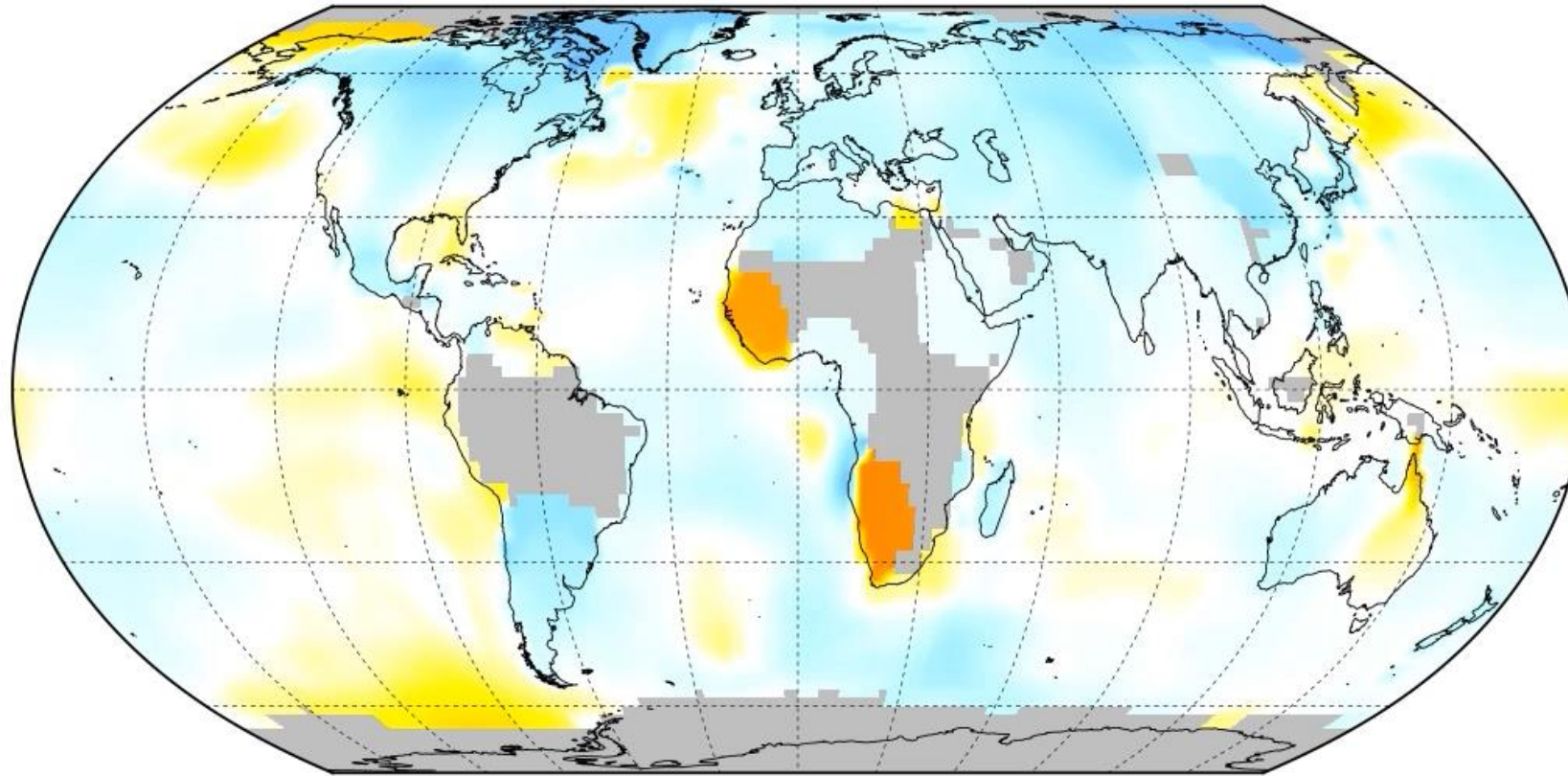


The challenge of long-term climate change

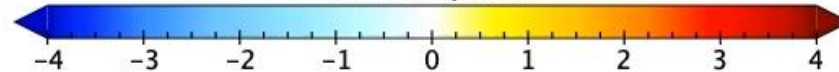
Prof. Dr. Mojib Latif, GEOMAR Helmholtz Center for Ocean Research Kiel and University of Kiel

GISTEMP 10-Year Annual LOTI Anomaly

1880-1889



Anomaly (°C)

