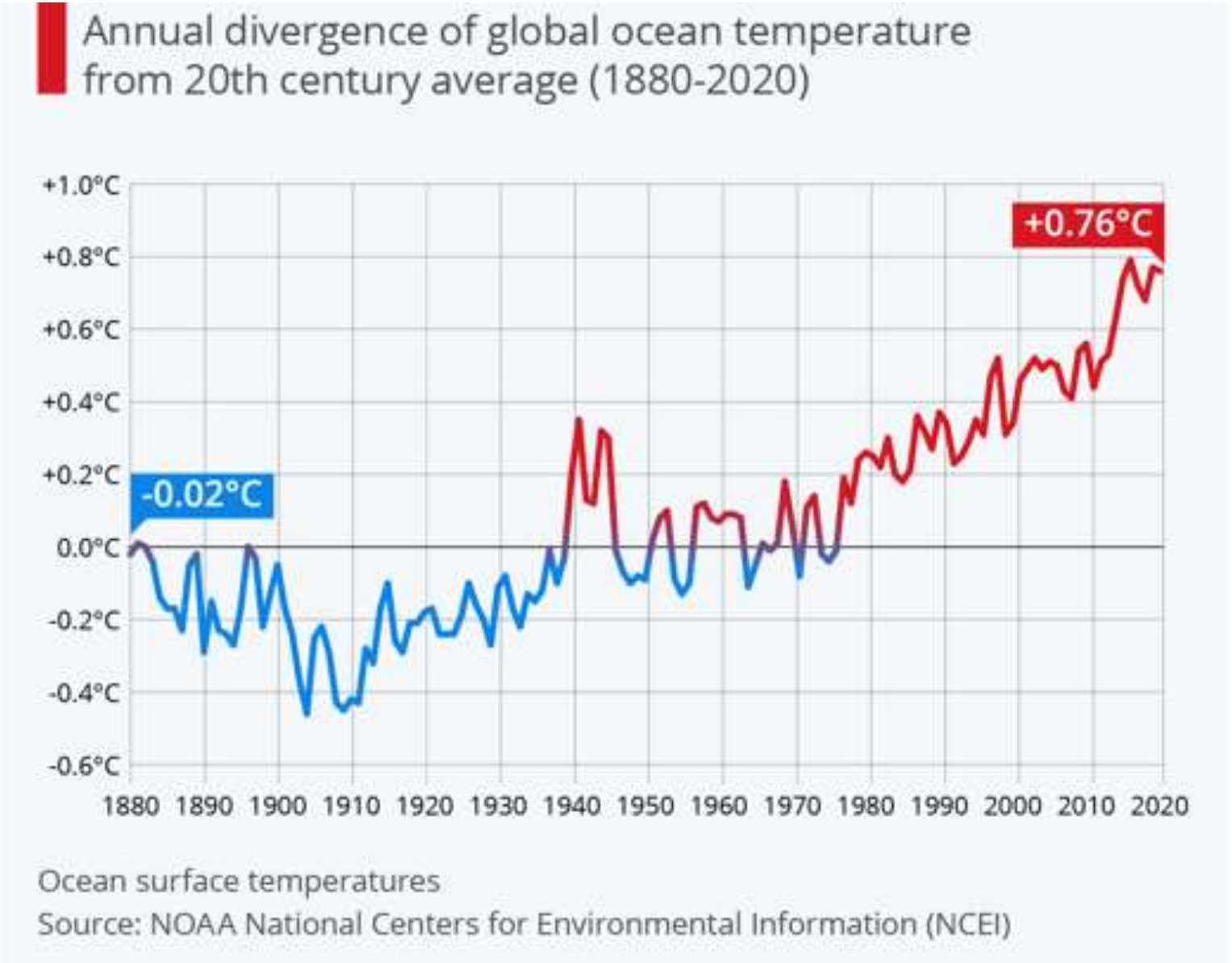
But how can they know that?

By using proxy data - preserved physical characteristics of the environment, mainly:

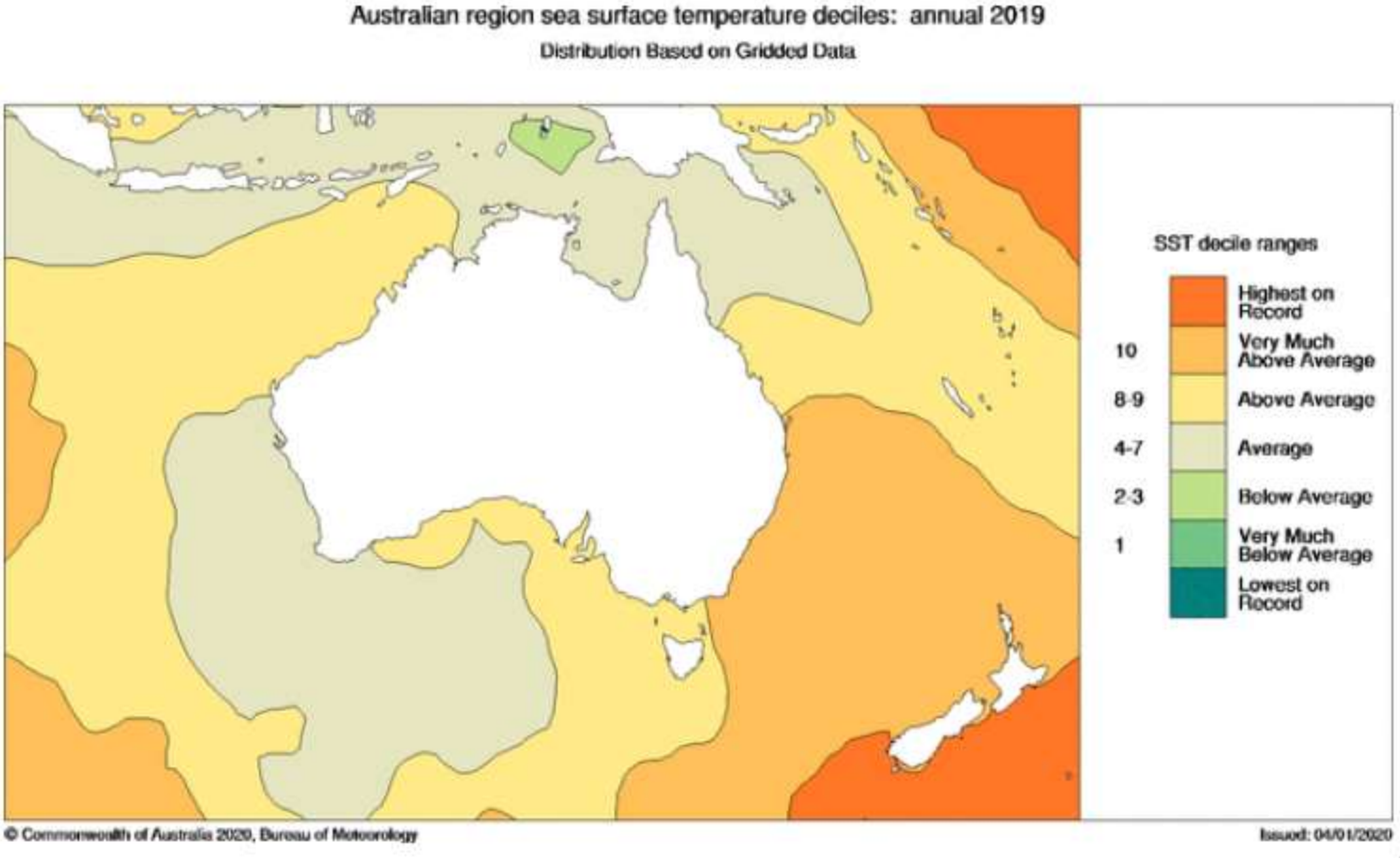
- tree rings,
- ice cores,
- fossil pollen,
- ocean sediments, and
- corals.

(NOAA)

Oceans are heating up all over the planet



It’s pretty hot on our east coast



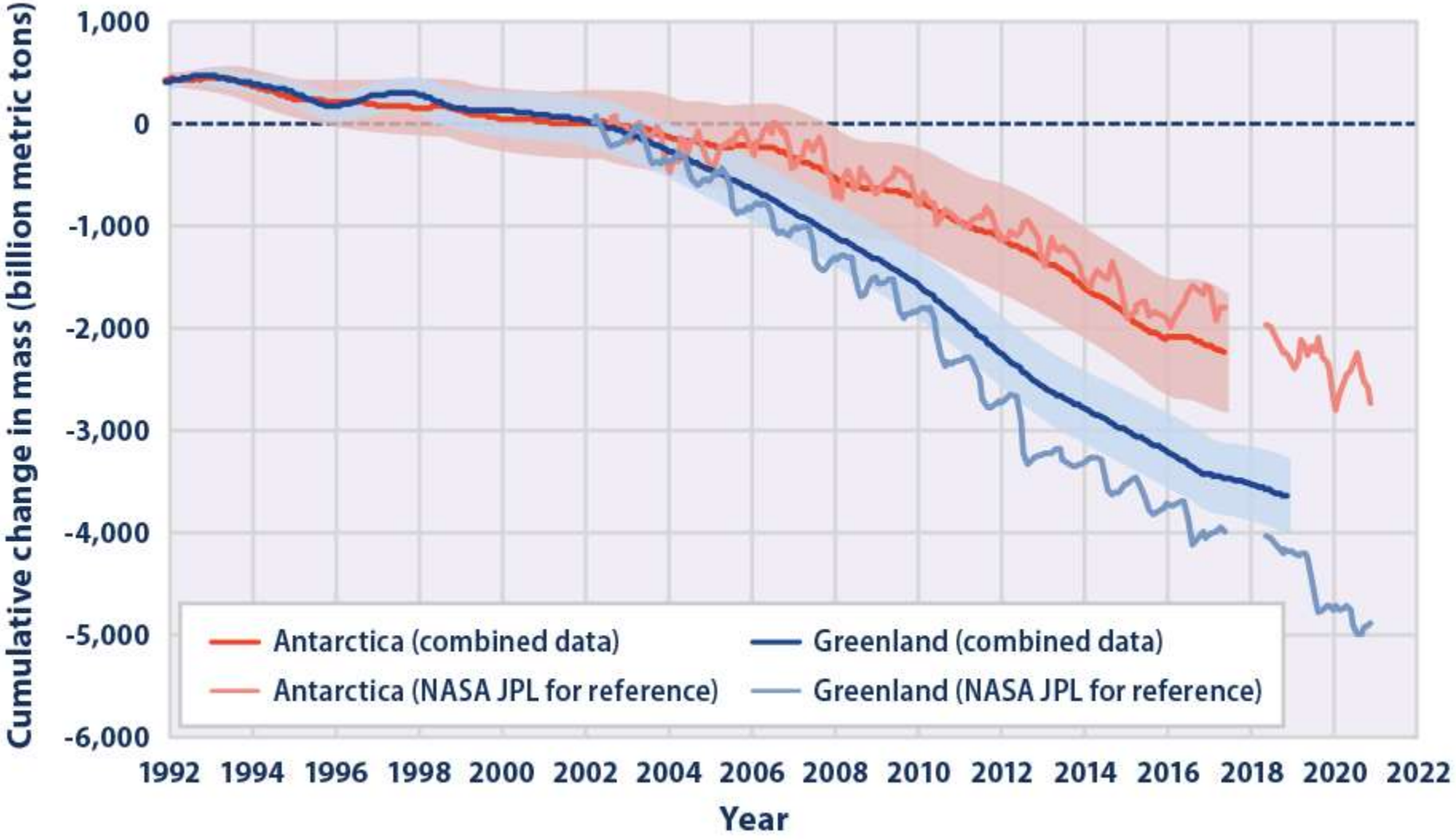
But isn’t the planet warming naturally as part of the inter glacial period?

Not according to NASA:

- Earth is currently in an interglacial period (a period of milder climate between Ice Ages).
- If there were no human influences on climate our planet should be cooling, not warming, continuing a long-term cooling trend that began 6,000 years ago.

Global warming is changing everything: the big stuff

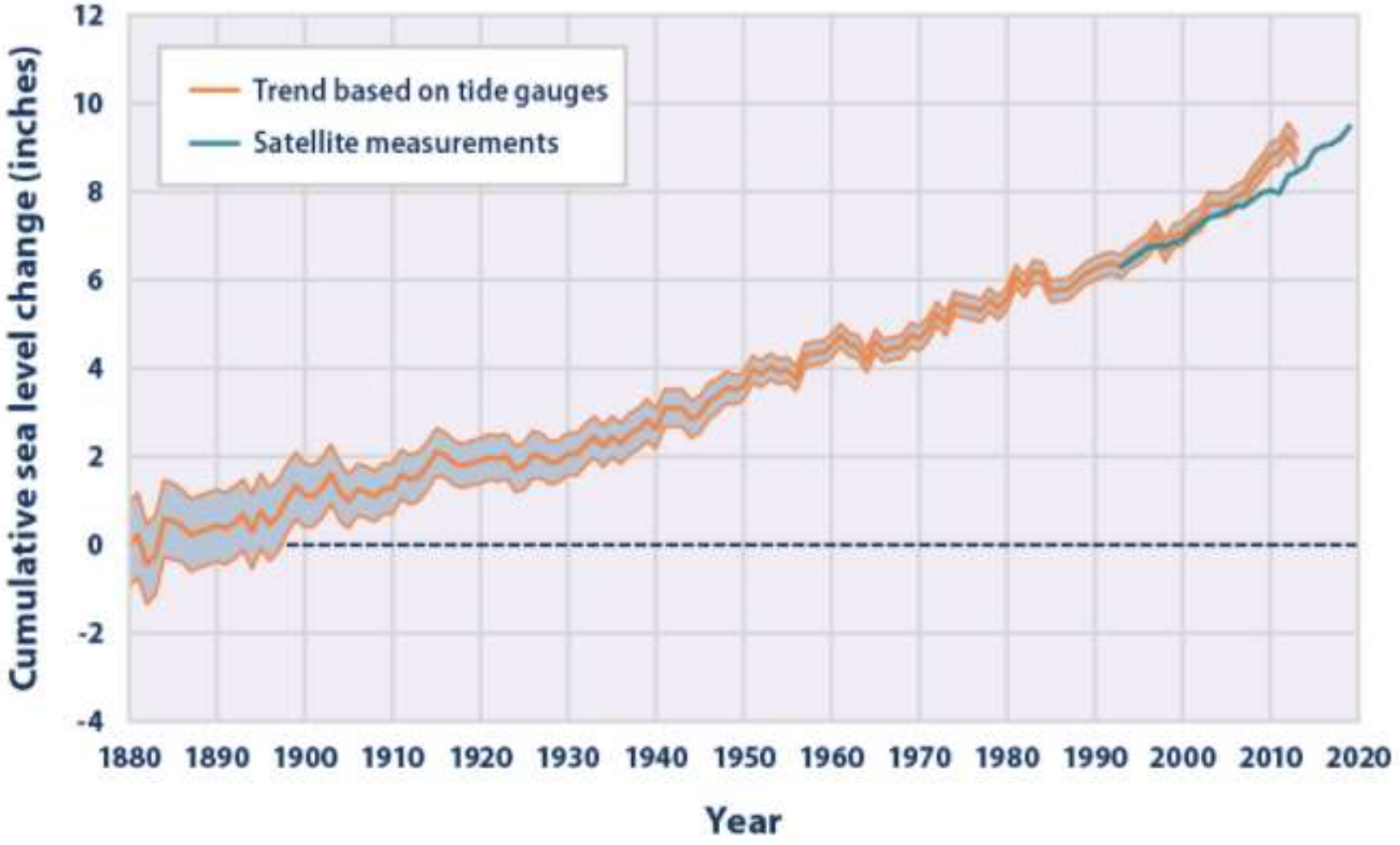
The ice cover is shrinking



US EPA

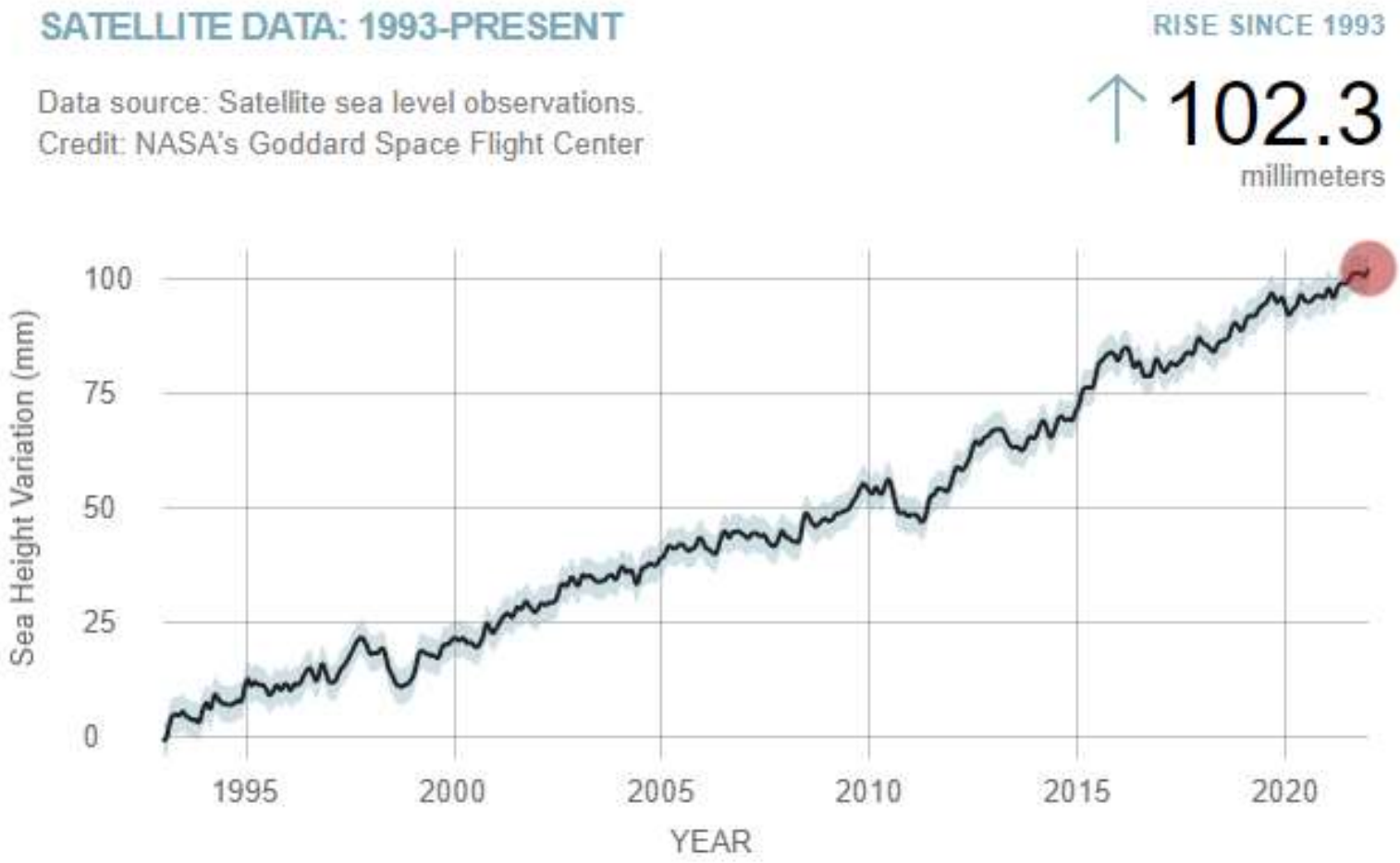
Global sea levels are rising

Figure 1. Global Average Absolute Sea Level Change, 1880–2019



EPA

NASA agrees with EPA



Why are sea levels rising?

