

1

Why the warming?

While the sky can feel limitless,

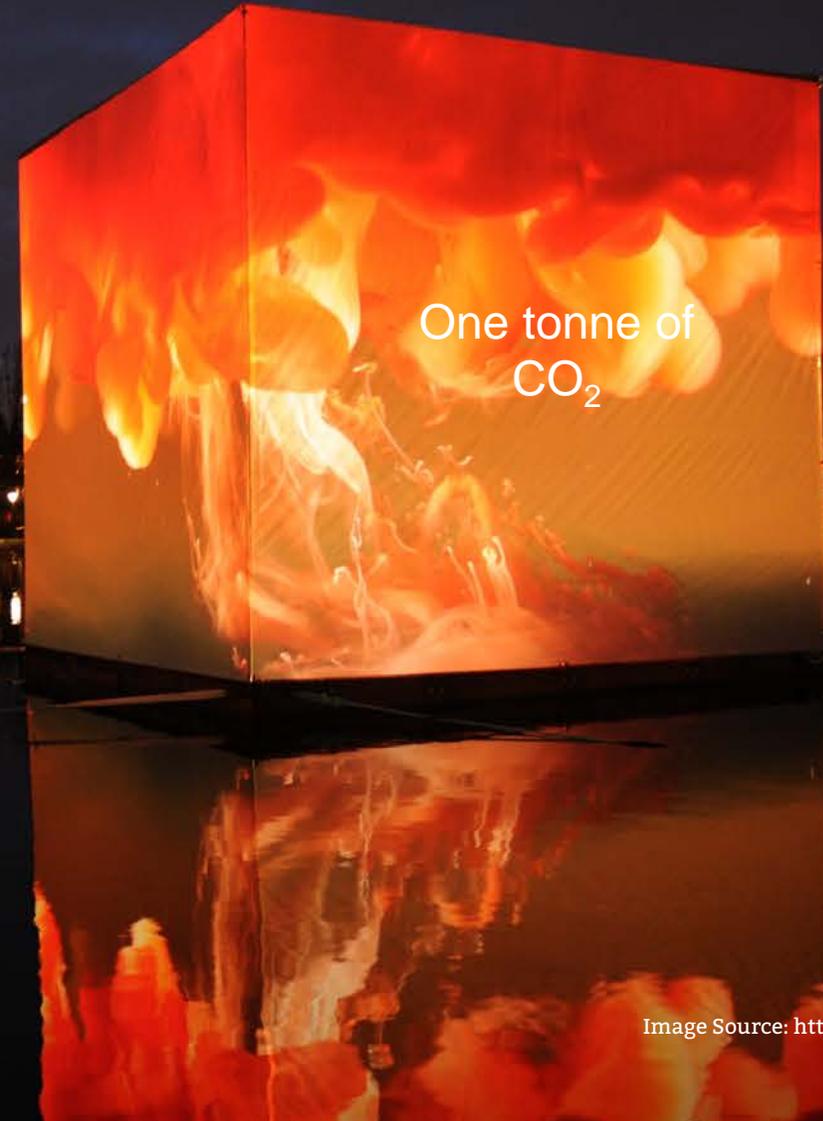


The atmosphere is just a paper-thin layer over the earth's surface.

If you could drive straight up in a car at highway speed, you'd be in outer space in under an hour.

