LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | C A U | KIT Karlsruher Institut für Technologie | P I K | SENCKENBERG world of biodiversity | TUM

Saving the World?

Carbon Dioxide Removal (CDR) in Germany

Karlsuhe | KSETA 10 years anniversary | 2022-10-28

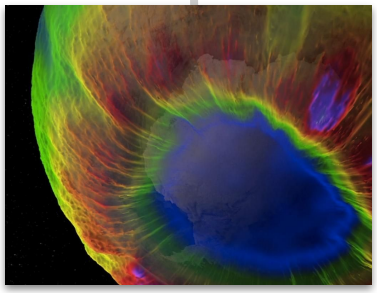
Stefanie Falk for the STEPSEC project

SPONSORED BY THE
Federal Ministry of Education and Research

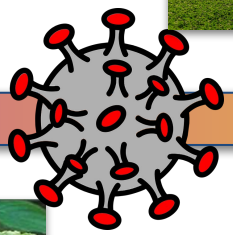
Motivation

Timeline of my scientific work…

2011



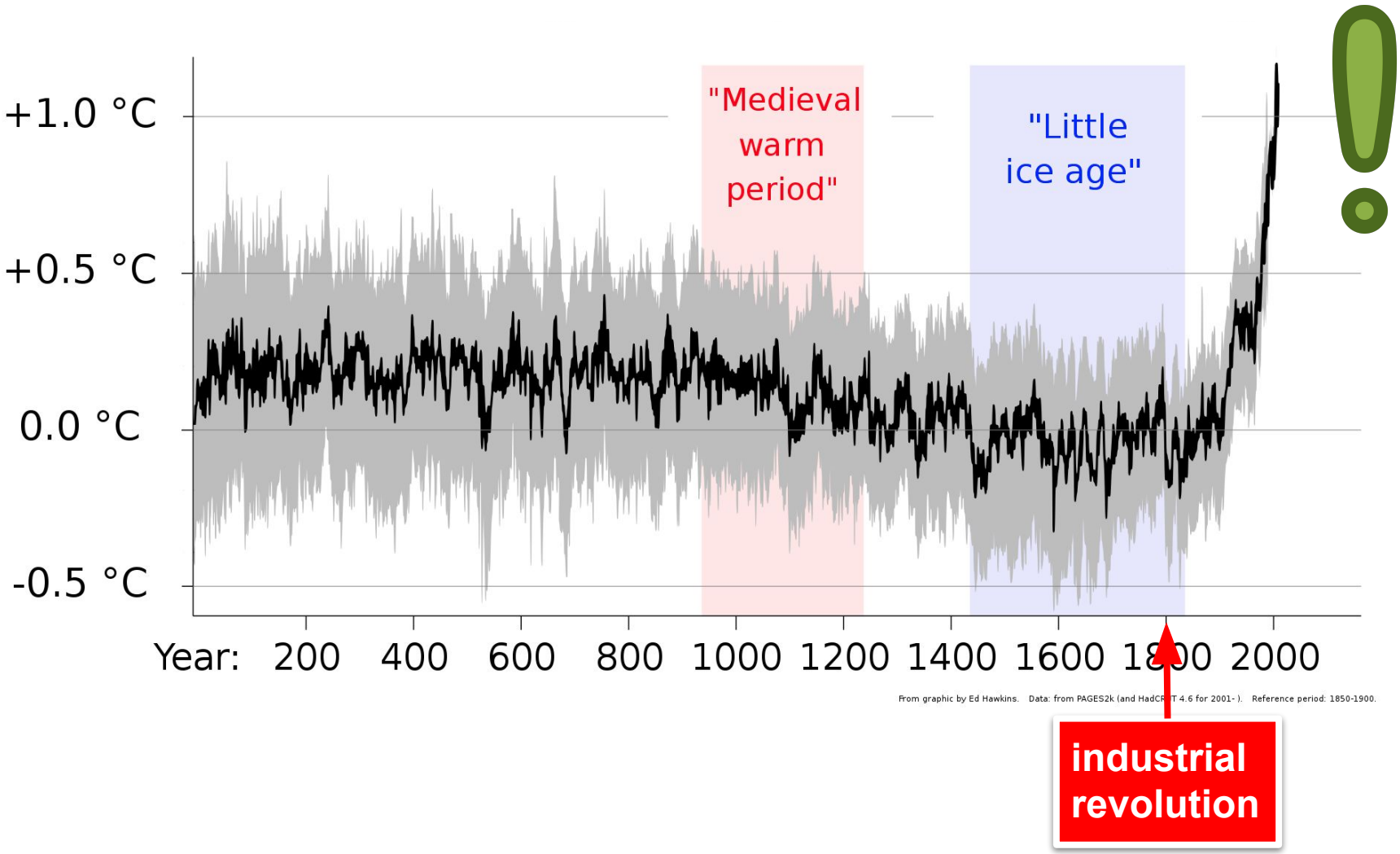
2018



2021

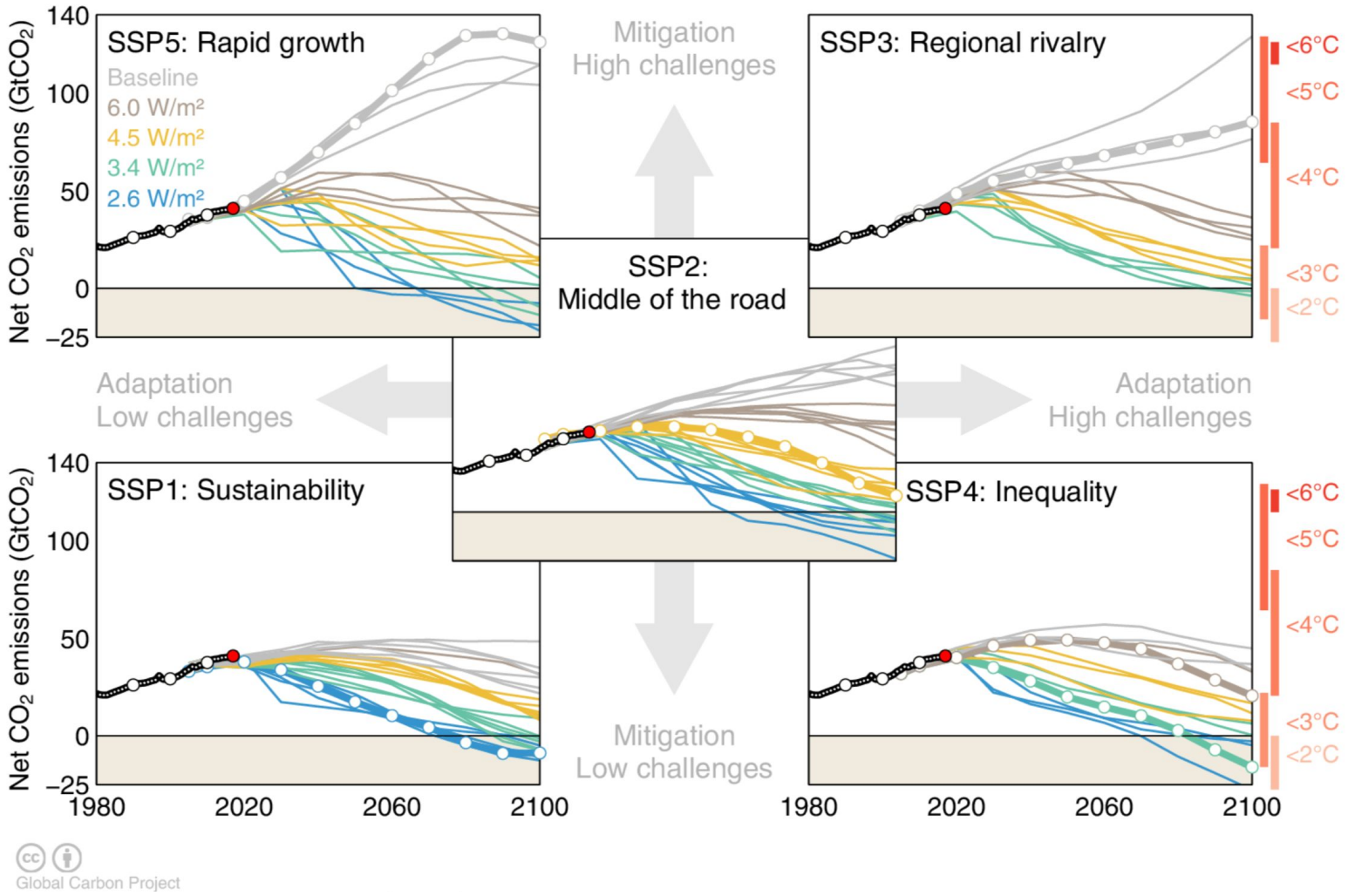
Motivation

Global mean temperature change over the past 2022 years…



Motivation

To keep **global warming** below **2°C**, **carbon dioxide removal** (**CDR**) **methods** are applied in all shared socio-economic pathway (SSP) scenarios!



