



Utrecht University

**Faculty of Law, Economics and Governance**

Utrecht University School of Law

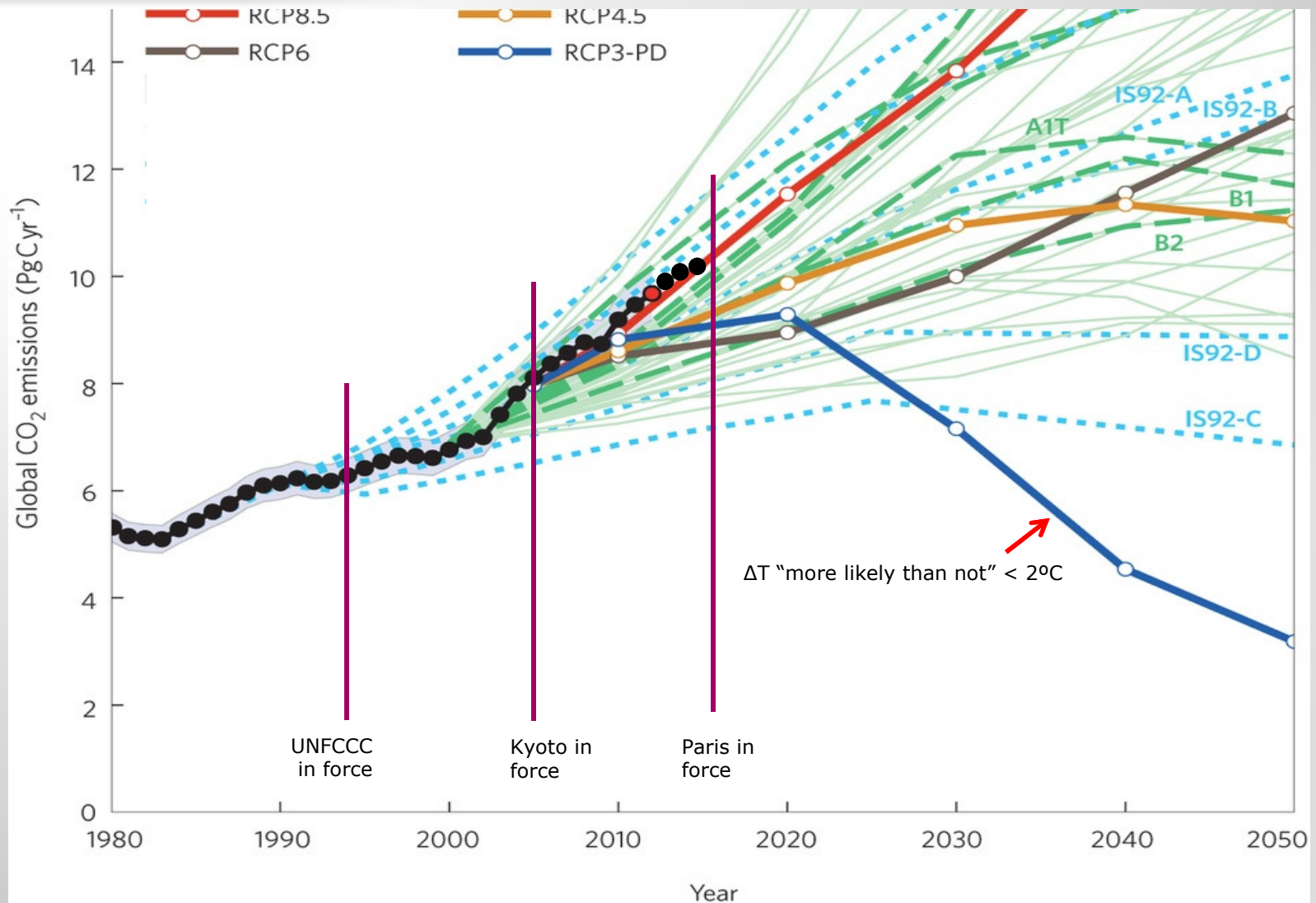
Utrecht Centre for Water, Oceans and Sustainability Law

# Climate engineering

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## Responses to climate change

- **Reduce emissions**
- **Adapt society**

- **Interventions in earth systems:**
  - Remove carbon dioxide?
  - Counterbalance warming?

