

# Overview of Climate Science and Policy

EES 3310/5310

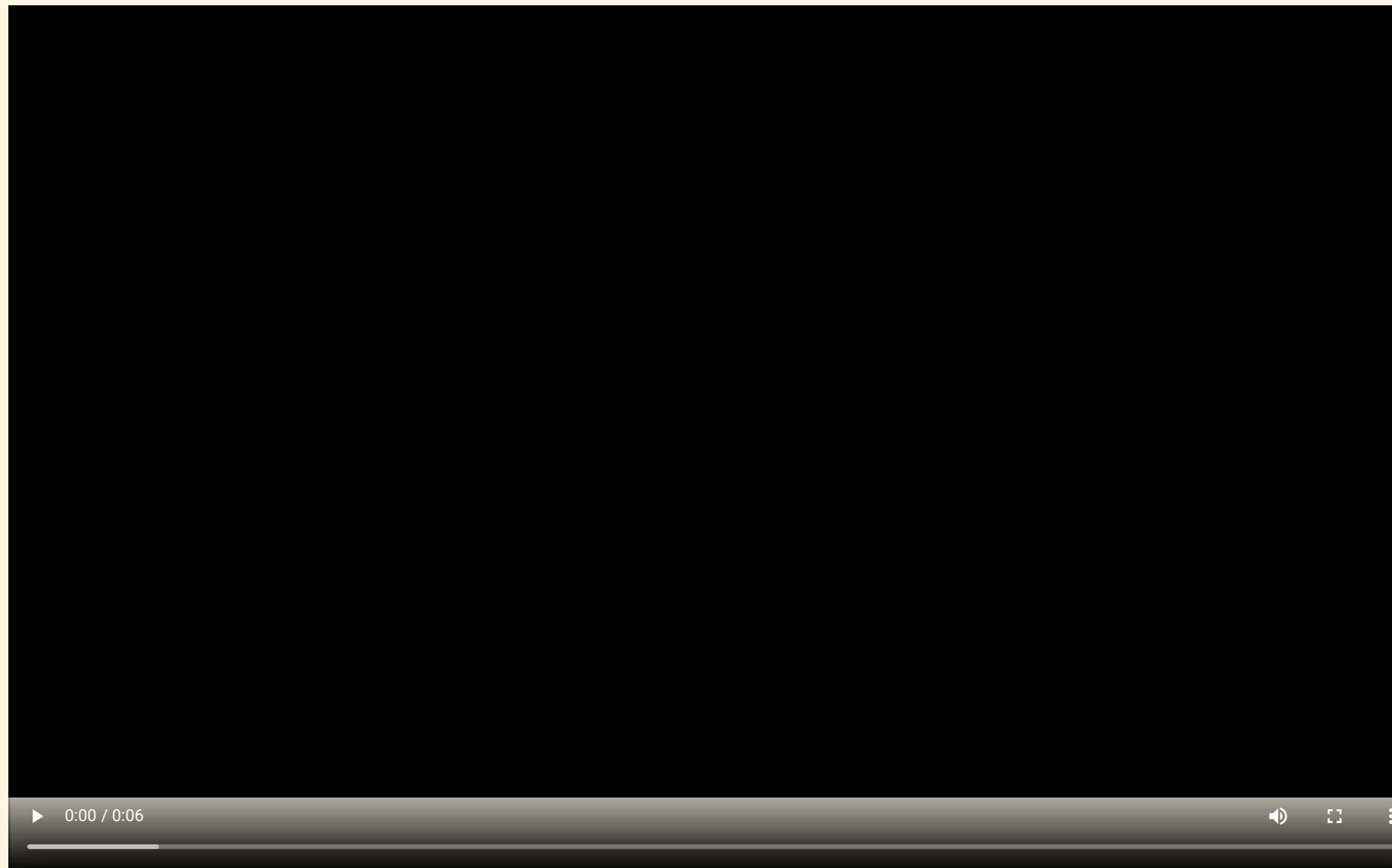
Global Climate Change

Jonathan Gilligan

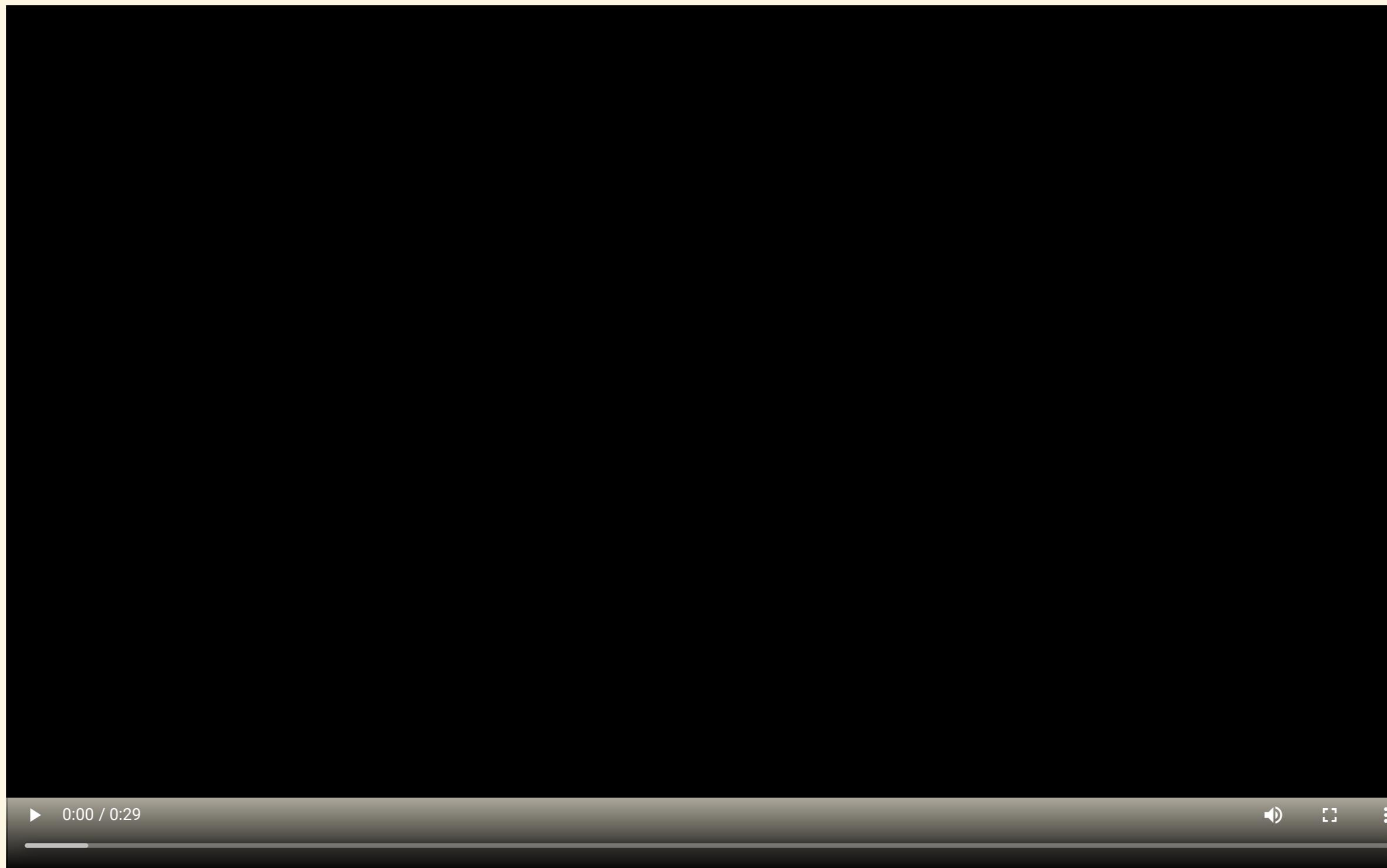
Class #2: Wednesday, January 8 2020