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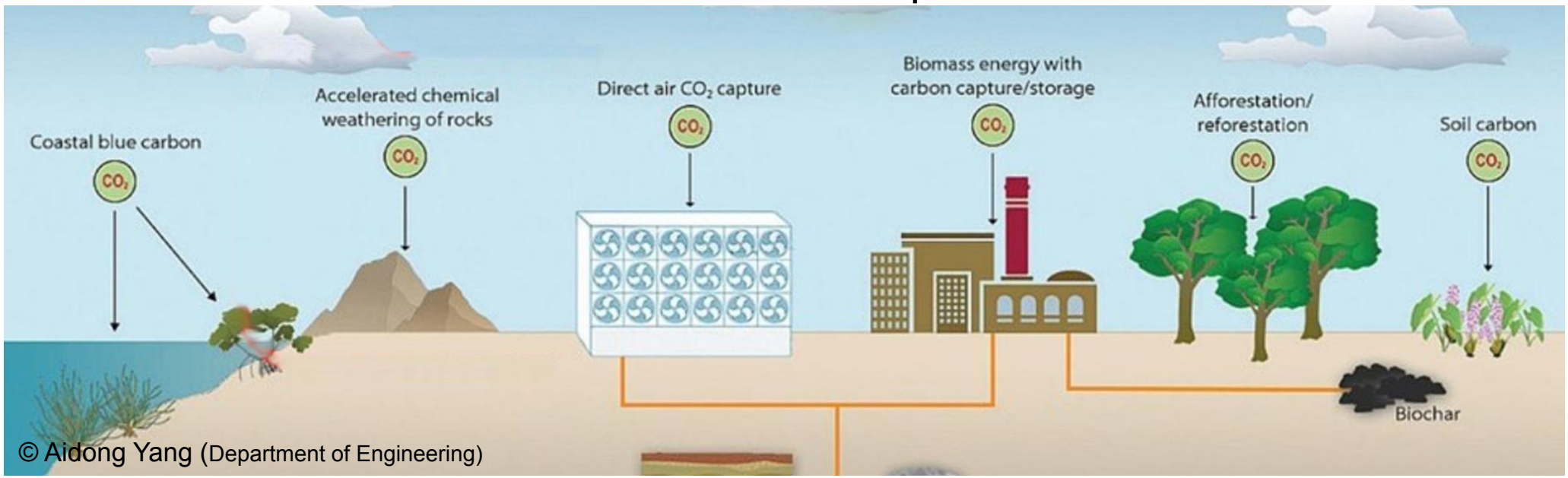
Portfolio of Carbon Dioxide Removal techniques



CDRterra

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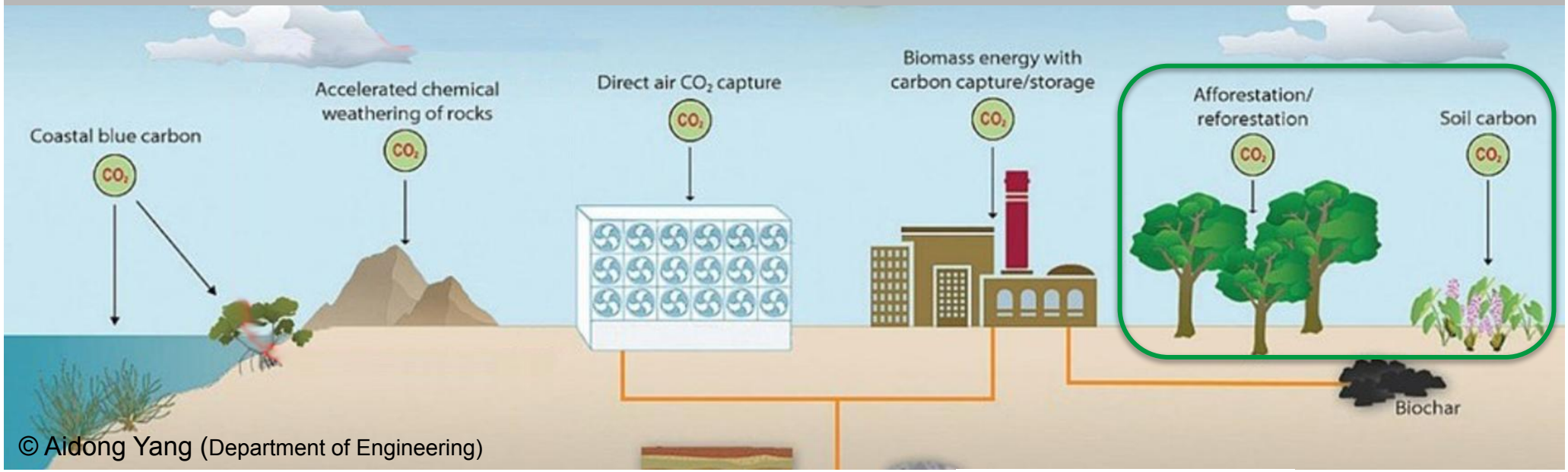
Portfolio of Carbon Dioxide Removal techniques



© Aidong Yang (Department of Engineering)

Motivation

To keep **global warming** below **2°C**, **carbon dioxide removal** (**CDR**) **methods** are applied in all shared socio-economic pathway (SSP) scenarios!