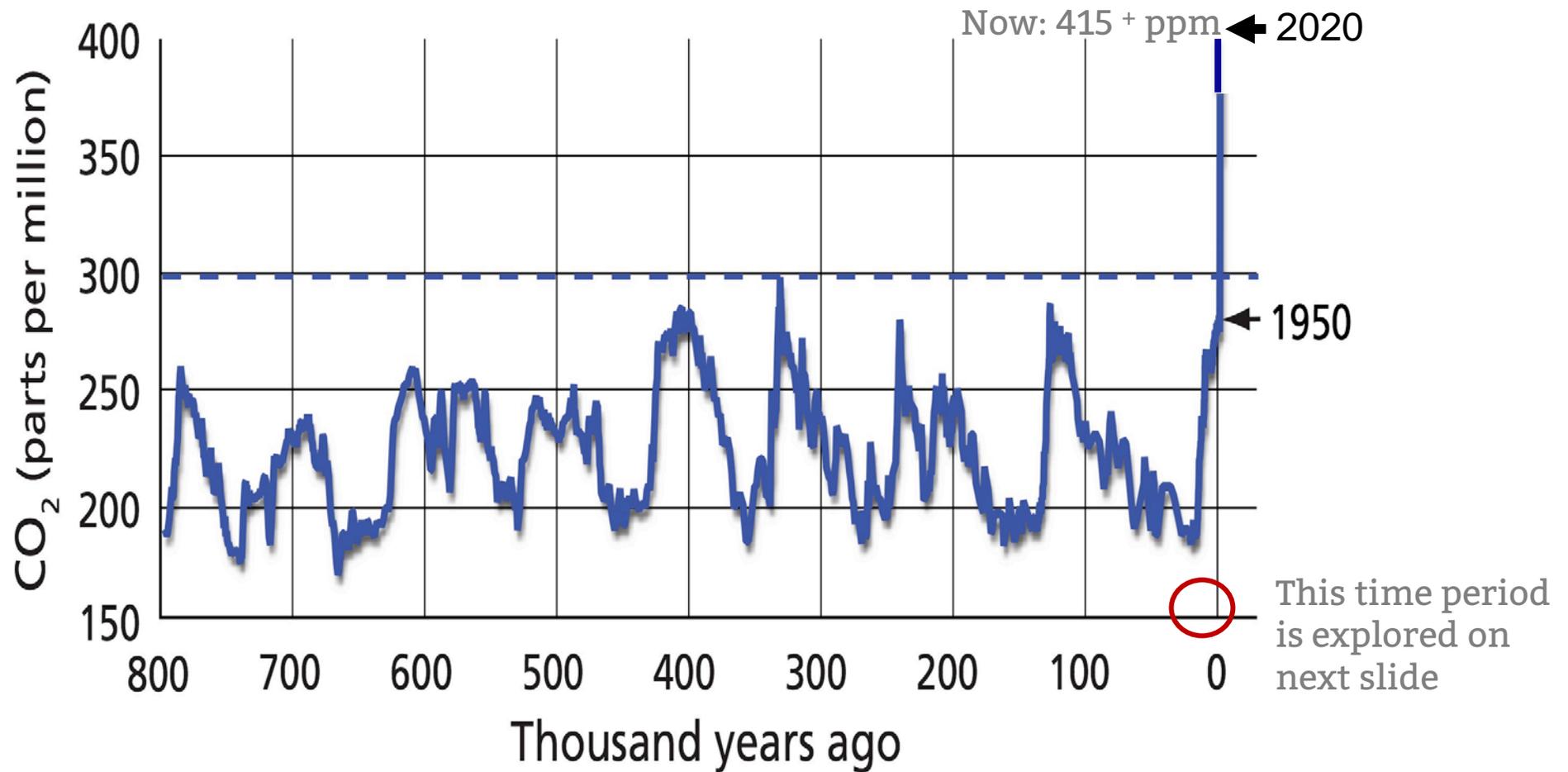


And yet we put 110 million tonnes of global warming pollution into this very thin space every day.