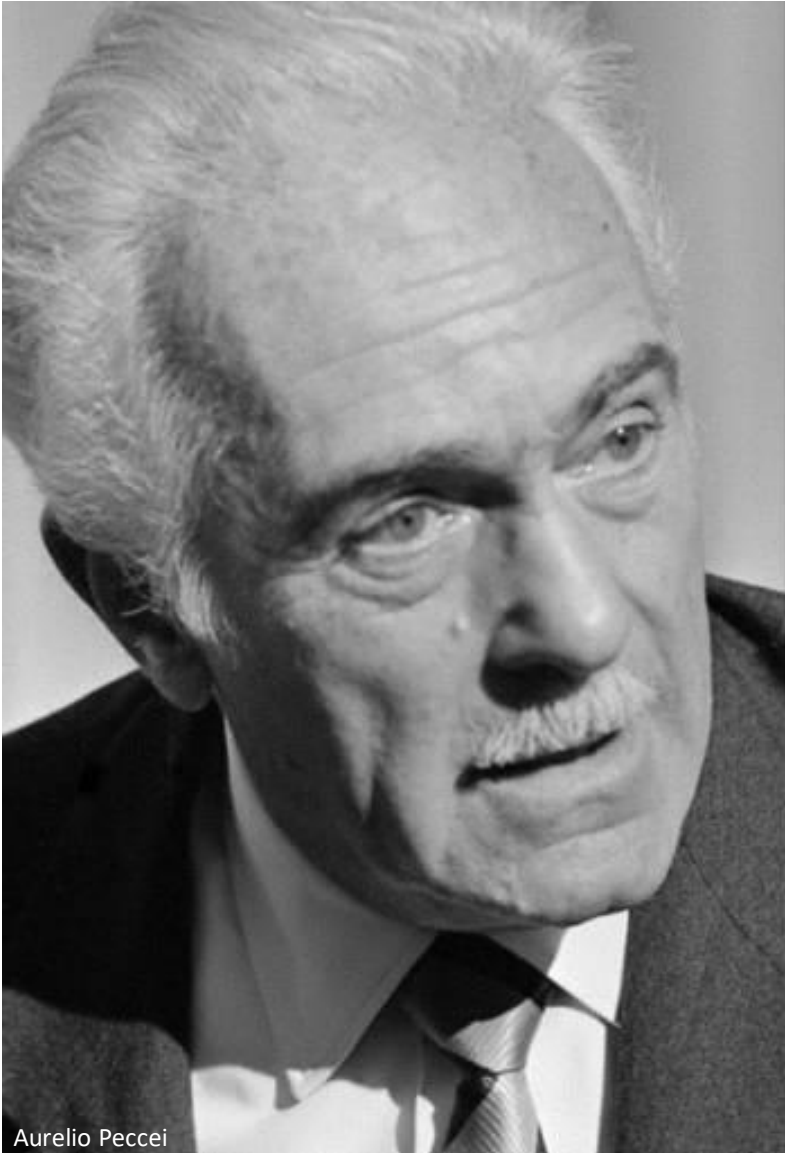


Base Period: 1951-1980

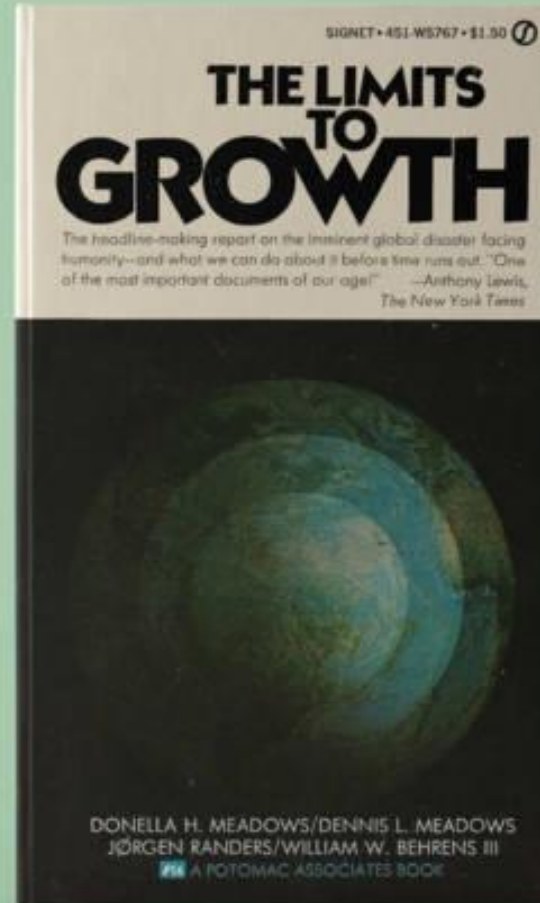
Data Min = -2.46, Max = 2.13, Mean = -0.23

NASA/GISS/GISTEMP/v4

The Club of Rome's *The Limits to Growth* (1972)



Aurelio Peccei



*„Doing nothing increases the risk of collapse [...]
If global society waits until the pressures and constraints become apparent, it has waited too long.“*

Maurice Strong at the Stockholm Conference (1972)



„But is it unrealistic to expect that man will be wise enough to do what he must for his own welfare?“

The climate problem is primarily an energy problem



Eunice Newton Foote in 1856



An atmosphere of that gas [i.e., carbon dioxide] would give to our earth a high temperature.

Svante Arrhenius* 1896

Latitude.	Dec.-
70	—
60	—
50	—
40	—
30	—
20	—
10	—
0	—
—10	—
—20	—
—30	—
—40	—
—50	—
—60	—