Afforestation/ Reforestation

Bioenergy with carbon capture

Forest management

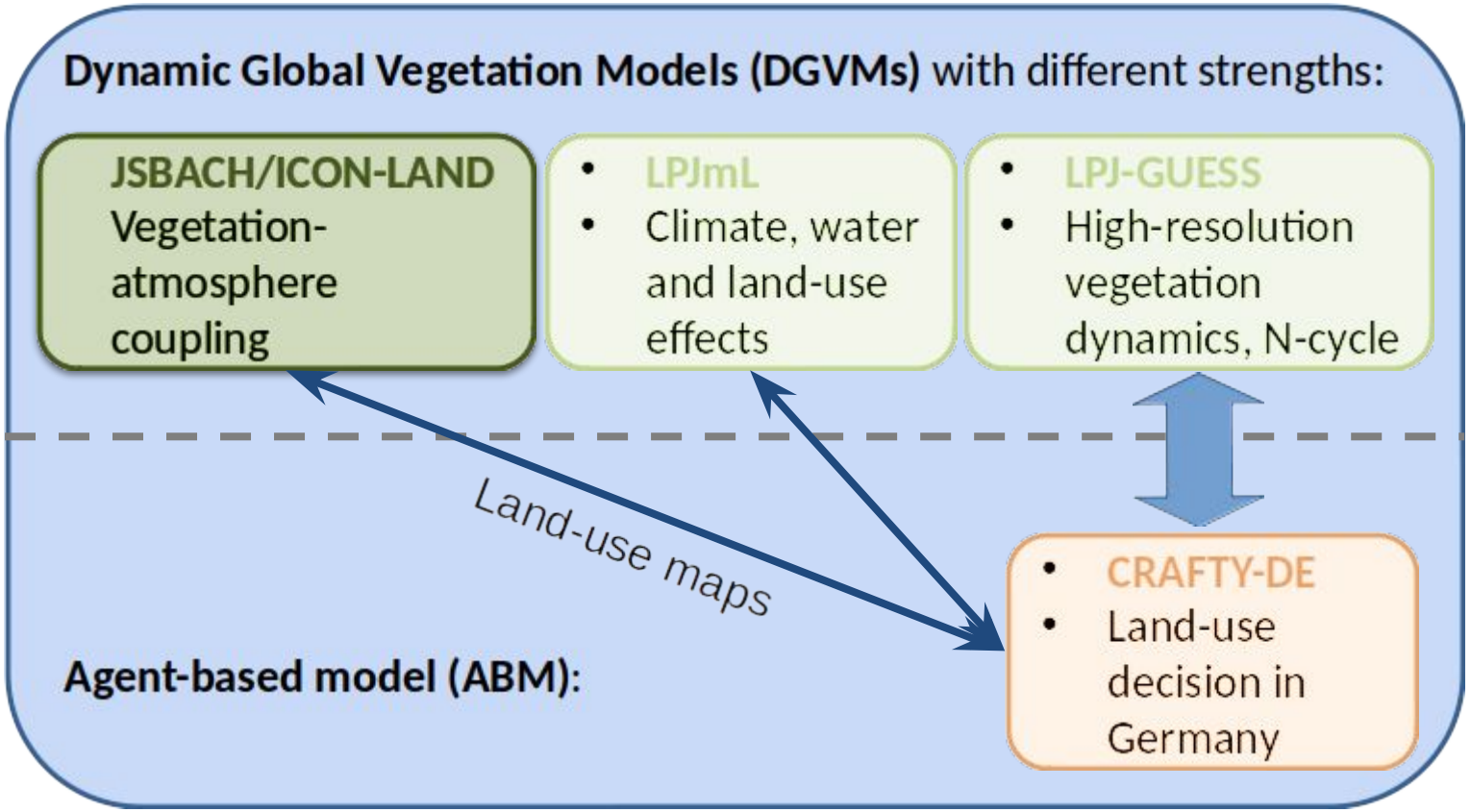
what is the potential of terrestrial CDR?

what is socially acceptable?

