Quantifying generational and geographical inequality of climate change

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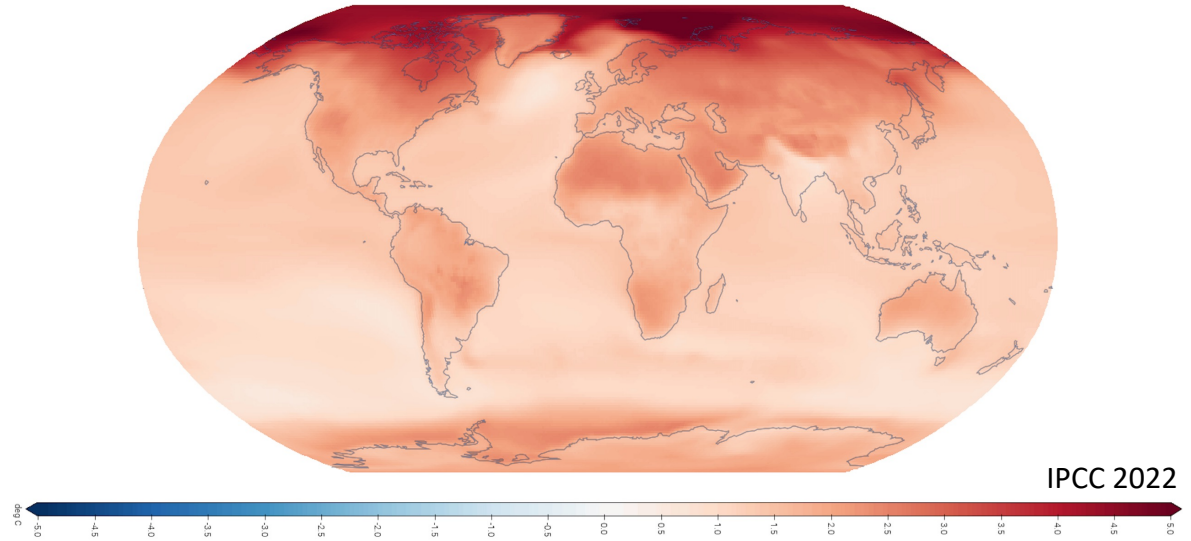
Background

- Good data availability
  - GHG emissions
  - Temperature records
  - Projections/ Scenarios

- Metric time scales?



Mean regional temperature change at 1.5°C global warming

- Instead: Generational time scale
- Relation of **experienced warming** & **GHG emissions**?
- **Birth cohorts & world regions**

Methods

Input Datasets

4 different SSPs

Output: Global & World Regions

Surface Temperature
Records & Projection (SSP)

Life Expectancy

Population
Records & Projection

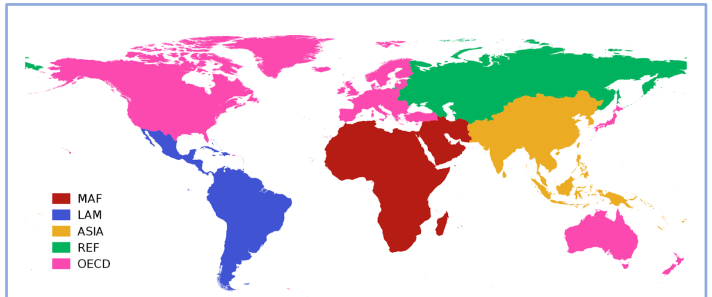
GHG Emissions
Records & Projection (SSP)

