THE ECONOMICS OF CLIMATE CHANGE

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CONCLUSIONES

El experimento es un ejemplo de la tragedia de los bienes comunes

¿Qué propondrías para resolver el problema de la explotación del lago?

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Pescando en el lago y la tragedia de los comunes

El experimento es un ejemplo de la tragedia de los bienes comunes

- Elementos:
  - El lago es un bien común: no se puede excluir a nadie
  - Las capturas generan una externalidad negativa que las y los pescadores no tienen en cuenta.

Problemas de coordinación en la explotación

Nadie se hace cargo

Si asignamos la propiedad, el problema es cómo asignar el uso

Soberexplotación

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Pescando en el lago y el Cambio climático

El experimento es un ejemplo de la tragedia de los bienes comunes

- Semejanzas entre el experimento y el cambio climático
- Diferencias entre el experimento y el cambio climático

  - ✓ Las emisiones de gases invernadero generan una externalidad negativa → Soberexplotación
  - ✓ La atmósfera es un bien común → Problemas de coordinación en la explotación. Nadie se hace cargo
  - ✗ En el cambio climático tratamos con un bien global
  - ✗ Los efectos tienen efectos a muy largo plazo

Las generaciones futuras no está presentes para expresar su opinión, y las presentes son las que han de tomar las decisiones

Necesidad de instituciones mundiales

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CLIMATE CHANGE

A change in global temperature caused by anthropogenic GHG emissions.

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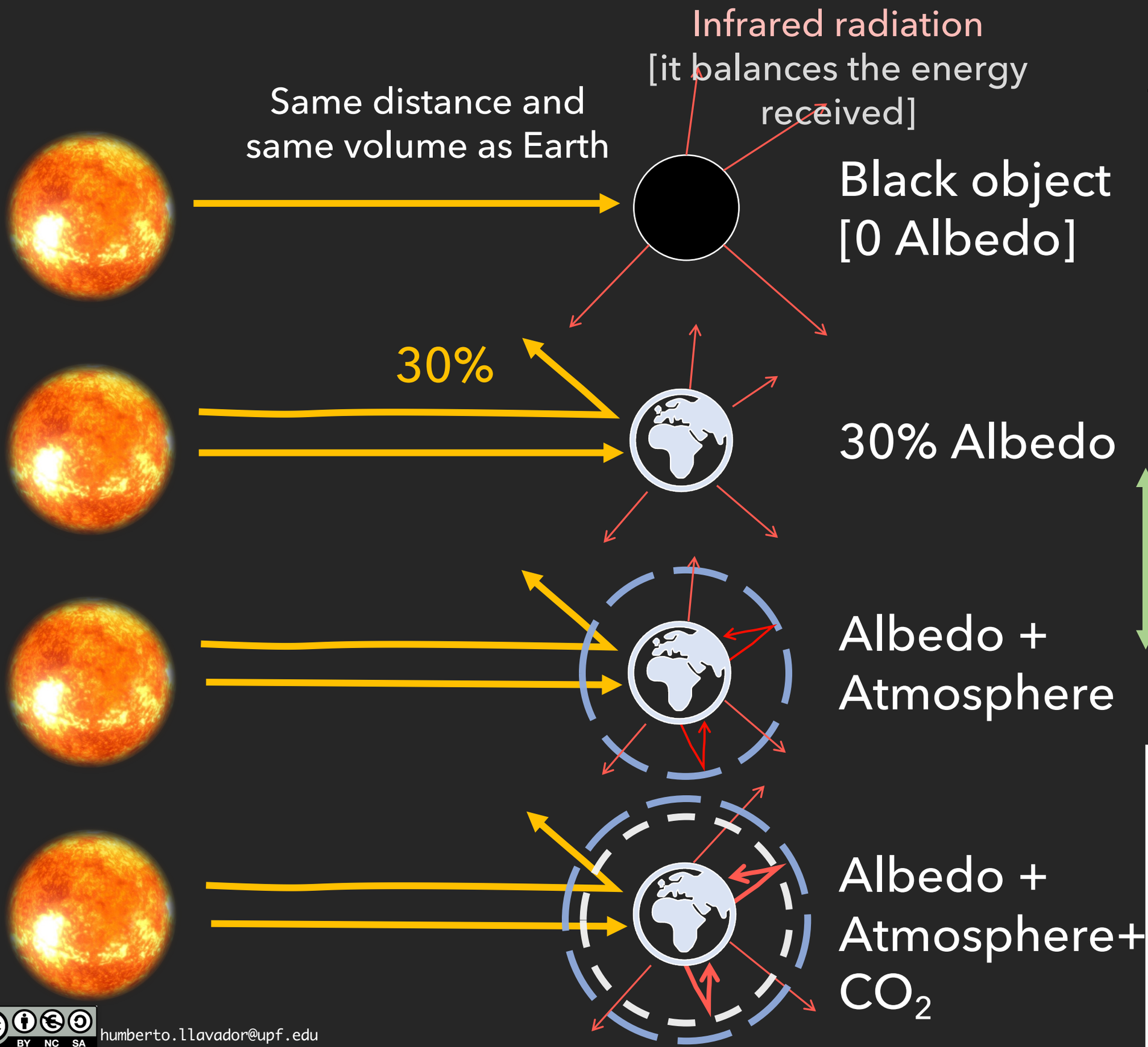
GREENHOUSE EFFECT: SIMPLIFIED ENERGY BUDGET (THERMODYNAMICAL EQUILIBRIUM)