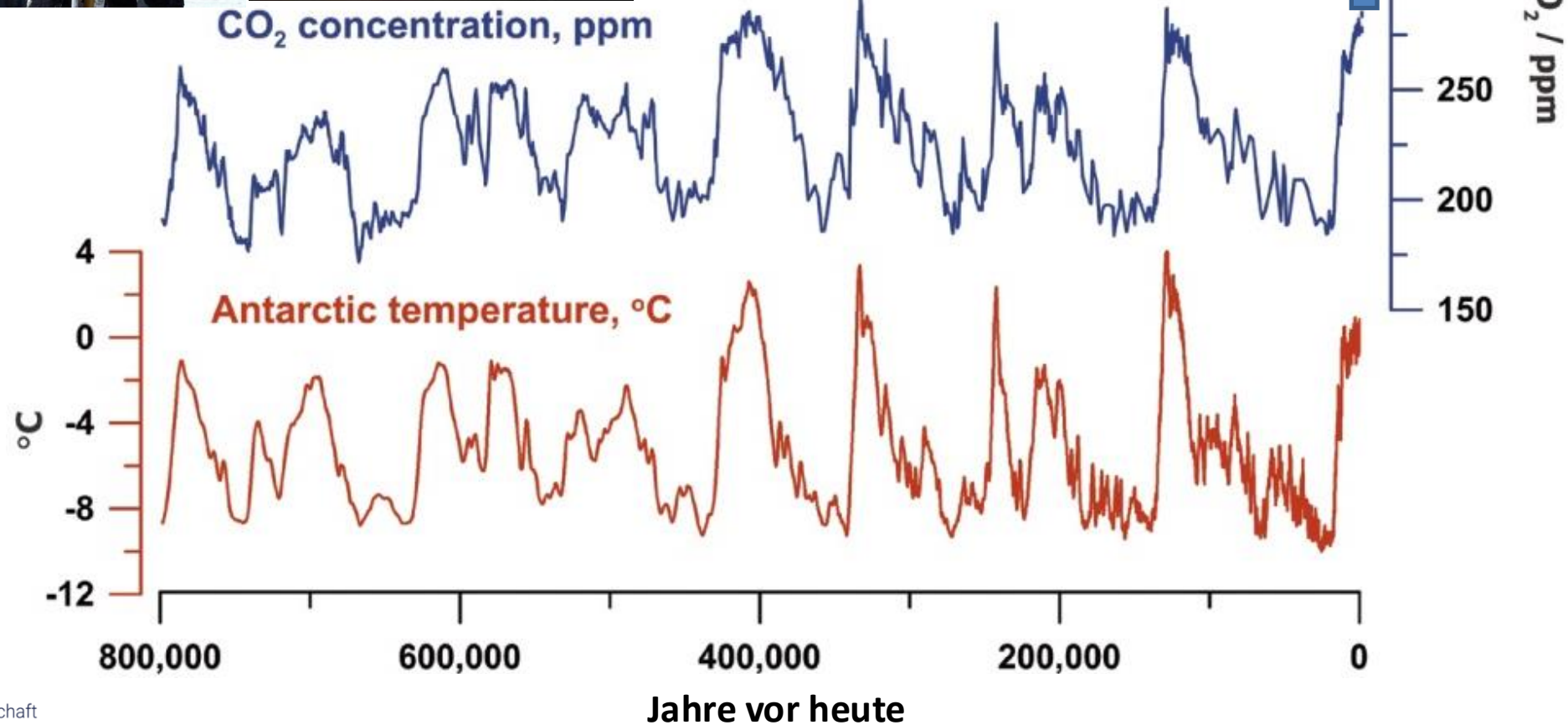
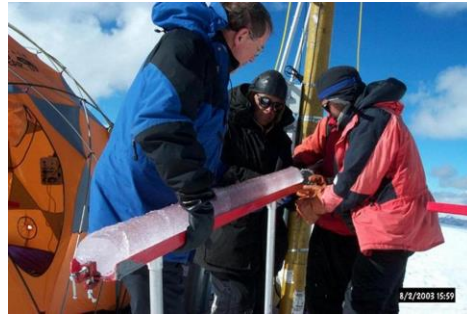
Sept.-	Nov.	Mean of the year.
9.4	9.3	
9.5	9.3	
9.2	9.17	
8.8	8.82	
7.9	8.1	
7.5	7.52	
7.3	7.3	
7.4	7.35	
7.6	7.62	
8.3	8.22	
8.8	8.8	
9.3	9.25	
—	—	

266 Prof. S. Arrhenius on the Influence of Carbonic Acid

On the influence of carbonic acid in the air upon the temperature of the ground. The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science 5, 237–276 (1896) (*Über den Einfluss von Kohlensäure in der Luft auf die Bodentemperatur*)