Methods

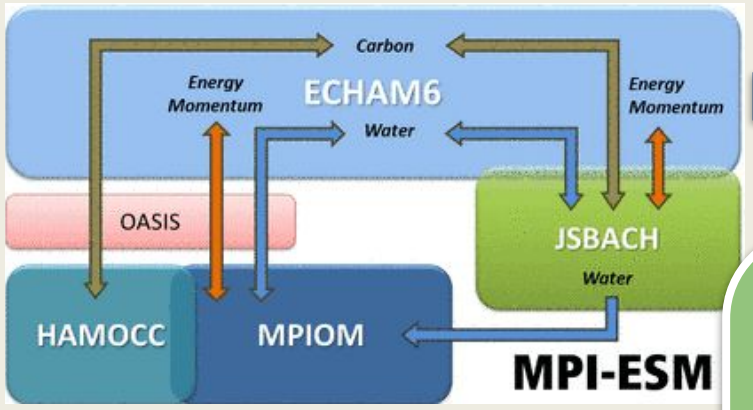
Global exploratory scenarios

National scenarios



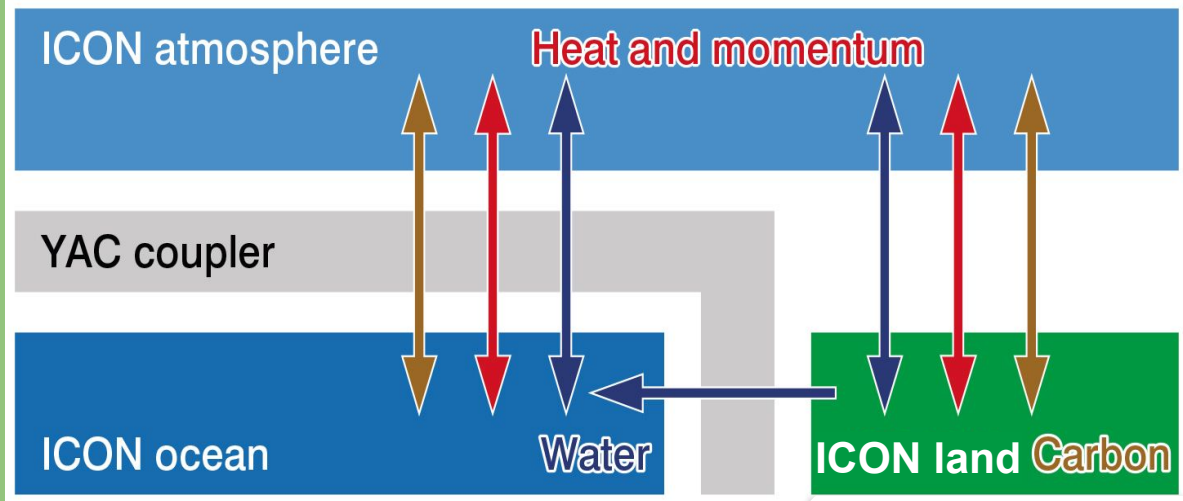
- **based on normative visions,** national/EU targets, ethical aspects
- Integration of **socio-ecological indicators** to feasibility framework

Earth System Models (ESMs)



- **coupled** atmosphere, ocean, and land surface through the exchange of energy, momentum, water, and carbon dioxide
- **components**
  - ECHAM6 (atmosphere)
  - MPIOM (ocean)
  - JSBACH (terrestrial biosphere)
  - HAMOCC (ocean biogeochemistry)

JSBACH as the land component of both MPI-ESM and ICON-ESM



ICON-ESM

- **coupled** fluxes of energy, momentum, water, and carbon dioxide at surface
- **components**
  - ICON-A (atmosphere)
  - ICON-O (ocean)
  - ICON-L (land)