Birth cohort life expectancy

GHG Emissions per capita

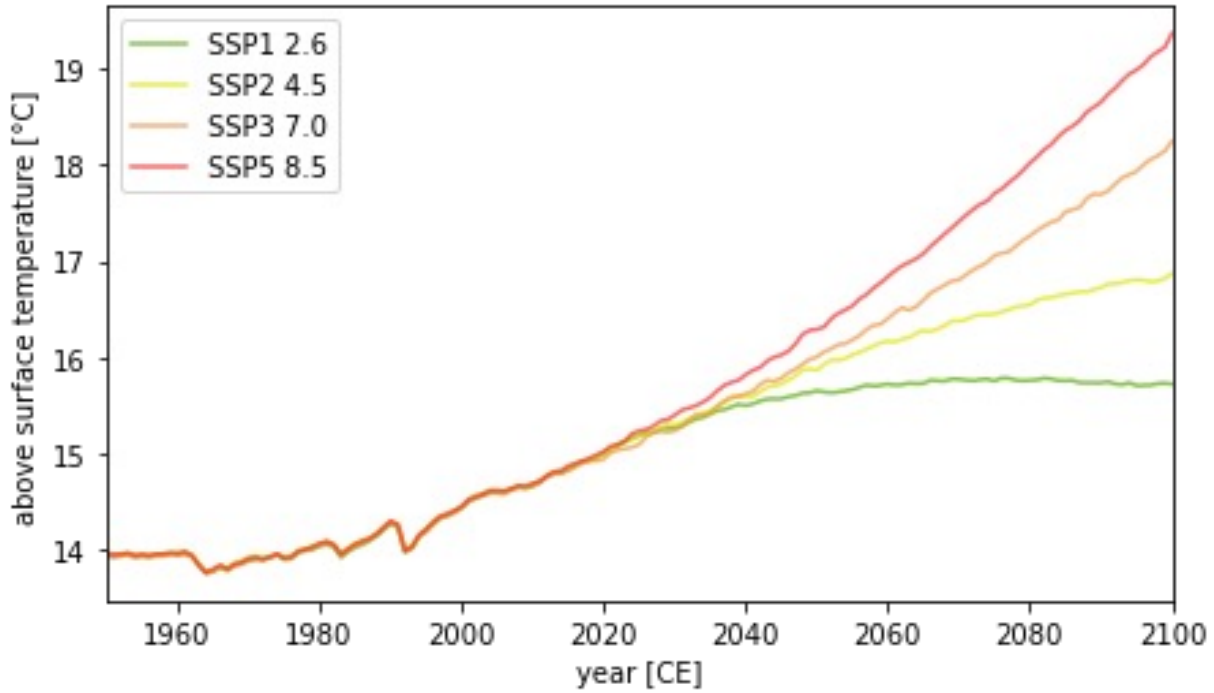
Lifetime per capita GHG Emissions

Lifetime experienced warming



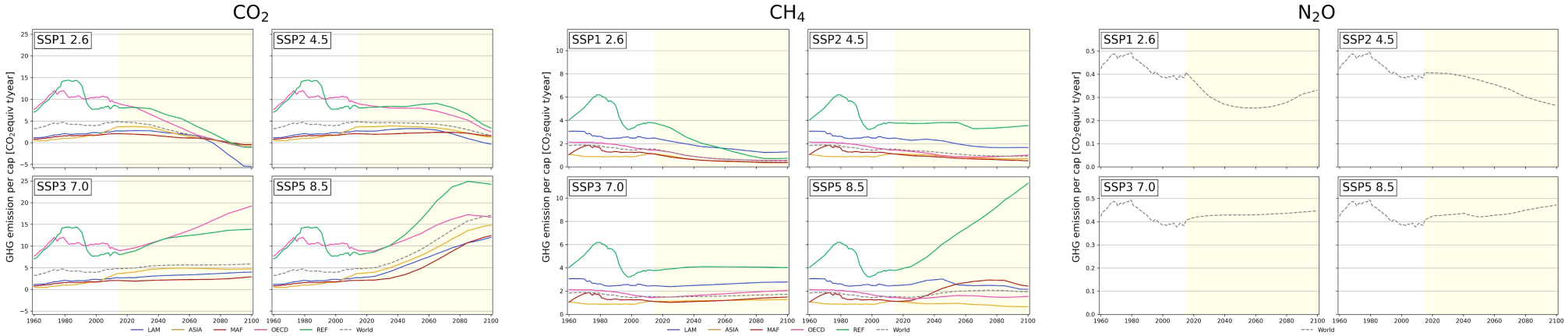
Why warming as CC proxy?

- Key indicator that couples and drives the majority of all other CC effects
- Data availability often incomplete for other proxies
- Easy to relate to and understand for people



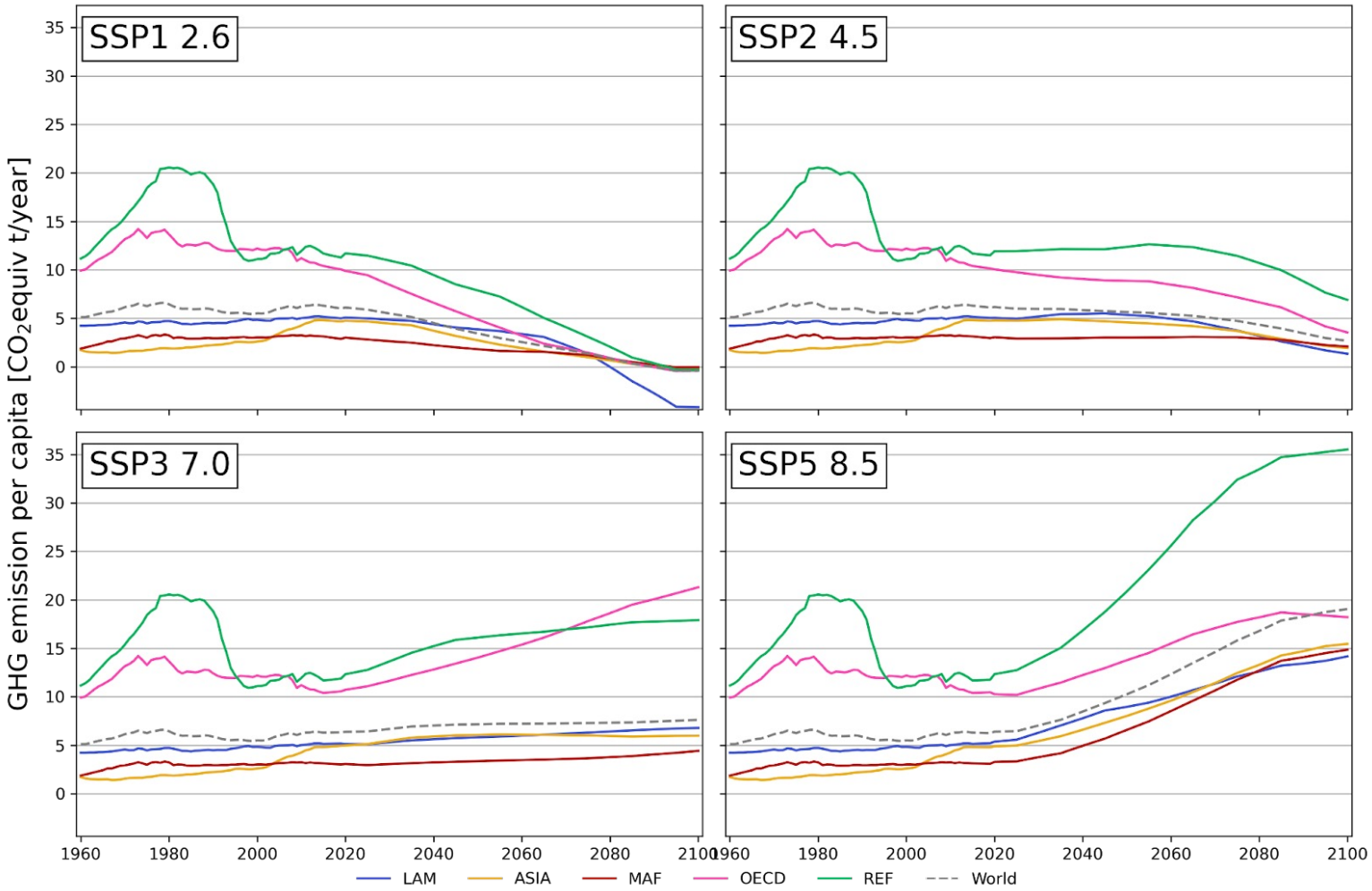
Why selected GHG emissions?