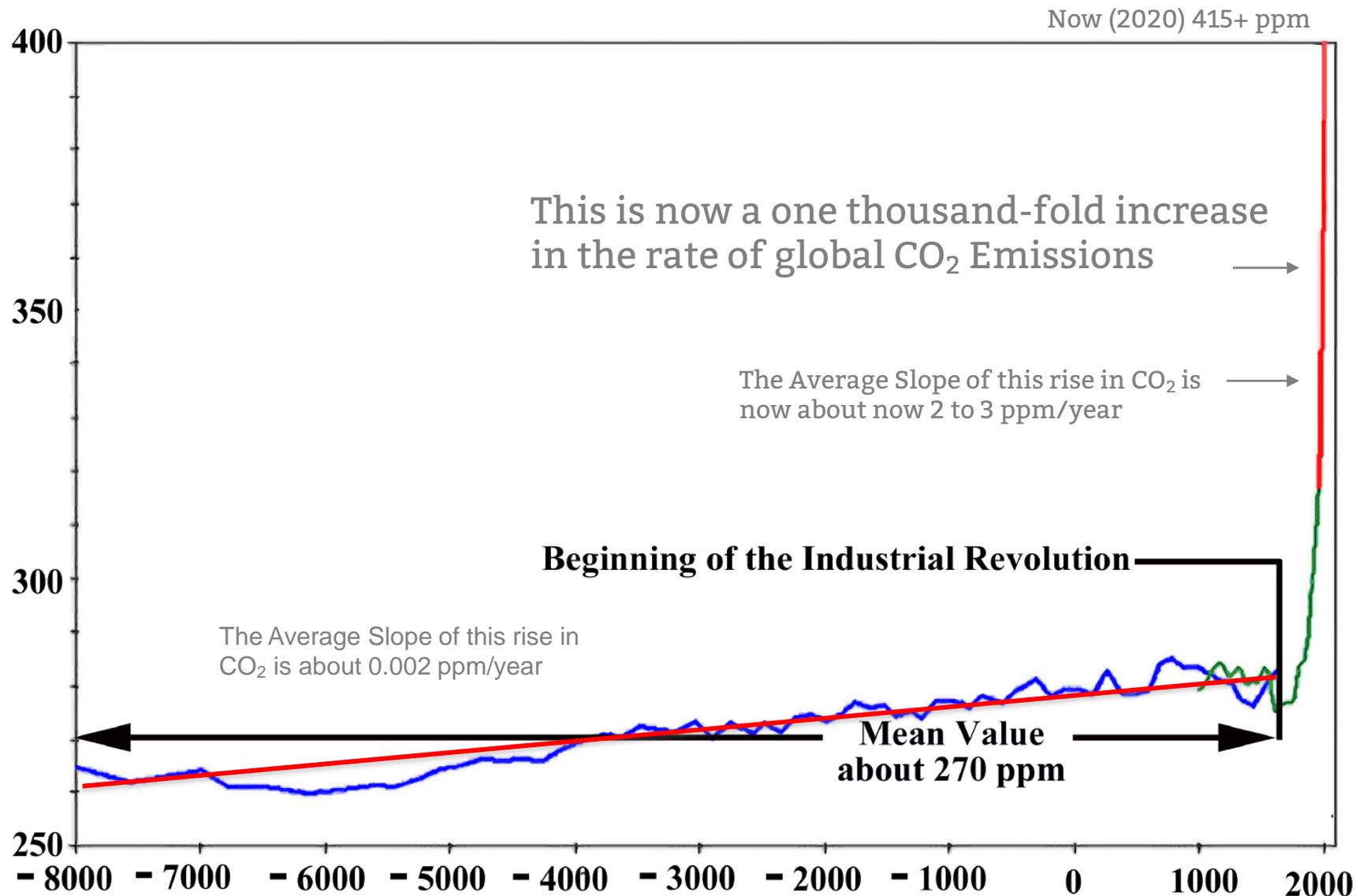


**What exactly does 110 million
tonnes of CO₂ look like?**

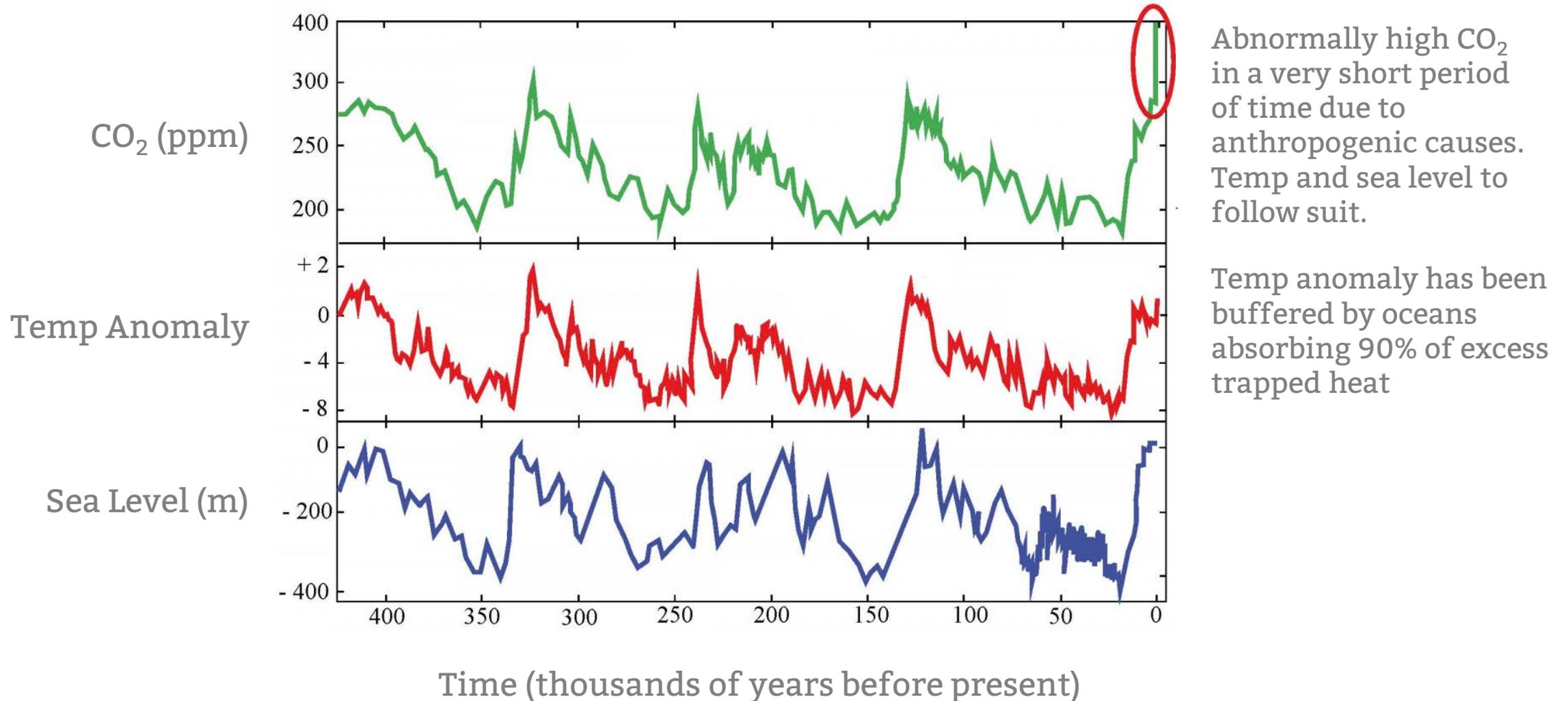