# How Politicians Talk about Climate Change

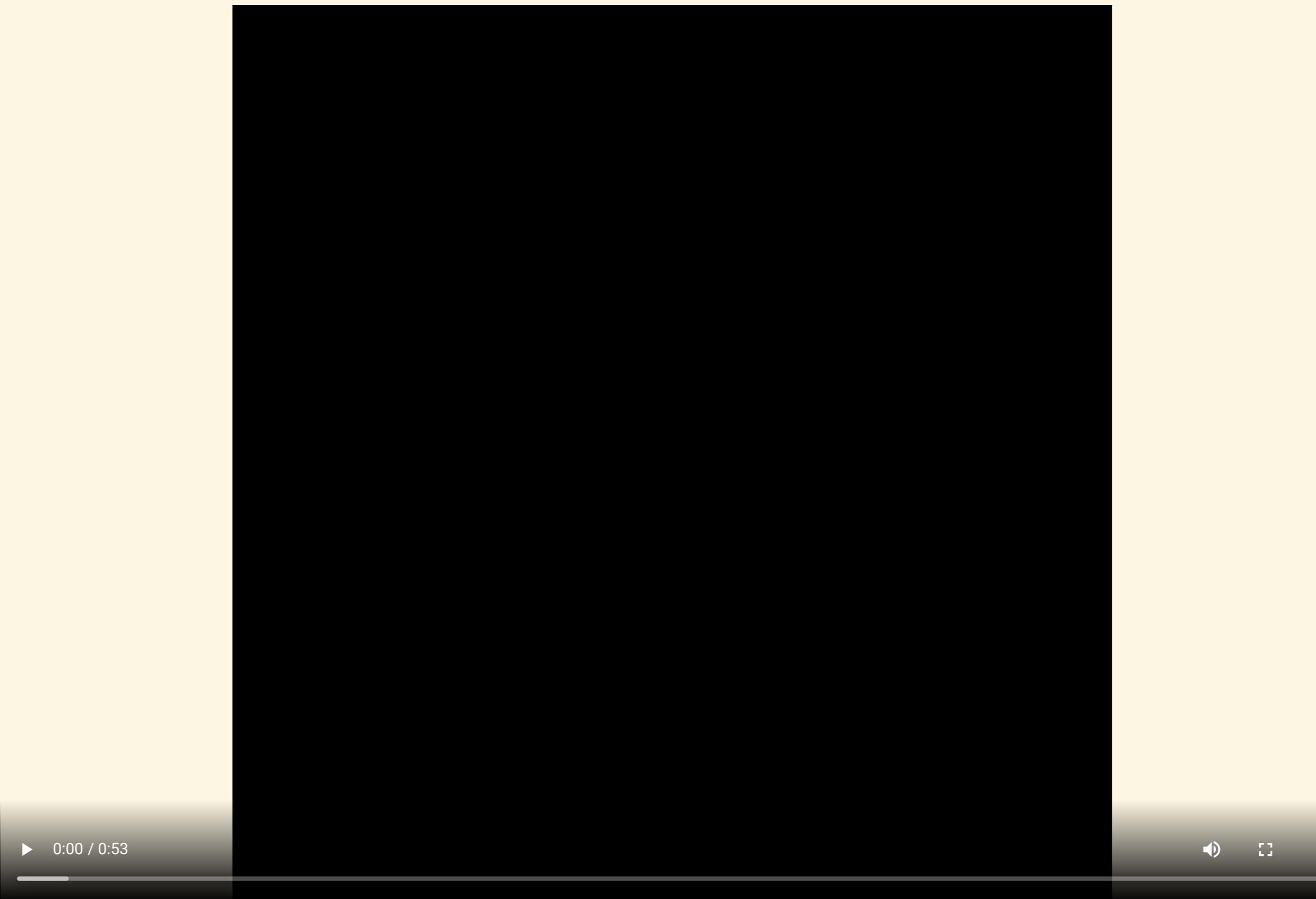
# Stereotype of Democrats



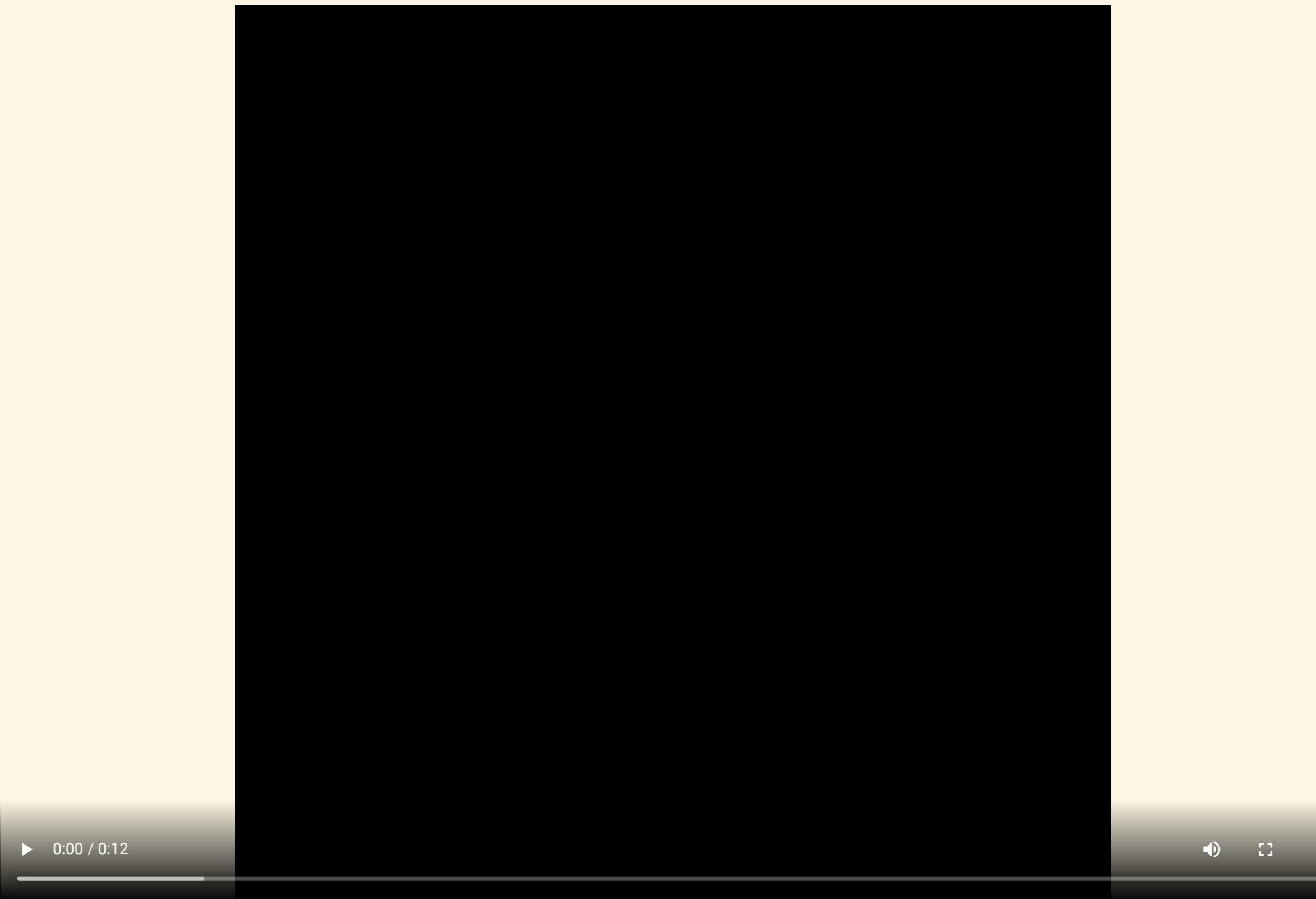
# Stereotype of Republicans