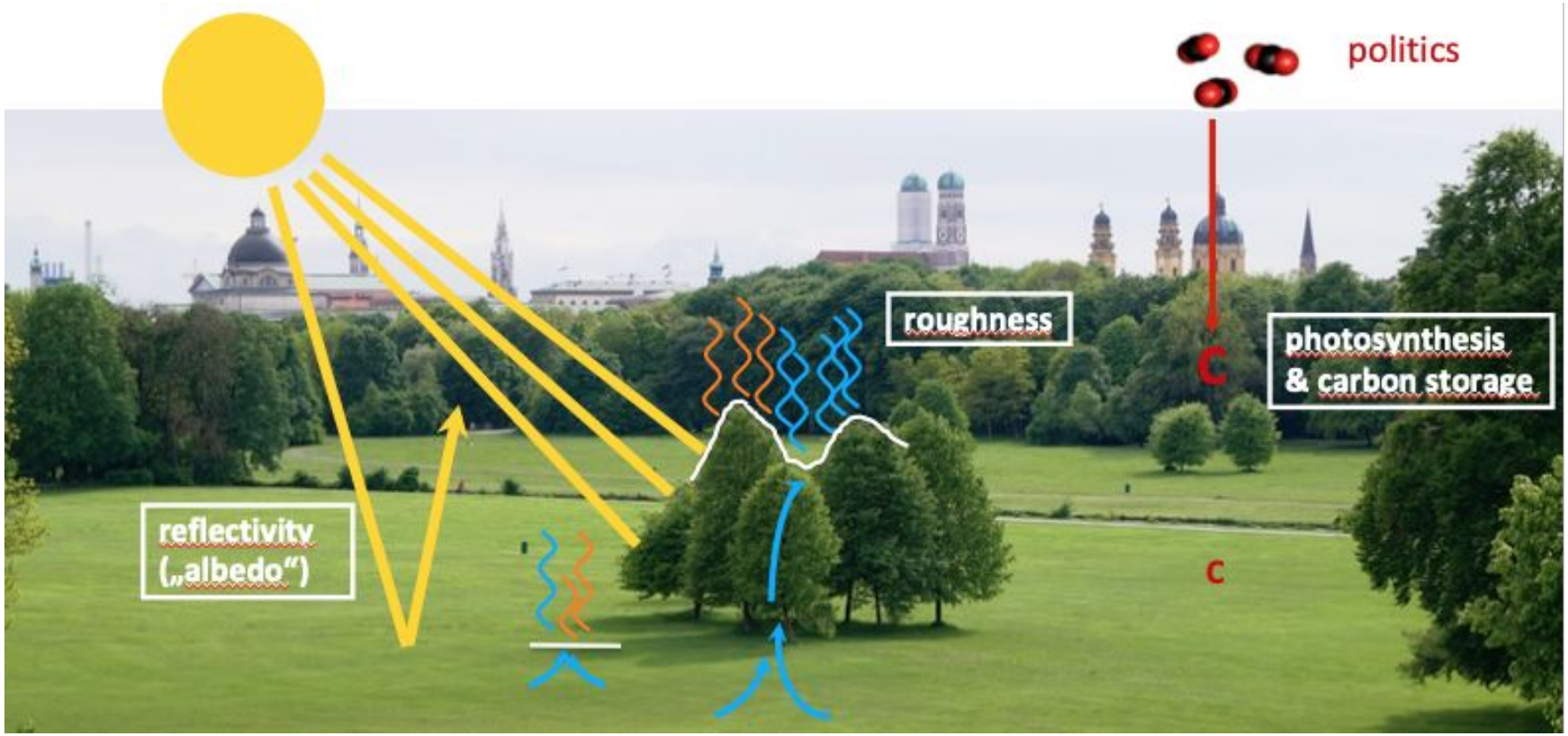
- TERRA
- **JSBACH4**
- QUINCY
- …

adapted from MPI Meteorology

Land Models in ESMs

Biogeophysical effects
→ albedo
→ evapotranspiration
→ vegetation roughness length

Biogeochemical effects
→ vegetation carbon
→ soil carbon



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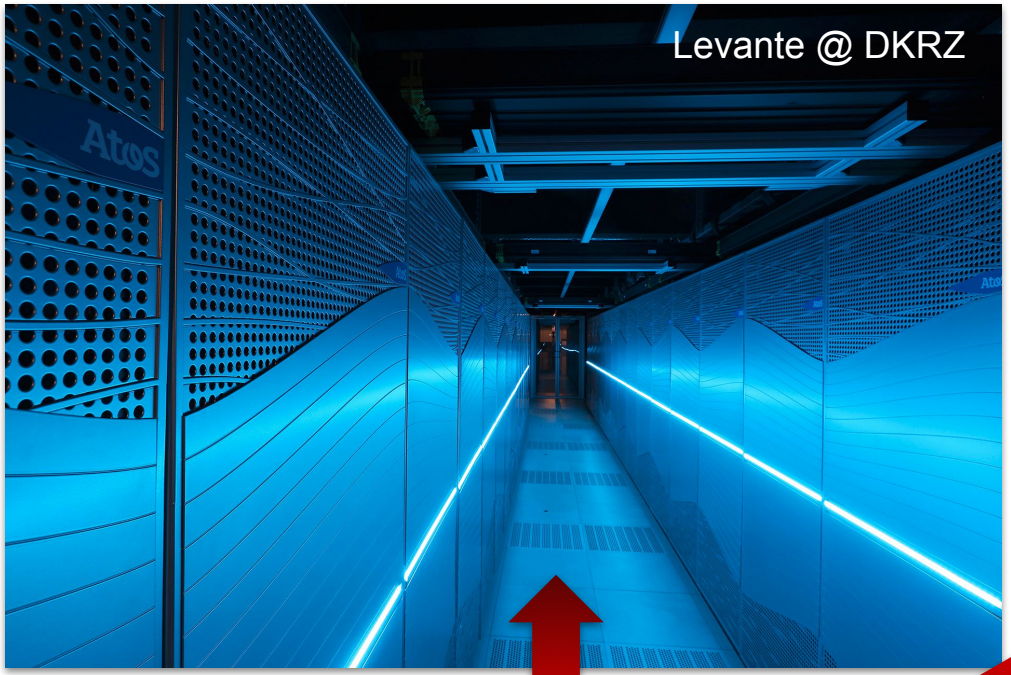
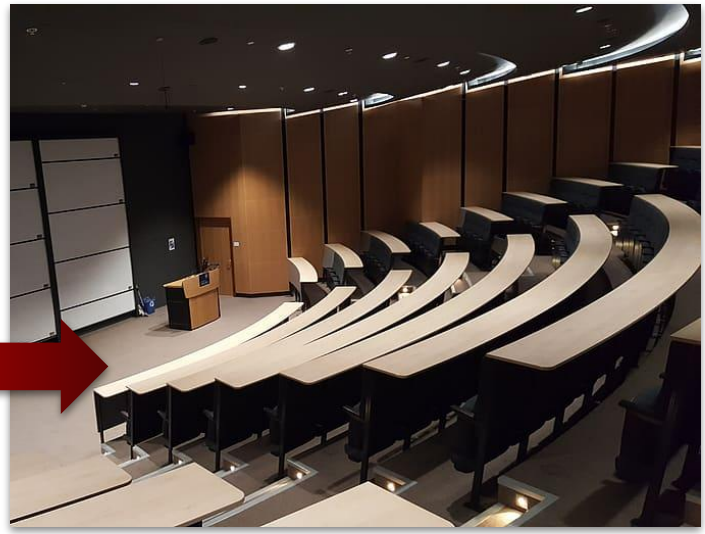
Welcome to my world…