Atmospheric CO₂: Past 800 000 years



Atmospheric CO₂: Past 10 000 years



450,000 Year Record from Ice Cores Records



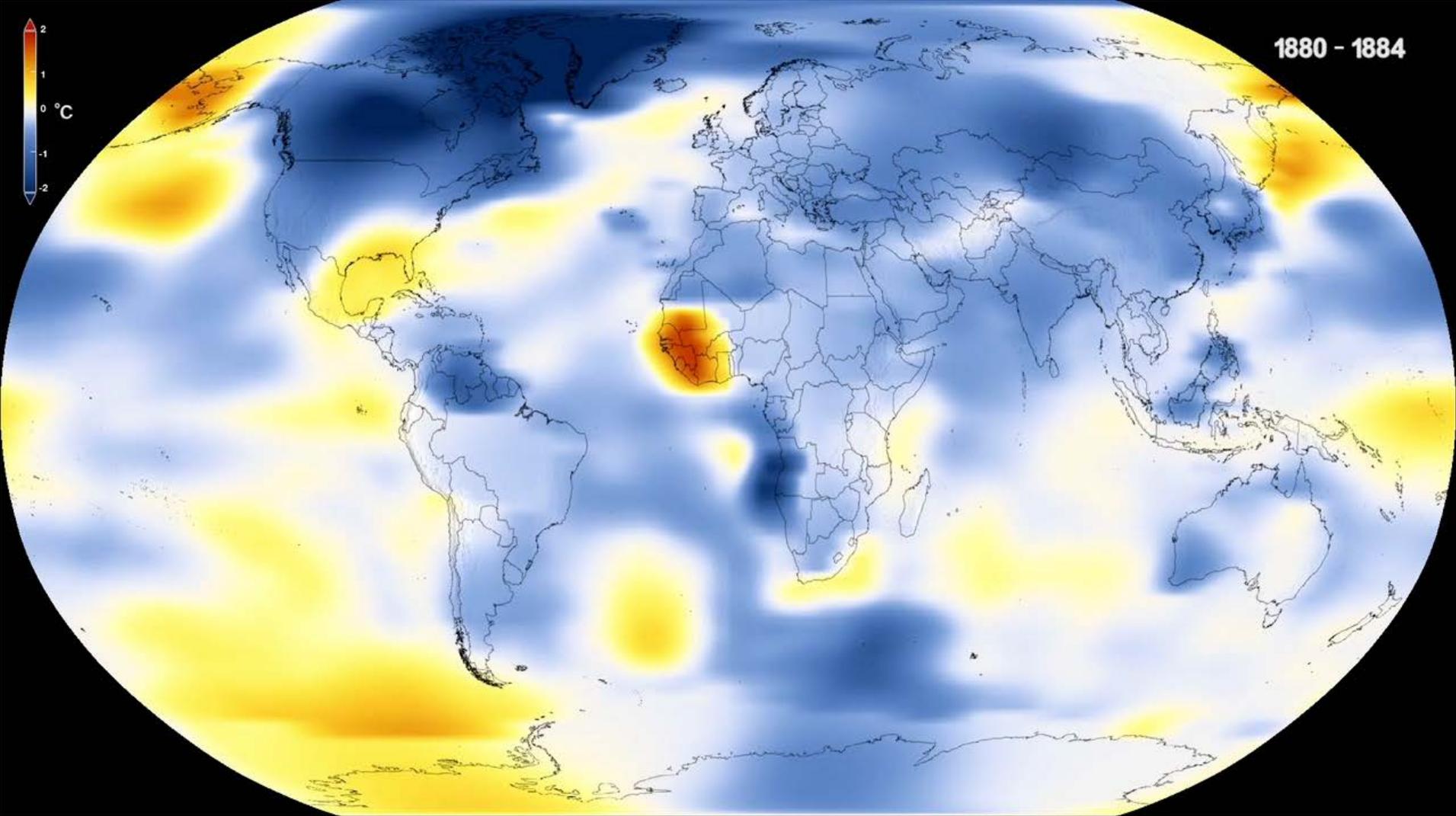
Getting the data

Measuring atmosphere of the past trapped in air bubbles in old ice to determine changes.