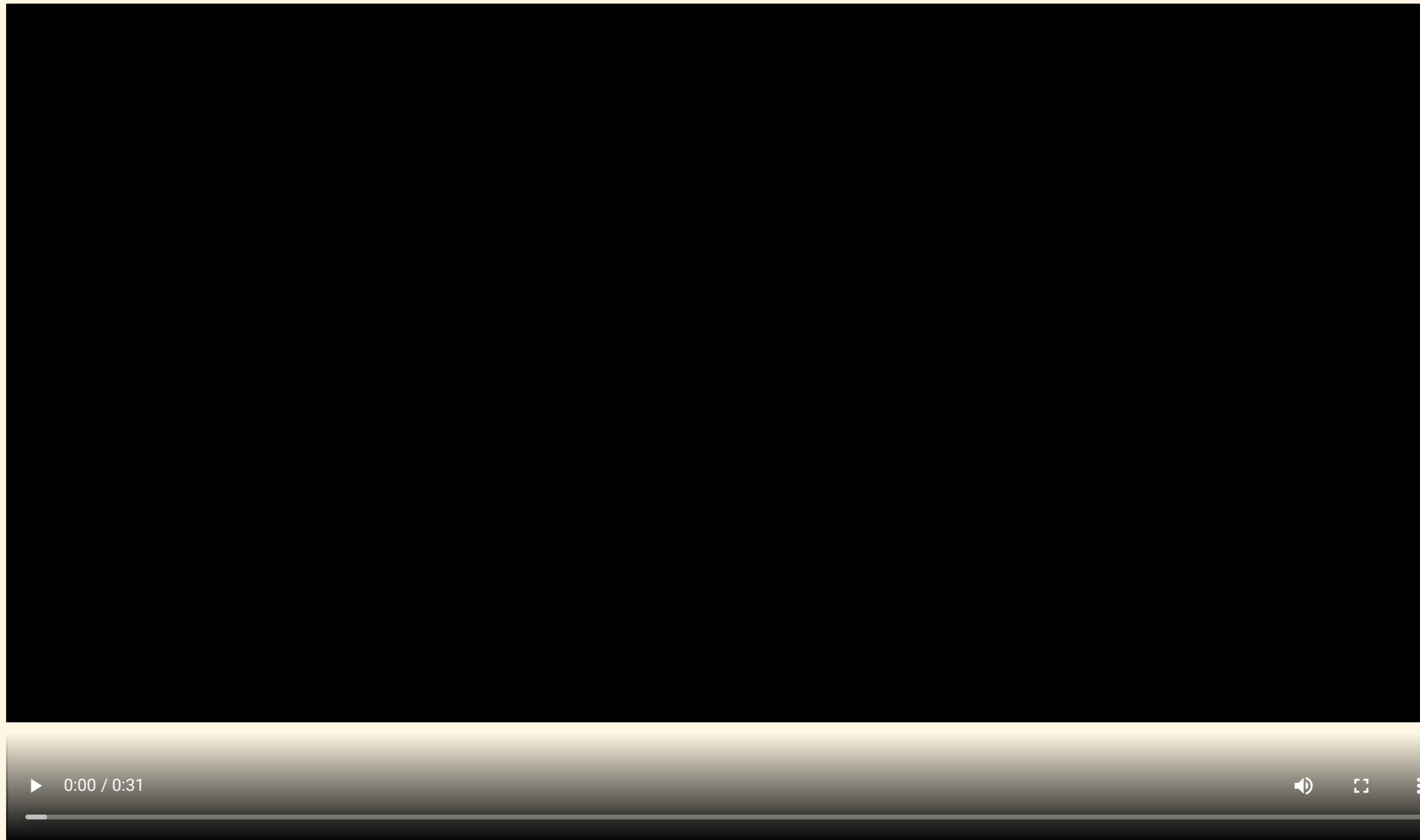
# It Wasn't Always Like This



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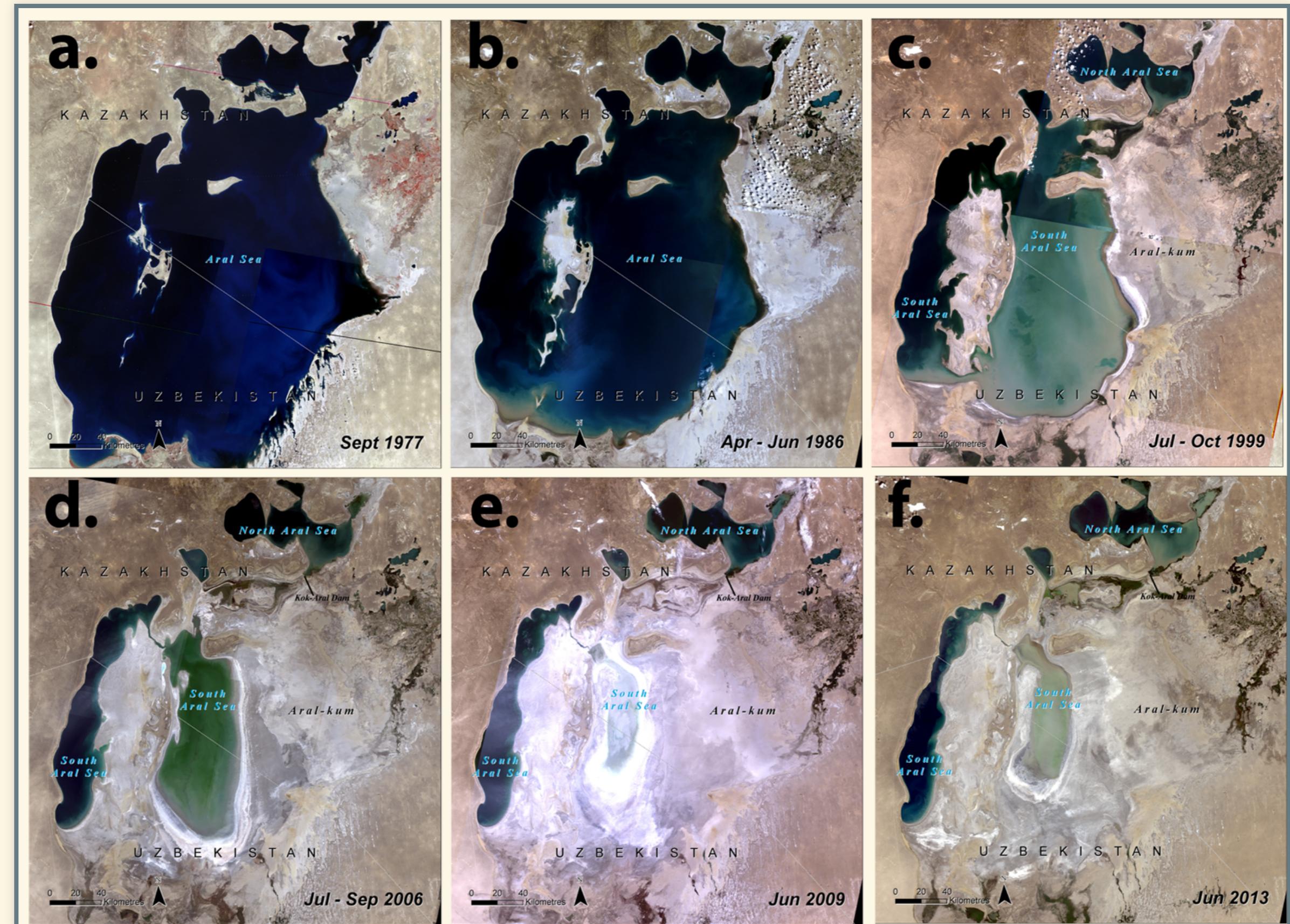


# Recent GOP Climate Activists