Mainly because of:

- the expansion of ocean water as it warms,
- loss of ice from glaciers, and
- loss of ice from the Greenland and Antarctic ice sheets.

Australian Academy of Science

But aren’t the Pacific Islands actually growing?

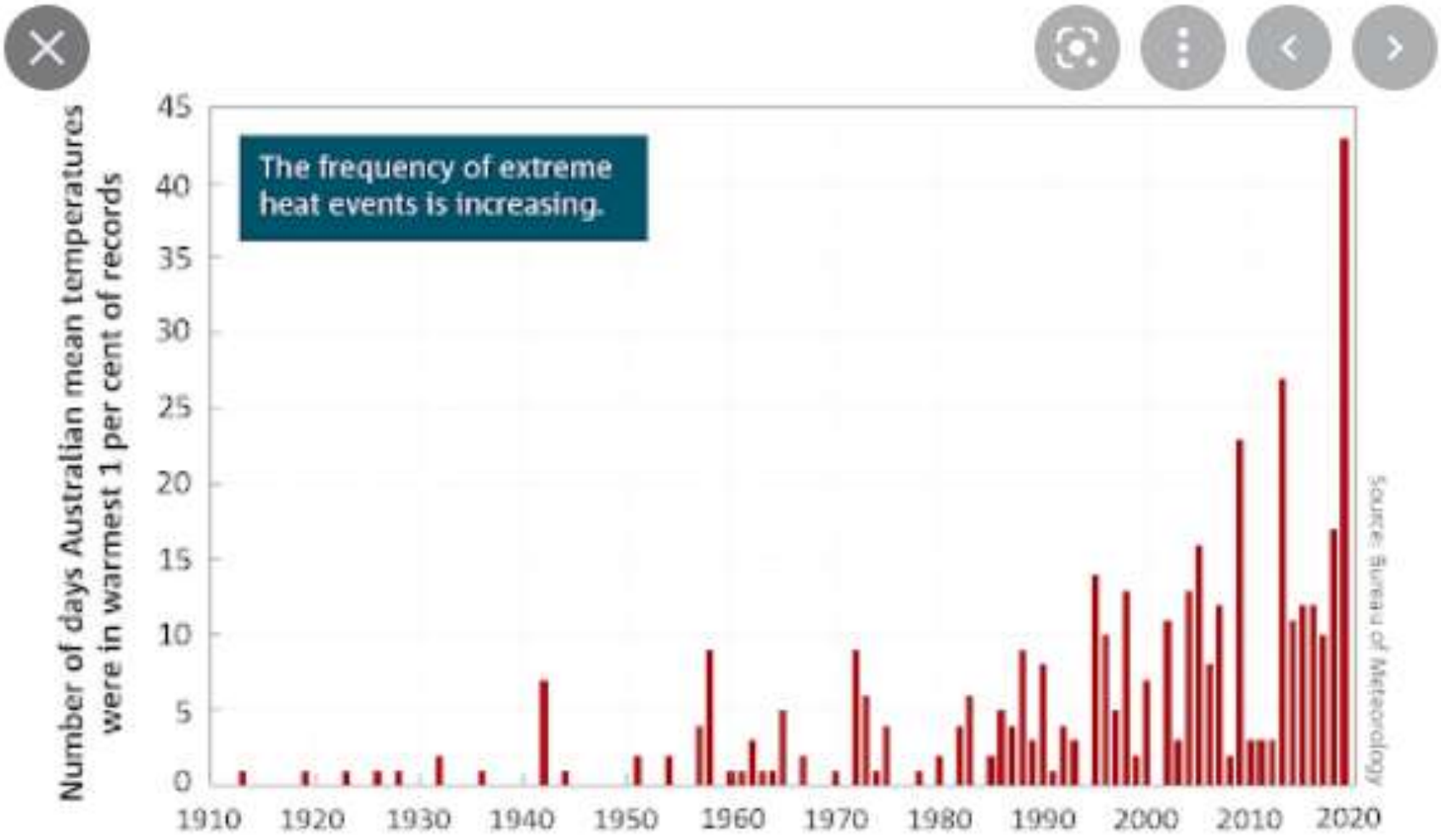
- Some yes and some no

- Increasing sea levels are a huge problem

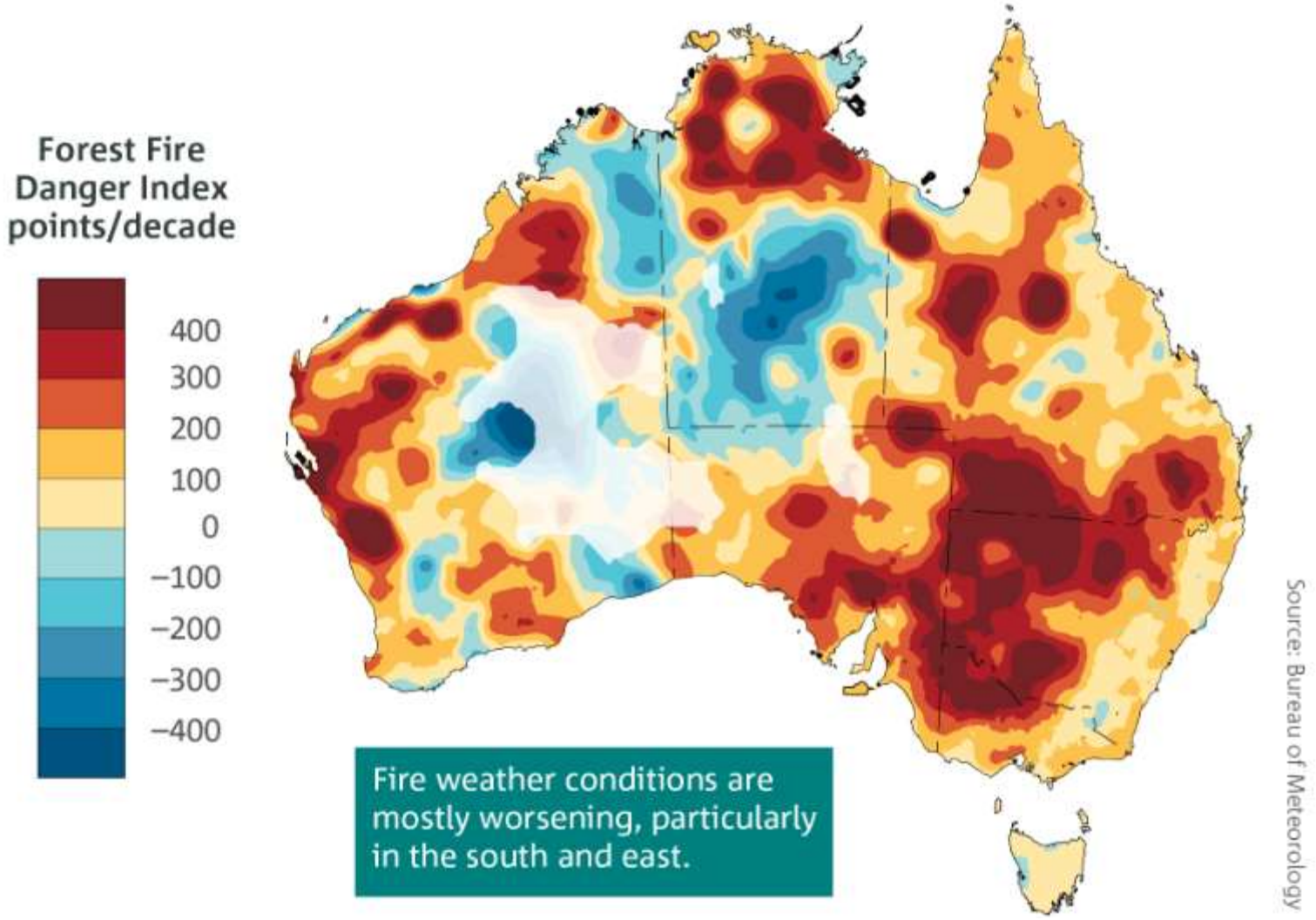
You can see the full story here

Global warming is changing everything: our daily lives

We’re getting more heatwaves



The bushfire danger has increased



The darker the red the worse it has become since 1978

Forest Fire Danger Index?

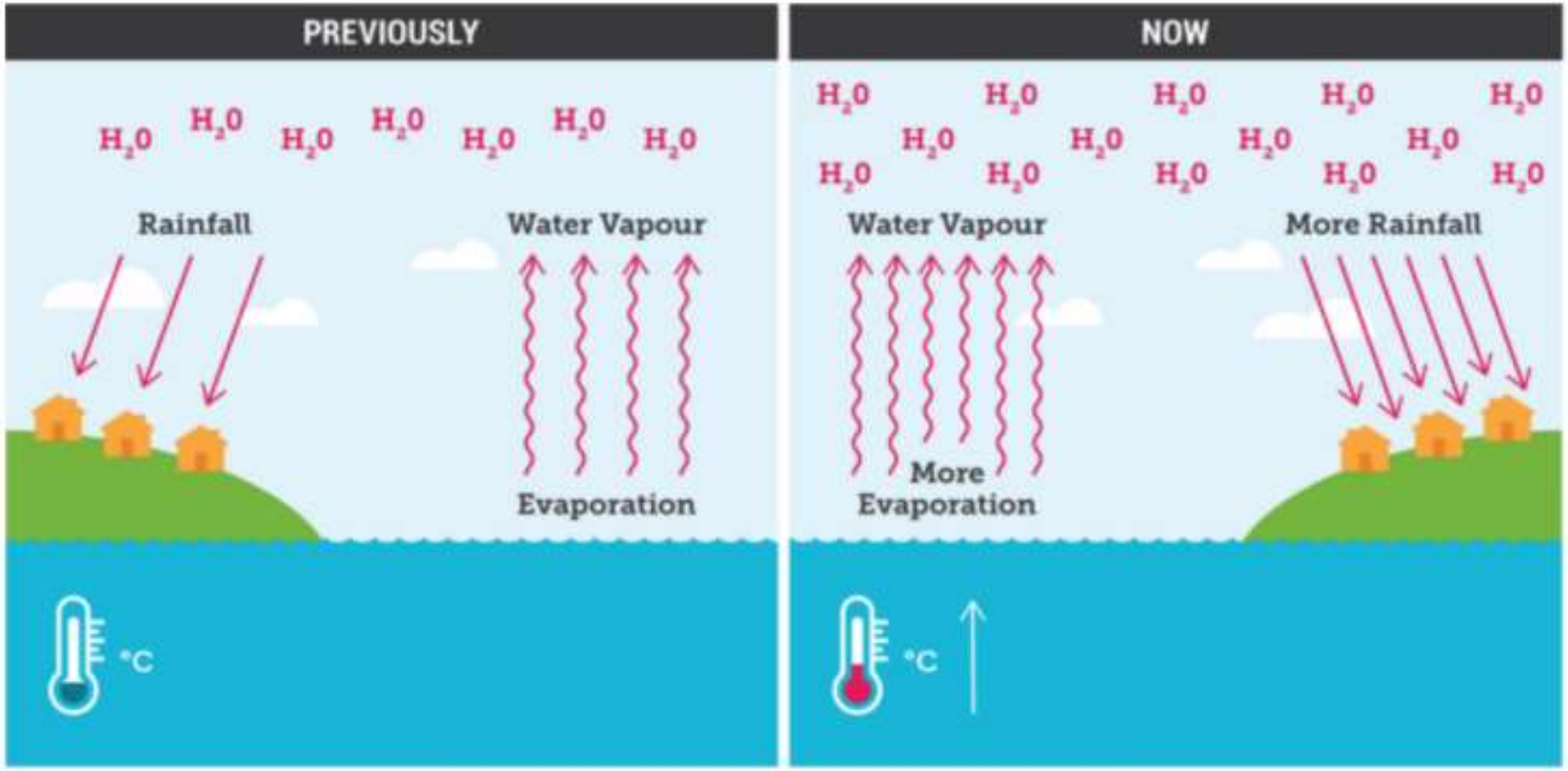
Estimates fire danger based on:

- temperature,
- rainfall,
- humidity, and
- wind speed

Index 1 – fire burns slowly if at all

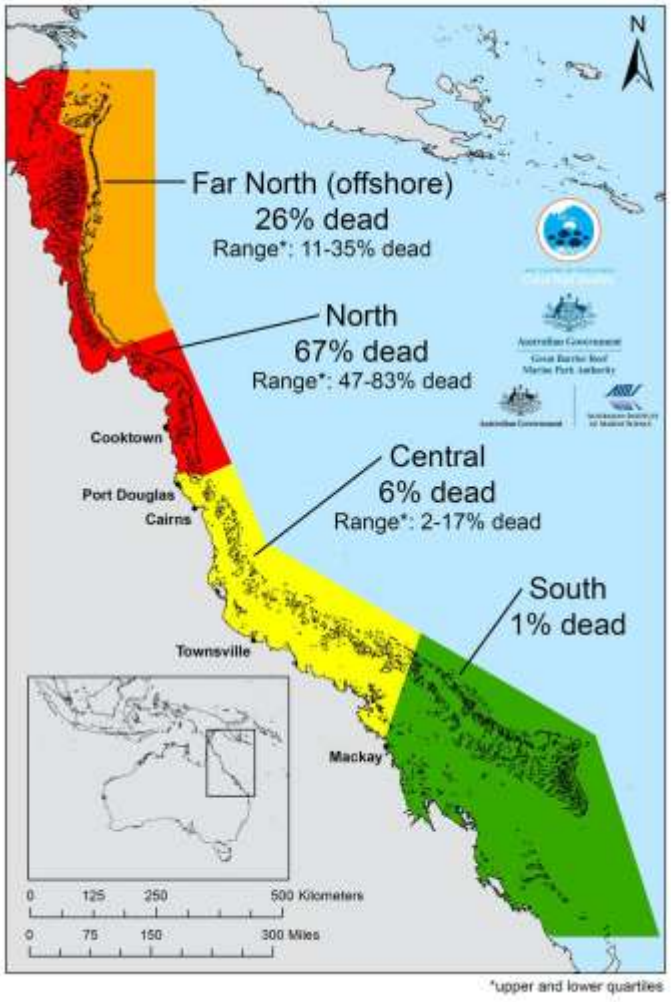
Index 100 – fire may be unstoppable

The danger of flooding has increased



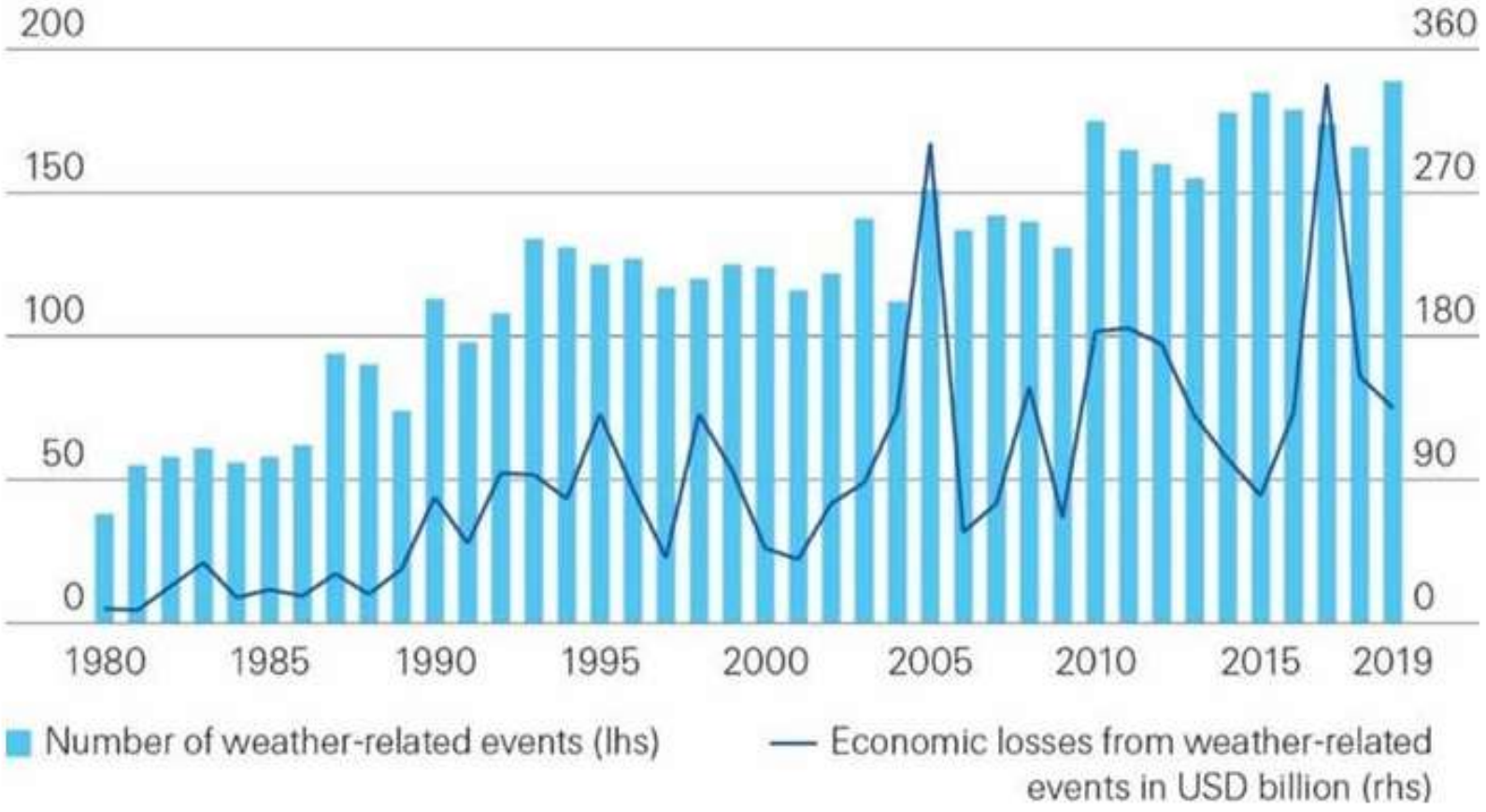
Climate Council

The Great Barrier Reef is suffering



Warming ocean temperatures and an increase in the frequency and intensity of marine heatwaves pose a major threat to the long-term health and resilience of coral reef ecosystems - *BOM and CSIRO*