Earth needs to warm further to be able to emit the same infrared radiation

Radiative forcing: the difference between the energy in and the energy out

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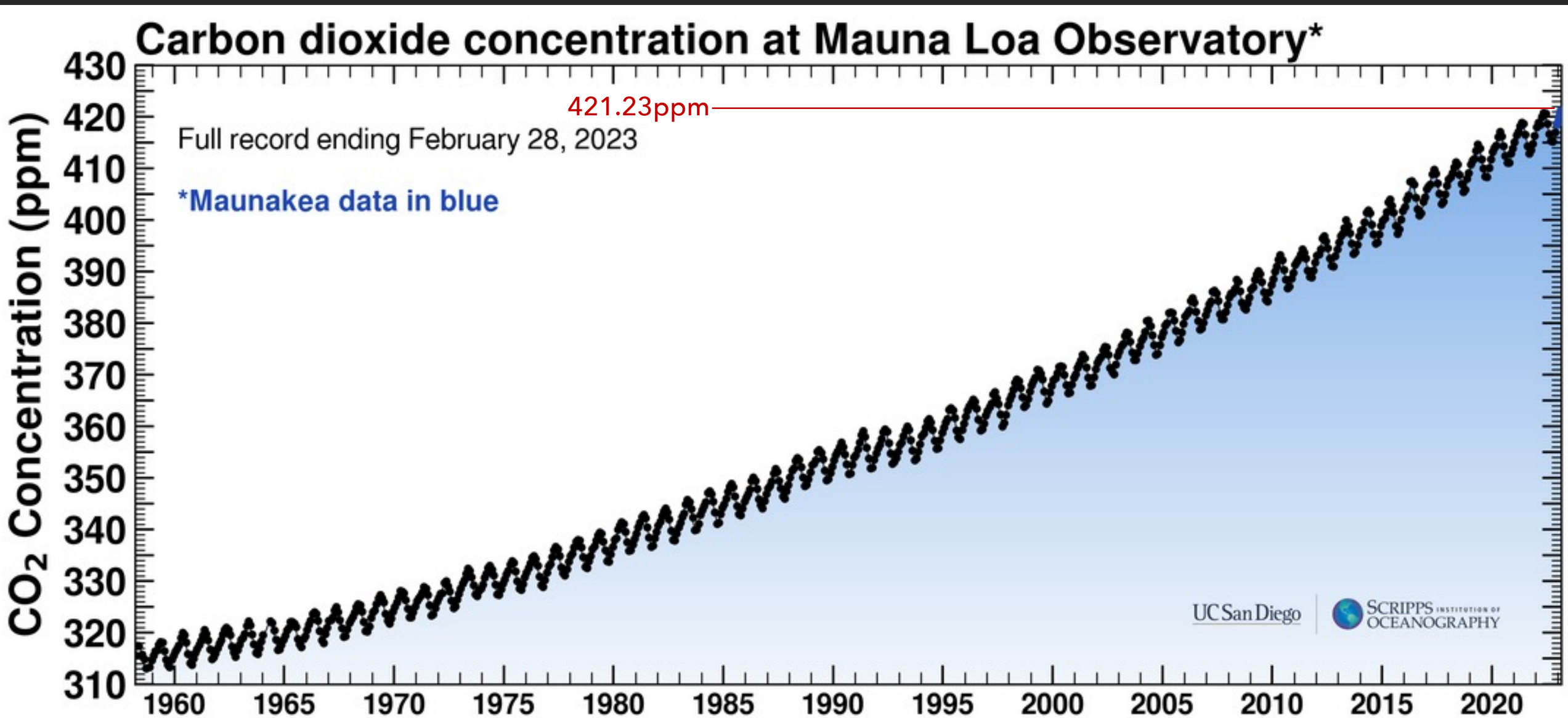
CO_2 CONCENTRATION IN THE ATMOSPHERE

THE (CHARLES DAVID) KEELING CURVE – UC-SAN DIEGO



Measuring temperature and CO_2 concentration with ice-cores

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19 cm long section of GISP 2 ice core from 1855 m showing annual layer structure illuminated from below by a fiber optic source. Section contains 11 annual layers with summer layers (arrowed) sandwiched between darker winter layers.

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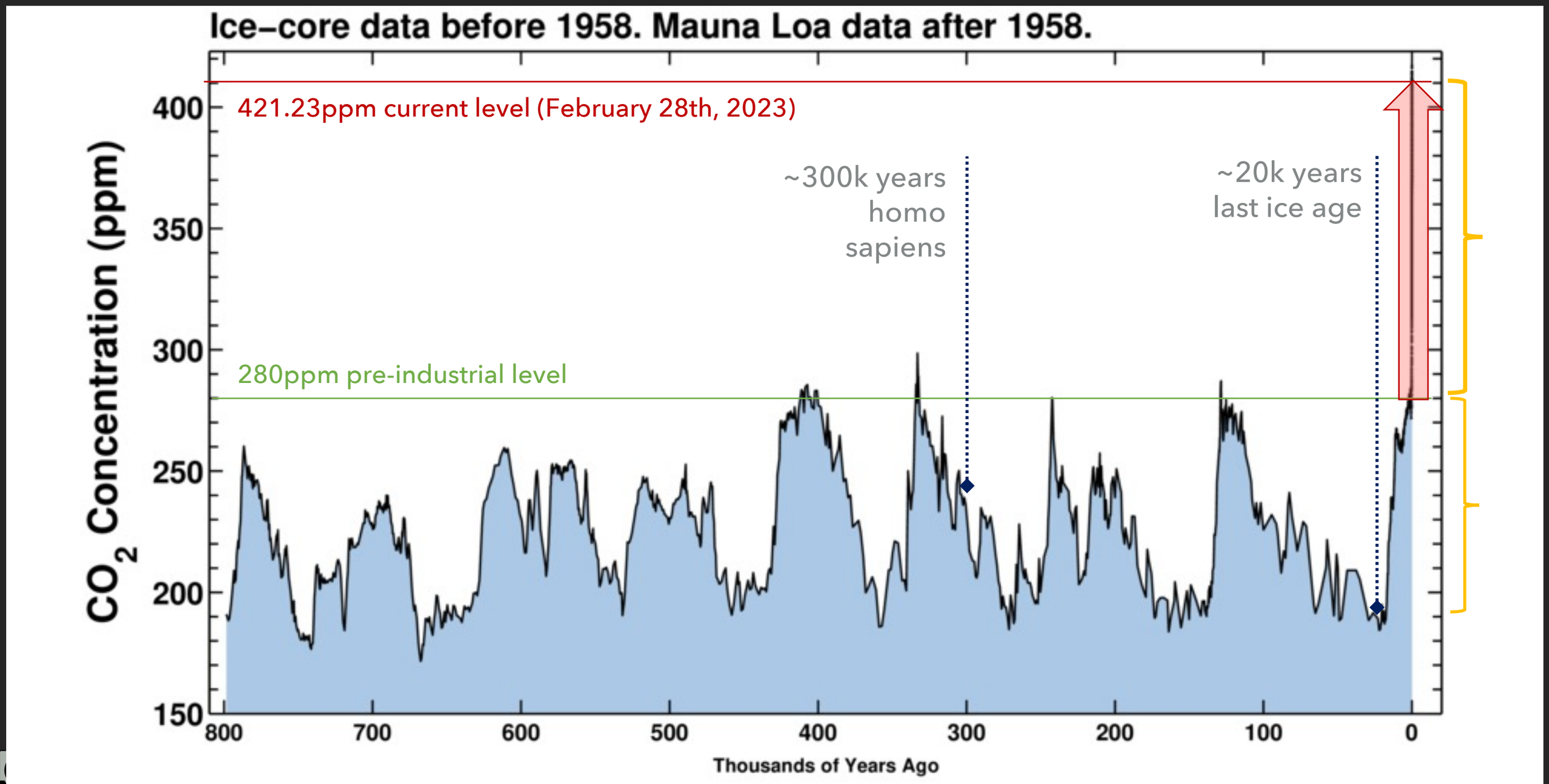
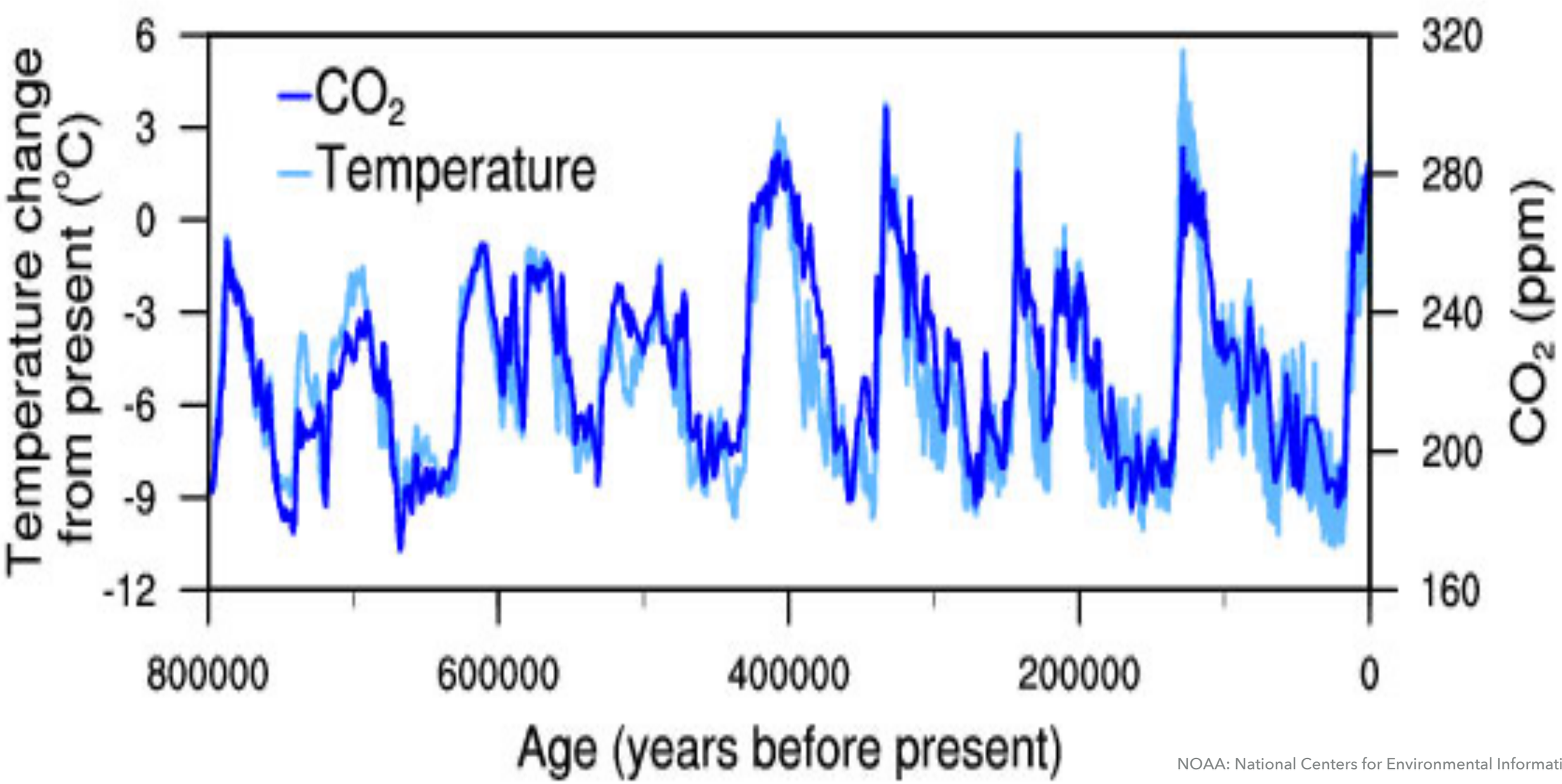