- Arthur Laffer (Economic Adviser to President Reagan)
- Bob Inglis (Former Republican Congressman from South Carolina)



# Aral Sea



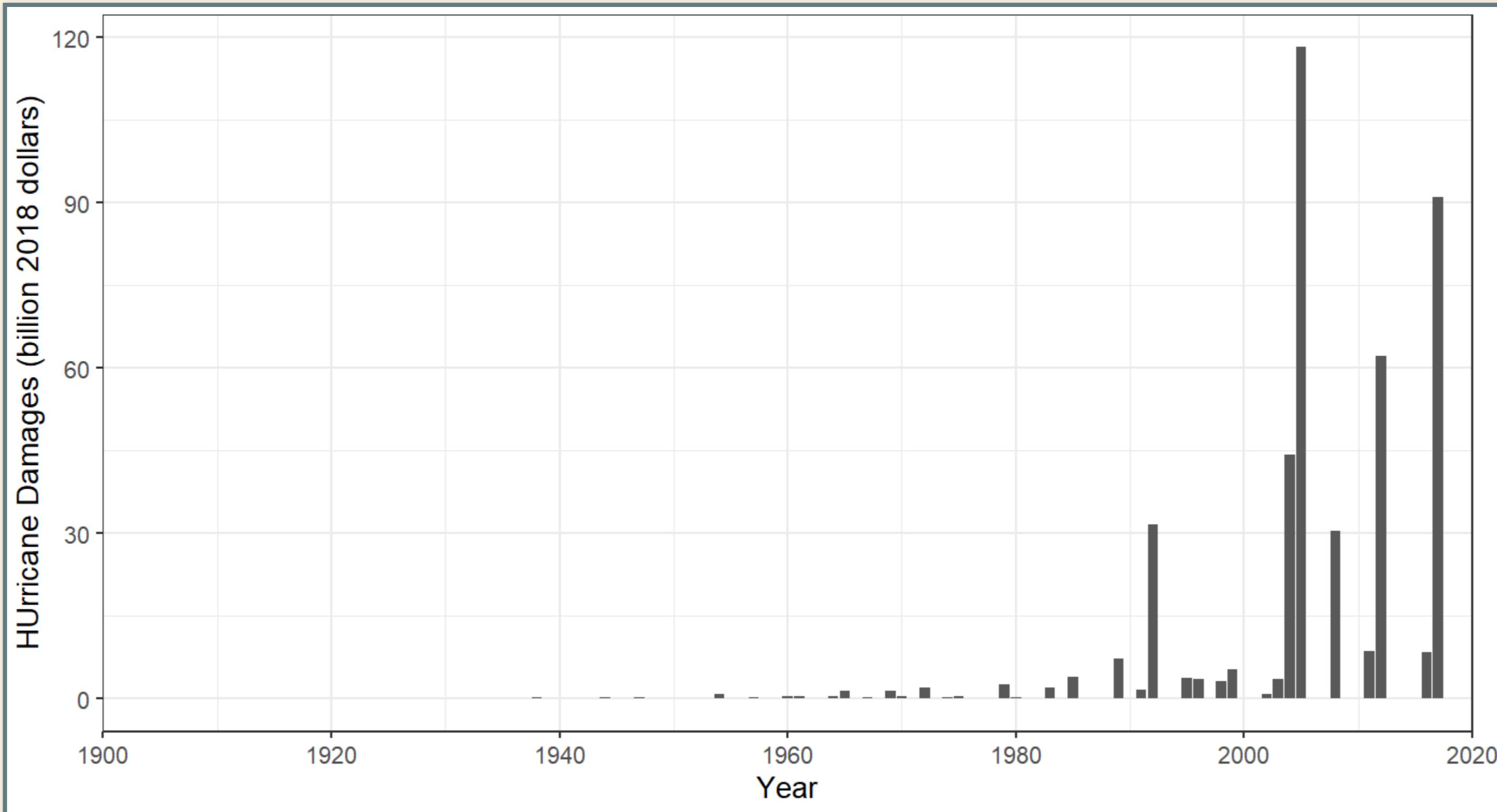
# Questions from Reading?