It’s costing us a lot of money



Swiss Re

Global warming is changing everything: the vexed question of rainfall

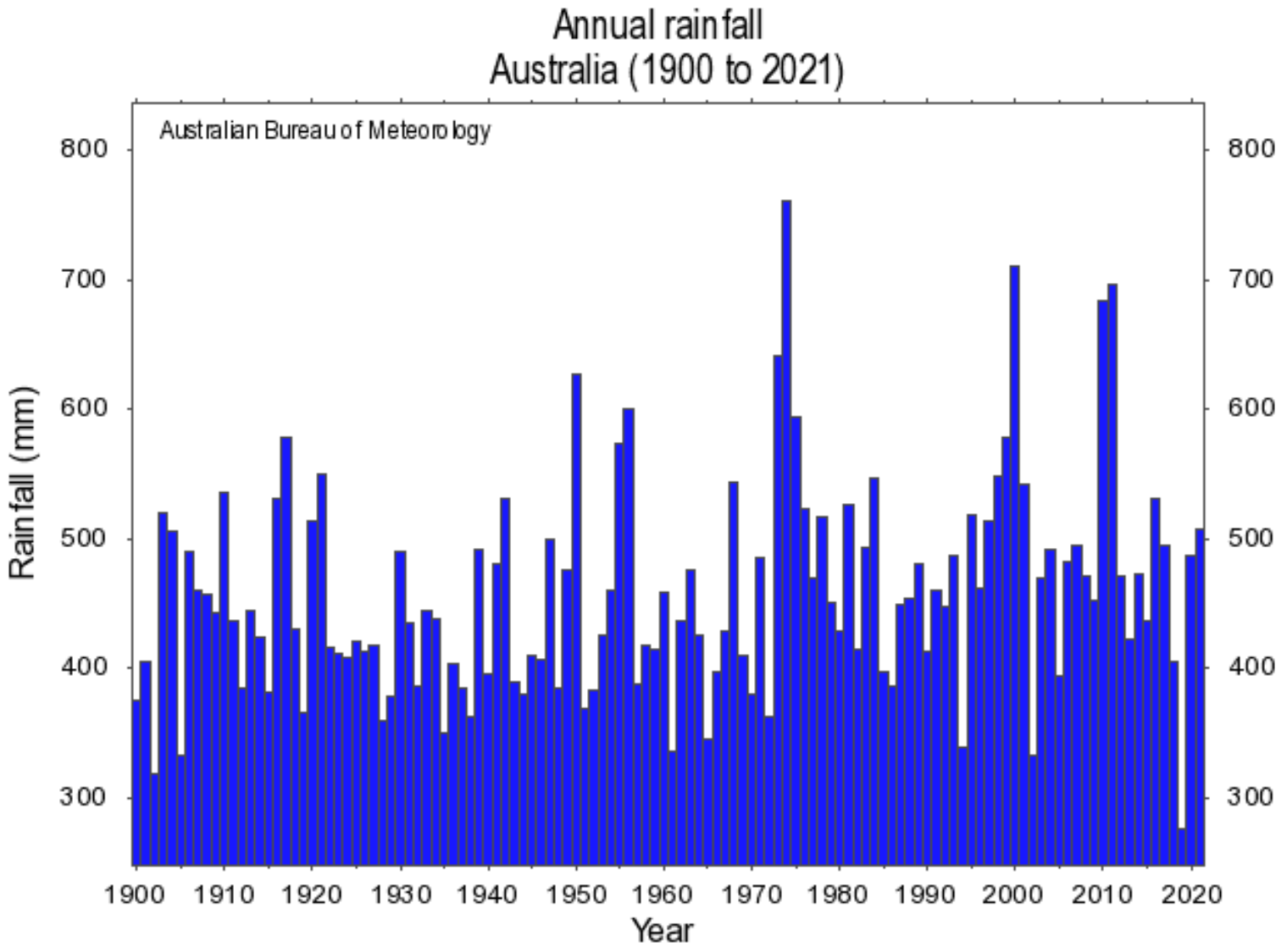
Global warming and rainfall

- As temperatures rise and the air becomes warmer, more moisture evaporates from land and water into the atmosphere.

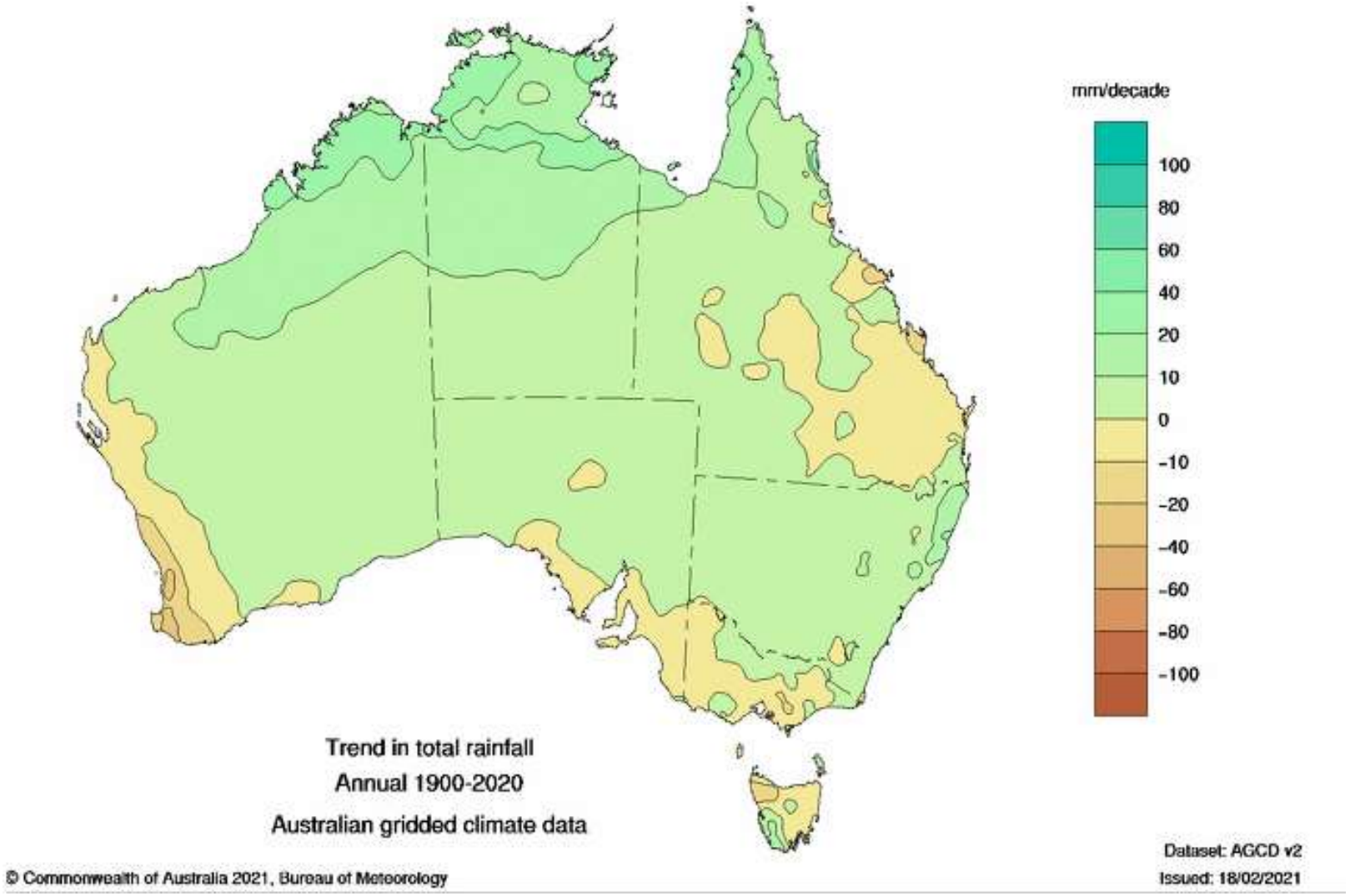
- More moisture in the air generally means we can expect more rain and snow and more heavy downpours.

- But this extra precipitation is not spread evenly around the globe, and some places might actually get less precipitation than they used to get.

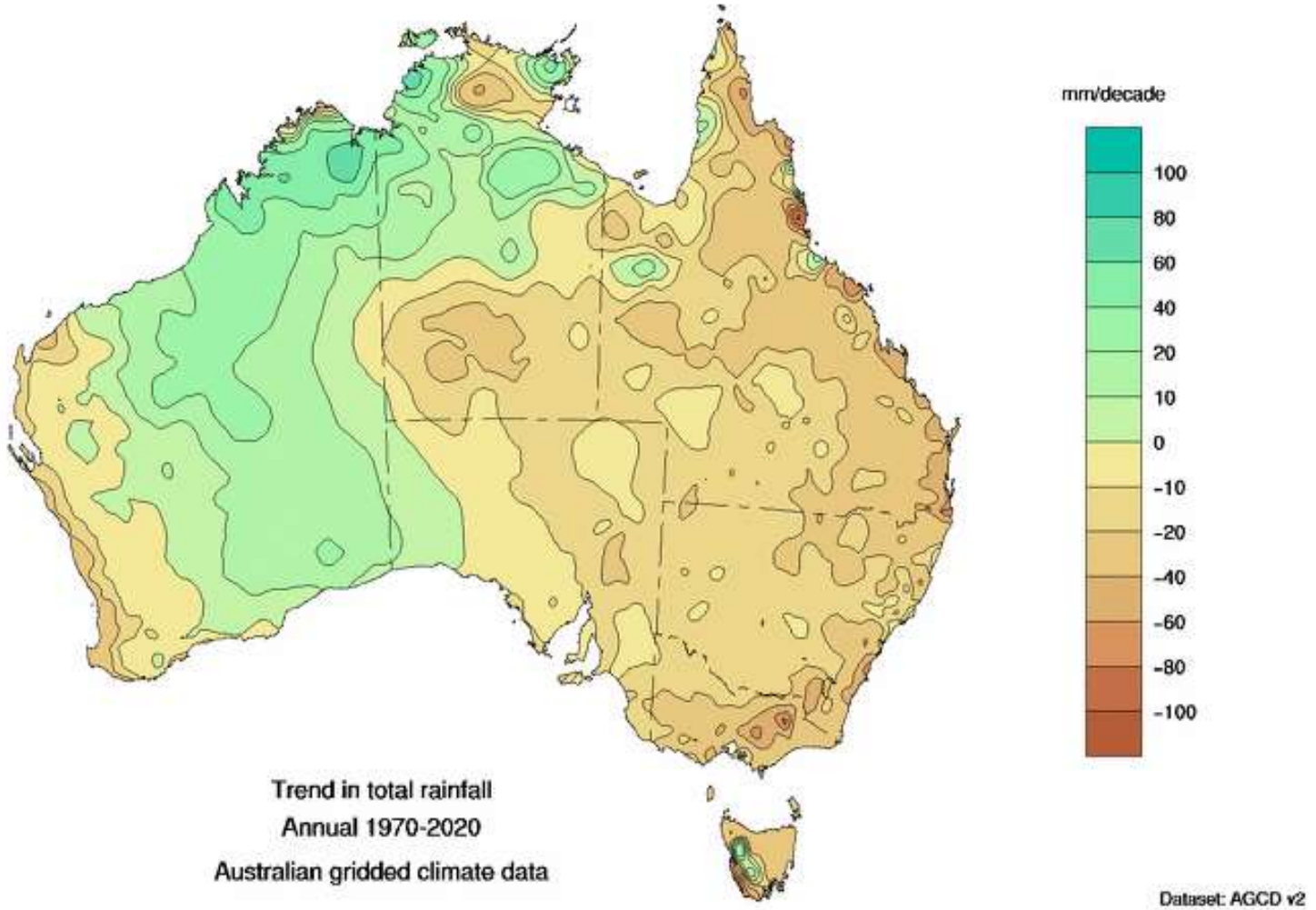
It’s a mixed picture for us



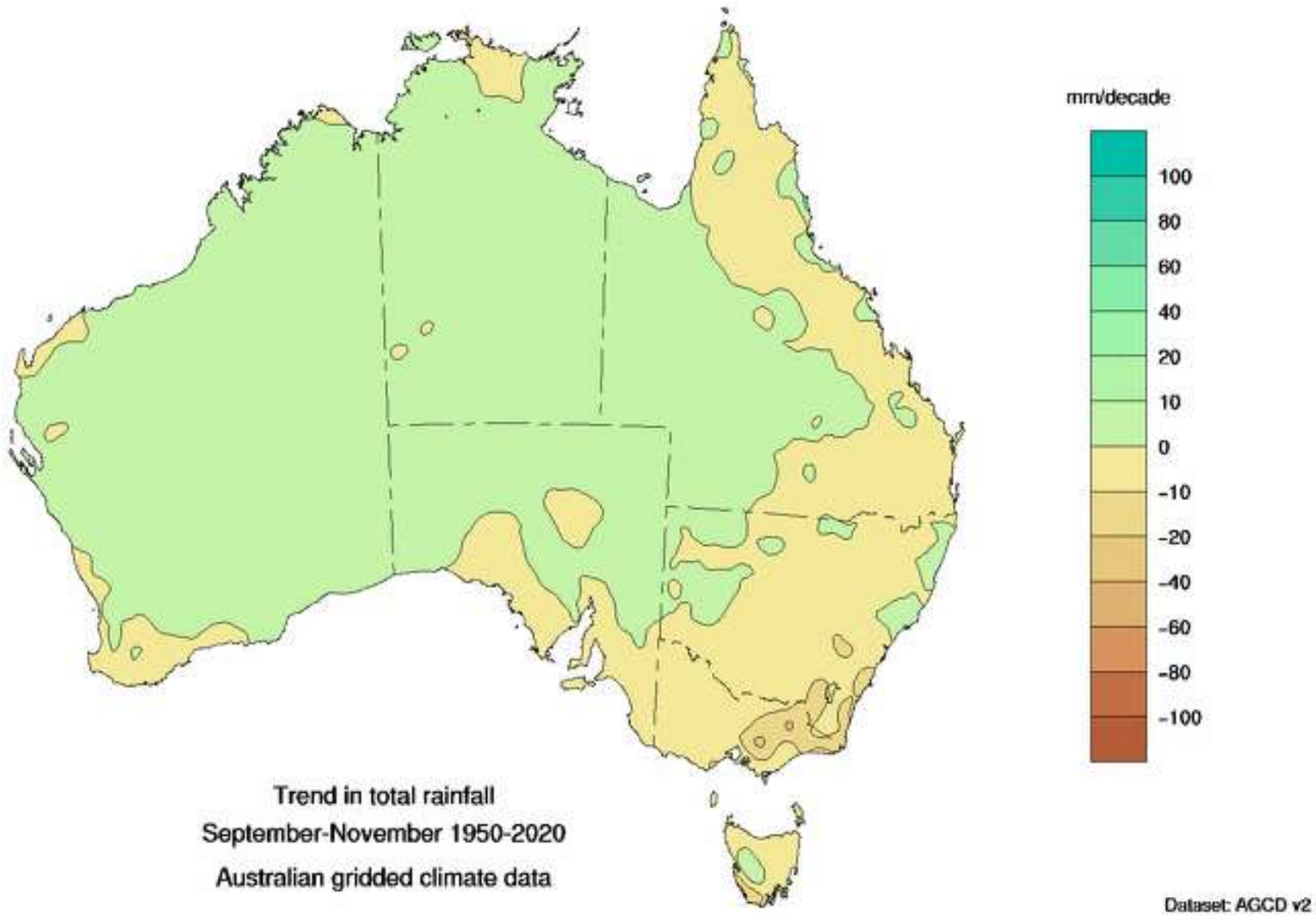
It’s mostly gone up since 1900



But down in patches since 1970



Our spring rain is decreasing



How does global warming affect our spring rainfall?