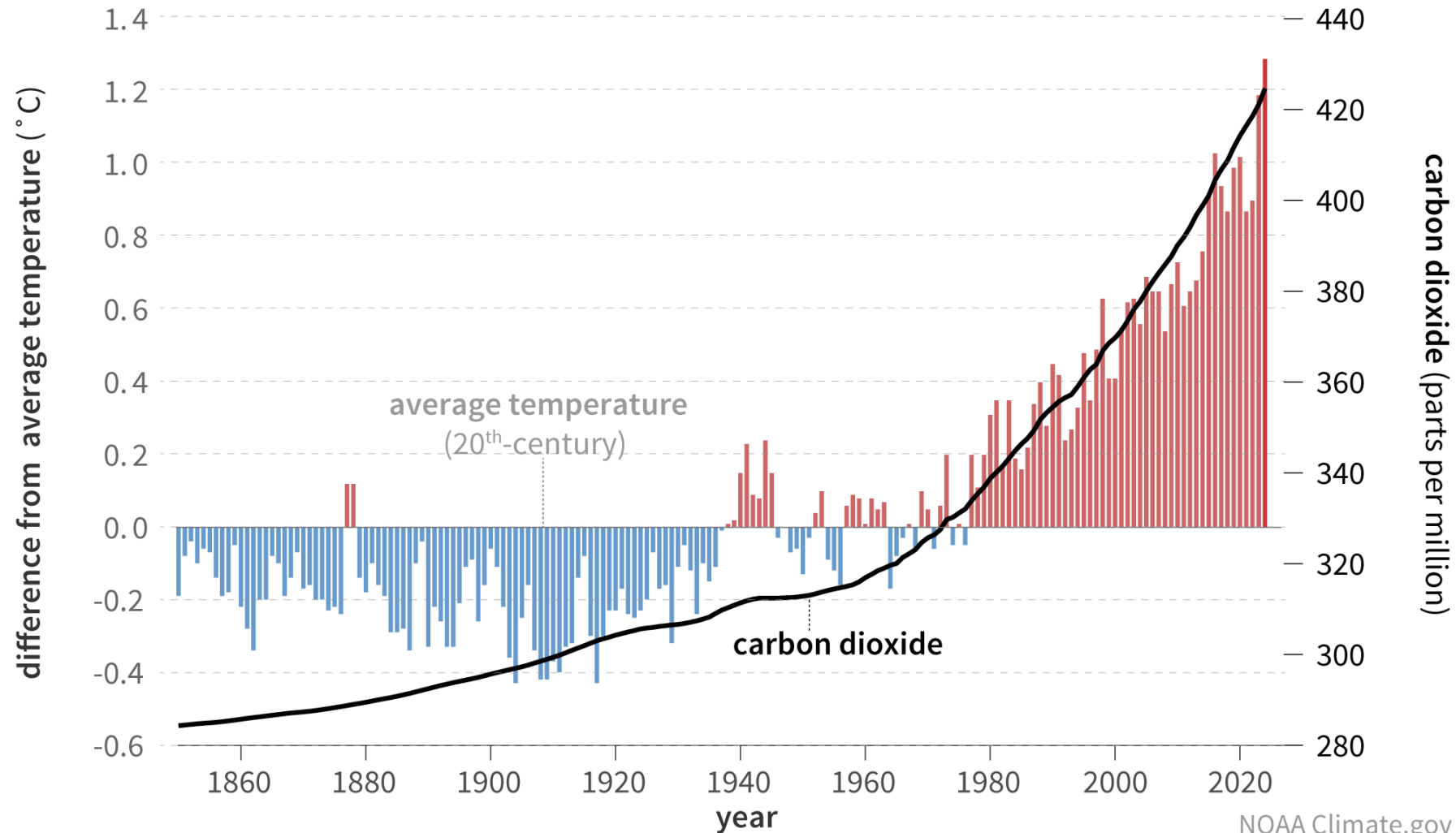
*Chemistry Nobel Prize 1903

Atmospheric CO₂-content



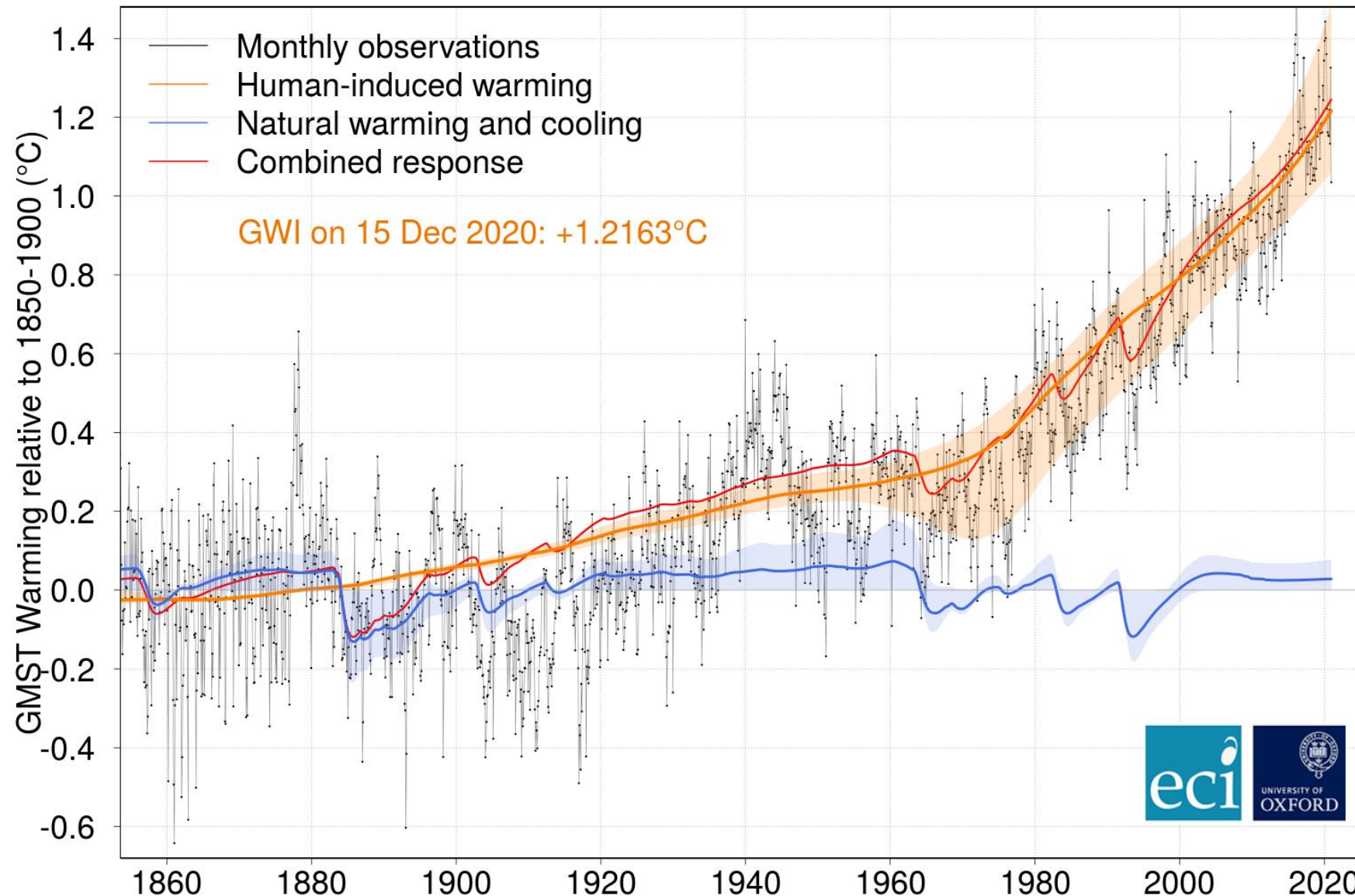
Atmospheric CO₂ content and globally averaged temperature