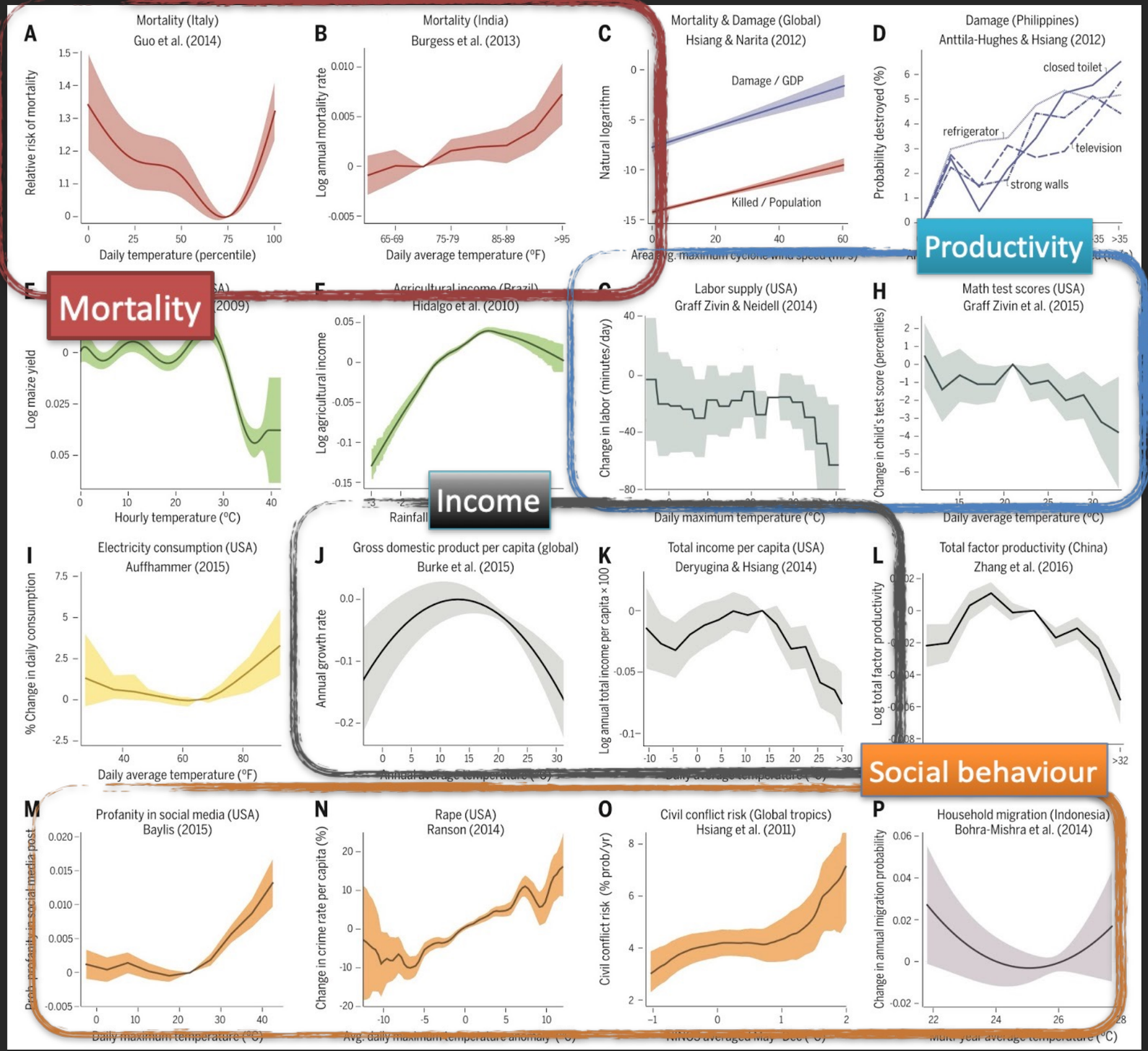
Larger CO_2 concentration, higher temperature