**Not enough?**

**“climate engineering”  
or “geoengineering”**

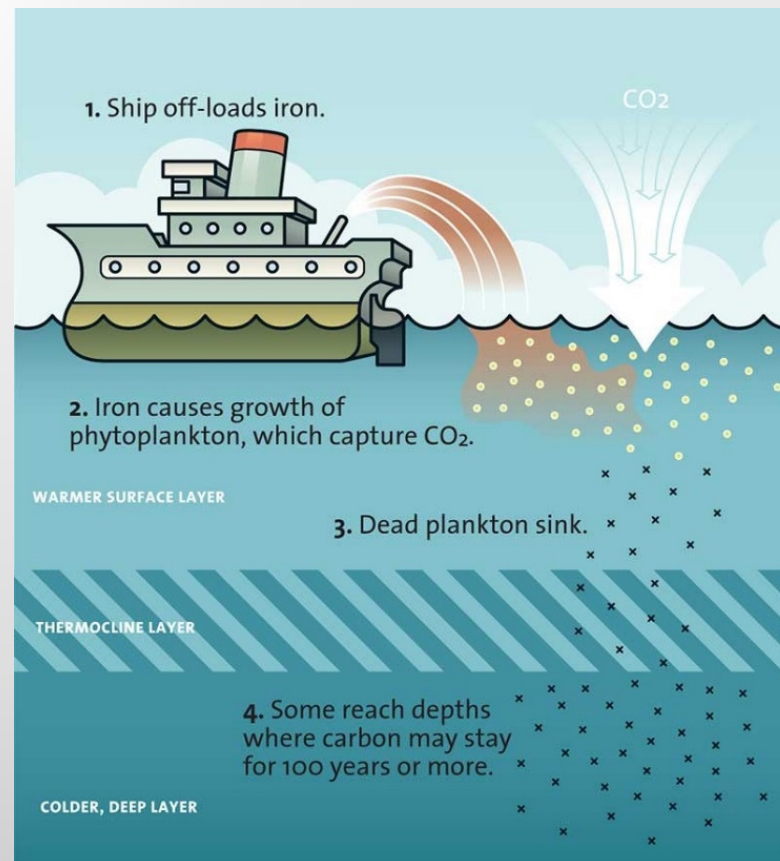
## Climate engineering

- Large scale, intentional interventions in natural systems to reduce climate change
- *Complement, not substitute for, emissions reductions!*
- Some methods appear to be effective and feasible
- Interest is increasing
- Controversial
- Two distinct types...

## Type 1: Negative emissions technologies (NETs)

- Remove carbon dioxide
- Long term need
- Slow (years to decades)
- Presently expensive (hundreds USD / ton C)
- Addresses climate change closer to the cause
- Relatively lower risks
- Already in climate scenarios
- Oceans