Increases in atmospheric carbon dioxide and global temperature (1850-2024)



NOAA Climate.gov
Data: NOAA, IAC

We are the cause of global warming



More extreme climate and weather events in a warmer world



Heat days in Germany over the last decades

heat days: temperature reaches at least 30 °C

Mittlere jährliche Anzahl der Heißen Tage

1953–1962

1963–1972

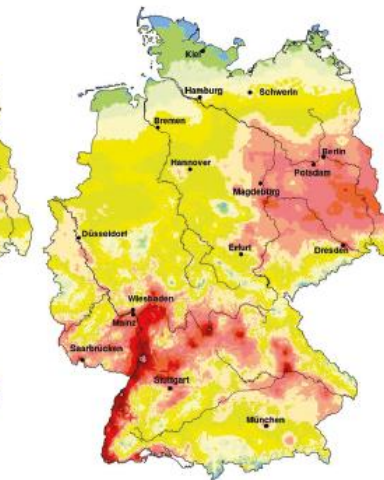
1973–1982

1983–1992

1993–2002

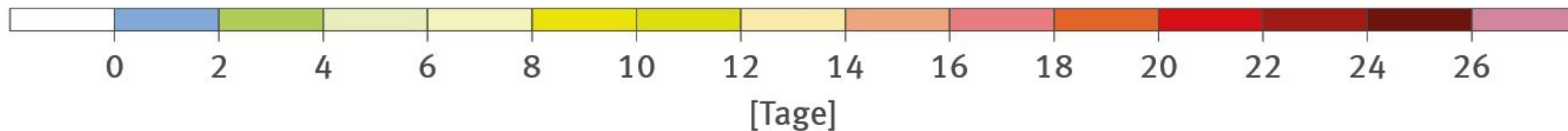
2003–2012

2013–2022



Min = 0 Tage

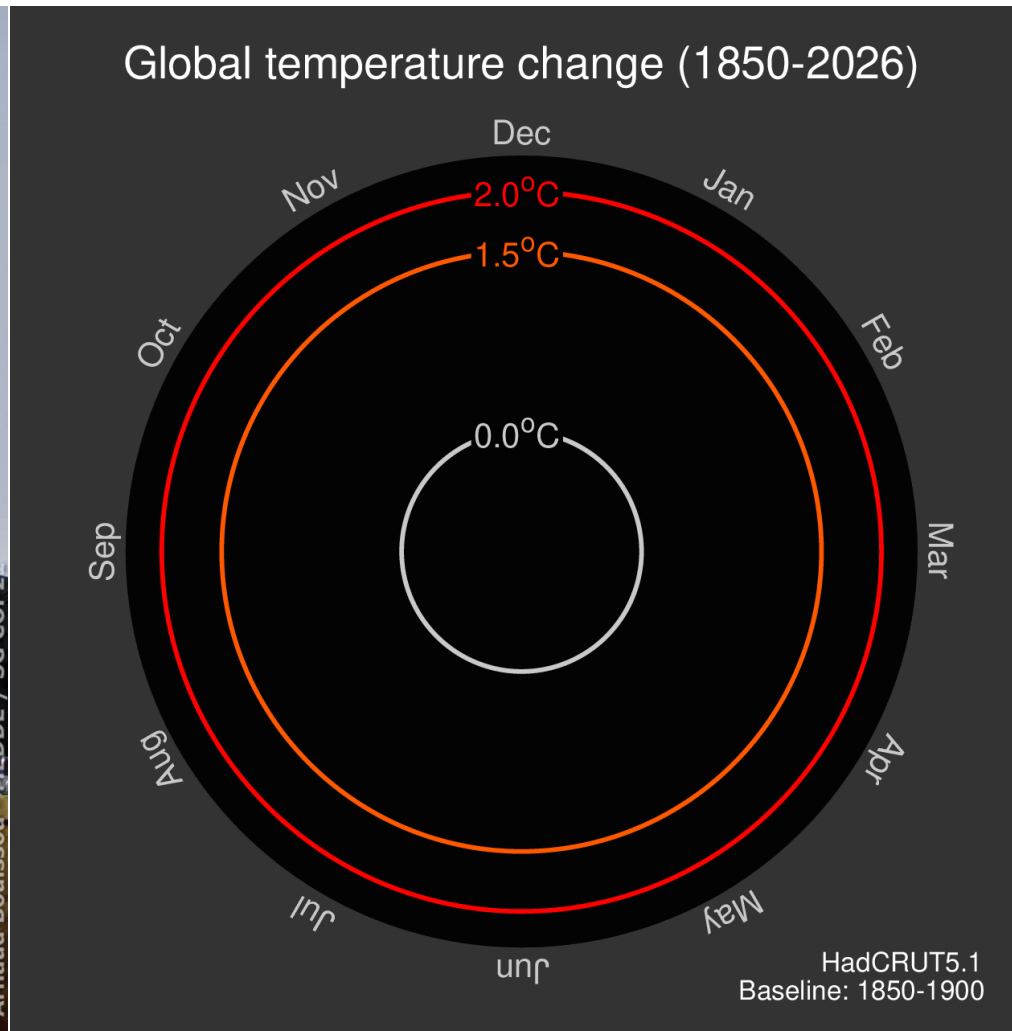
Max = 29 Tage





40,1 °C in the city of Hamburg in 2022!

The Paris Agreement 2015



...to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels.”

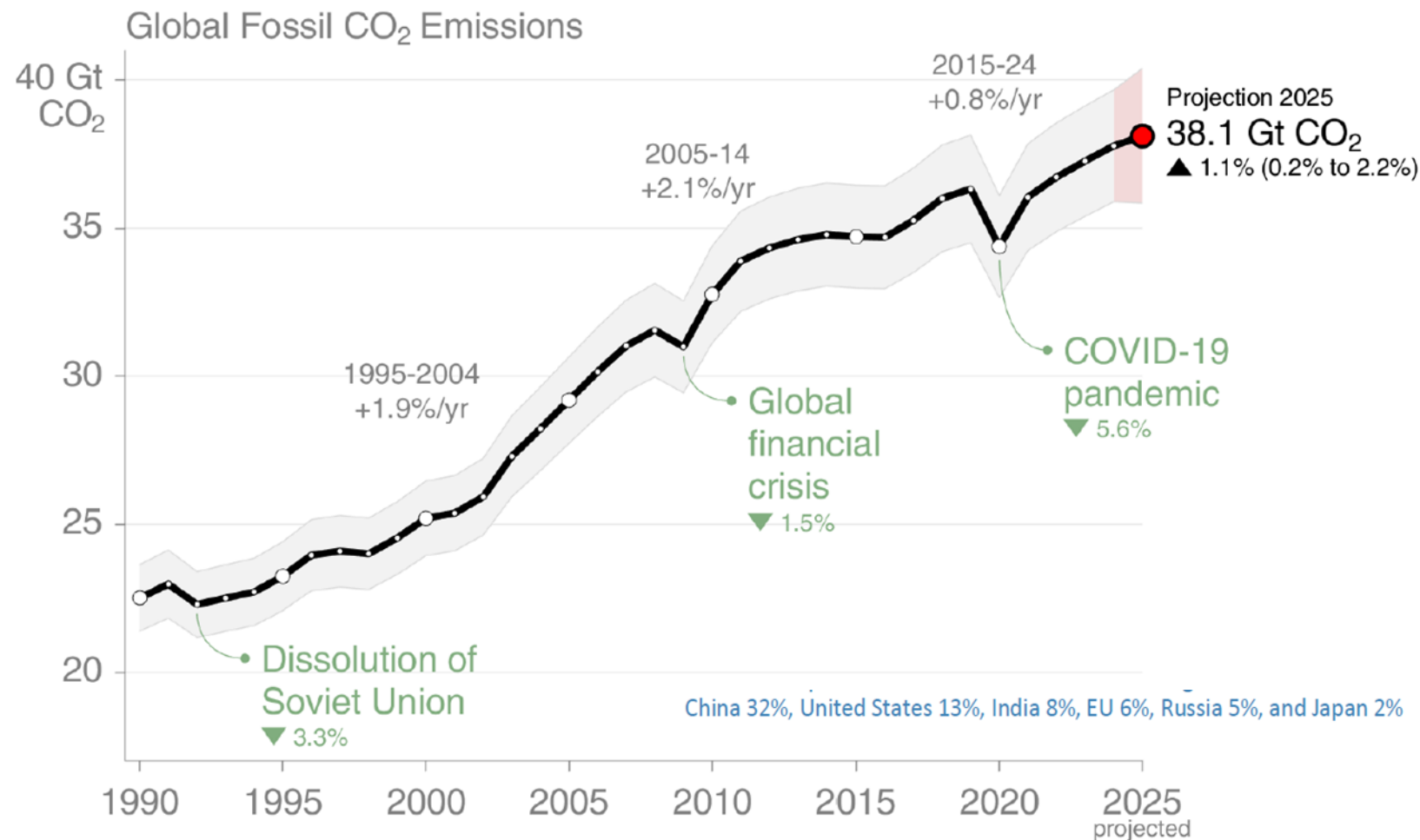
“We are on a highway to climate hell with our foot on the accelerator”