NOAA: National Centers for Environmental Information

Higher temperatures affects us both economically and socially

Climate affects economic and social outcomes in multiple dimensions



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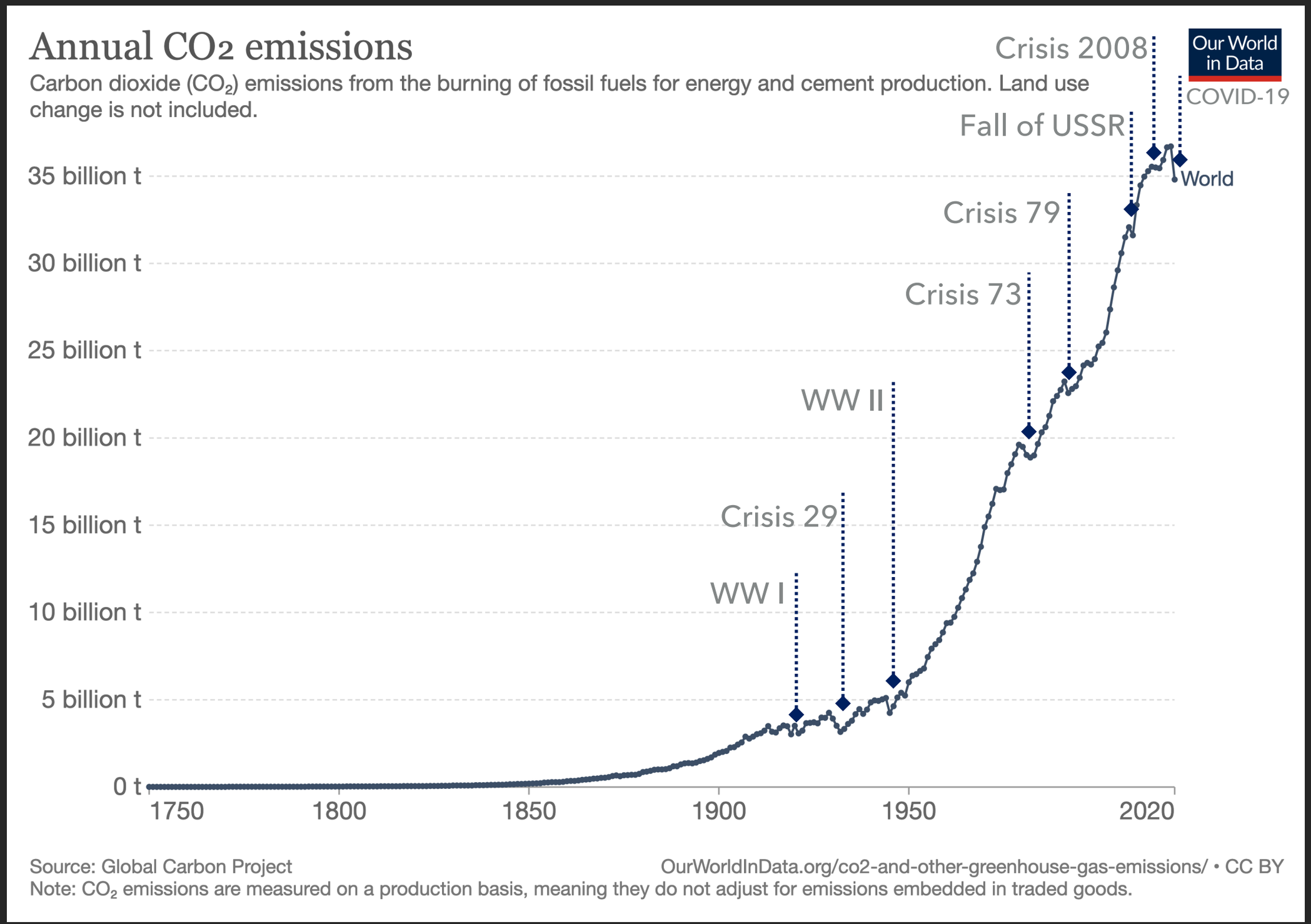
HUMANS ARE THE CAUSE OF CLIMATE CHANGE AND EMISSIONS ARE CLOSELY LINKED TO THE ECONOMIC ACTIVITY



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We need to reduce emissions and attain a net-zero emissions economy

The increase in temperature depends on total cumulative emissions

There is a carbon budget for each temperature target

There is a near linear relationship between cumulative anthropogenic CO_2 emissions and "short term" temperature increases