## NETs Example 1: Ocean fertilization



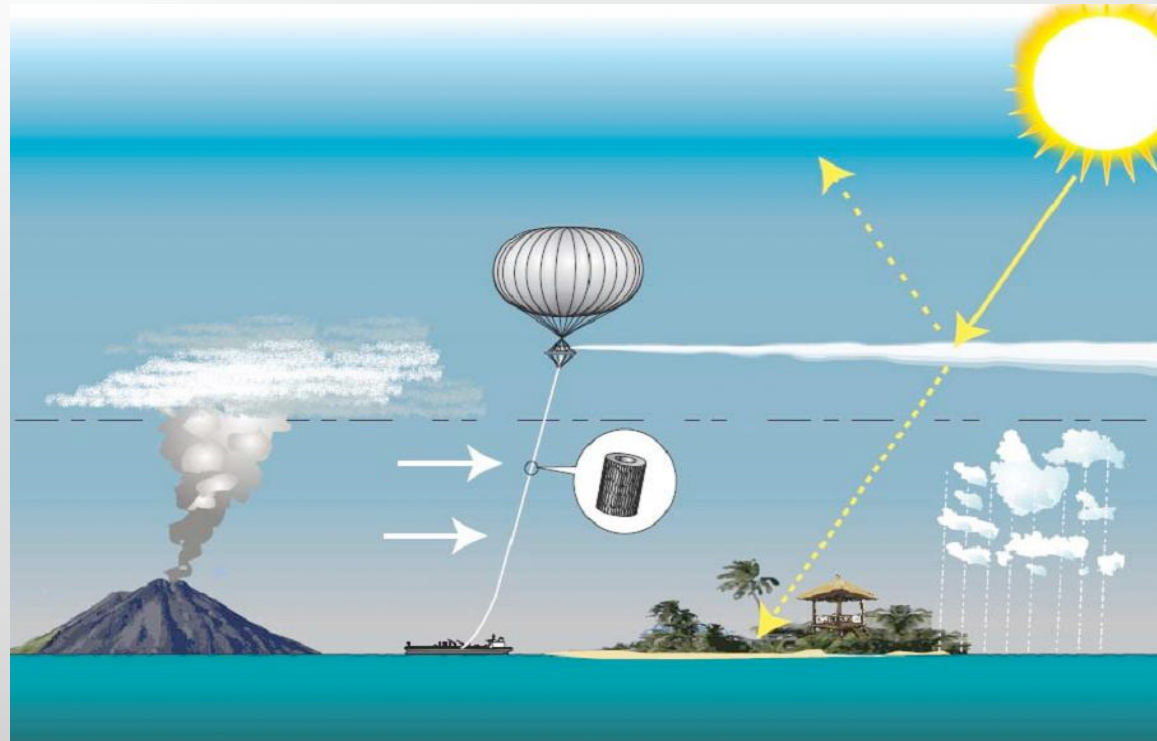
## NETs Example 2: Ambient air capture



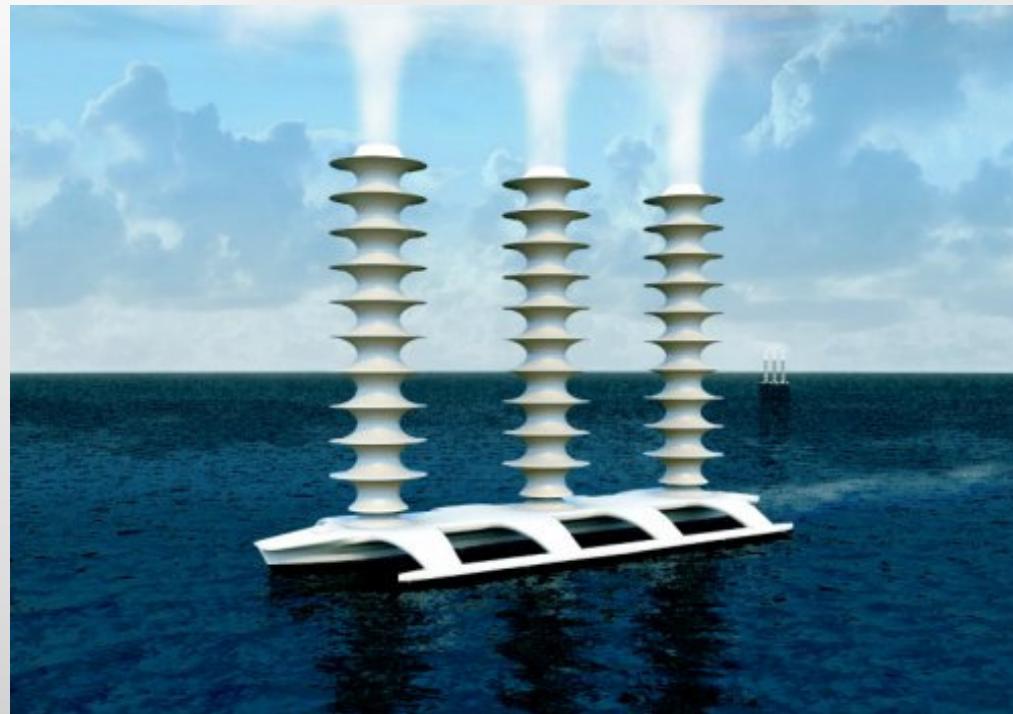
## Type 2: Solar climate engineering (SCE)

- Block or reflect incoming sunlight ( $\sim 2\%$  for  $2x \text{CO}_2$ )
- Short term need?
- Fast (months?)
- Inexpensive (tens B USD / year ?)
- Reversible *direct climatic* effects
- Treats only symptoms
- Relatively higher risks

## SCE Example 1: Stratospheric aerosol injection



## SCE Example 2: Marine cloud brightening



## Risks and concerns at three stages

- Discussion / lab work:
  - Undermining efforts toward emissions reductions
- Field research:
  - Slippery slope to deployment
  - (transboundary) risks to environment and human health (e.g., changes in precipitation in SCE)
- Deployment:
  - Decision making (SCE)
  - Disagreement among states (SCE)
  - Termination (SCE)
  - Ethics

## My research

- How is CE presently governed? How could it be? How should it be?
- How could principles of (international environmental) law guide the development of CE governance?
- What can we learn from analogous past phenomena?
- Would CE R&D hinder emissions reductions? If so, would this be undesirable? If so, what can we do about it?
- How could liability be structured to incentivize responsible research?
- Could innovative arrangements for intellectual property incentivize responsible research and avoid pitfalls?
- What is the purpose of environmental governance?