- Long-lived GHG **CO_2** and **CH_4**
- Selection constricted by data availability
- Gridded datasets → country resolution
- together account for about **90%** of the change in **effective radiative forcing**
- Neglecting of **air traffic emissions** → regional attribution?
- Neglecting (anthropogenic) **aerosols** → negative health impact



Per capita greenhouse gas emissions from 1960 to 2100.

Why selected GHG emissions?

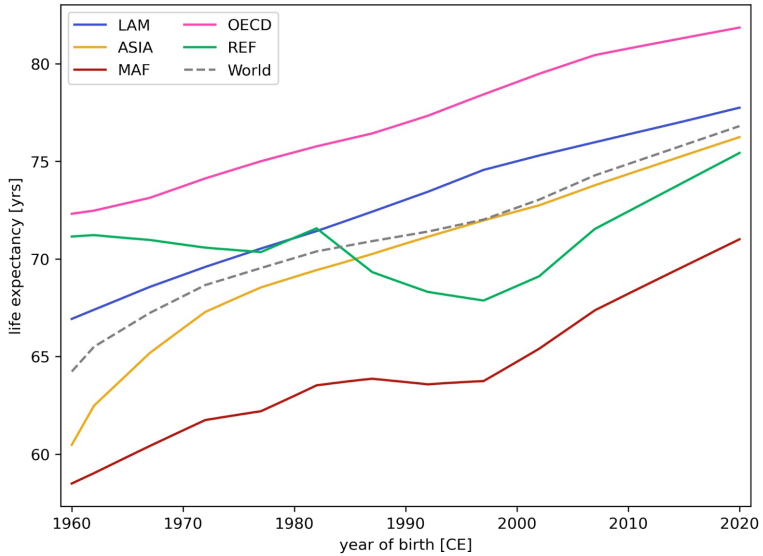


GHG Emissions: **CO_2** and **CH_4**

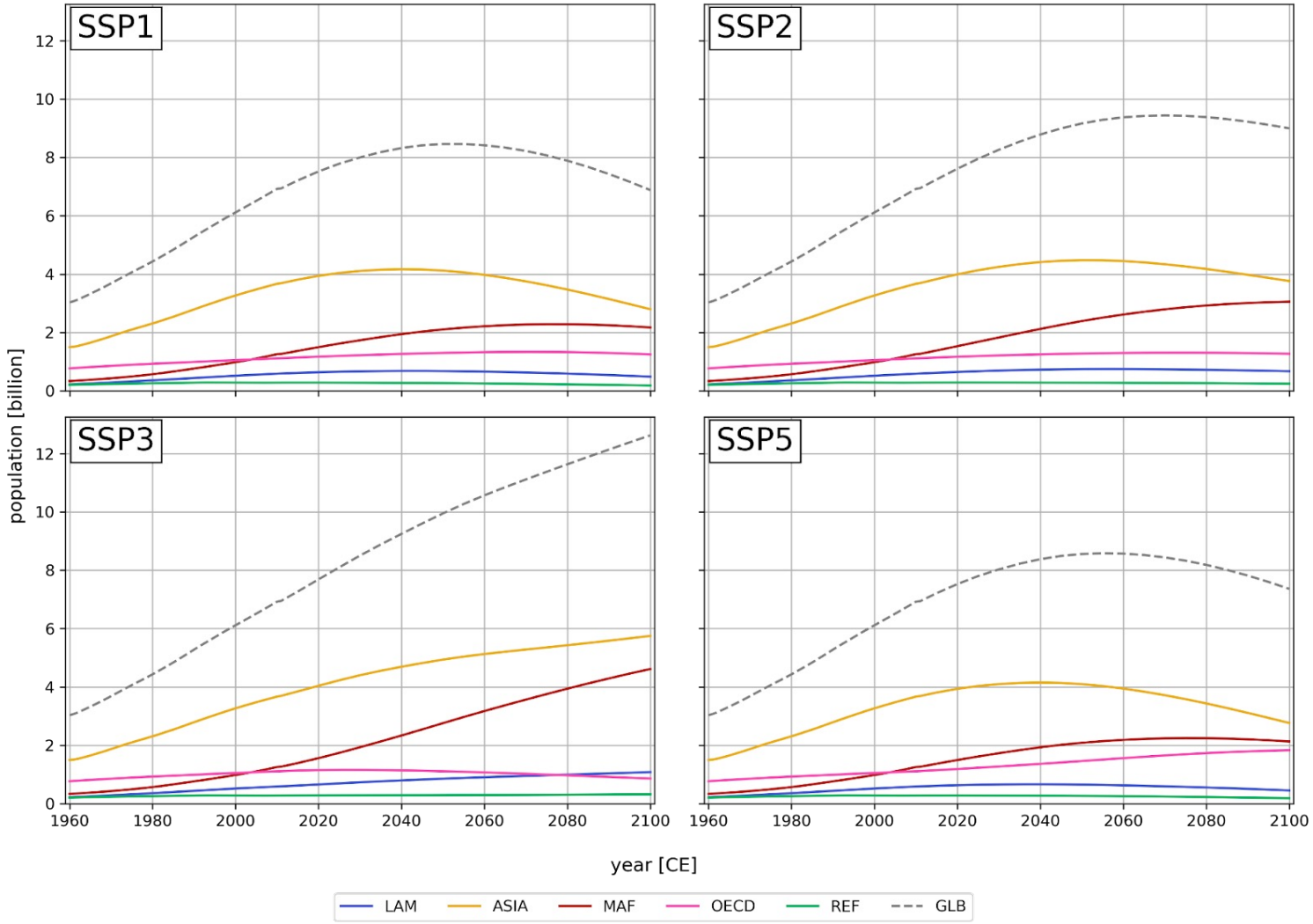
Life expectancy

- At age 5 to account for child mortality

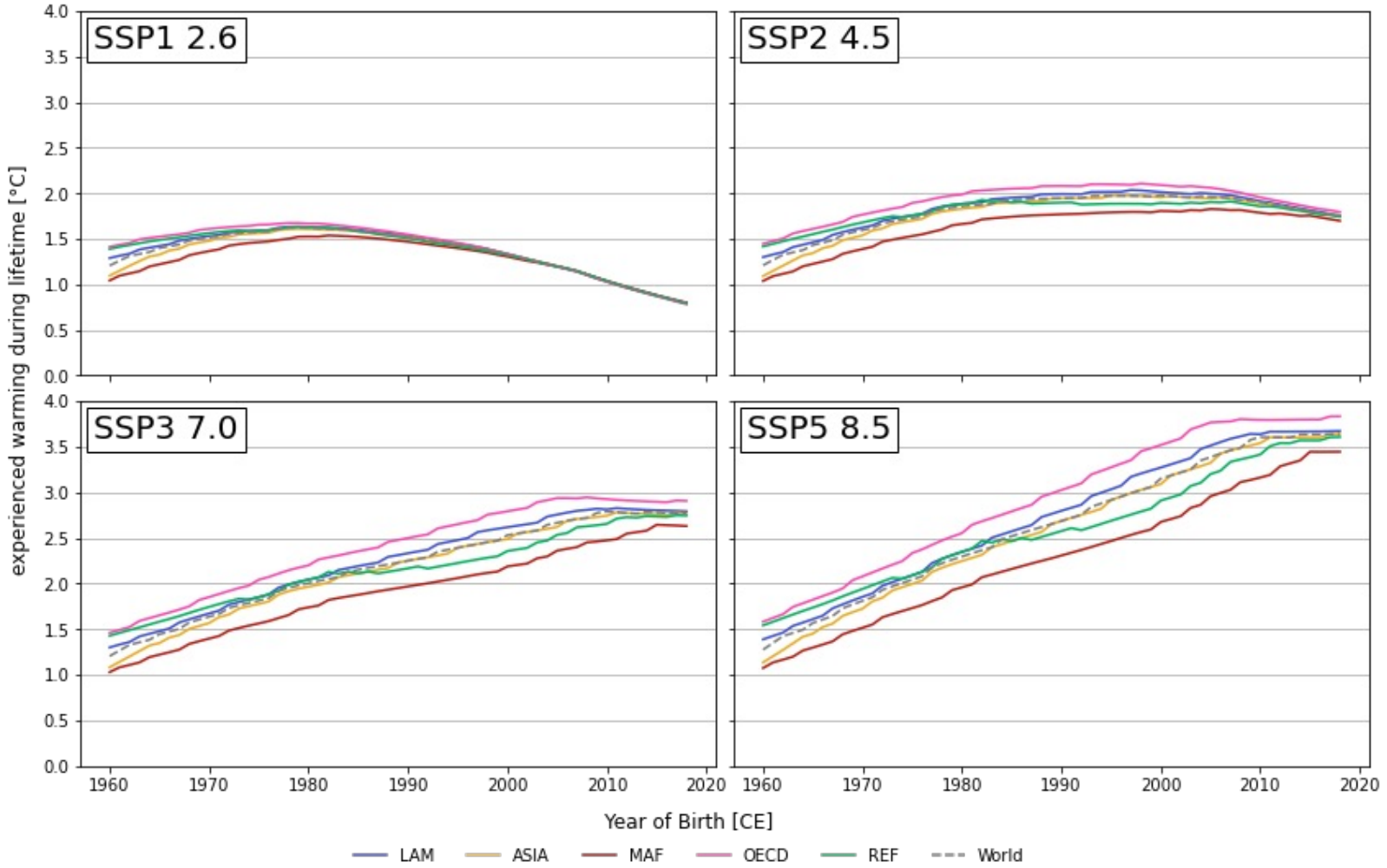
- At what age can a person be held responsible for their emissions?
- Longer life expectancy = right to emit more GHG?