Every 1000 GtCO2 increase temperature in 0.45ºC

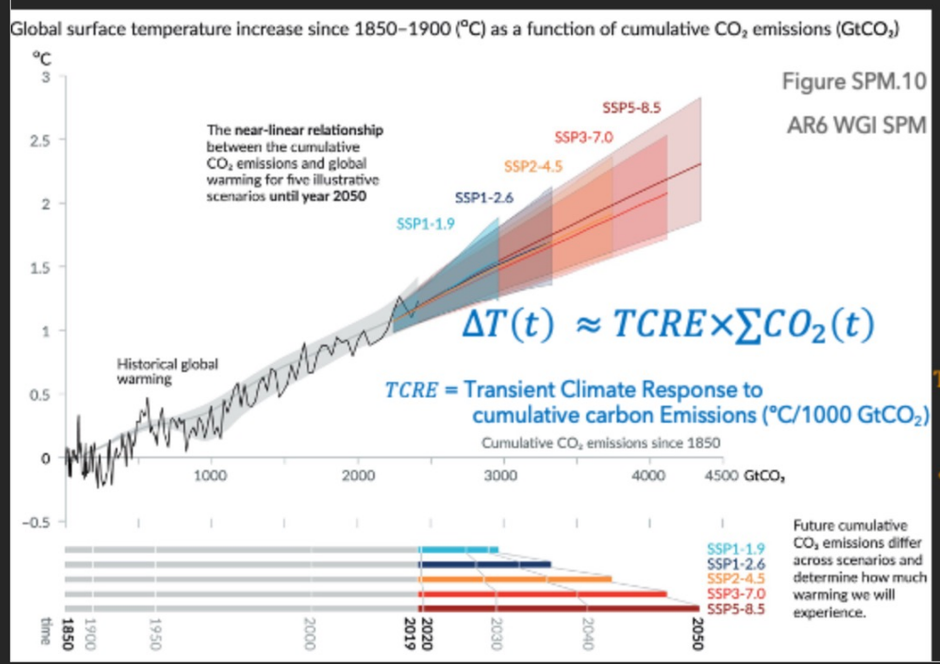


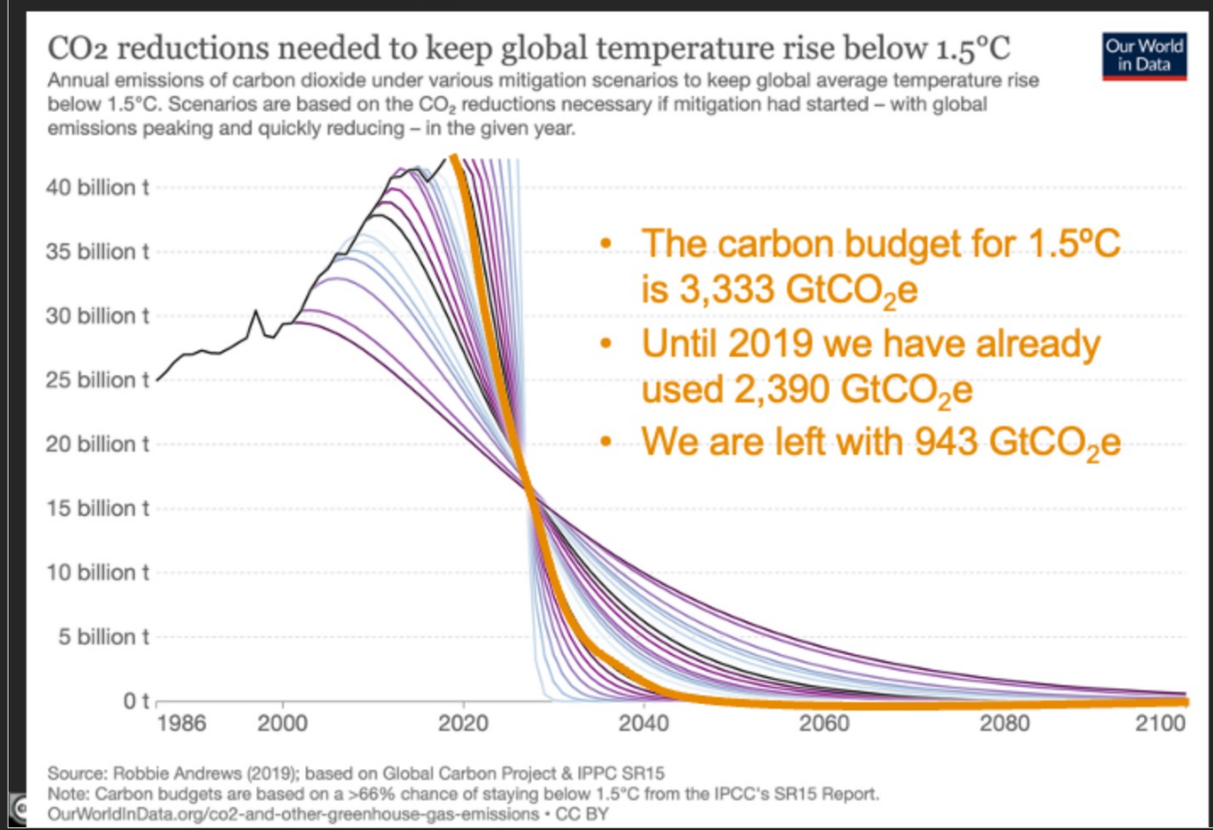
Figure SPM.10

AR6 WGI SPM

$TCRE \in [0.27, 0.62]$

Best estimate 0.45 °C/1000 $GtCO_2$

Emission paths for 1.5ºC



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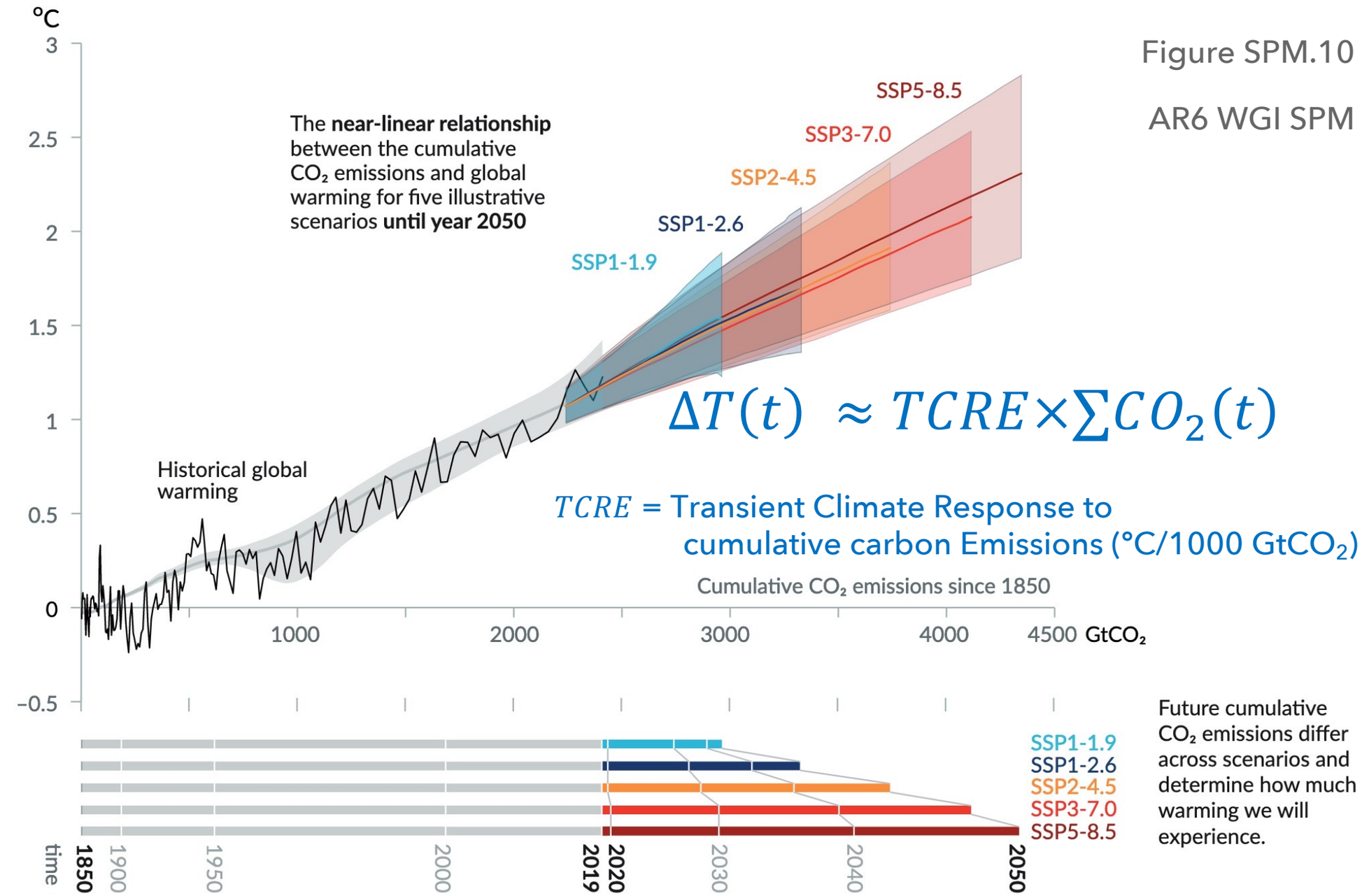
THERE IS A NEAR LINEAR RELATIONSHIP BETWEEN CUMULATIVE ANTHROPOGENIC CO_2 EMISSIONS AND "SHORT TERM" TEMPERATURE INCREASES

Every 1000 GtCO2 increase temperature in 0.45ºC

Global surface temperature increase since 1850–1900 (°C) as a function of cumulative CO_2 emissions ($GtCO_2$)



$$\Delta T(t) \approx TCRE \times \sum CO_2(t)$$

$TCRE$ = Transient Climate Response to cumulative carbon Emissions (°C/1000 $GtCO_2$)

Future cumulative CO_2 emissions differ across scenarios and determine how much warming we will experience.