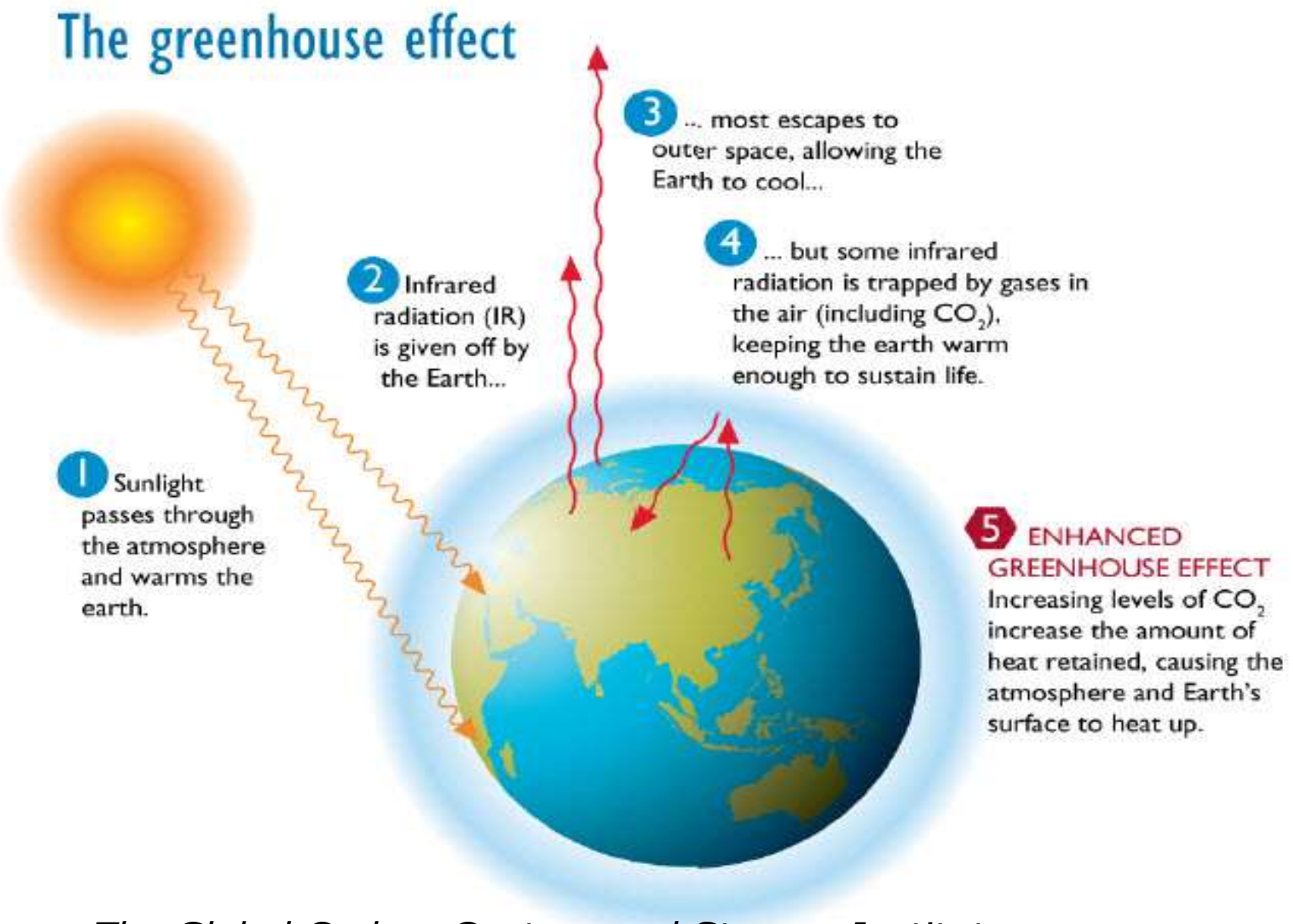
Global warming causes:

- higher sea level atmospheric pressure in southern latitudes, which means
- more high pressure systems and less lows, which means
- fewer cold fronts, and therefore
- less winter/spring rain in the south

BOM

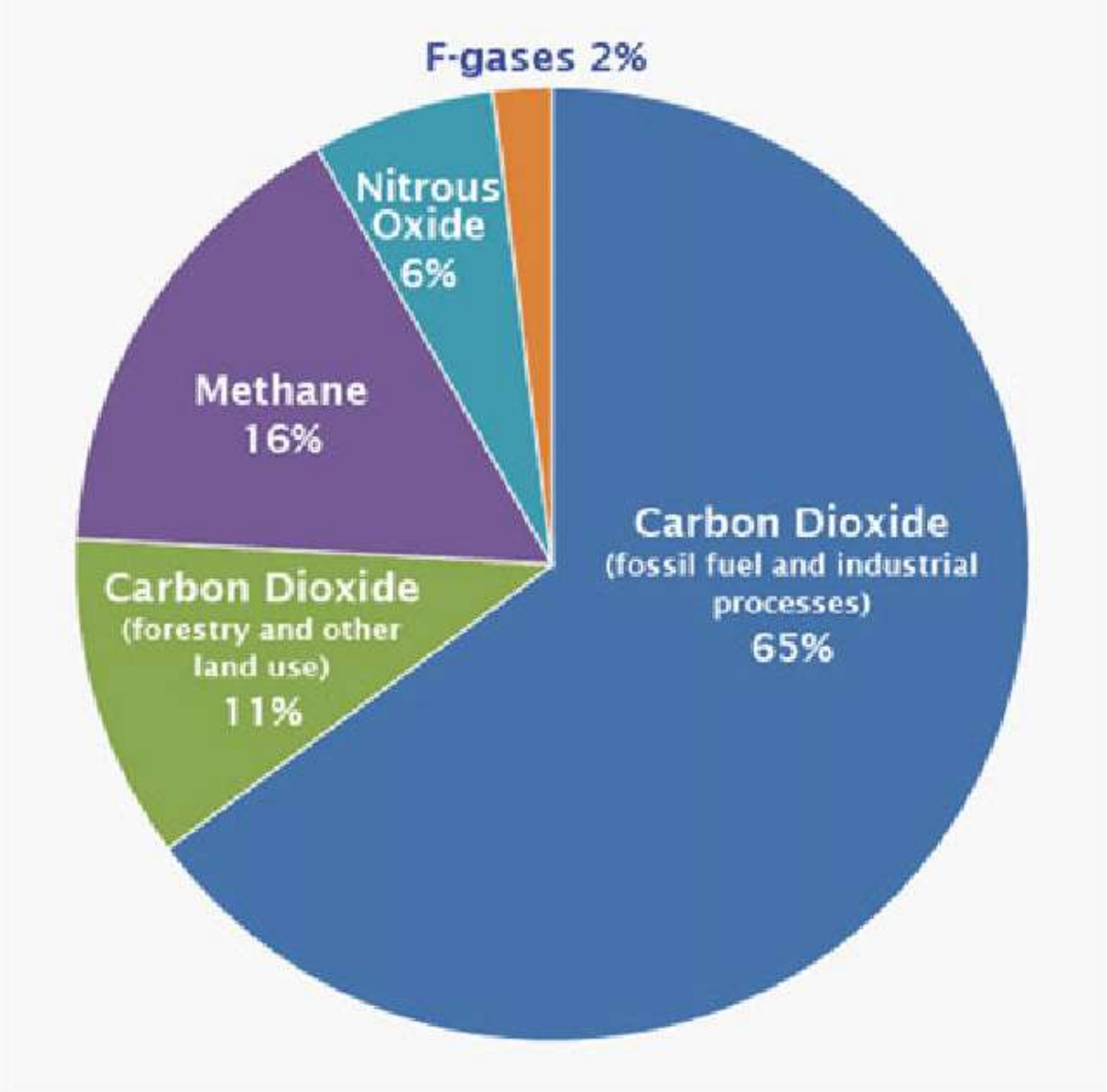
We’re making greenhouse gas emissions go up

Why would that matter?



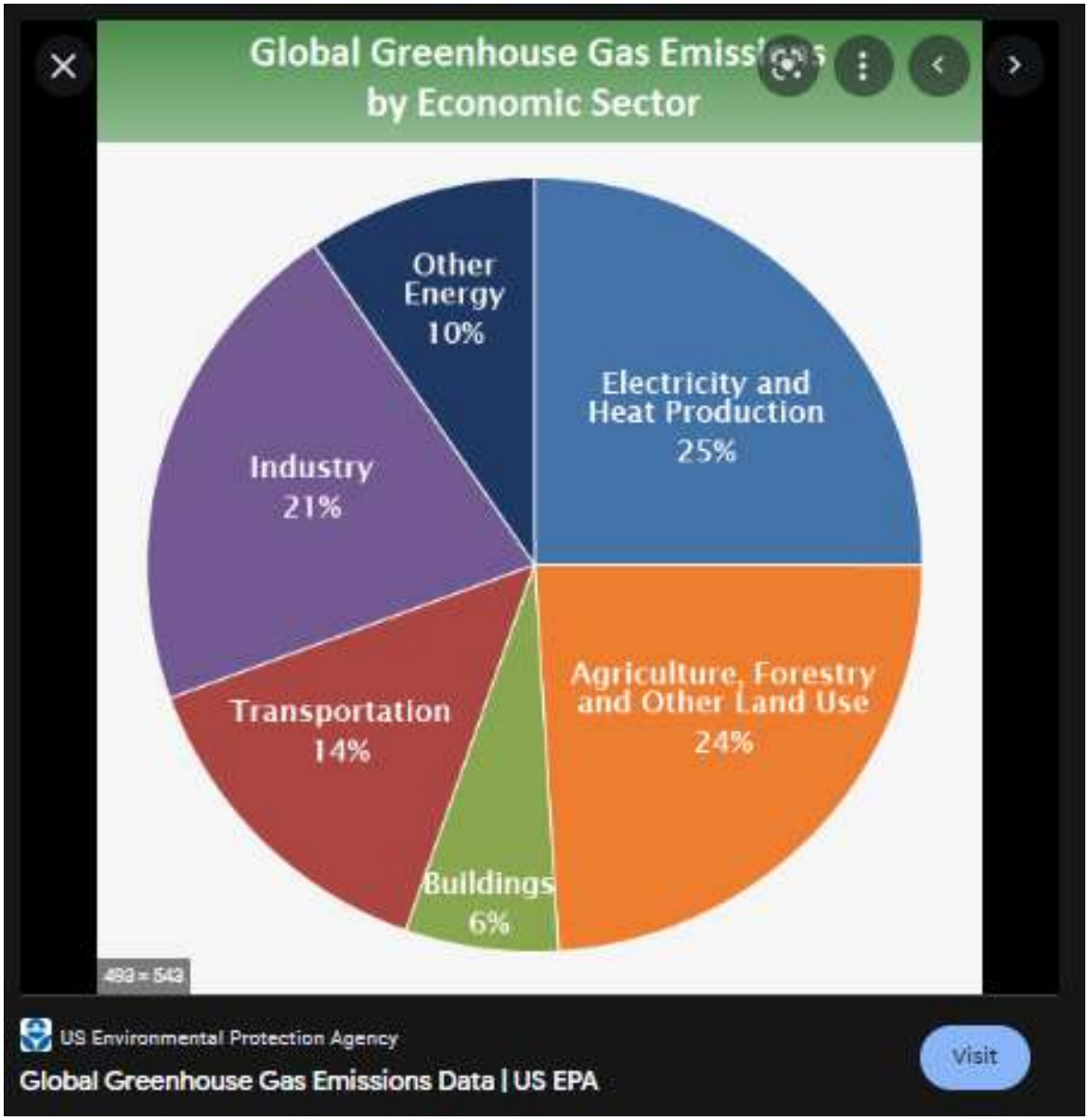
The Global Carbon Capture and Storage Institute

What are the greenhouse gases?

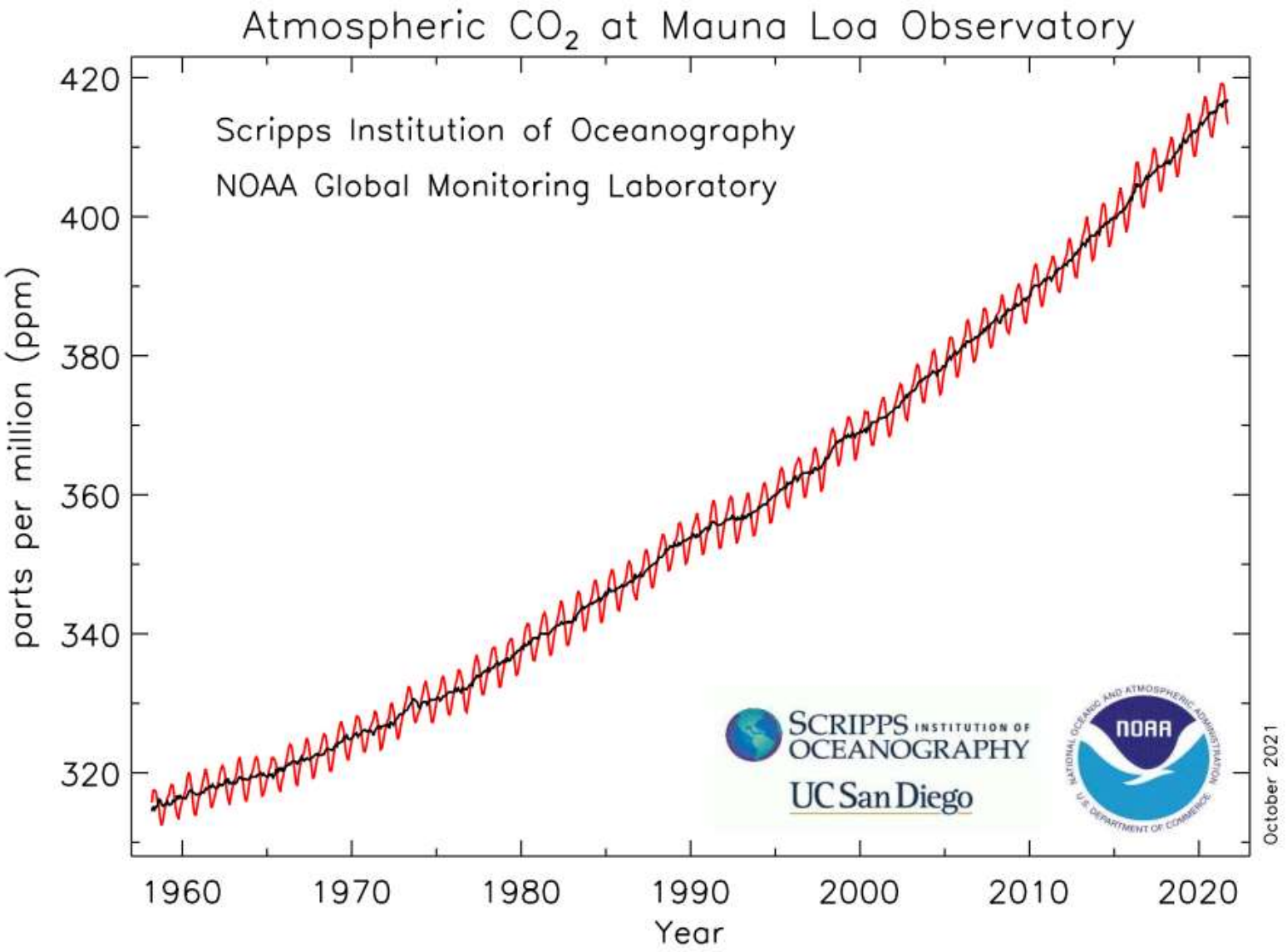


ResearchGate

Where do the greenhouse gases come from?



Carbon Dioxide emissions are going up



But aren't Mauna Loa's measurements distorted by the volcano near it?

Not according to NASA:

- Most of the time, the observatory experiences "baseline" conditions and measures clean air which has been over the Pacific Ocean for days or weeks.

- We know this because the CO_2 analyzer usually gives a very steady reading which varies by less than 3/10 of a part per million (ppm) from hour to hour.

- These are the conditions we use to calculate the monthly averages that go into the famous 50-year graph of atmospheric CO_2 concentration.