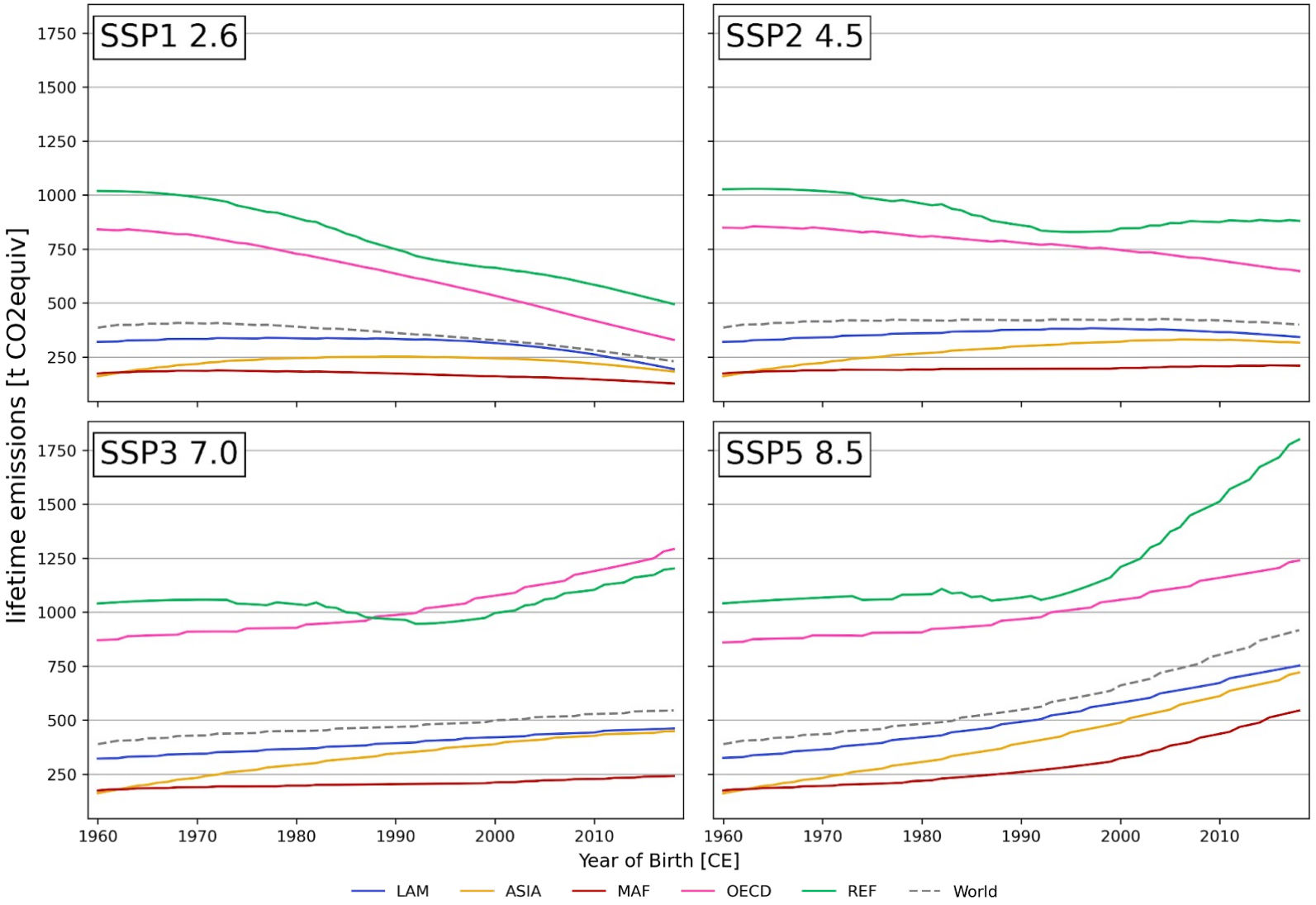
Population development



Experienced Global Warming

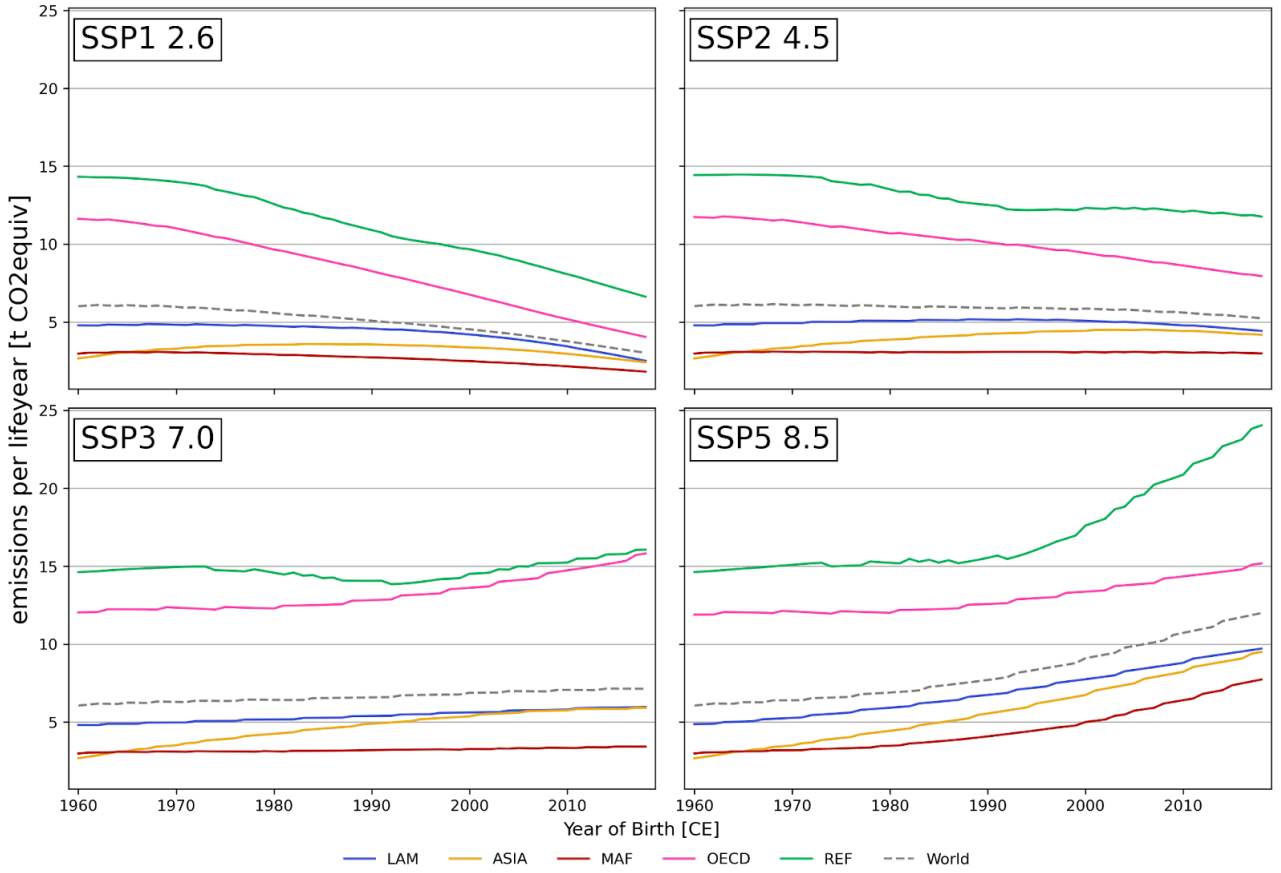


Lifetime GHG Emissions



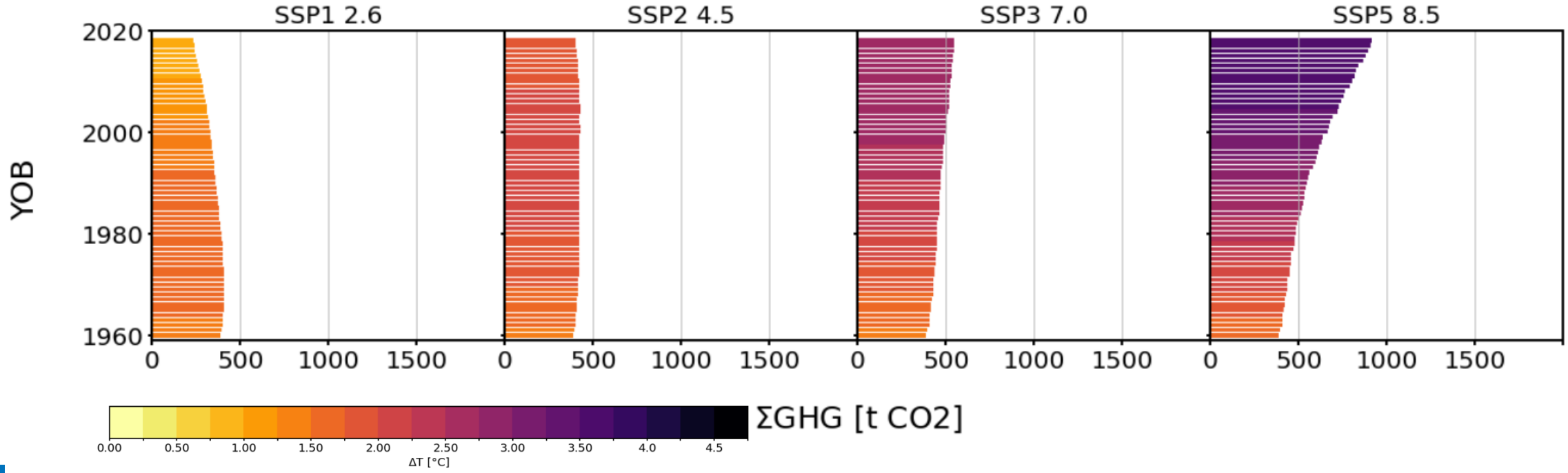
Lifetime GHG Emissions: Annual average

- GHG Emissions: Average emissions per year of life