# Severe Storms and Disasters

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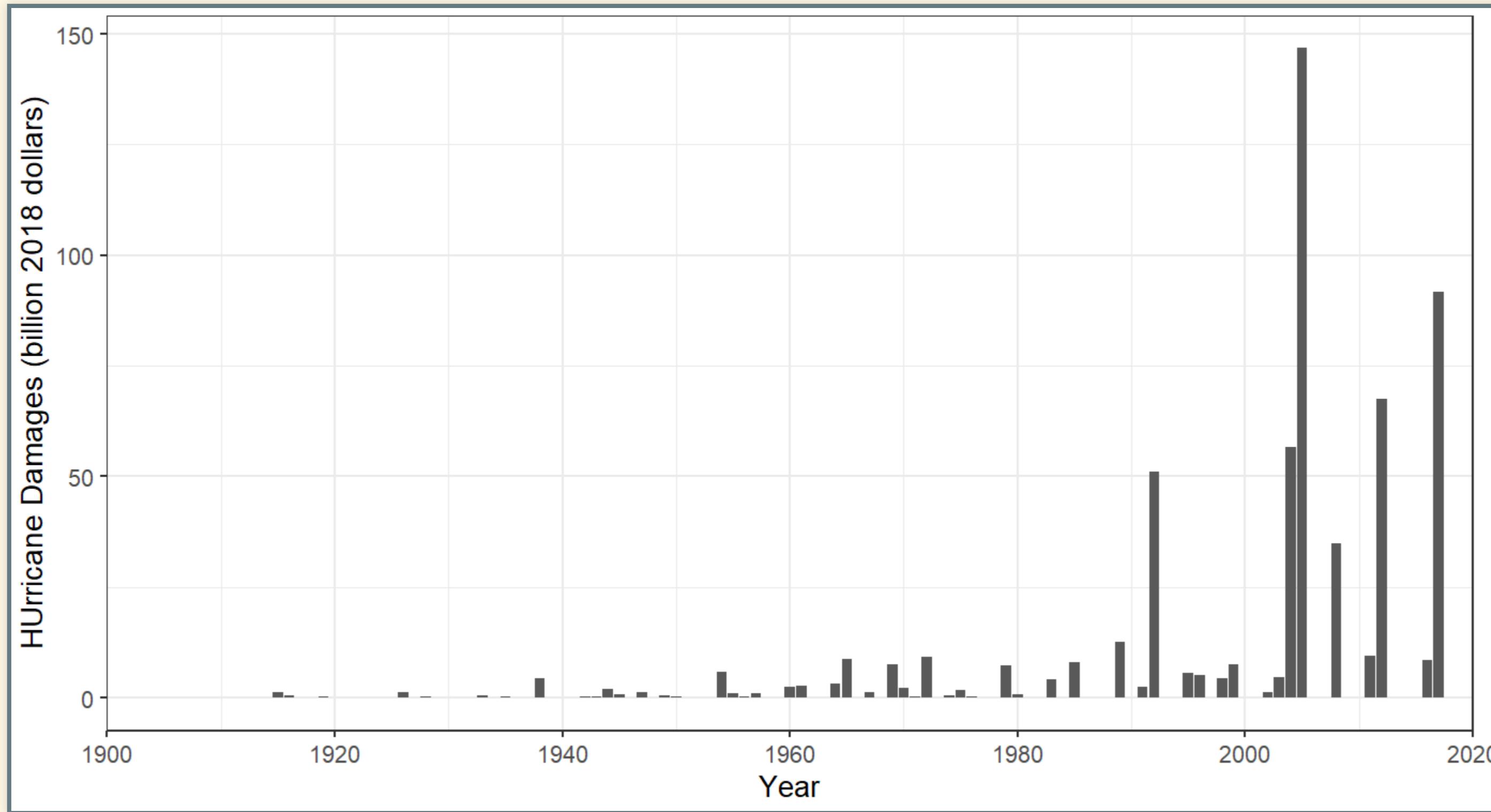
- Are severe storms, such as hurricanes and tornadoes becoming more severe because of climate change?