And it’s not just Mauna Loa anyway

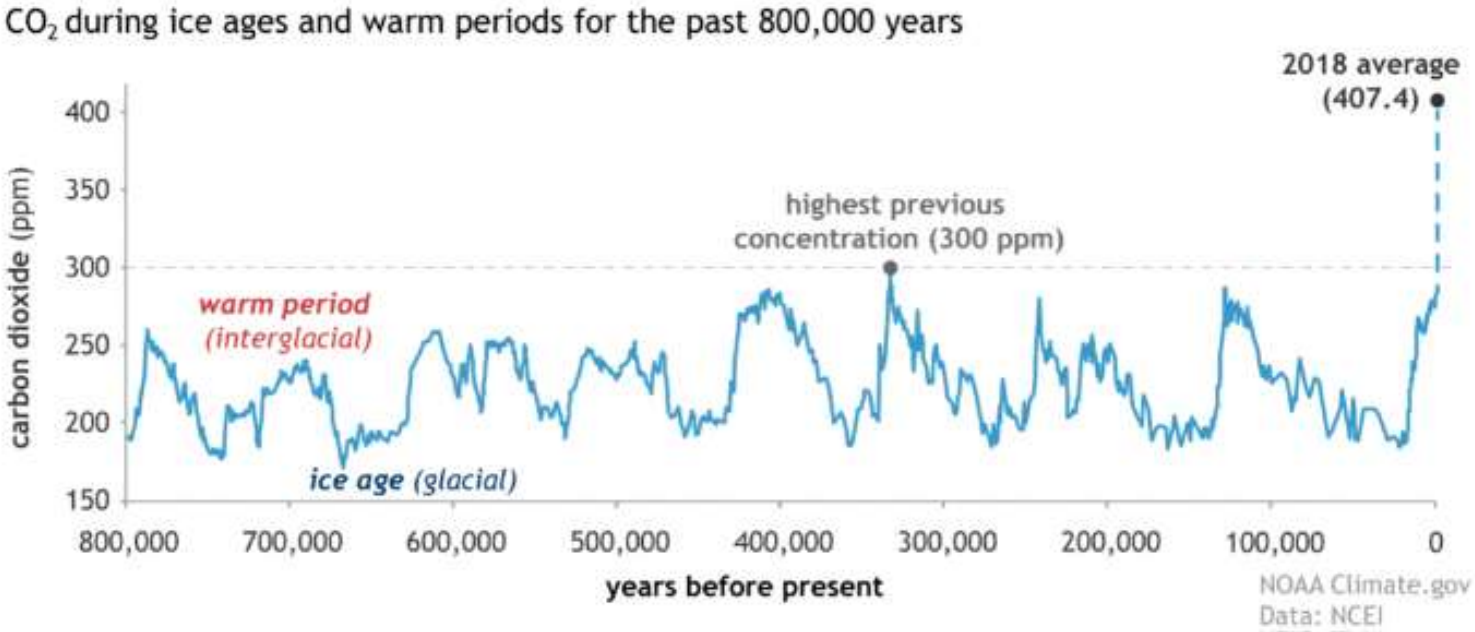
Australia’s own Professor Will Steffen points out that:

- CO_2 measurements from Cape Grim in Tasmania are used with the Mauna Loa measurements to give a globally balanced picture.

- There is no volcano anywhere near Cape Grim.

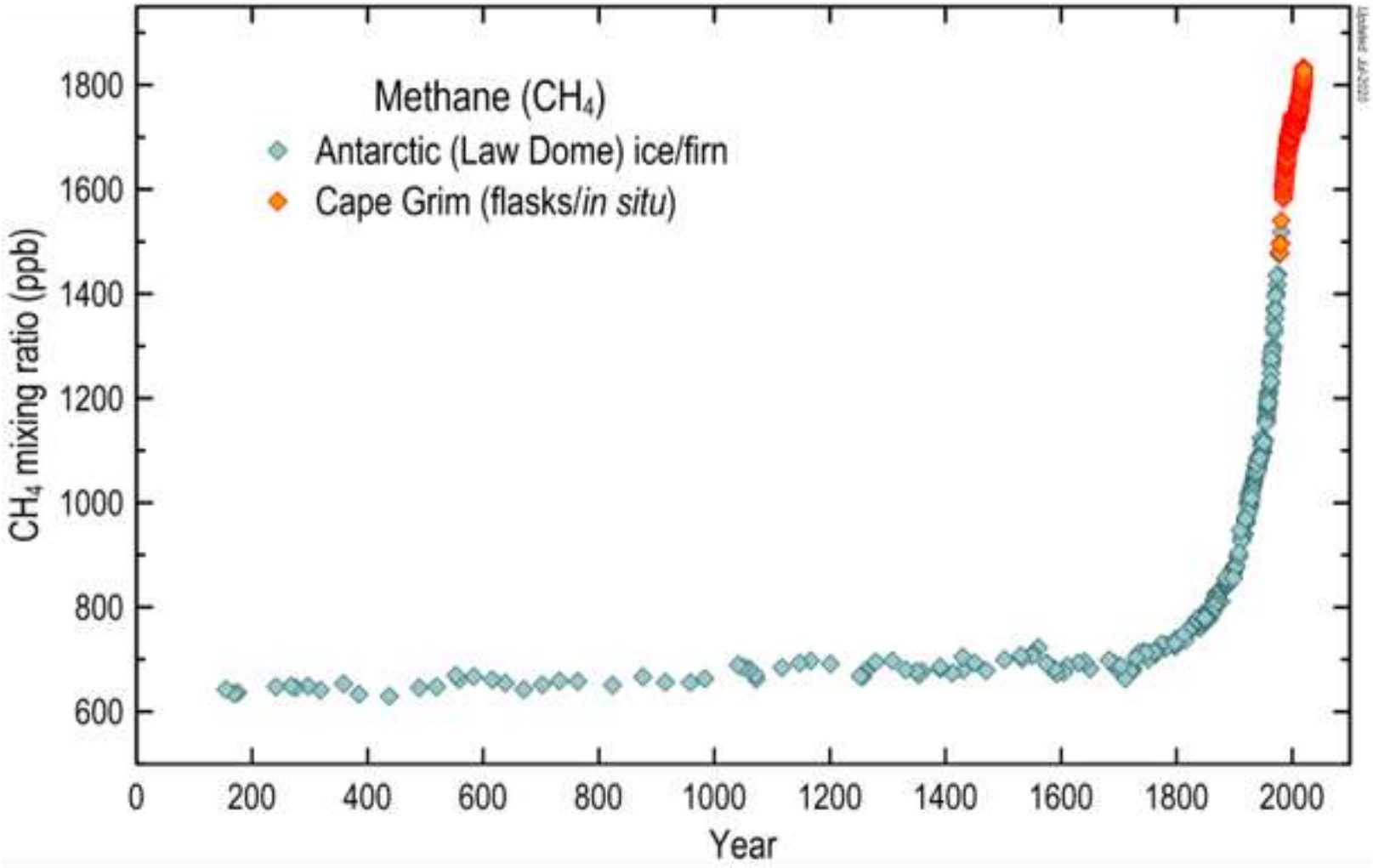
- The CSIRO measurements there are the same as Mauna Loa but offset by about 6 months due to the vastly different distribution of the terrestrial biosphere between the two.

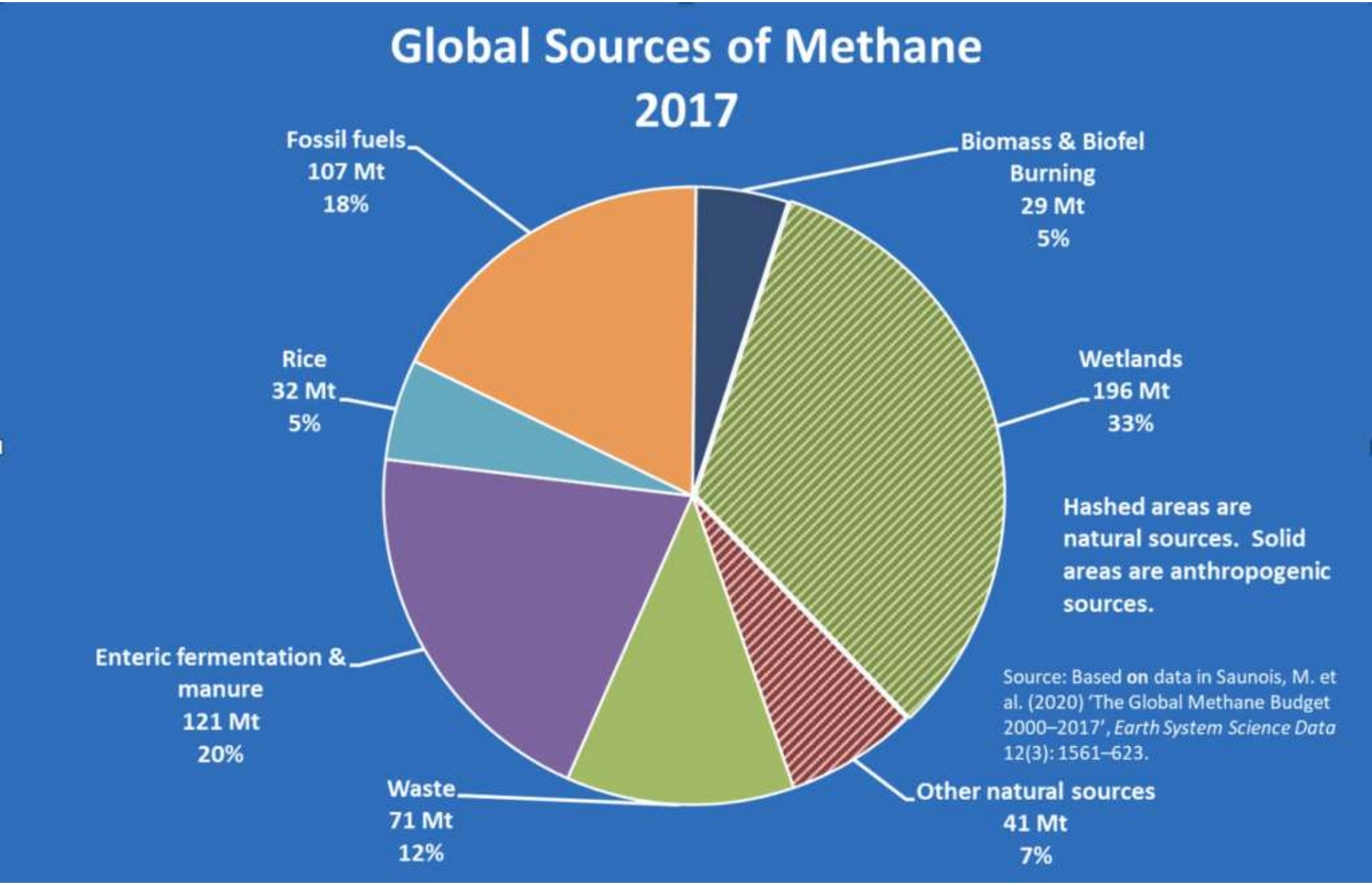
But haven’t CO2 levels been high in the past?



*Carbon dioxide levels in the atmosphere over the past 800,000 years, based off data from ice cores. C02 levels have never been as high as they are now. Source: **NOAA***

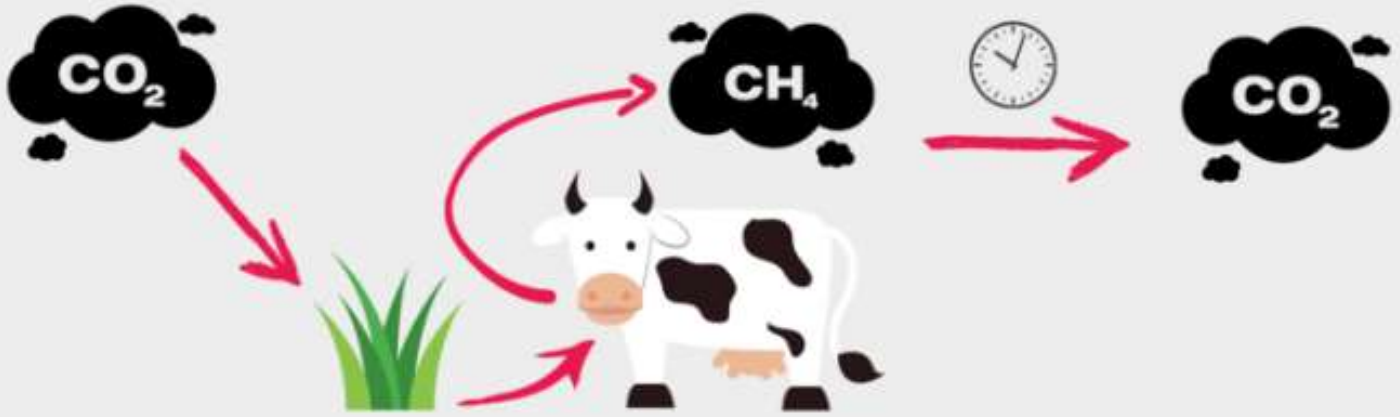
Methane emissions are going up





https://methaneaction.org/

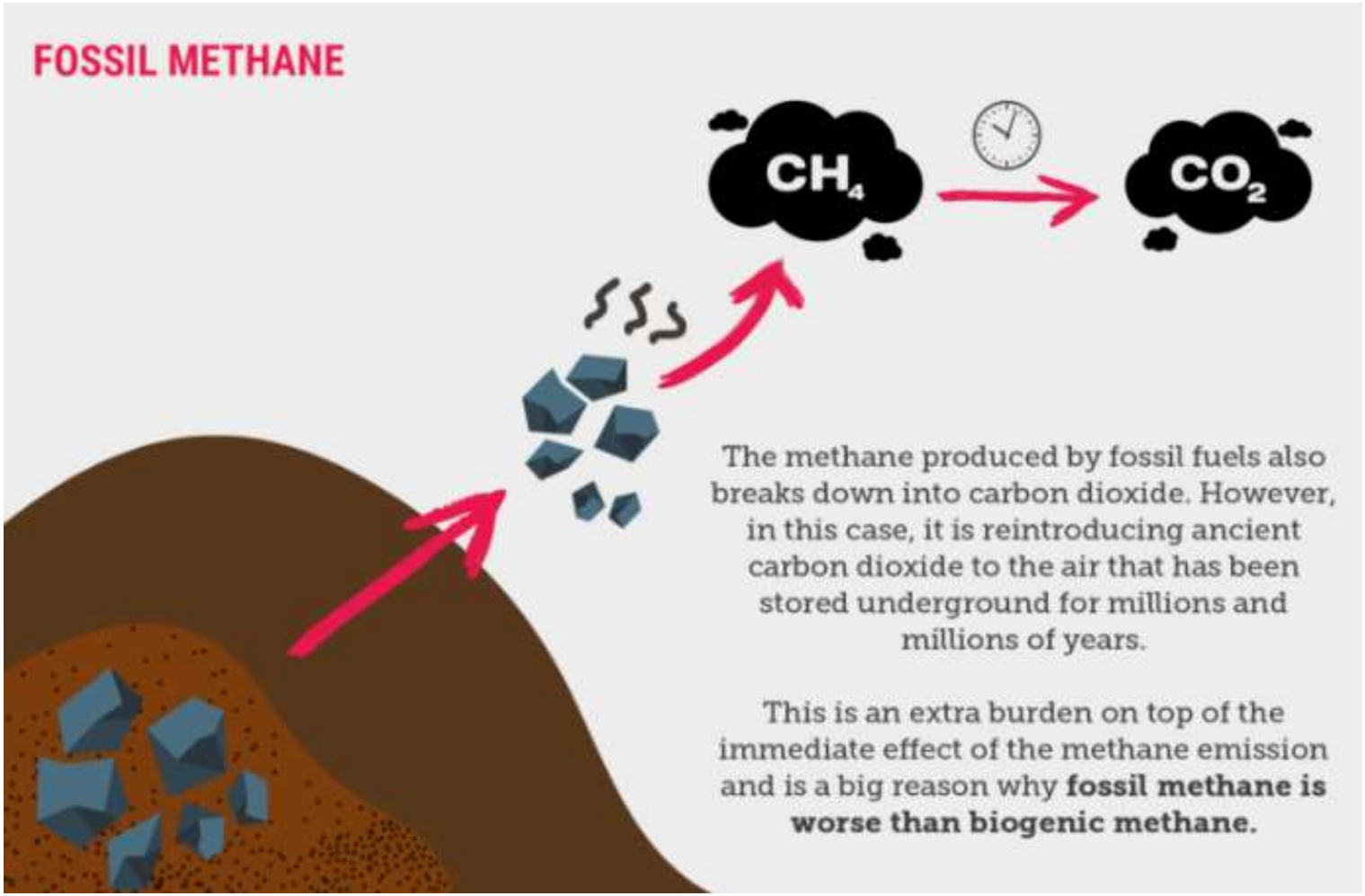
BIOGENIC METHANE



Most methane from agriculture comes from the breakdown of plants, whether as waste or in an animal's stomach.