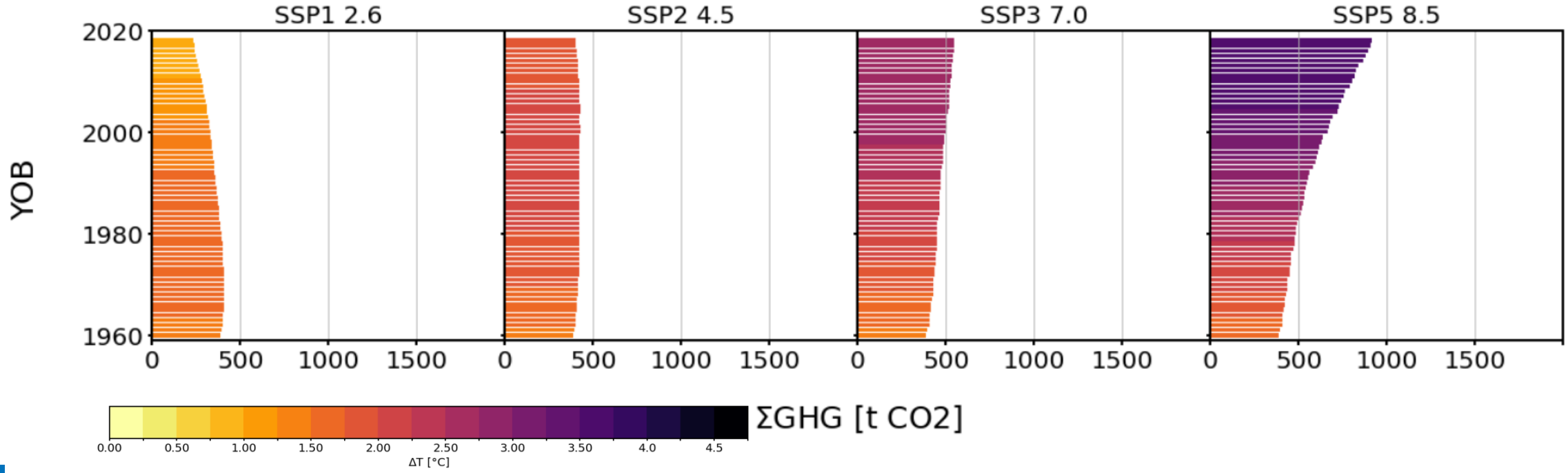
Results: Global

- Bars: Birth cohorts (YOB)
- Length: GHG Emissions (ΣGHG/ t CO_2)
- Color: Lifetime warming (ΔT/ °C)



Results: Global

- Turning points SSP 1 & 2
- YOB 1970: Diverging SSPs
- YOB 1980: 0.5°C difference = 60% population