# Hurricane Damages in the Continental U.S.

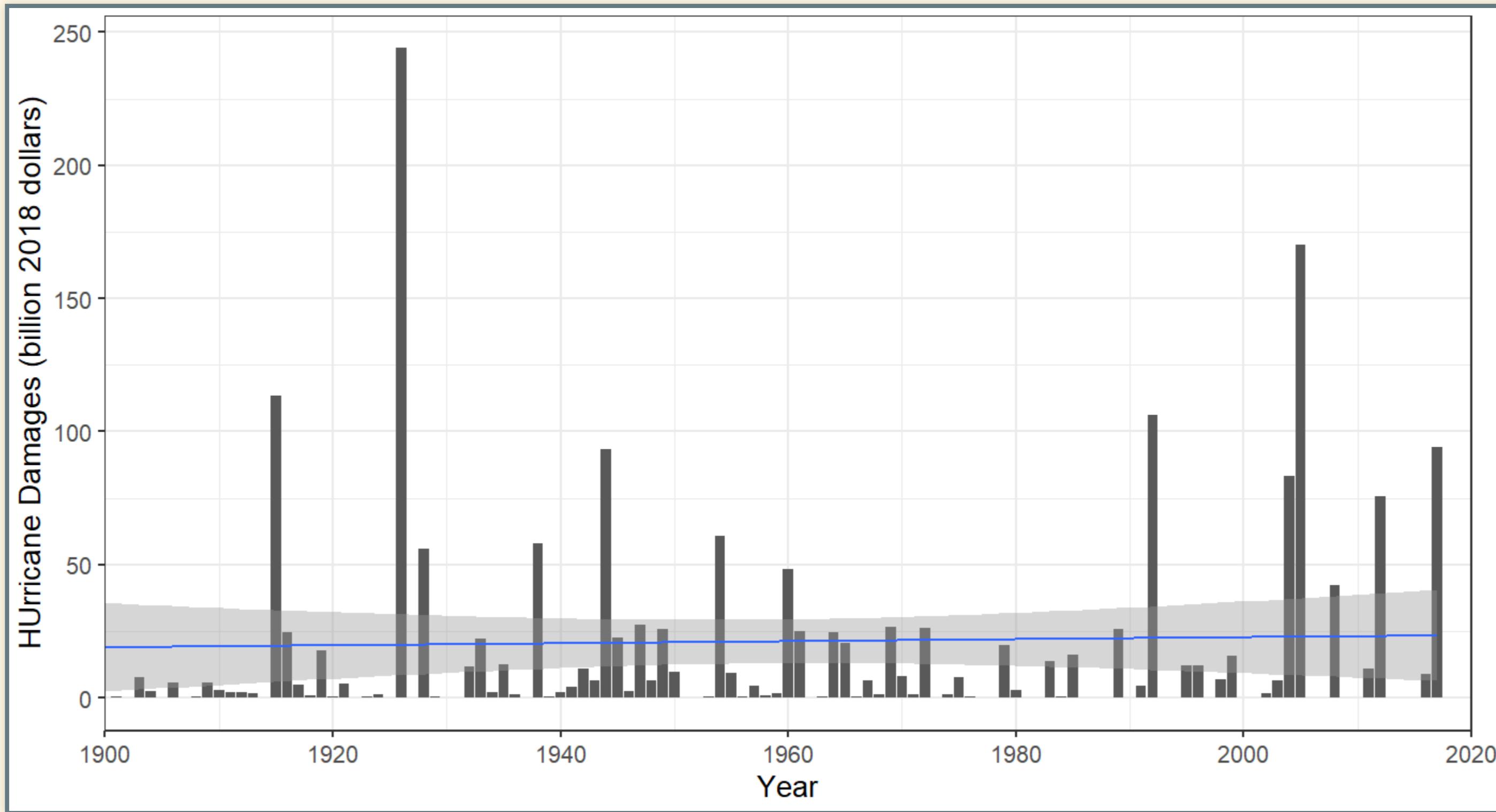


- Correct for inflation

# Hurricane Damages in Constant Dollars

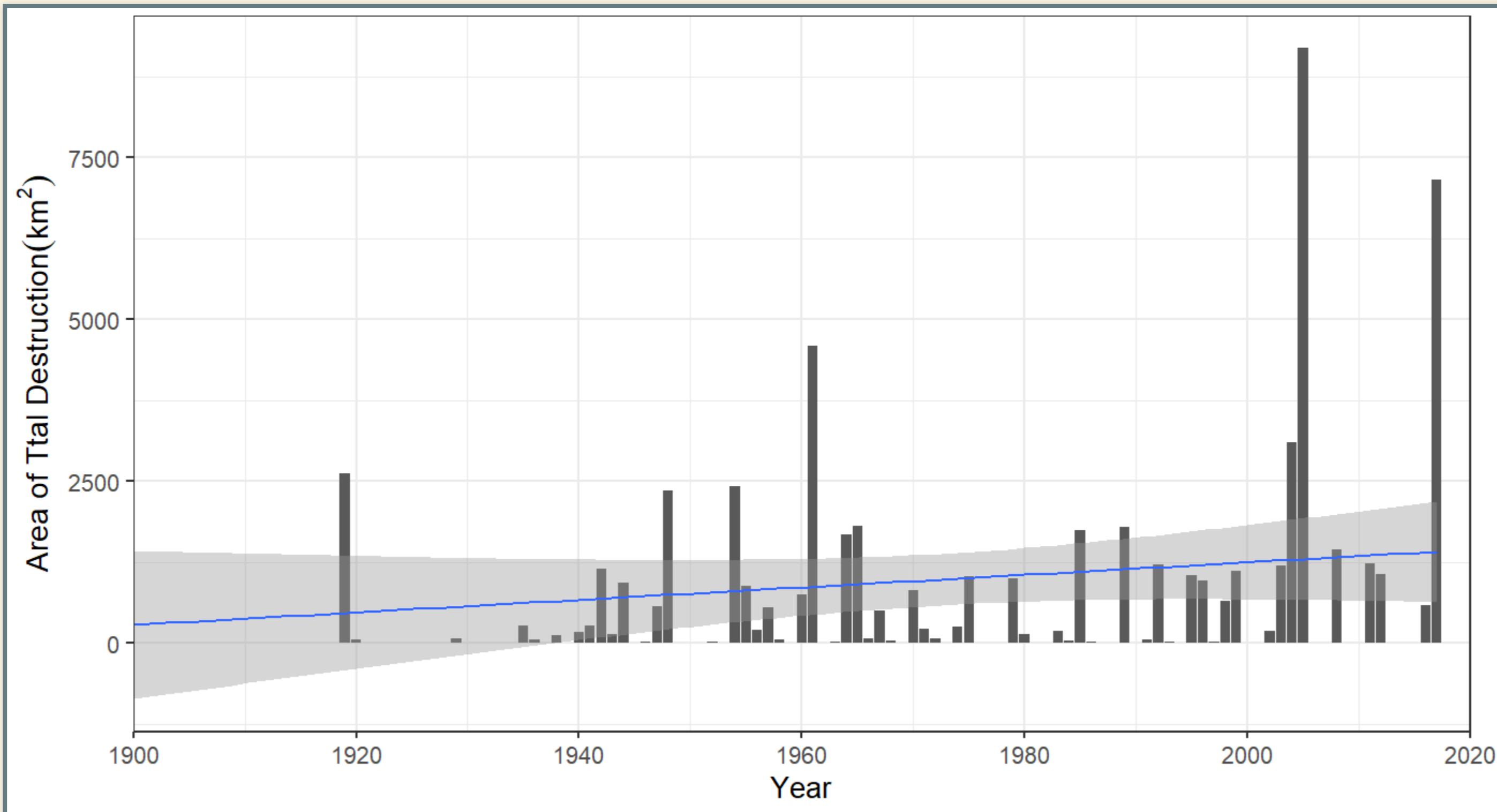


# Normalized Damages



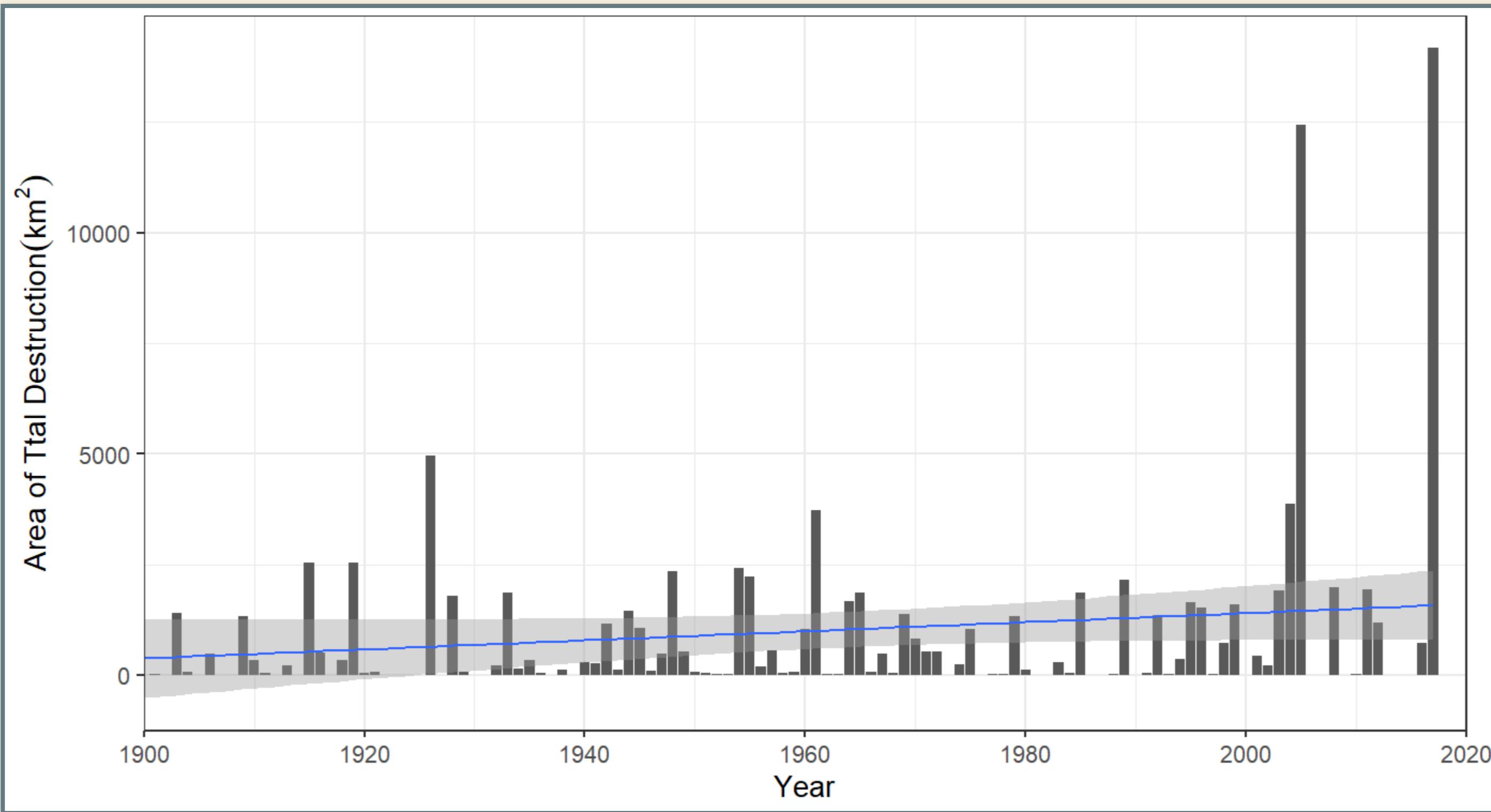
- Account for higher density of valuable property.