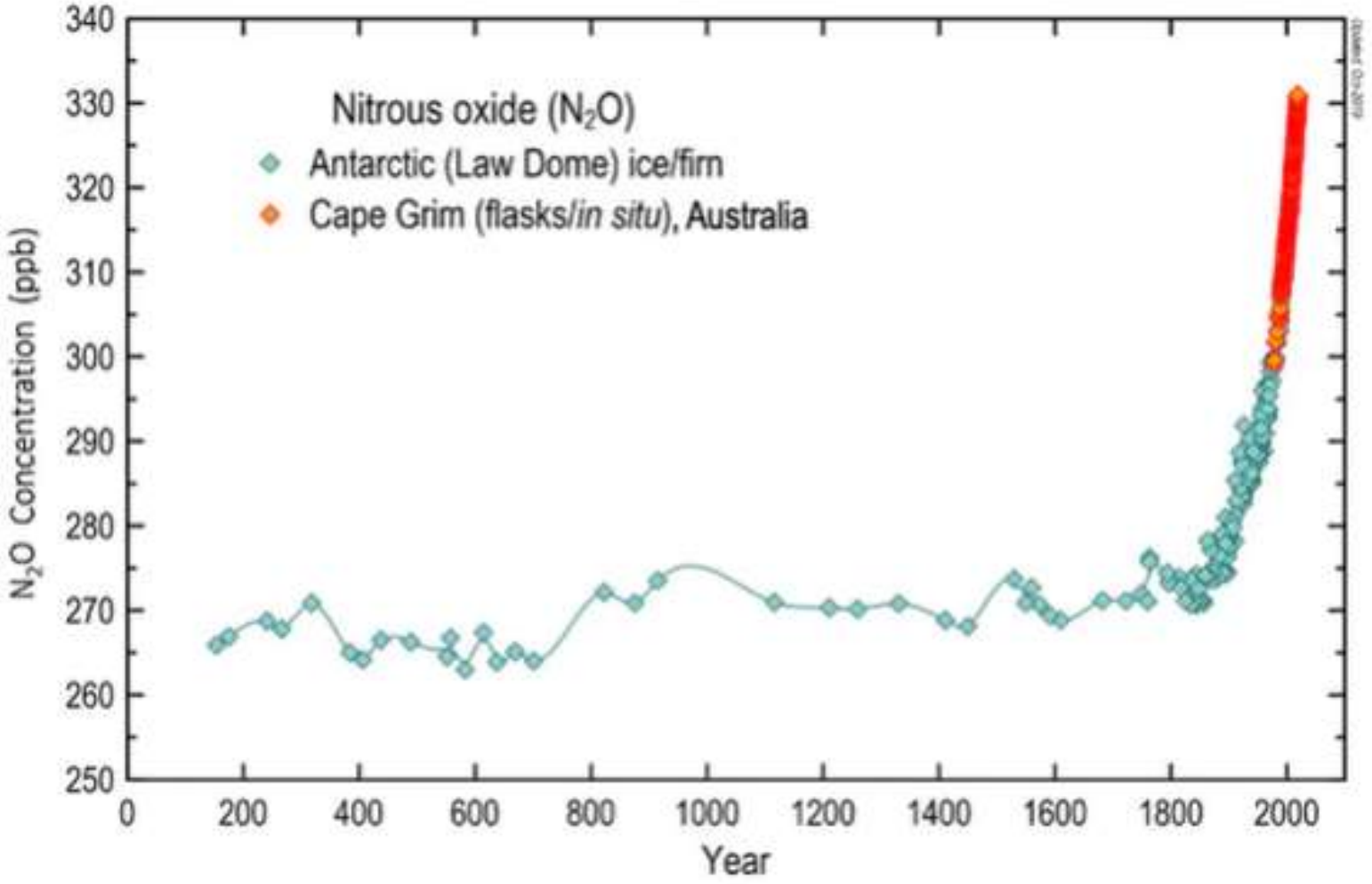
When those plants grew, they pulled carbon dioxide from the air. When methane breaks down, it re-introduces the carbon dioxide to the air. **This balances out the additional impact of carbon dioxide.**

Climate Council

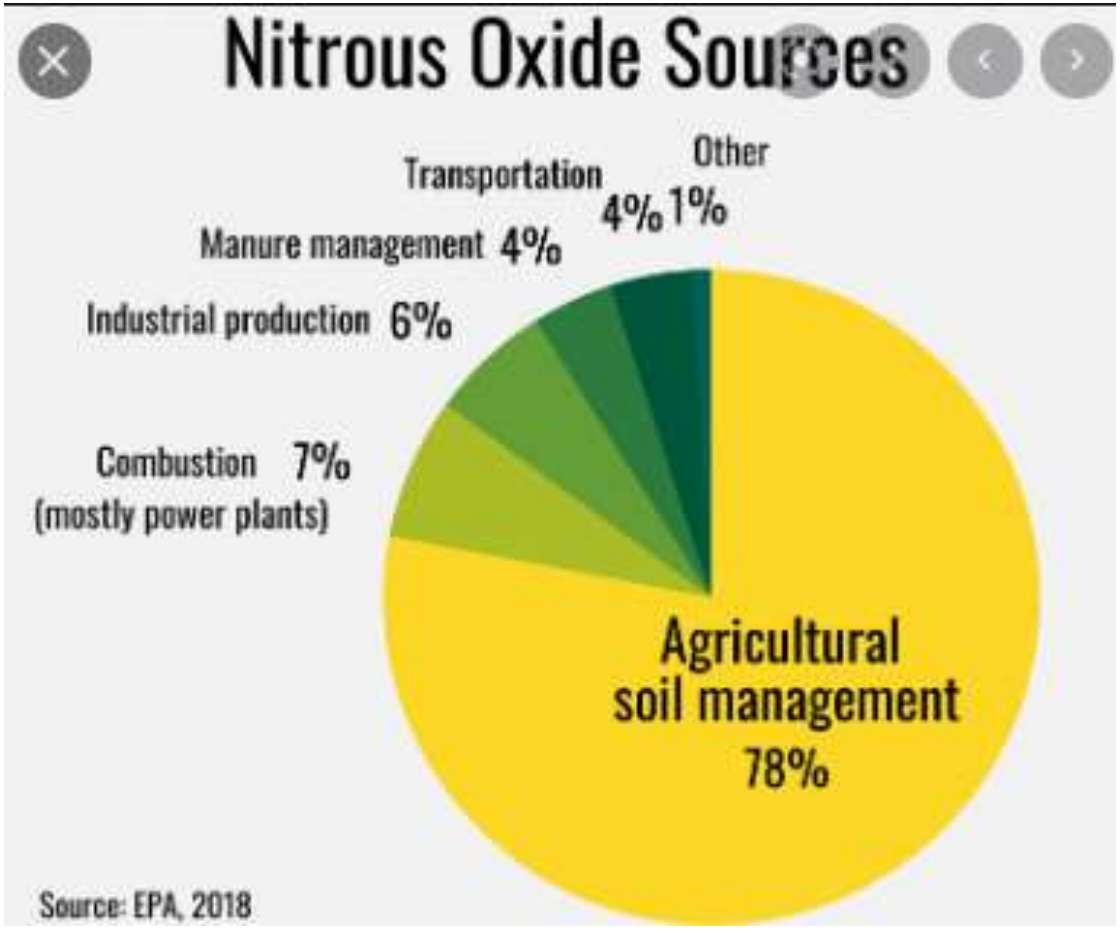


Climate Council

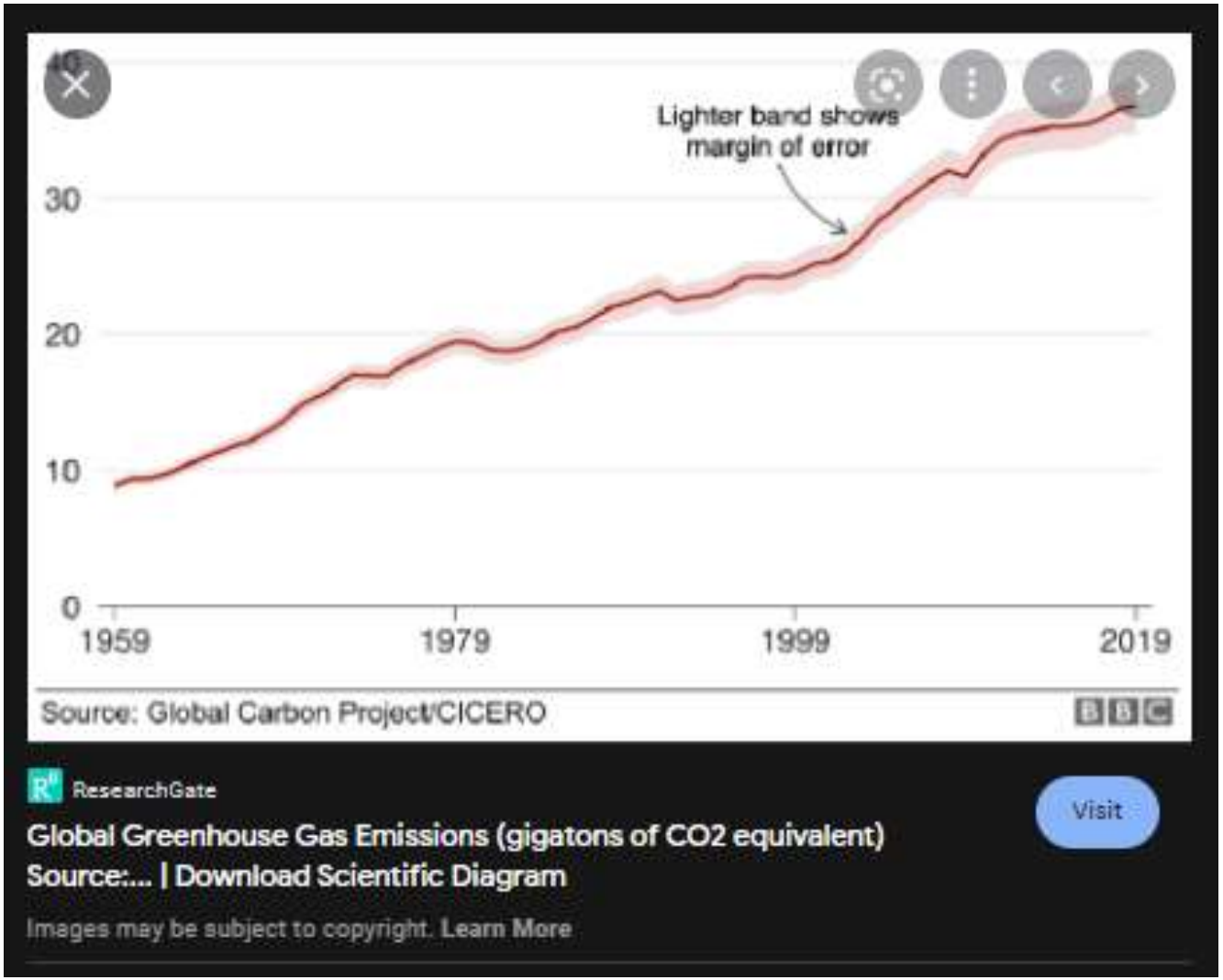
Nitrous oxide emissions are going up



2000 years of atmospheric nitrous oxide concentrations. Observations taken from ice cores and atmosphere. Source: BoM/CSIRO/AAD.


Nitrous Oxide Sources
Other
1%
Transportation
4%
Manure management 4%
Industrial production 6%
Combustion 7%
(mostly power plants)
Agricultural
soil management
78%
Source: EPA, 2018

All emissions are going up

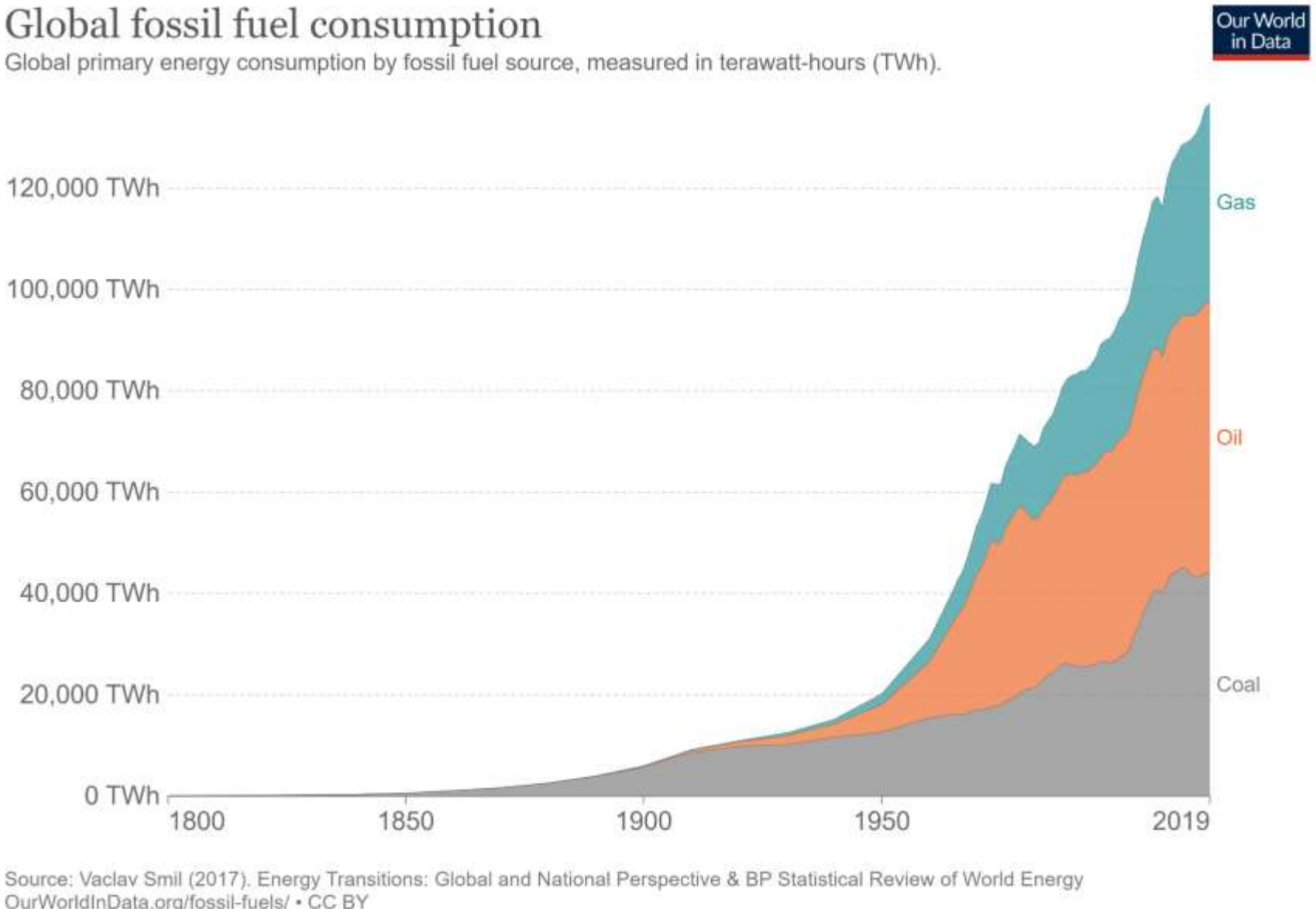


CO2e?

CO2e is a formula that calculates the combined carbon footprint from all six greenhouse gases:

- Carbon dioxide (CO2),
- Methane (CH4),
- Nitrous oxide (N2O),
- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs), and
- Sulphur hexafluoride (SF6).

Where are all these increases coming from?



What gases are released from burning fossil fuels?

- **Carbon dioxide** (CO_2) makes up the vast majority,

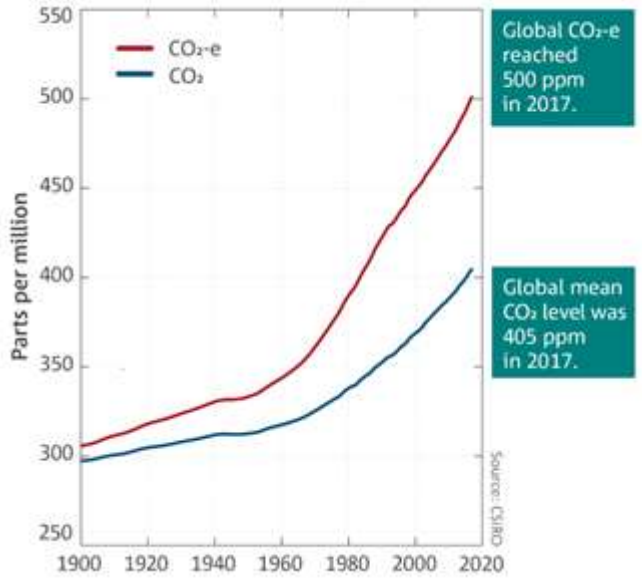
- plus smaller amounts of **methane** (CH_4) and **nitrous oxide** (N_2O).