Difference from the mean: 1880 – 2017

2°C above the mean →
Mean / Average temp →
2°C below the mean →



Difference from the mean: 1880 – 2017

2°C above the mean →

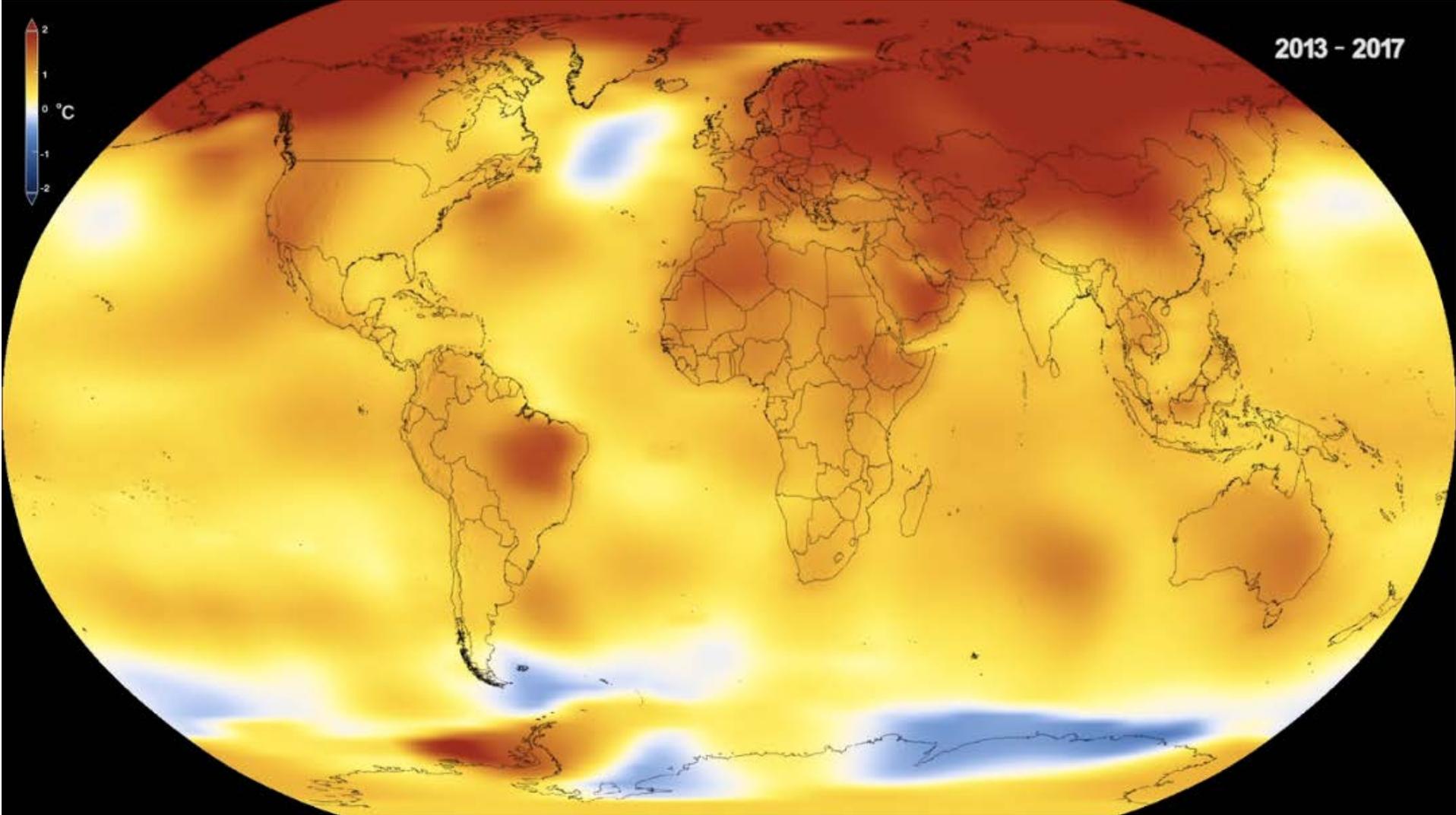
Average temp →

2°C below the mean →

Global Mean Surface
Temperature
Increase = 0.9
Degrees C

The Arctic warms 2 to 3
times the global mean.

Ave. Surface Temperature
Increase = > 2° C



**18 of the 19 hottest
years on record have
occurred this century.**

Global temperature change since records began in 1850

Thanks to the “greenhouse effect” life flourished

Earth has a natural
“greenhouse effect.”
Without this, it would
be too cold to support
life as we know it.

But human activities, primarily the burning of fossil fuels, have thickened the blanket of heat-trapping gases, thereby intensifying the natural greenhouse effect and causing surface temperatures to rise.



4 Main Greenhouse Gasses

①

Carbon Dioxide

②

Methane

③

Nitrous Oxide

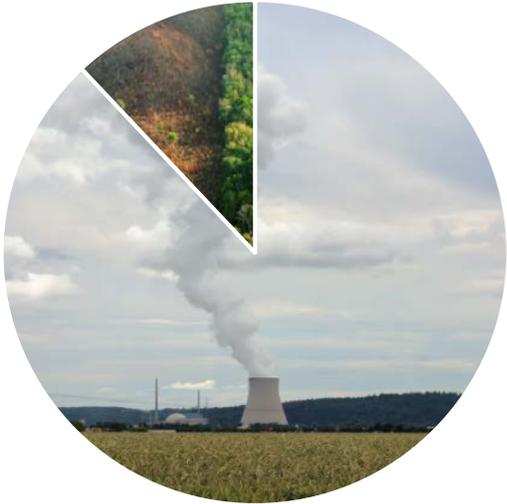
④

Water Vapour

Fate of Anthropogenic CO₂ Emissions

(2007-2016 Data)