# Area of Total Destruction



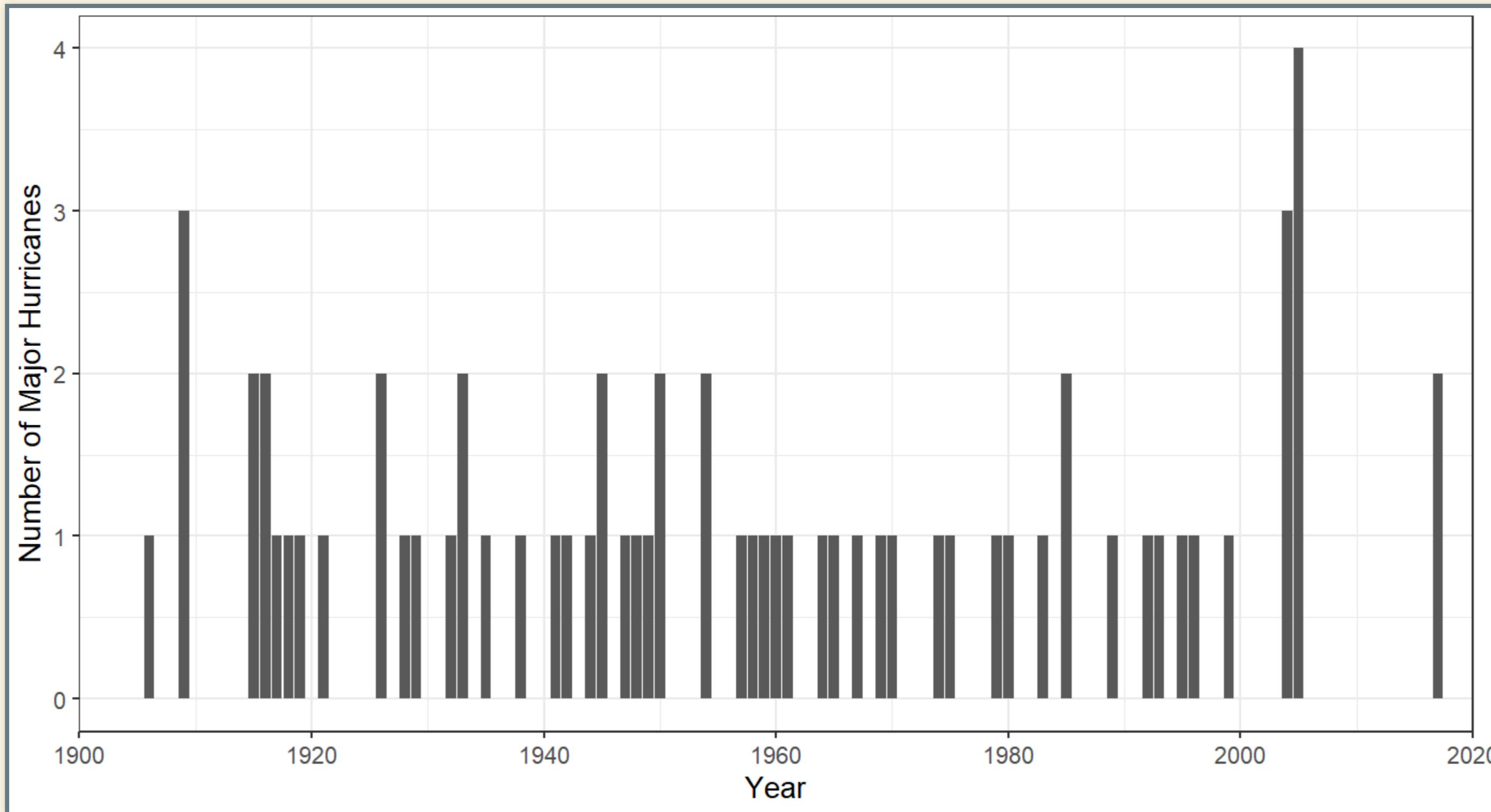
- Normalized damages may under-estimate recent hurricanes by including lots of properties in places that weren't affected by the storm.
- Focus on the size of the area destroyed.