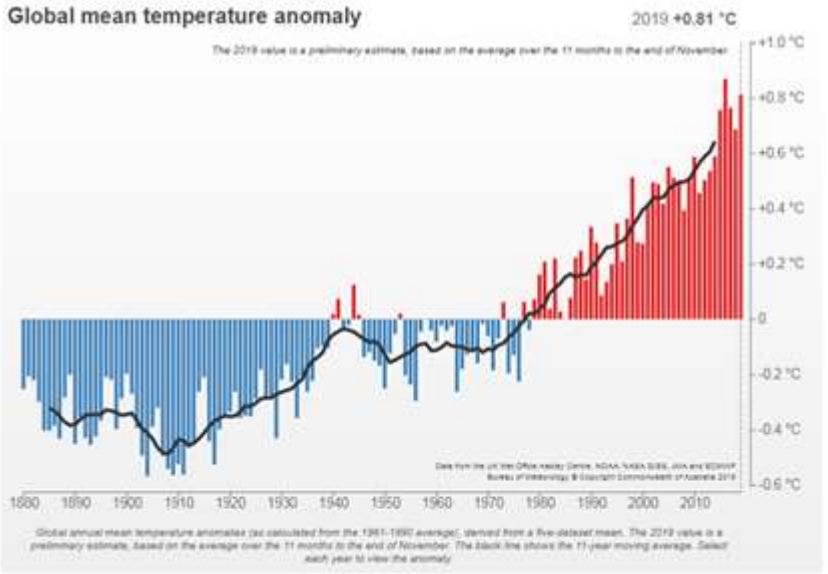
U.S. Environmental Protection Agency

Increasing emissions = global warming

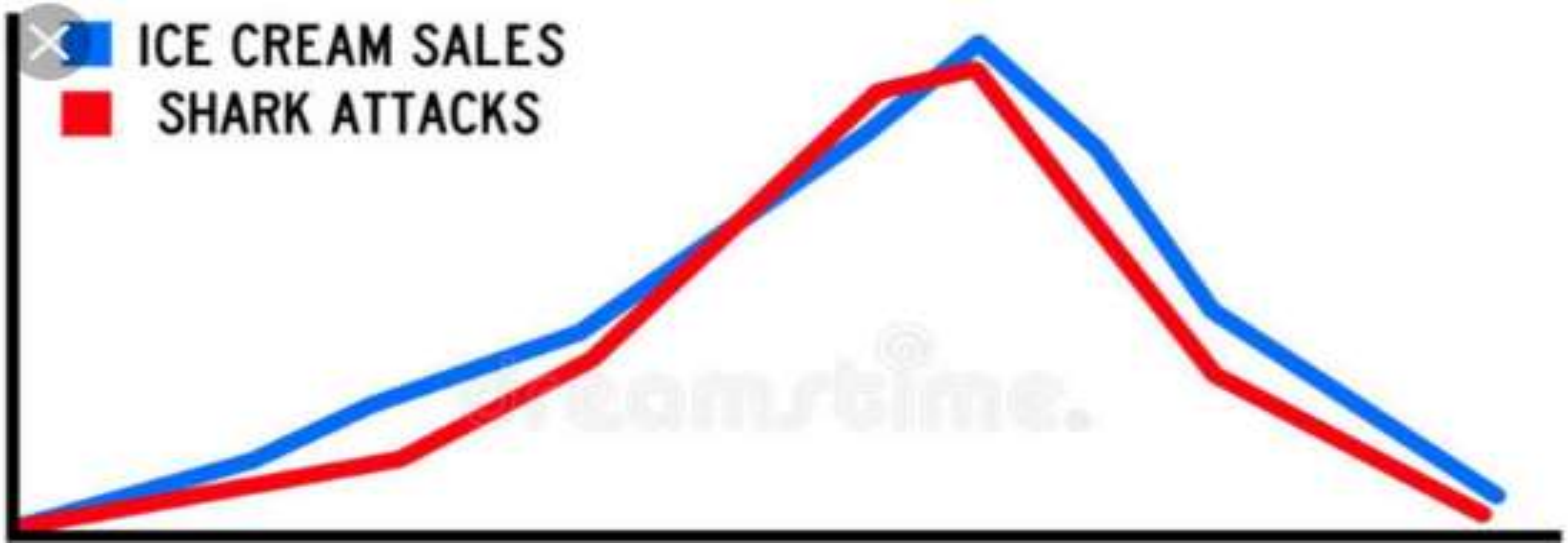
Emissions and temperatures go up together

Like this:





One thing may not cause the other



But this time it does

In 1896, Swedish scientist Svante Arrhenius first predicted that **changes in the levels of carbon dioxide in the atmosphere could substantially alter the surface temperature** through the greenhouse effect.

(NASA)

In 2022 the Australian Academy of Science says:

"Earth's climate has changed over the past century.

The best available evidence indicates that greenhouse gas emissions from human activities are the main cause".

https://www.science.org.au/learning/general-audience/science-booklets/science-climate-change/summary

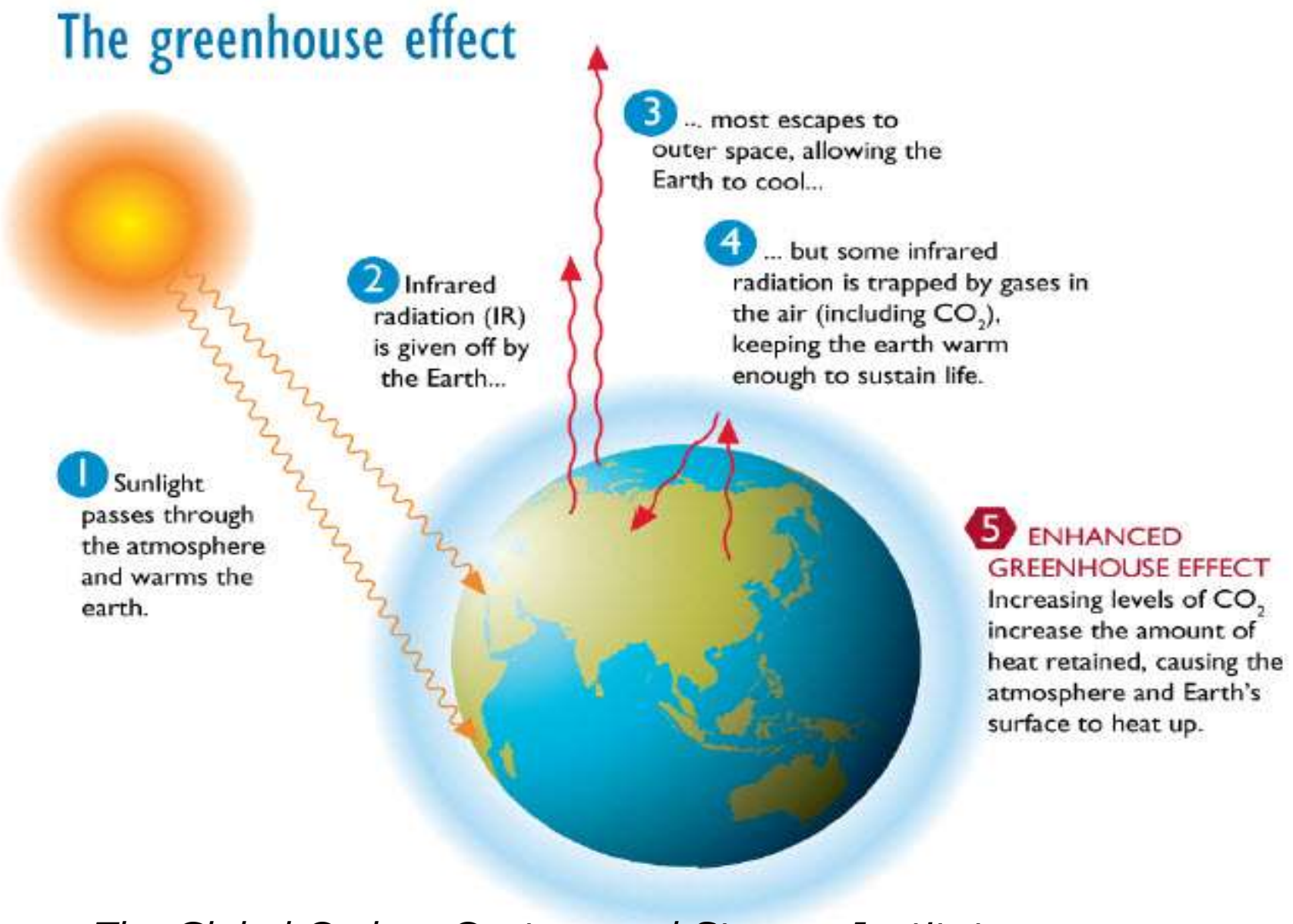
But how could such a small amount of CO2 cause global warming?

Oxygen and Nitrogen make up 99% of the atmosphere and CO2 only 0.04% - about 420 parts per million!

Climate scientist Jason Smerdon from New York's Columbia University says:

- Oxygen and nitrogen absorb energy that has wavelengths of around 200 nanometers or less
- Infrared energy travels at wider wavelengths of 700 to 1,000,000 nanometers
- Carbon dioxide absorbs energy at a variety of wavelengths between 2,000 and 15,000 nanometers
- As CO2 absorbs the infrared energy, it vibrates and re-emits it back in all directions
- About half of that energy goes out into space, and about half of it returns to Earth as heat, contributing to the 'greenhouse effect'

And don't forget



The Global Carbon Capture and Storage Institute

So…..

A. Burning fossil fuels

=

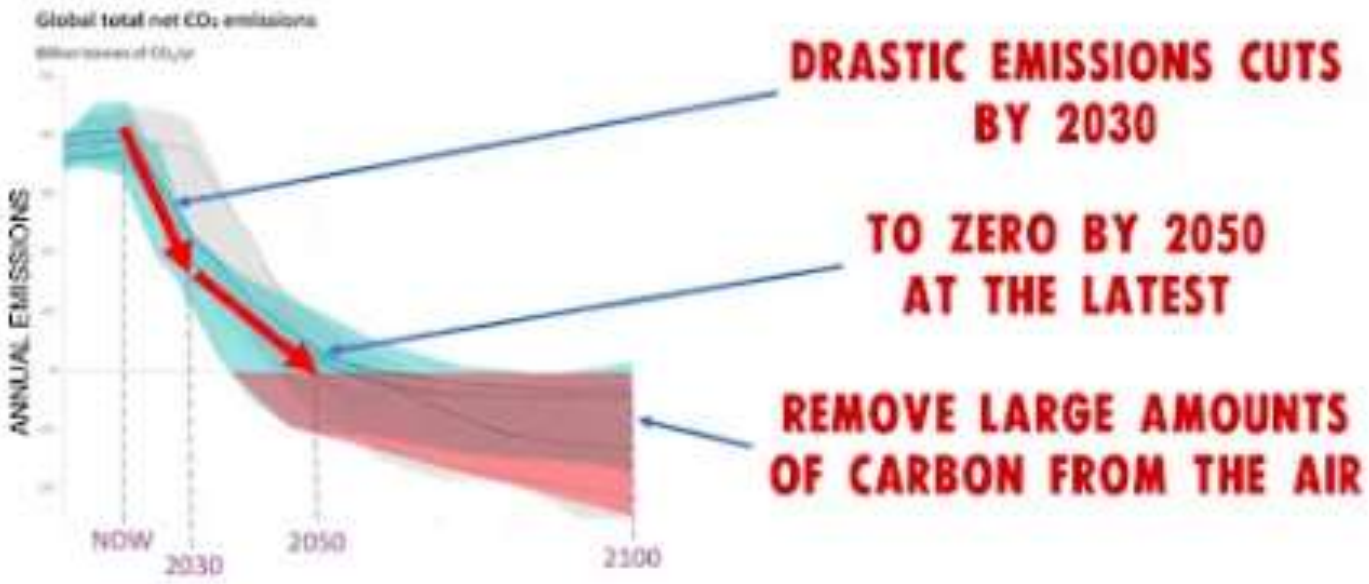
B. Increasing greenhouse gas levels

=

C. Global warming

So – what are we going to do about it?

WHAT THE IPCC SAYS WE MUST DO



512 × 290

Extinction Rebellion

The recent IPCC Report says it all

The World Economic Forum summary has 4 Key sentences:

- "The report suggests that the world must cut its total emissions by 45% by 2030 to avoid climate catastrophe.
- At current levels, global emissions will increase by almost 14% over this period.
- If this is the case, we will have to adapt to irreversible impacts such as melting ice caps, frequent and intense weather events, and immense biodiversity and ecosystem loss.
- The report finds that almost 3.3 billion people now live in highly vulnerable climate contexts, and the mass die-off of fauna and flora is well-underway."

The US Union of Concerned Scientists says we can fix it:

"The good news is that we have the … solutions at hand to accomplish it.

As individuals, we can … reduce our personal carbon emissions.

But to fully address the threat … we must demand action from our elected leaders …"

So it's up to us to make it happen!

What you and I can do

Simple Things To Do

- Turn off your computer or the TV when you're not using it.

- Take shorter showers. Heating water uses energy.

- Keep rooms cool by closing the blinds, shades, or curtains.

- Turn off the lights when you leave a room.

Switch to LED lighting

The NSW State Government has a scheme to help.

For full details google "accredited power LED"

Buy green power

How does it work?

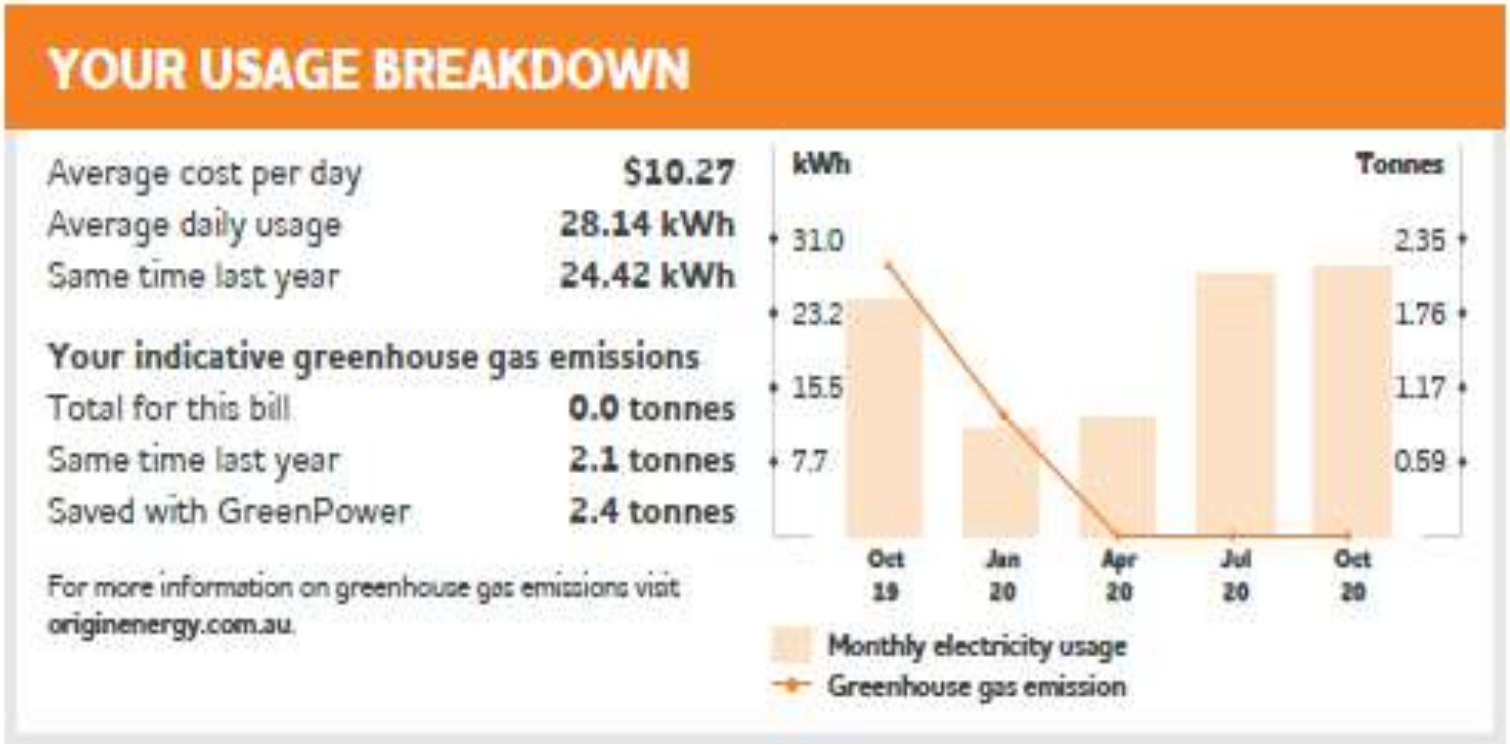
To find out Google “greenpower”

The cost of GreenPower?

According to the Government website GreenPower.gov.au “An average household might find this is about 1 dollar a day”.

The emissions reduction?

This is what happened to our emissions when we joined up – even though our usage went up:



YOUR USAGE BREAKDOWN

Average cost per day	**$10.27**
Average daily usage	**28.14 kWh**
Same time last year	**24.42 kWh**

Your indicative greenhouse gas emissions

Total for this bill	**0.0 tonnes**
Same time last year	**2.1 tonnes**
Saved with GreenPower	**2.4 tonnes**

For more information on greenhouse gas emissions visit originenergy.com.au.

The impact of GreenPower

Over the last 15 years, the Program has achieved:

•over 19 million megawatt hours of voluntary renewable energy purchases

•more than 16 million tonnes of greenhouse gas emissions offset with renewable electricity

•over 6 million cars equivalent taken off the road for a full year.

From Greenpower.gov

Install Solar

Travel less

One of the most effective ways to begin thinking about how to reduce your carbon footprint is to reconsider how much, and how often, you travel.

Offsetting emissions

You can do it with Greenfleet

Qantas

Virgin

Jetstar .

The cost of airline offsets

Is it just greenwashing?