Global CO₂ emissions are still rising

Global fossil CO₂ emissions: 37.8 ± 2 GtCO₂ in 2024, 69% over 1990

- Projection for 2025: 38.1 ± 2 GtCO₂, 1.1% [0.2% to +2.2%] higher than 2024

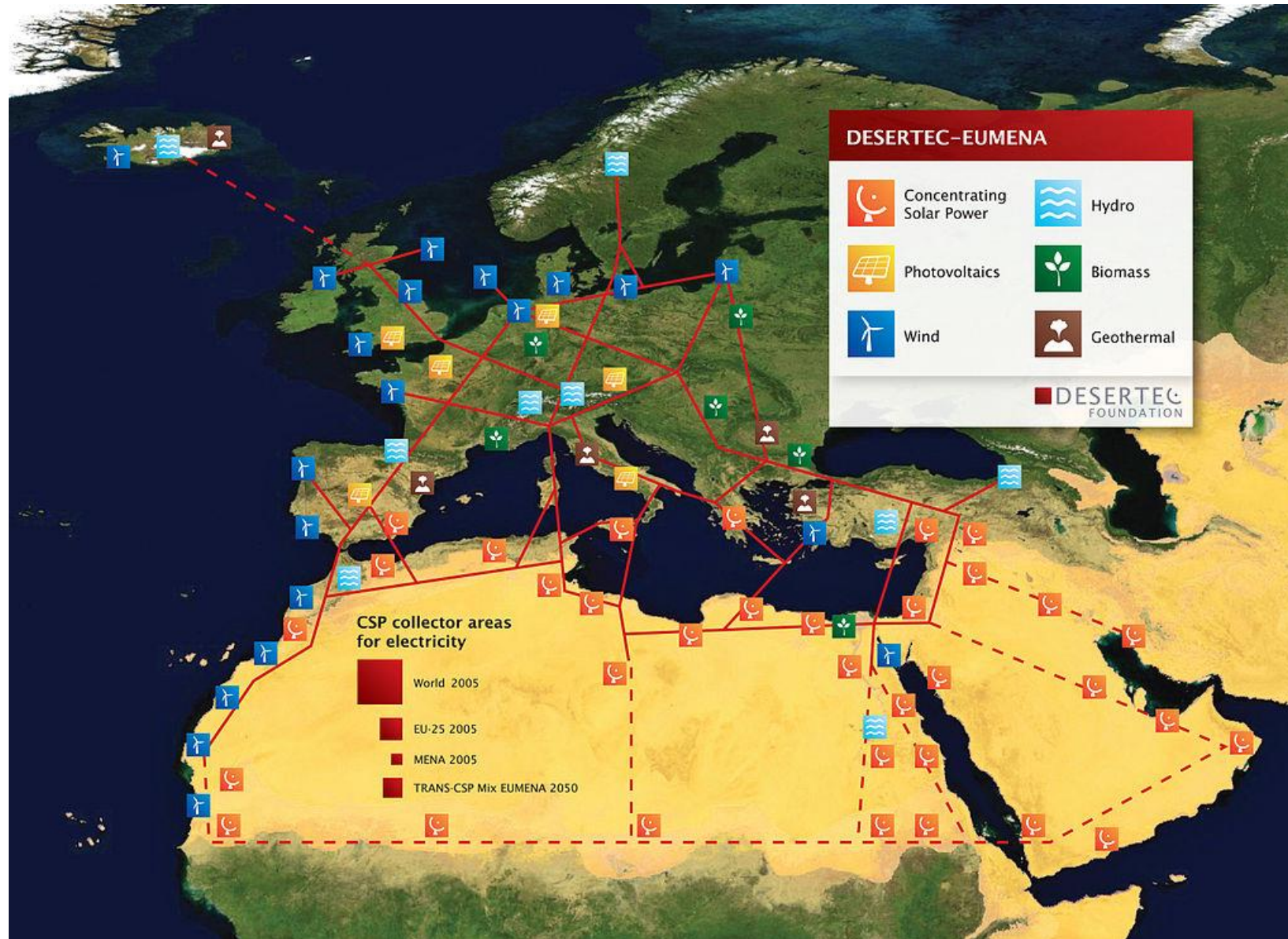


© Global Carbon Project • Includes cement carbonation sink

We have the energy, the technology and the money



There is no energy shortage on Earth



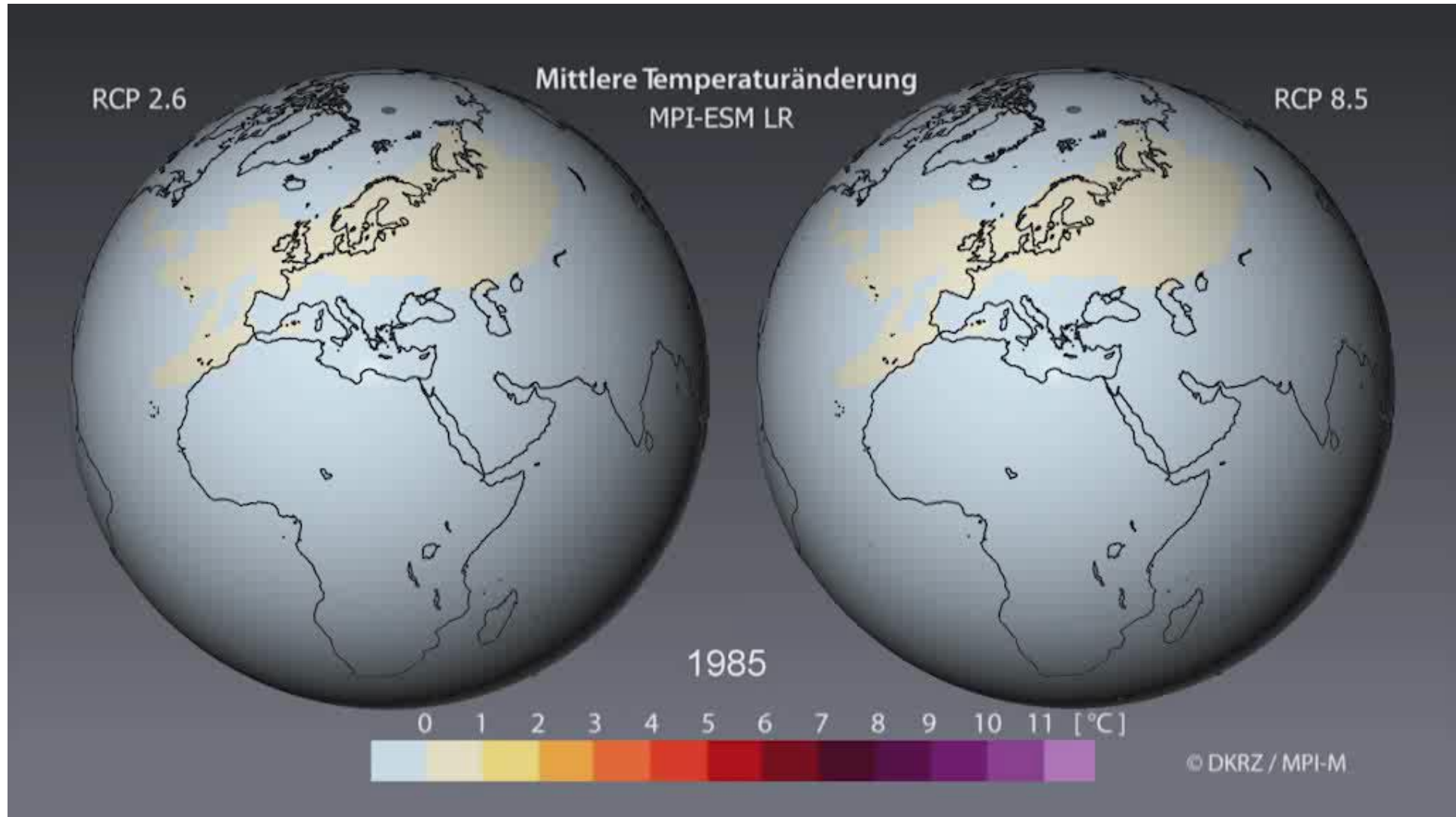
... what is required in the first place is international cooperation

World's first methanol-powered container ship