STEPSEC



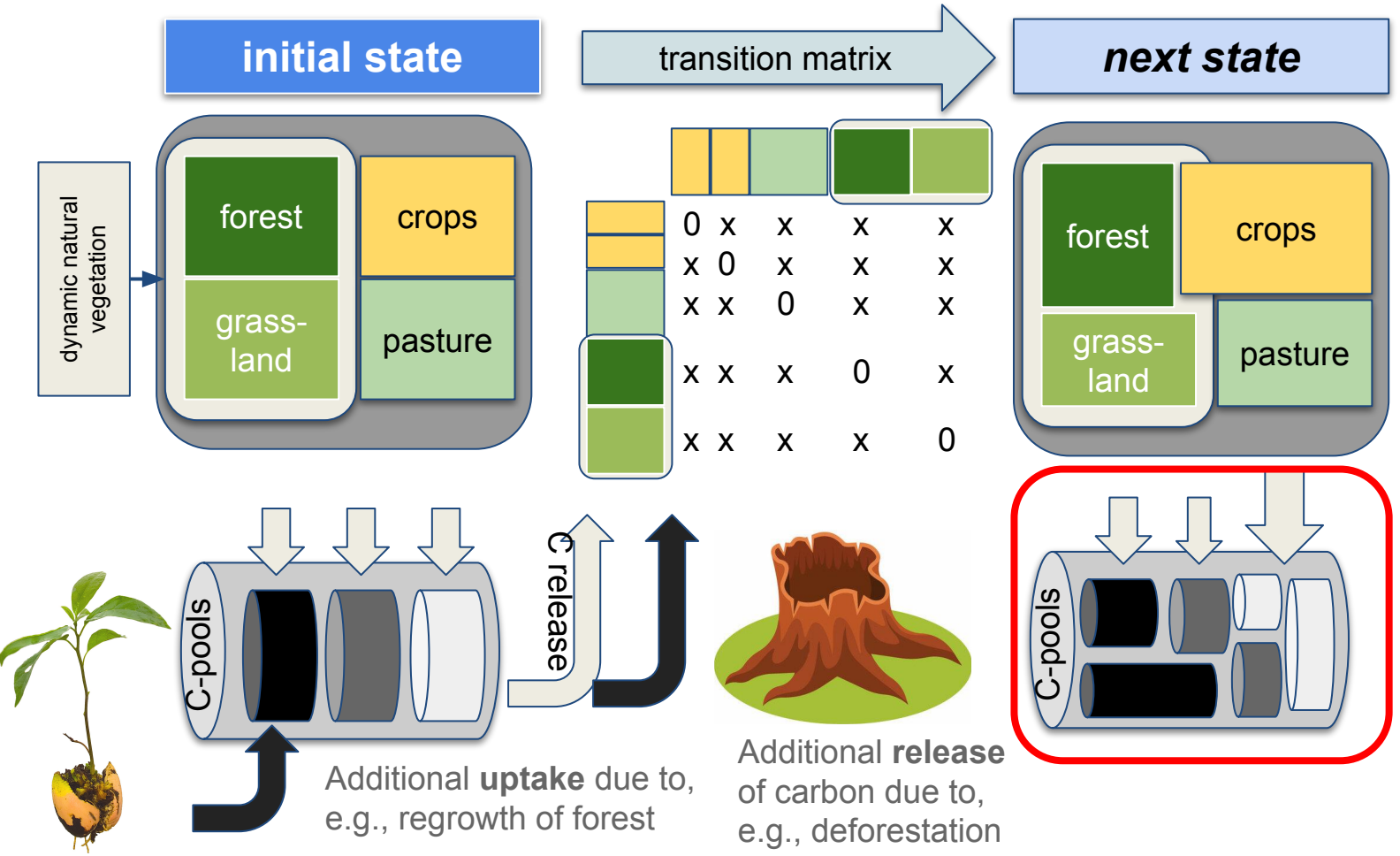


Model Development

Land use transition scheme

JSBACH3

JSBACH4



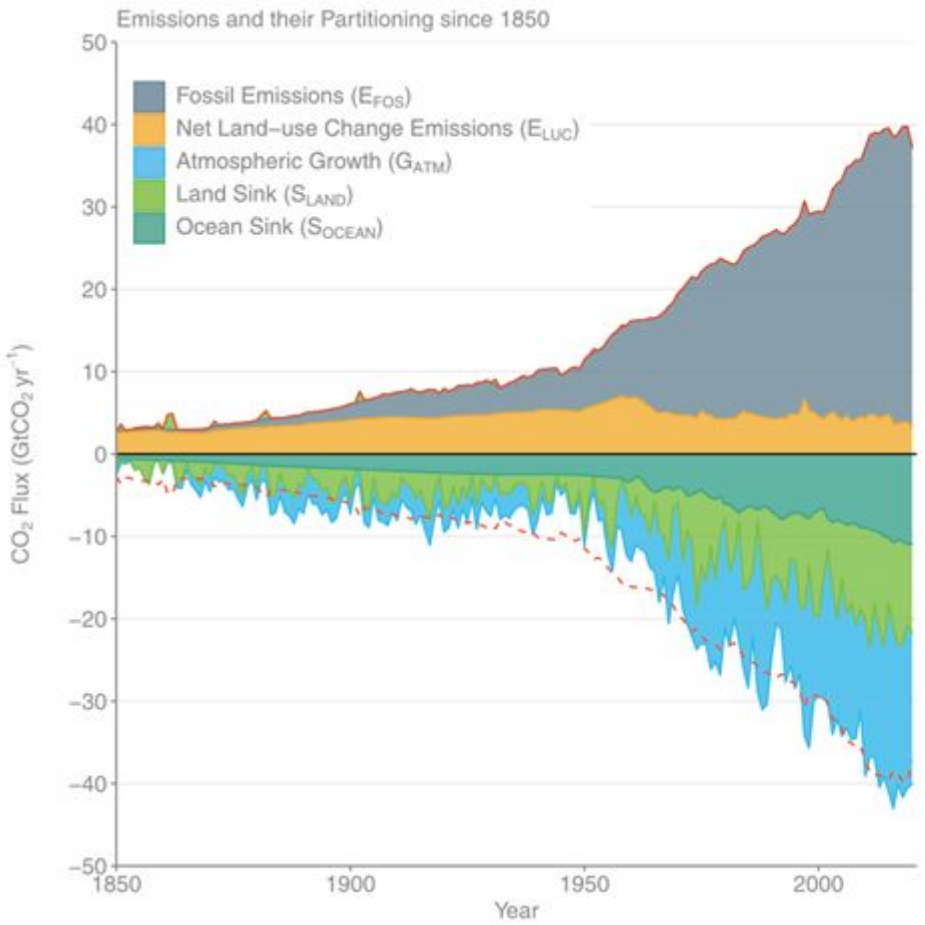
planned developments

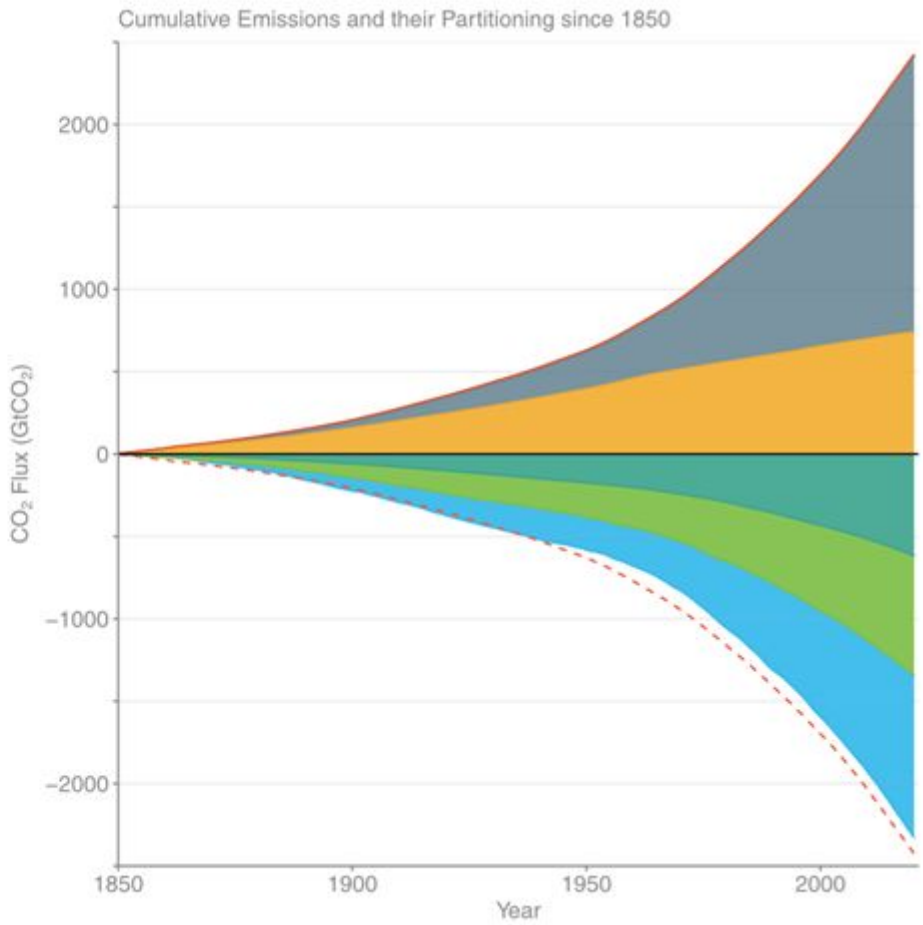
Additional land use classes

Additional product pools

Global Carbon Budget

Contributing to accounting carbon sources and sinks with JSBACH3 simulations





Will we be able to **save the world**?

As emission reduction is mainly going the right way but by far not sufficient,
CDR may soon become the only option left.

But no nation can do it on its own!

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