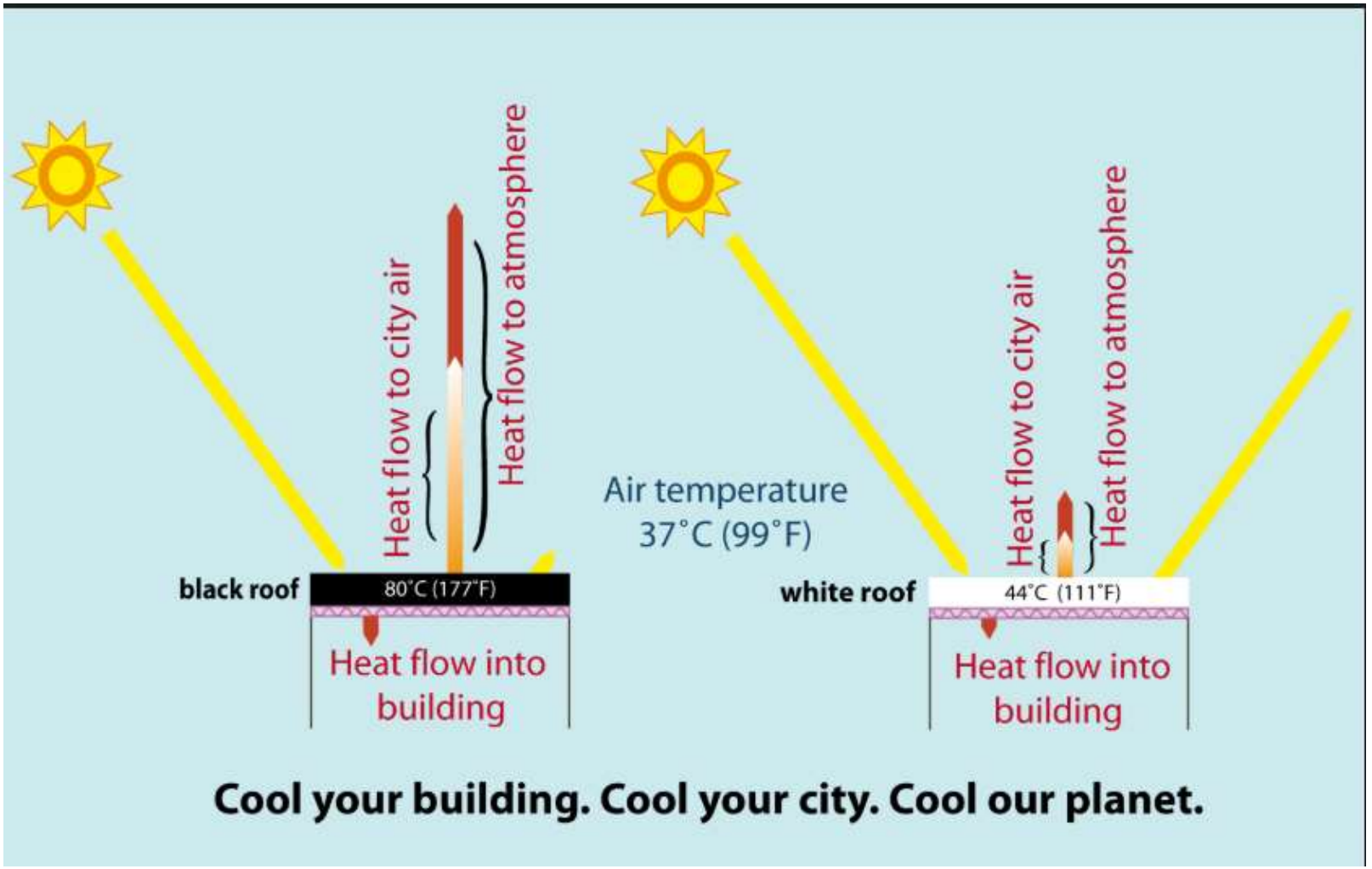
Key points:

- Offsets are designed to neutralise carbon dioxide emissions and are certified by third parties
- They can buy us time to transition to clean energy but cannot reverse the burning of fossil fuels
- Just 1 per cent of Australians offset their flights

Should I buy an electric car?

The NRMA says yes

Go for a white roof



The surface of a black roof (left) heats up 78F above the air temperature, while the surface of a white roof (right) heats up only 12F. Additionally, with a black roof, far more heat flows both to the city and into the atmosphere (arrow lengths are proportional to heat flow).

Be a leader

Protest

Join a lobby group

Join the Climate Council

The Climate Council was founded in 2013 by tens of thousands of supporters to create a new, independent and 100% community-funded organisation .

We provide actionable scientific information to many groups, ranging from emergency services, to farmers, schools and universities and politicians.

To date, the Climate Council has produced over 80 peer-reviewed reports, briefing papers and fact sheets on extreme weather, climate solutions and international action.

Parents acting together can help

Are you concerned about your child's future in a warming world?

Australian Parents for Climate Action is the voice for all parents, grandparents and carers of children in Australia to show their deep concern about the impact of climate change on our children's safety and survival, now and into the future.

First Name | Last Name

Email | Postcode

JOIN TO SHOW YOUR SUPPORT

Australian Parents for Climate Action

is Australia's leading organisation to engage, organise and empower parents and carers to advocate for a safe climate for our children's future.

With over 14,000 supporters and 30 local groups, our supporters are from across the political spectrum, in every Australian electorate, and from diverse socio-economic backgrounds. We seek non-partisan responses from government and business to climate change and its impacts.

We're on a mission to engage and empower millions of parents across Australia to advocate for climate action in their communities, in the media and to politicians and businesses.

Our vision is for our children to live safe, healthy, full lives because Australian governments and businesses have implemented the solutions required to ensure a safe climate.

Parents are a very large constituency reaching across all sectors of society and politics who together hold strong moral, electoral and purchasing power. If we engage and empower a strong constituency of parents to advocate for climate action, together our pressure will increase the sustained political and corporate will to implement the solutions required to ensure a safe future for our children.

We are motivated by love - for our children and families, for thriving cultures and communities, for the natural world and all species in it.

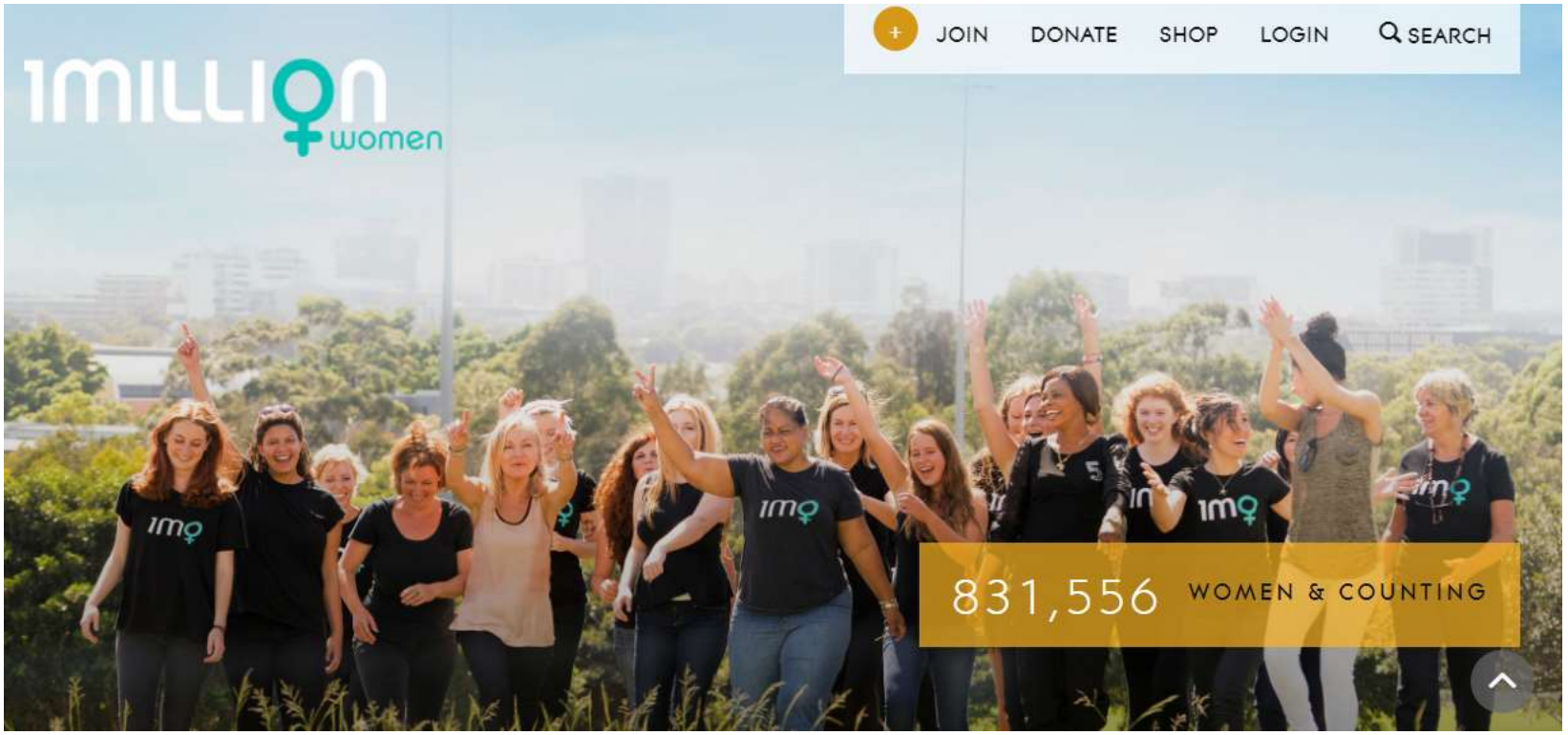
Grandparents acting together can help

Grandparents CAN

Grandparents for Climate Action Now

For all the details google "grandparentscan.org"

Women acting together can help



For full detains Google "1millionwomen"

Farmers acting together can help

Farmers for Climate Action is a movement of farmers, agricultural leaders and rural Australians working to ensure farmers are a key part of the solution to climate change.

For all the details google "farmersforclimateaction"

Young people acting together can help

Google AYCC for the website

All of us acting together can help

For all the details google "350.org"

Personally push the politicians

The federal government and every state and territory has made the commitment

They have a lot of work to do

Support the Governments' good things

Federal Government - Australia's Climate Change Strategies

NSW – Renewable Energy Zones

NSW - Electric Vehicle Fast Charging Master Plan

Queensland

Victoria

Tasmania

South Australia

Western Australia

Northern Territory

Australian Capital Territory

Push Local Government to:

Aim for net zero emissions by 2050

Join Cities Power Partnership

Convert to electric vehicles

Require low emissions development

Encourage renewable energy businesses

Lobby state and federal government

Push State Government to:

Limit land clearing

Stop supporting coal mining (NSW)

Stop supporting coal mining (Qld)

Transition communities away from fossil fuels

Construct solar and wind farms

Lobby federal government

Push Federal Government

Put a price on carbon

Stop playing politics (both sides)

Stop accepting donations from fossil fuel companies (both sides)

Push for a renewables led recovery

Lower vehicle emissions – Australia Lower vehicle emissions - Europe

Stop subsidising fossil fuels

Lobby the world

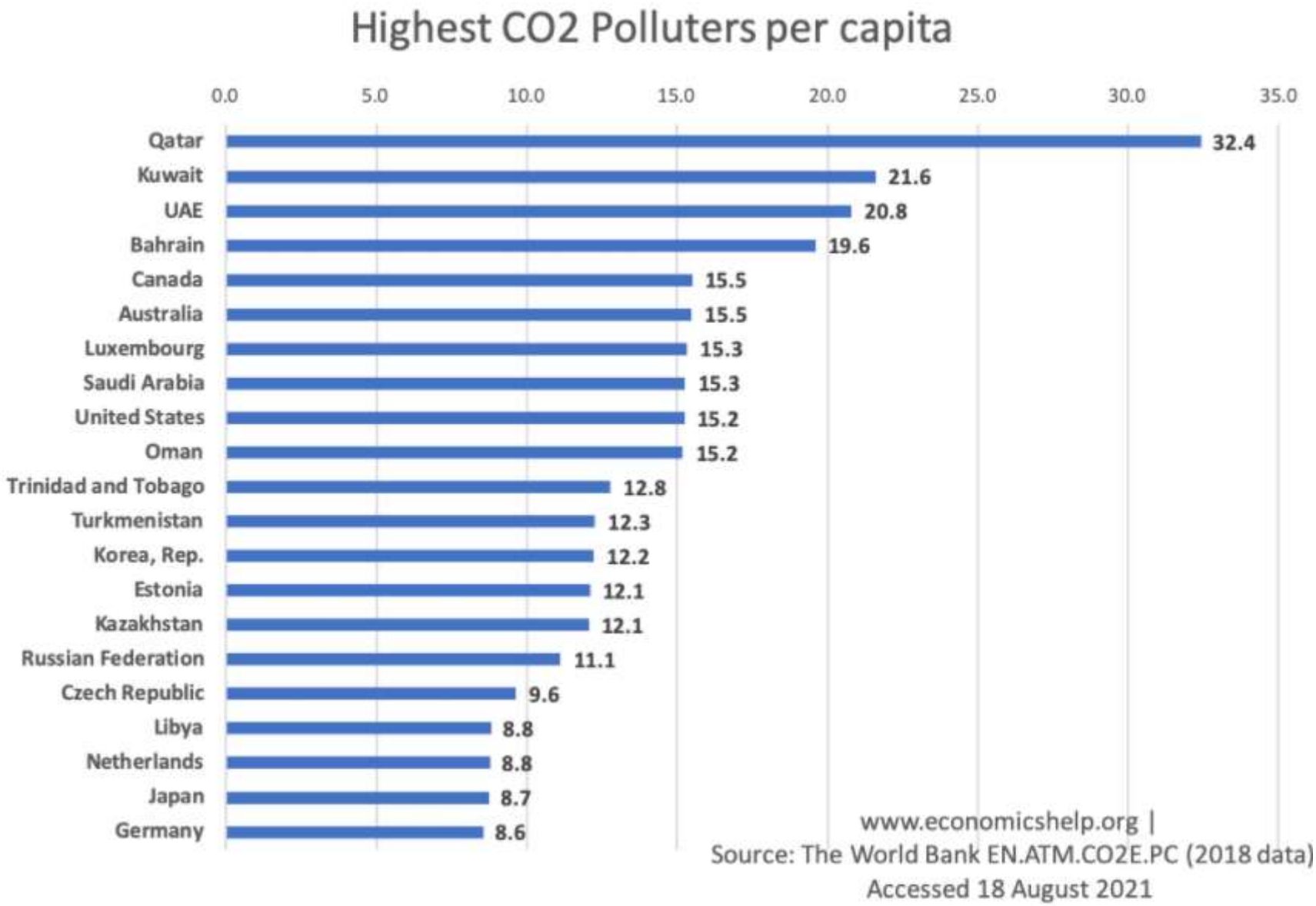
How are our emissions going?

We're small cheese on a global comparison

Rank	Country	Total CO2 (kt)
1	China	10,313,460
2	United States	4,981,300
3	India	2,434,520
4	Euro area	2,207,420
5	Japan	1,106,150
6	Germany	709,540
7	S. Korea	630,870
8	Iran	629,290
9	Indonesia	583,110
10	Canada	574,400
11	Saudi Arabia	514,600
12	Mexico	472,140
13	South Africa	433,250
14	Brazil	427,710
15	Turkey	412,970
16	Australia	386,620
17	United Kingdon	358,800
18	Italy	324,850
19	Poland	312,740
20	France	309,960

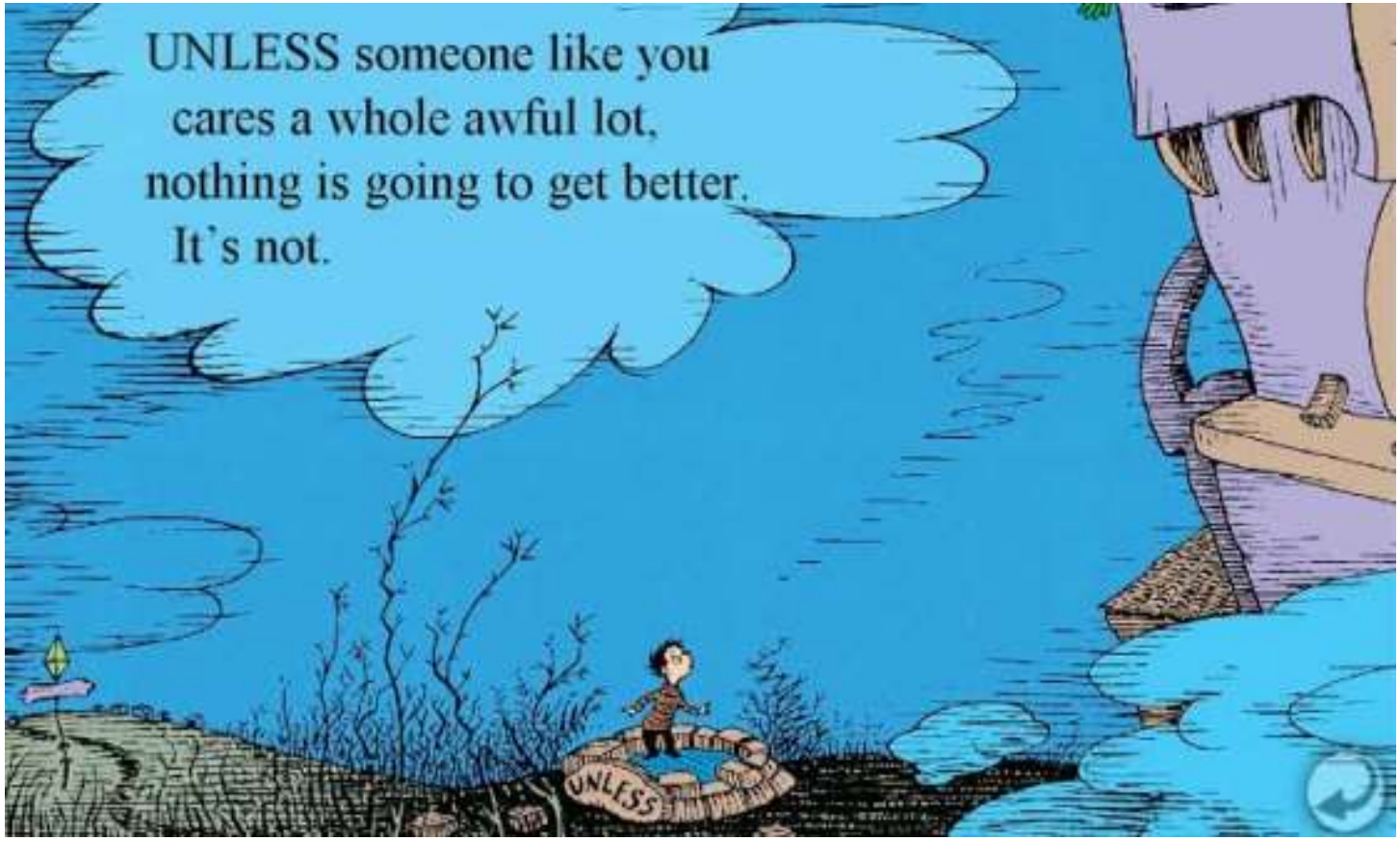
Source: World Bank CO2 emissions (kt)

But we're equal 5th per capita



We’re behind most of the surveyed 76 countries in fixing it

From the Green Future Index 2022 of the MIT Technology Review



And it can get better