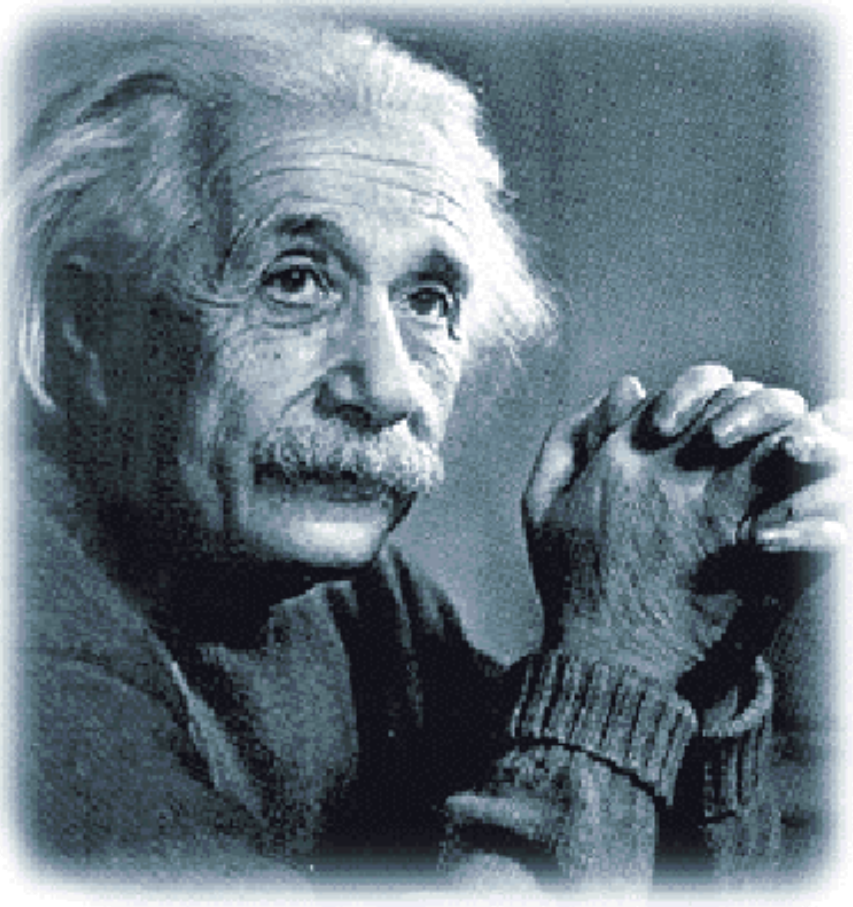


Green methanol is a clean fuel produced from renewable sources instead of fossil fuels. It is primarily split into e-methanol (synthesized from green hydrogen and biogenic CO₂) and biomethanol (derived from organic waste). It is critical for decarbonizing shipping and chemical industries.

Which world do we want?



Albert Einstein



**We cannot solve our
significant problems from
the same level of thinking
we were at when we
created these problems.**