

# Geoengineering 1: Solar Radiation Management

EES 3310/5310

Global Climate Change

Jonathan Gilligan

Class #36: Wednesday, Nov. 14 2018



# Geoengineering

# Scope of Problem

- After 10,000 years:
  - High-level nuclear waste: about 0.03% of excess radioactivity remains
  - CO<sub>2</sub>: about 25% remains in atmosphere (for release of 4,000–5,000 GTC)
- Consequences uncertain
  - Possible catastrophic consequences lasting thousands of years
  - Experts think “business as usual” has high probability (>50%) of tipping point to disaster
- Eliminating fossil fuels quickly looks very challenging, expensive

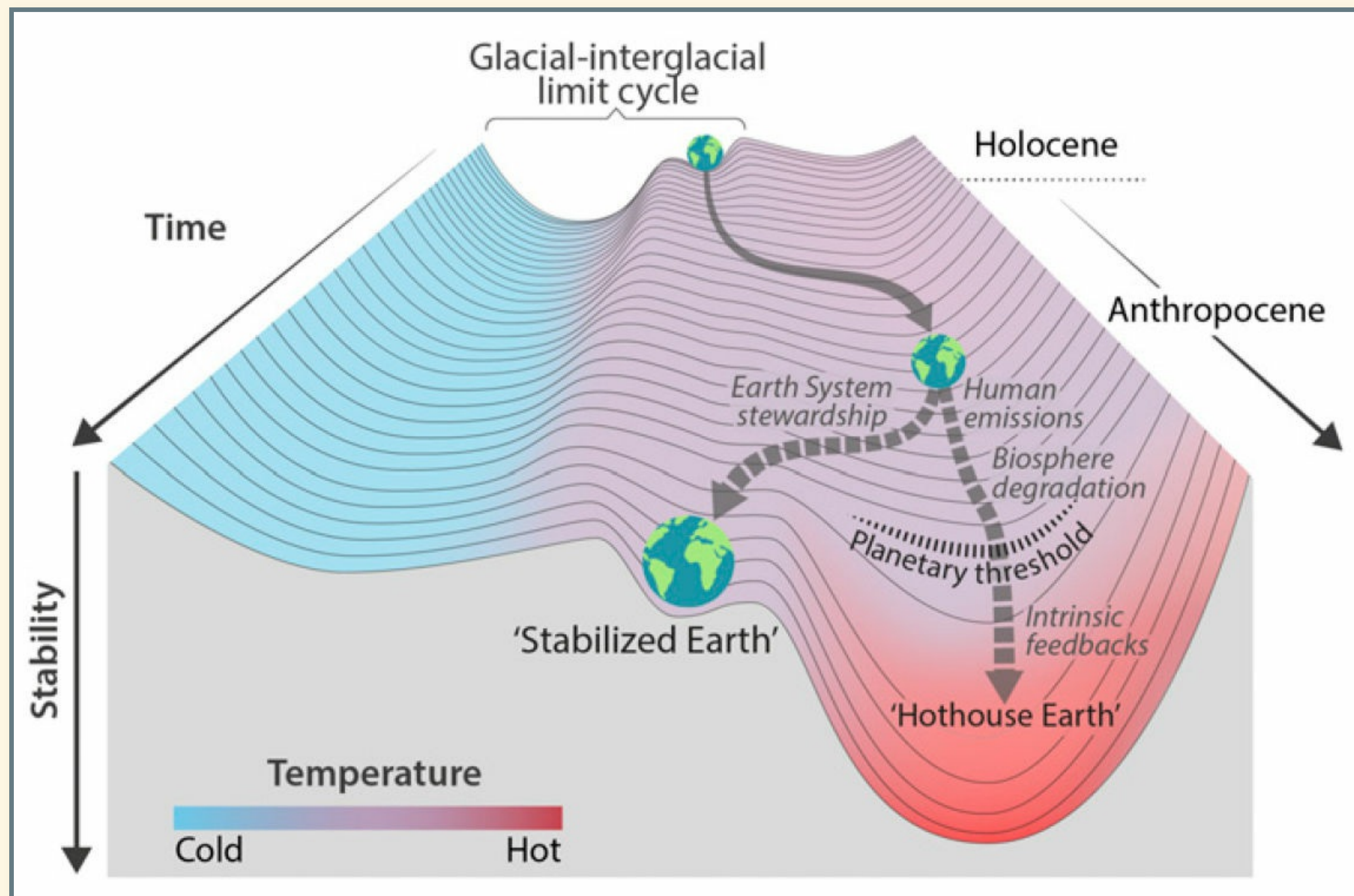
# Comparing imperfect solutions

- Mitigation:
  - Cut emissions
  - Geoengineering
- Adaptation
  - Manageable, unmanageable, and unmanaged systems
- Do nothing

*“We have three options:  
mitigation, adaptation, and suffering.”  
— Prof. Lonnie Thompson*