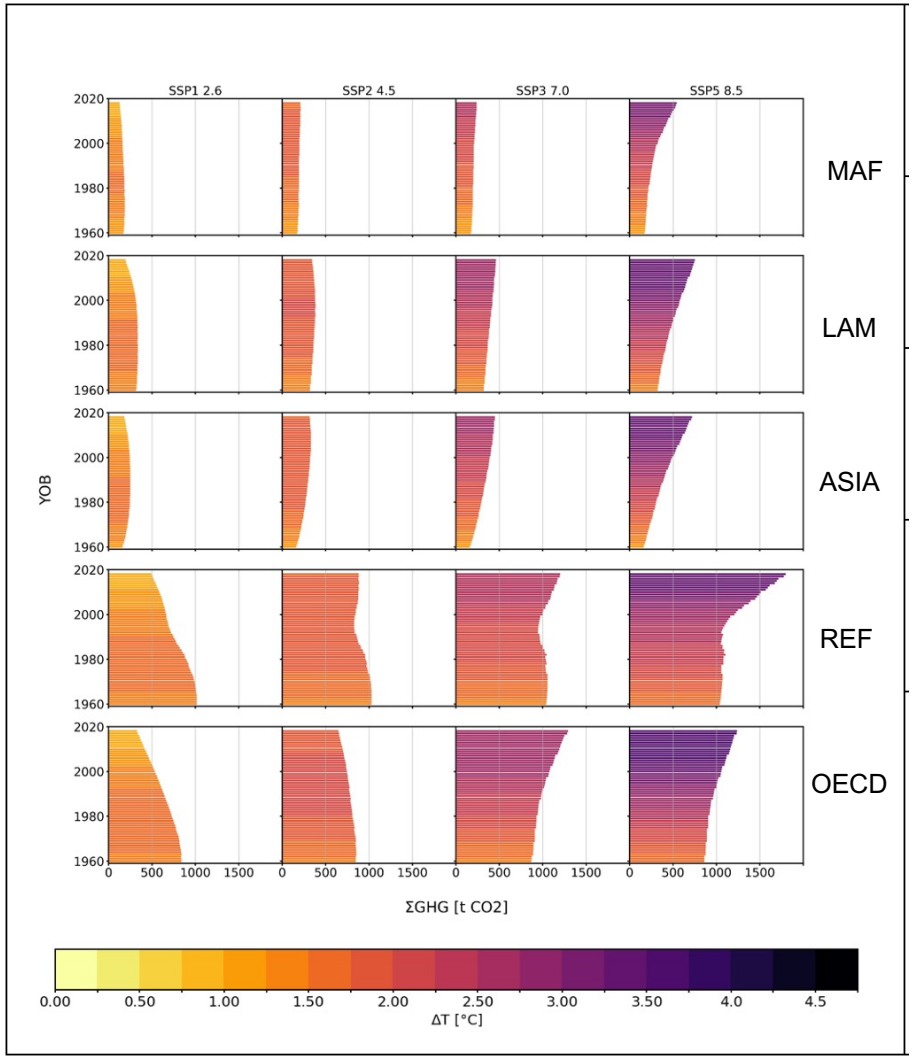


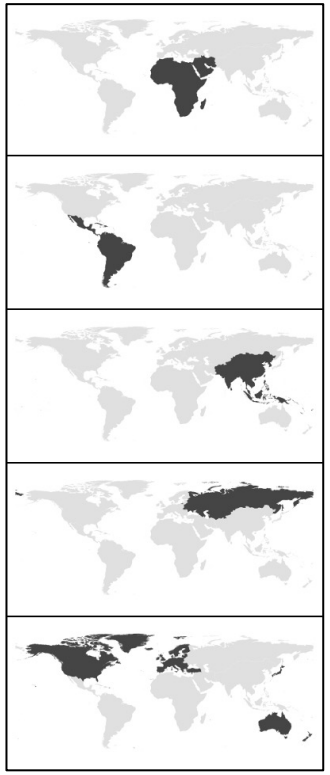
Results: World Regions

- Global North
  - High per-capita GHG emissions
  - OECD, REF
- Global South
  - Low per-capita GHG emissions
  - MAF, LAM, ASIA

- Different life expectancies → shifted turning points

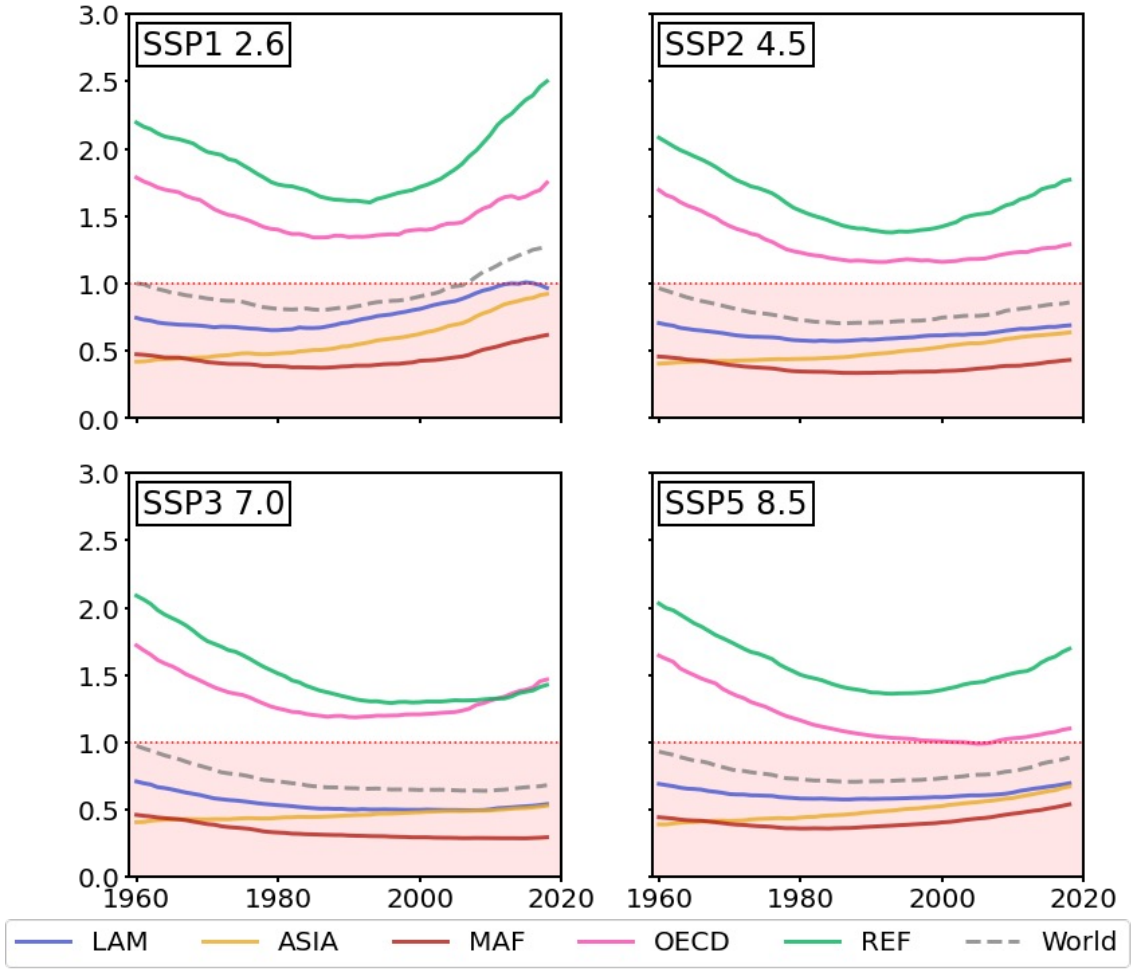
- Clear spatial pattern
- No decrease of inequality