Sources of CO₂



- Burning fossil fuels
- Changes in land-use

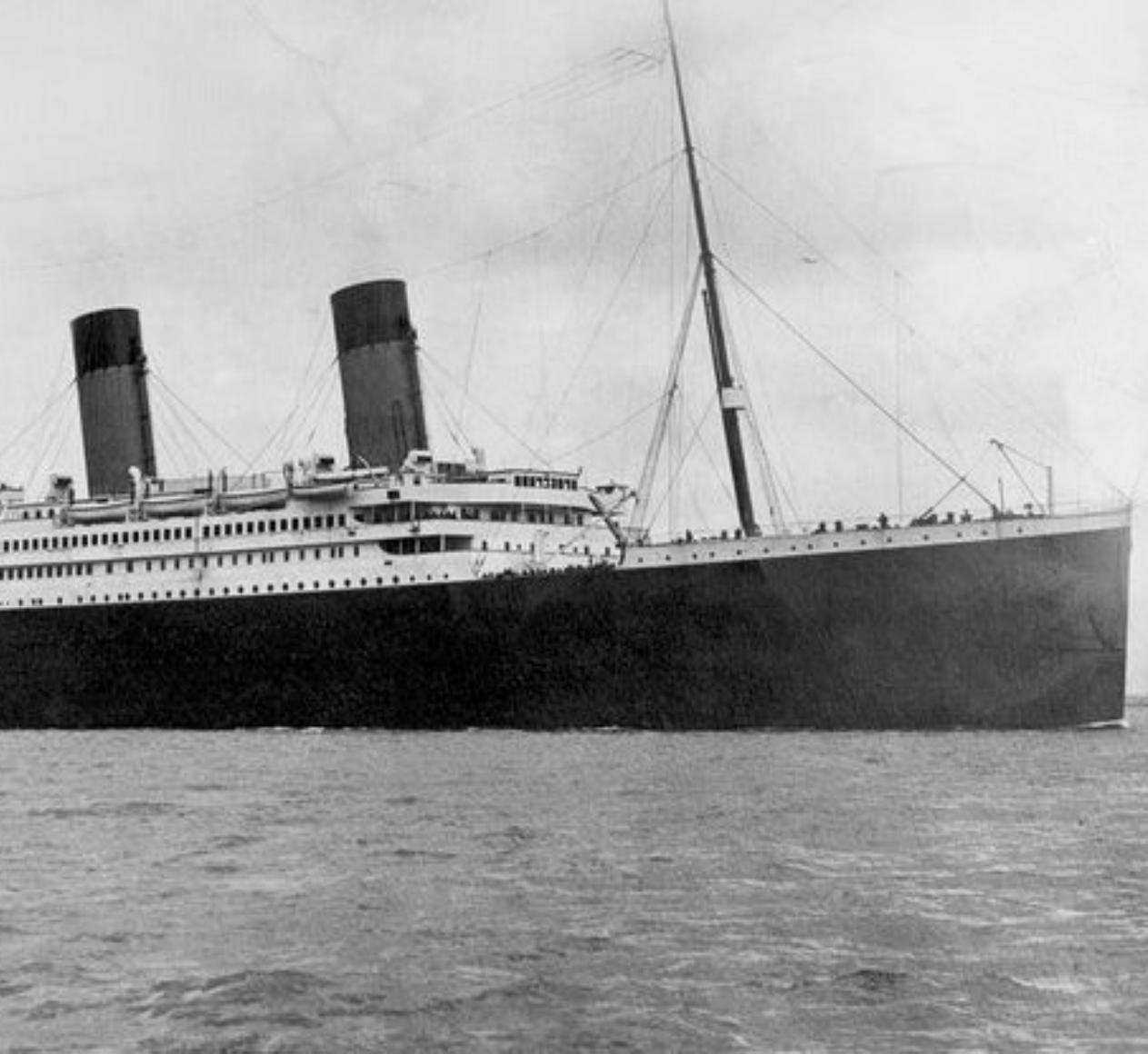


CO₂ is stored in three places



- The atmosphere
- Plants and plant matter
- Oceans

Lifespan of CO₂



- CO₂ is very long-lived and steadily accumulates in the atmosphere over centuries and millennia.
- Some of the CO₂ produced by the Titanic is still in the atmosphere contributing to warming the planet and will continue to do so for centuries to come.
- CO₂ produced by our parents is still in the air today, as ours will be when our grandchildren grow old.

Climate Feedbacks

While CO₂ may be the main actor in the climate change story, it is supported by a crew of powerful feedback loops which greatly amplify small changes. The three main feedbacks are:

①

Increased evaporation

②

Melting of snow and ice

③

CO₂ released from soils
and oceans

Feedback 1: Increased Evaporation

Increase in carbon dioxide, methane, and other greenhouse gases leads to a warmer atmosphere.

This causes more evaporation which increases the amount of water vapor.

Water vapour holds in more warmth and creates more clouds which also trap heat.

This leads to more evaporation in a self-reinforcing cycle or “feedback loop.”



Feedback 2: Melting of Snow and Ice

As the world warms, snow and ice, which are white and thus reflect heat away from the planet, begin to melt.

This reveals darker land and water underneath, which causes the Earth to absorb rather than reflect much of the Sun's heat, increasing the initial warming.

Feedback 3: CO₂ released from Soils and Oceans

Enormous amounts of decomposed matter (carbon) are stored in permafrost soils.

As the permafrost thaws, it releases much of this carbon in the form of carbon dioxide or methane.

Methane is 89% more powerful than CO₂ – trapping more heat, creating more warming and more permafrost melt.

Methane hydrate is an ice-like substance found in some ocean sediment in the polar regions. They alone contain more carbon than all of Earth's proven reserves of coal, oil, and natural gas combined.