Figure SPM.10

AR6 WGI SPM

$\mathrm{TCRE} \in [0.27, 0.62]$

Best estimate
0.45
°C/1000 $GtCO_2$

EMISSION PATHS FOR 1.5ºC

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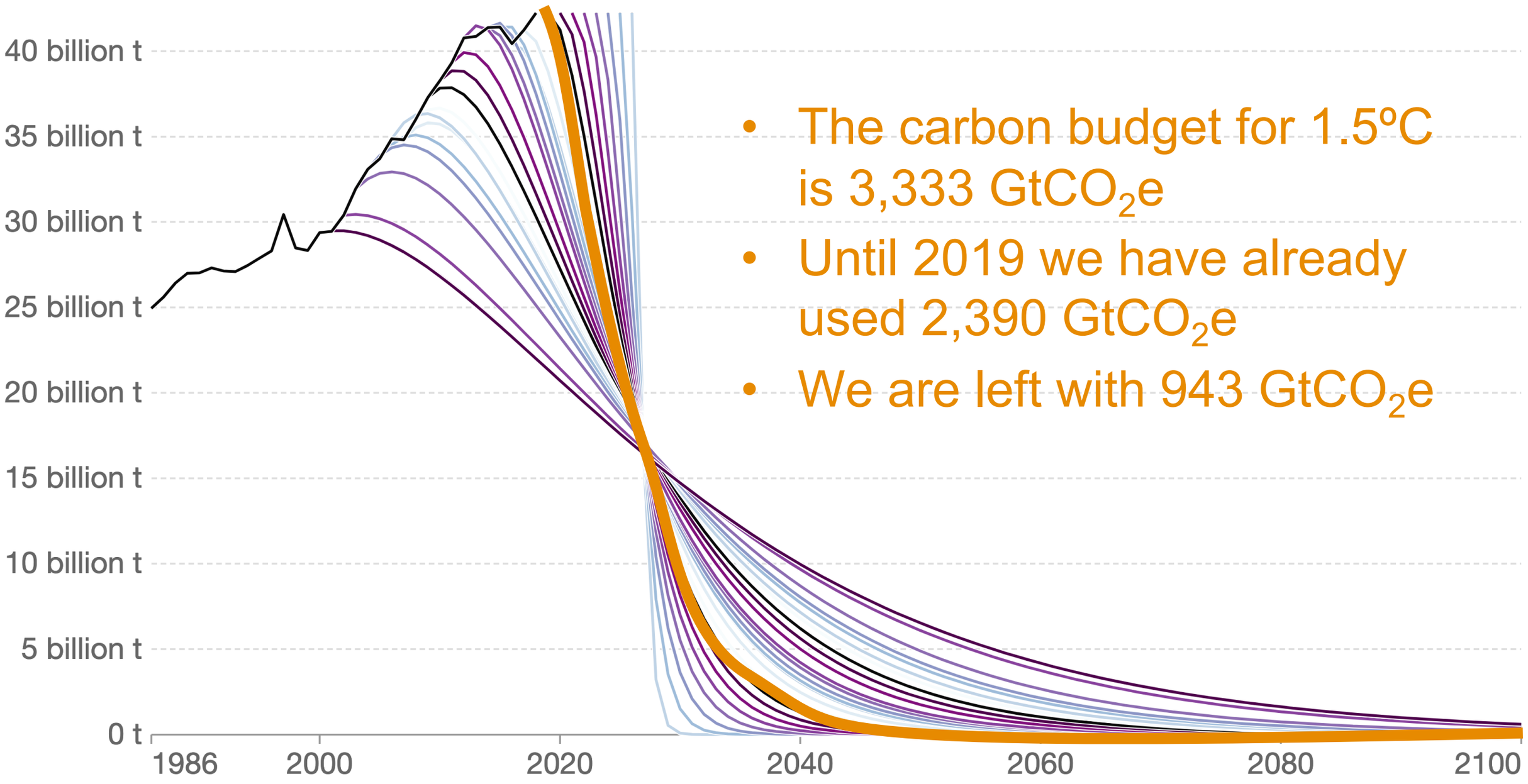
CO_2 reductions needed to keep global temperature rise below 1.5°C

Annual emissions of carbon dioxide under various mitigation scenarios to keep global average temperature rise below 1.5°C. Scenarios are based on the CO_2 reductions necessary if mitigation had started – with global emissions peaking and quickly reducing – in the given year.

Our World in Data



- The carbon budget for 1.5ºC is 3,333 $GtCO_2e$
- Until 2019 we have already used 2,390 $GtCO_2e$
- We are left with 943 $GtCO_2e$

Source: Robbie Andrews (2019); based on Global Carbon Project & IPPC SR15
Note: Carbon budgets are based on a >66% chance of staying below 1.5°C from the IPCC's SR15 Report.
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

How can we reduce emissions?

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How can we reduce CO_2 emissions? The Kaya identity

$$CO_2 = Population \times \frac{GDP}{Population} \times \frac{E}{GDP} \times \frac{CO_2}{E}$$

Population

GDP per capita

Energy intensity

Carbon intensity

Reduce population

Reduce consumption

Renewable energy

More efficient technology*

* Or changes in the the consumption basket

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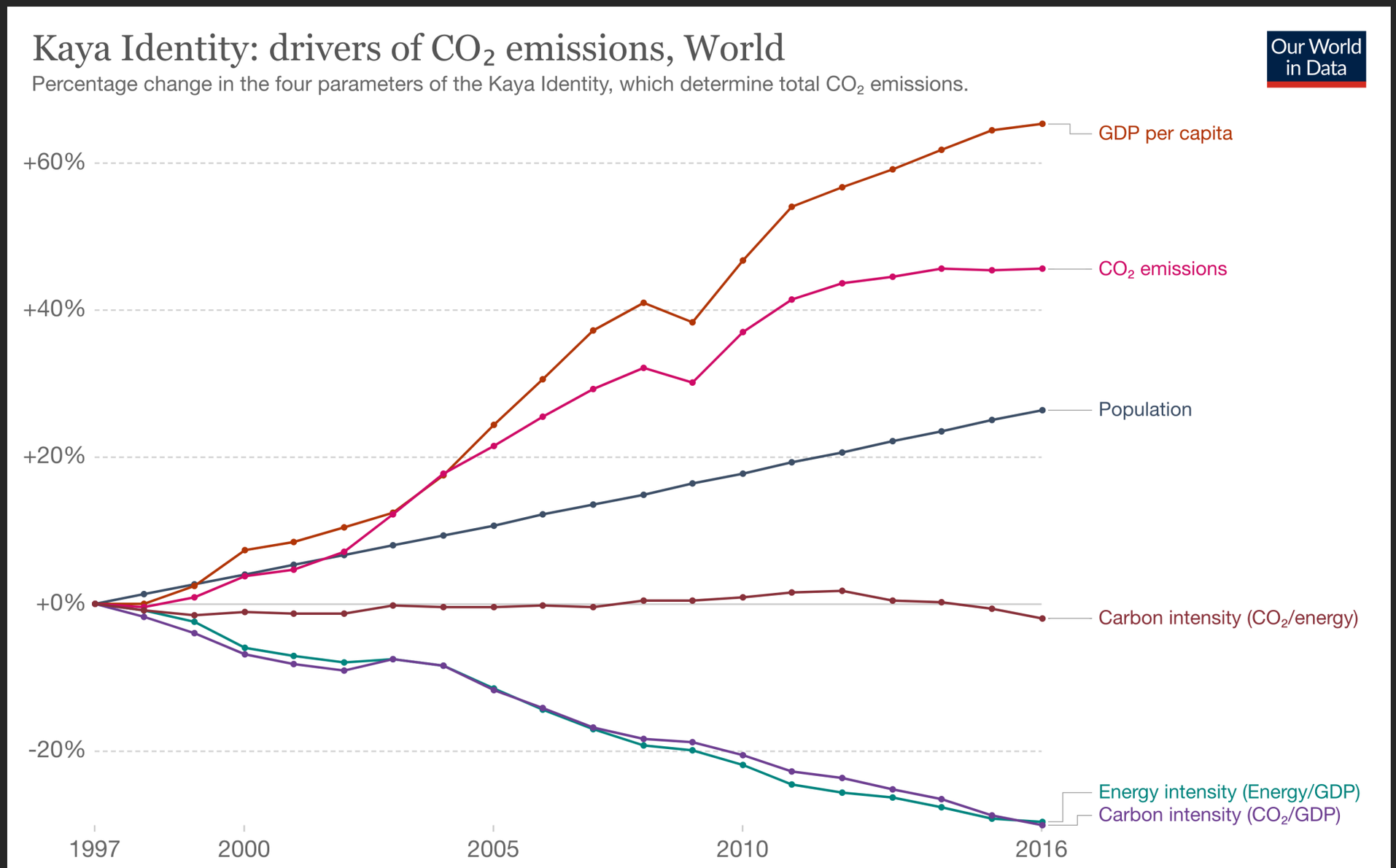
How have we done it?