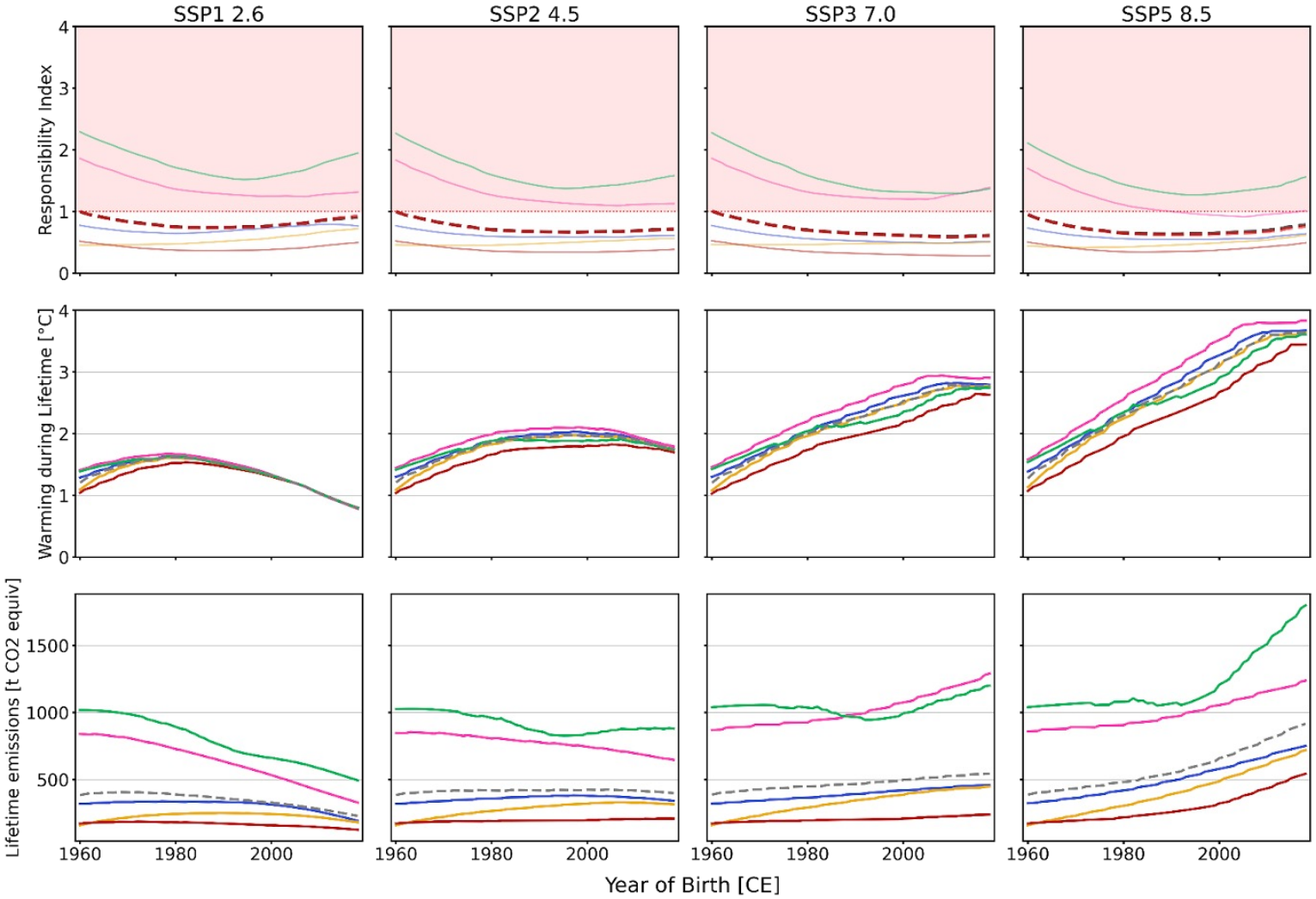


Responsibility index

- **Index: ΔT/ΣGHG**
  - YOB 1960/Global = 1
- **High** (above-average) vs. **Low** (below-average) index regions
  - Global North regions
  - Global South regions
- Different driving mechanisms over time!
  - High emissions/ little warming (YOB 1960-1980)
  - Low emissions/ increasing warming (YOB 2000-2018)
- Amplified Inequality SSP1?



Drivers of responsibility index



Summary

- Differences over time (birth cohorts) and between world regions
- The **majority** of todays population (60%) sees a **difference** between the **scenarios** (SSP) → urgency & chances of low emission future
- **Geographical inequality** significant across als SSPs and birth cohorts
- **Generational inequality** evident in all SSPs
  - Time lag of effects of emissions
  - When does responsibility start (age)?
- Relative warming over lifetime; neglect of absolute increase of temperature relative to preindustrial → display material online

Thank you for your attention!

Please reach out for any questions or feedback.

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