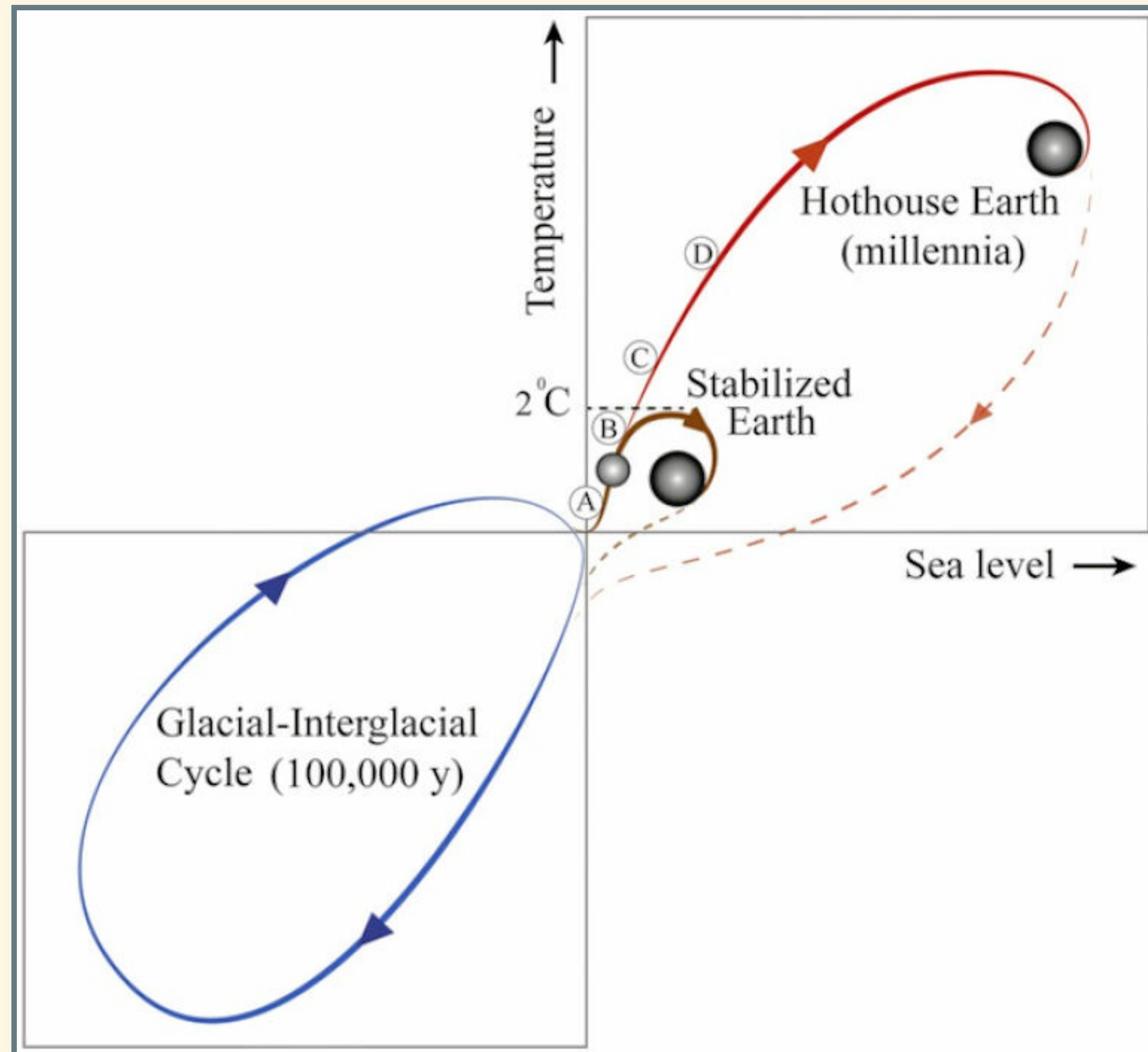
# New Challenges

# Stability of the Climate





# Pathways for Climate System



# Defining Geoengineering



# Defining Geoengineering

- Scale and Intent

# Defining Geoengineering

- Scale and Intent
  - Intent without scale: *ornamental gardening*

# Defining Geoen지니어ing

# Defining Geoengineering

- Scale and Intent

# Defining Geoengineering

- Scale and Intent
  - Intent without scale: *ornamental gardening*

# Defining Geoengineering

- Scale and Intent
  - Intent without scale: *ornamental gardening*
  - Scale without intent: *pollution, global warming*



# Defining Geoengineering

- Scale and Intent
  - Intent without scale: *ornamental gardening*
  - Scale without intent: *pollution, global warming*
  - **Scale with intent: geoengineering**

# Basic Concepts

# Basic Concepts

- Wicked problem

# Basic Concepts

- Wicked problem
- Technological fix

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering



# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix
    - Nordhaus:

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix
    - Nordhaus:
      - Reflecting 2% of sunlight cancels doubling CO<sub>2</sub>

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix
    - Nordhaus:
      - Reflecting 2% of sunlight cancels doubling CO<sub>2</sub>
      - Costs 1-10% as much as reducing emissions

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix
    - Nordhaus:
      - Reflecting 2% of sunlight cancels doubling CO<sub>2</sub>
      - Costs 1-10% as much as reducing emissions
      - “Fire truck” vs. “Fire insurance”

# Basic Concepts

- Wicked problem
- Technological fix
- Geoengineering:
  - Albedo engineering
    - Pielke: Doesn't work as technological fix
    - Nordhaus:
      - Reflecting 2% of sunlight cancels doubling CO<sub>2</sub>
      - Costs 1-10% as much as reducing emissions
      - “Fire truck” vs. “Fire insurance”
      - “Salvage therapy”