- The advances in reducing carbon emissions have been caused by a decrease in energy intensity.
- Carbon intensity has barely changed

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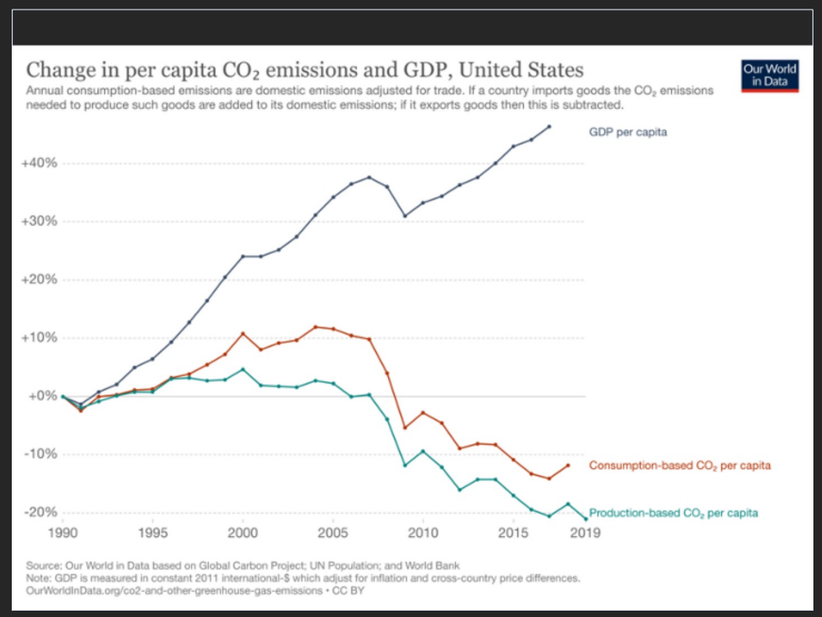
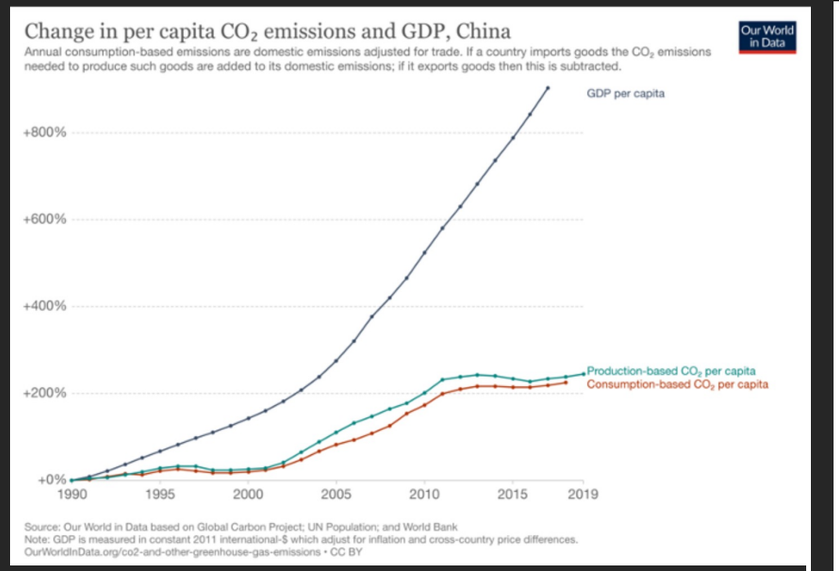
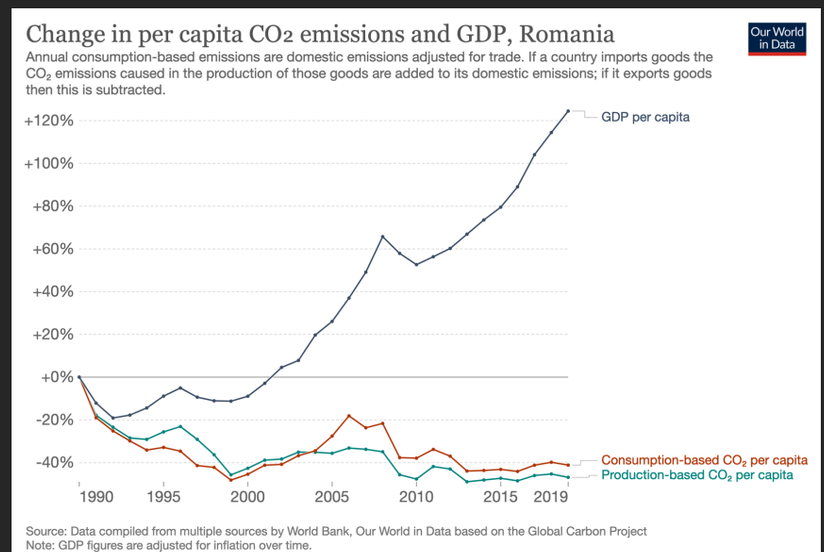
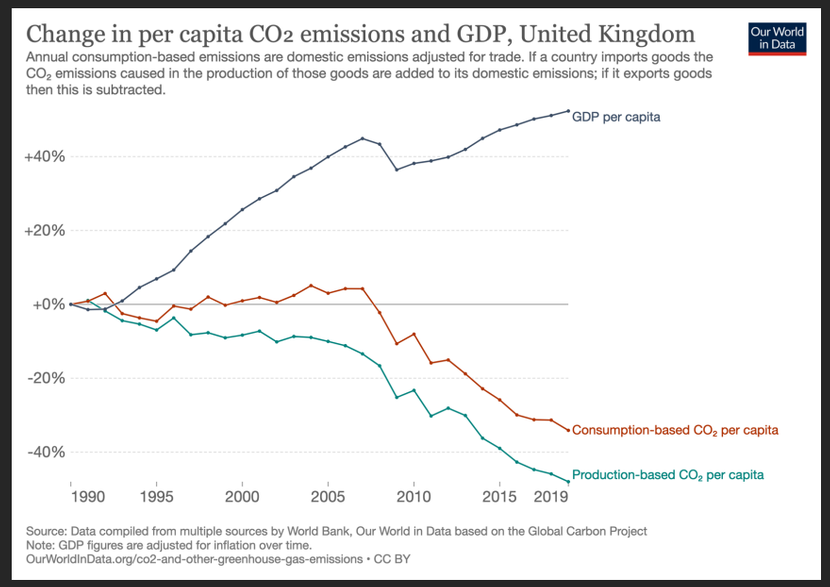
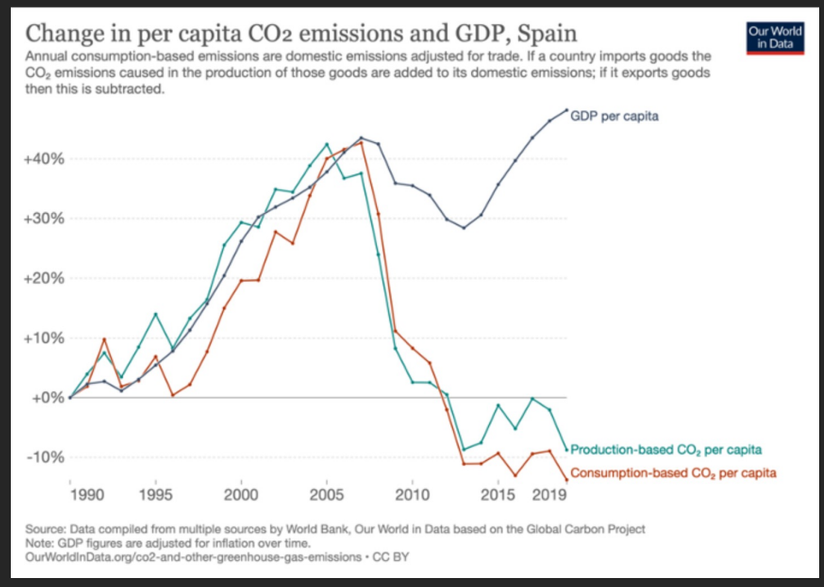
MANY COUNTRIES HAVE DECOUPLED ECONOMIC GROWTH FROM CO_2 EMISSIONS, WITHOUT NECESSARILY MOVING THEIR EMISSIONS ABROAD (OFFSHORED PRODUCTION)

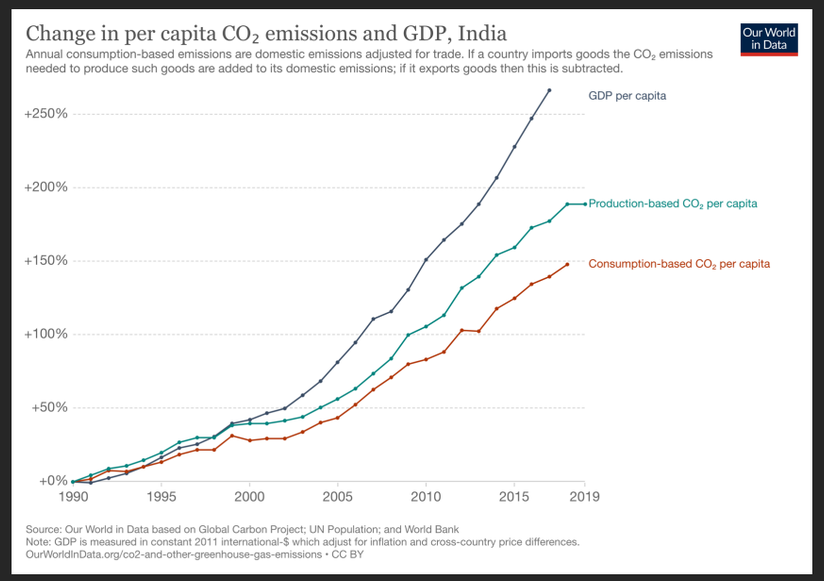












https://ourworldindata.org/grapher/co2-emissions-and-gdp-per-capita?time=1990..2019

Still several open questions

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How are we doing globally?

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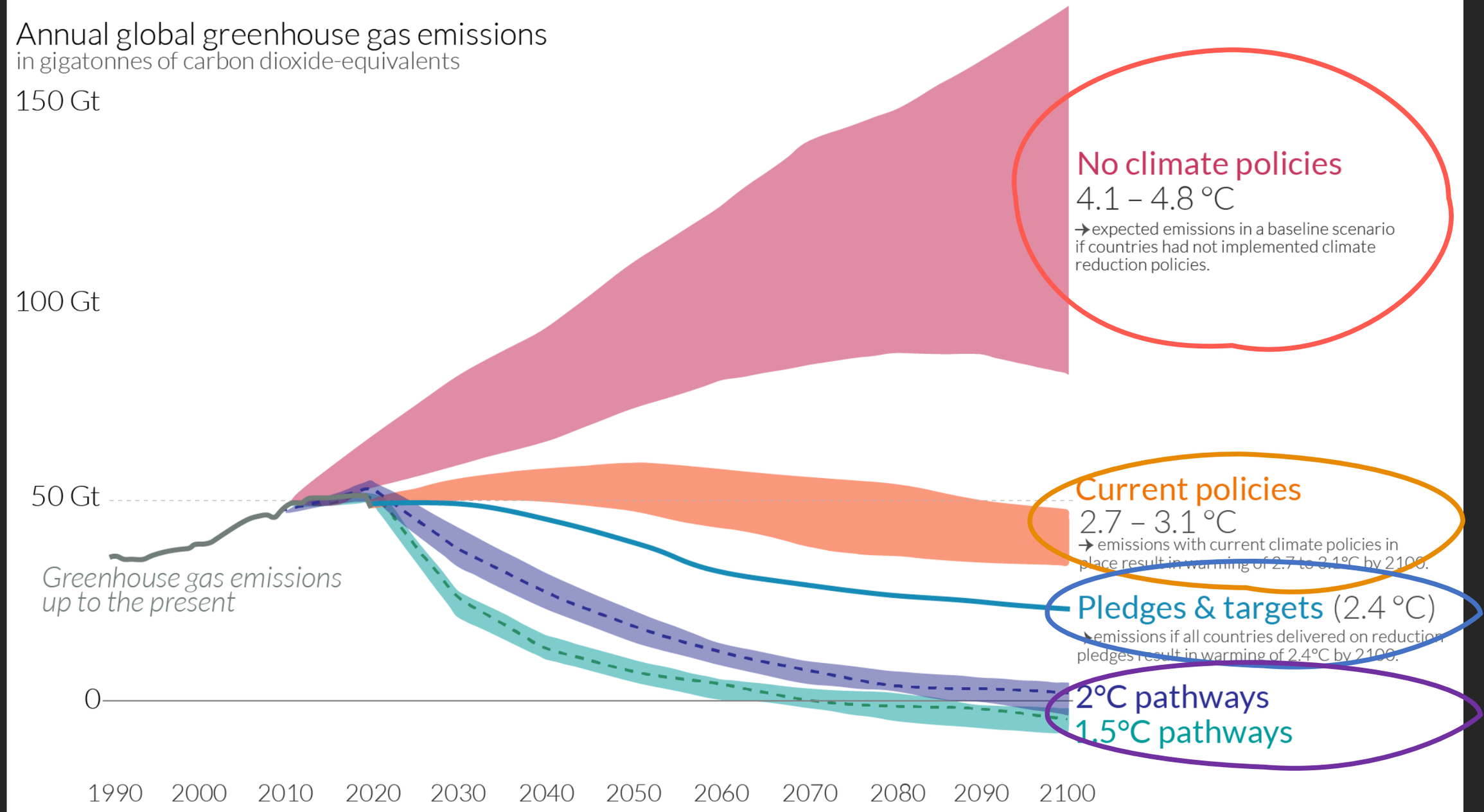
Global greenhouse gas emissions and warming scenarios

Our World in Data

– Each pathway comes with uncertainty, marked by the shading from low to high emissions under each scenario.
– Warming refers to the expected global temperature rise by 2100, relative to pre-industrial temperatures.



Data source: Climate Action Tracker (based on national policies and pledges as of May 2021).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

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