# Area of Total Destruction with Insurance Industry Data



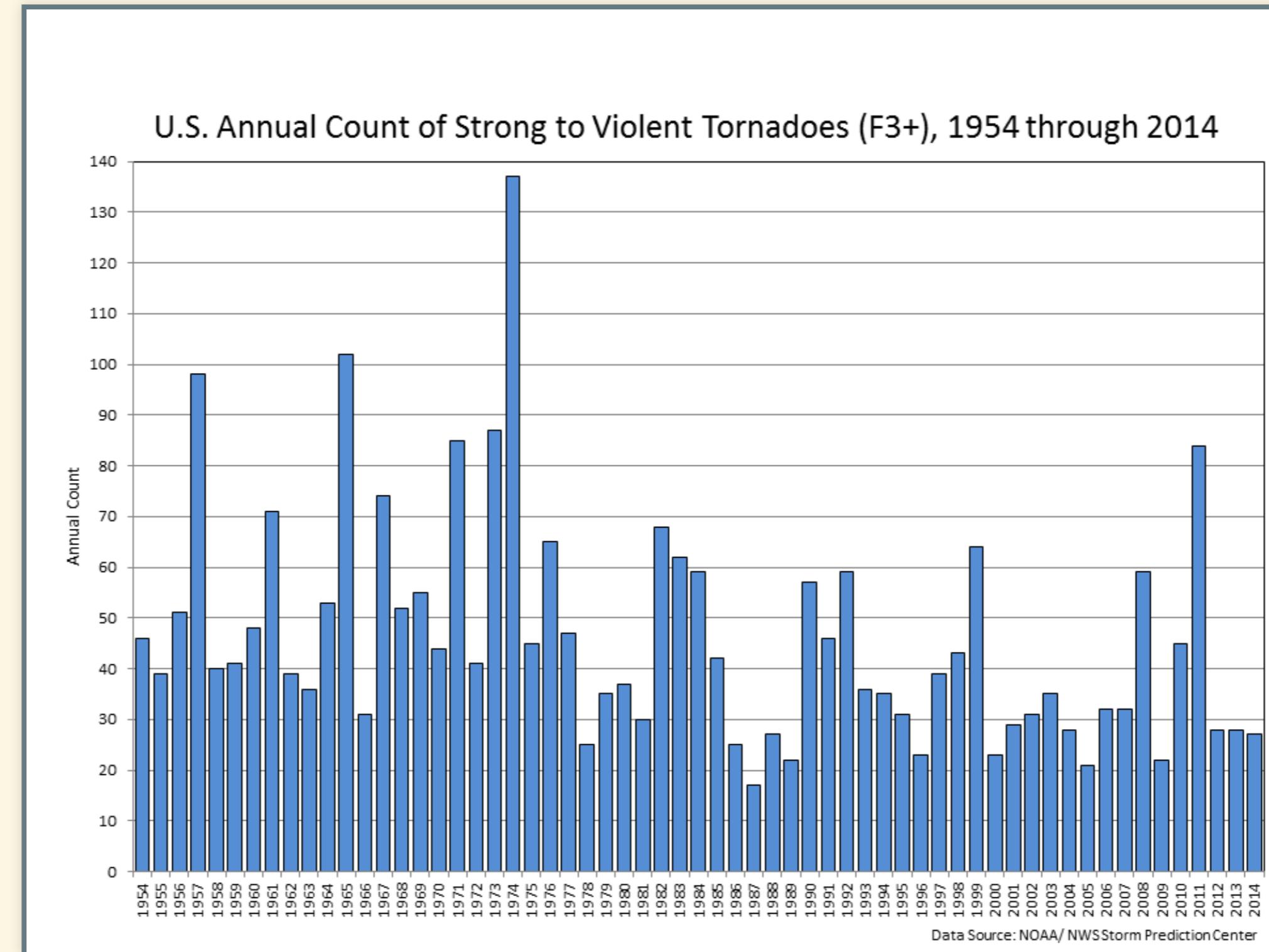
- Use damage & destruction data from International Catastrophe Insurance Managers LLC (ICAT)

# Major Hurricane Landfalls on Continental US



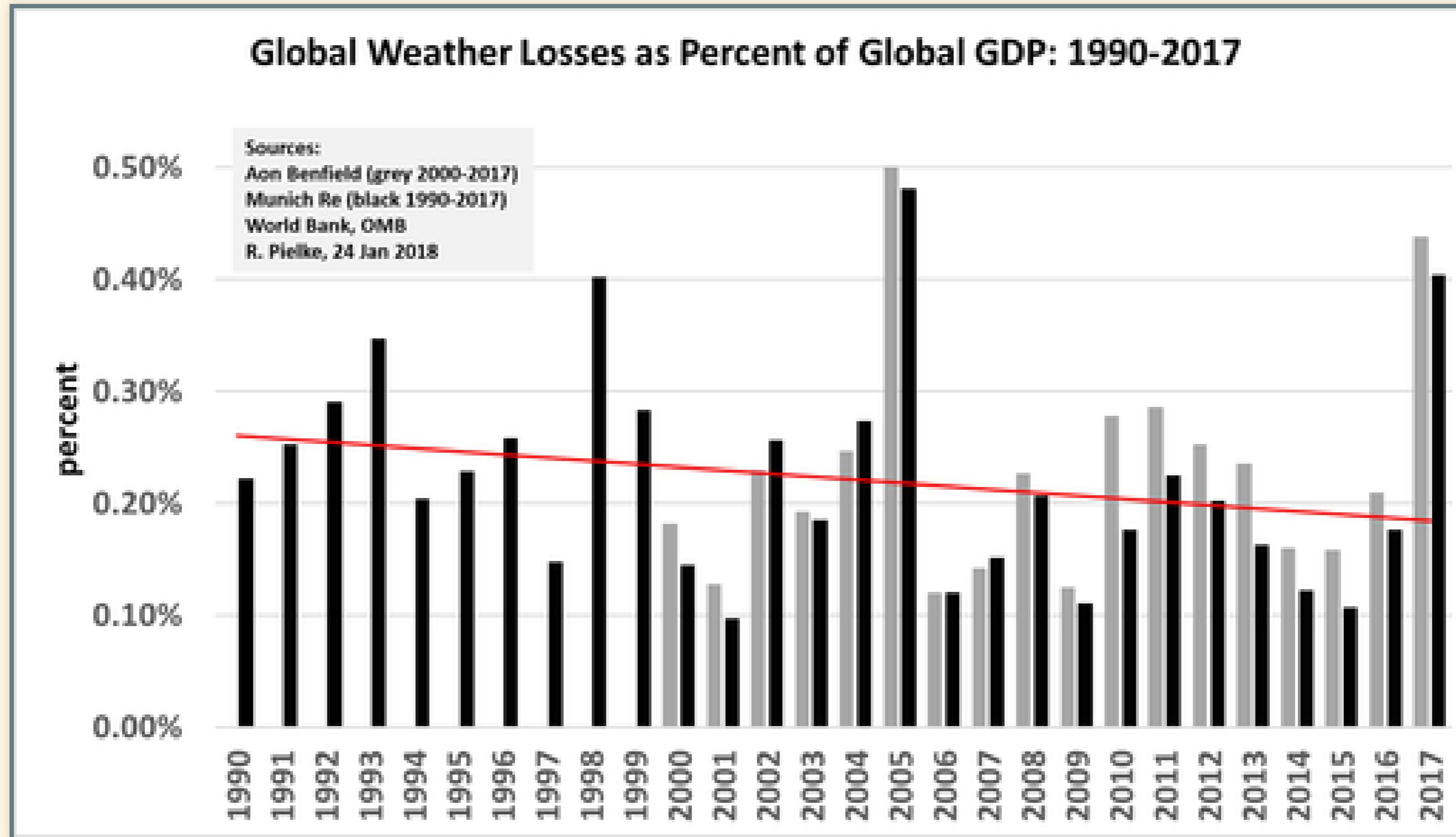
- 2006–2016: Unprecedented gap of 11 years with no major hurricanes.

# Severe Tornadoes



- 2018 was the first year on record with no violent tornadoes in the U.S.

# All Weather Disasters



# Human Impact on Climate System:

# Important Concepts:

- What kinds of things can cause the global temperature to change?
  - Energy Balance:
    - Temperature is steady when  $\text{Heat}_{\text{in}} = \text{Heat}_{\text{out}}$ .
    - What happens when  $\text{Heat}_{\text{in}} > \text{Heat}_{\text{out}}$ ?
  - What kinds of things can cause  $\text{Heat}_{\text{in}}$  to change?
  - What kinds of things can cause  $\text{Heat}_{\text{out}}$  to change?

# Temperature Change

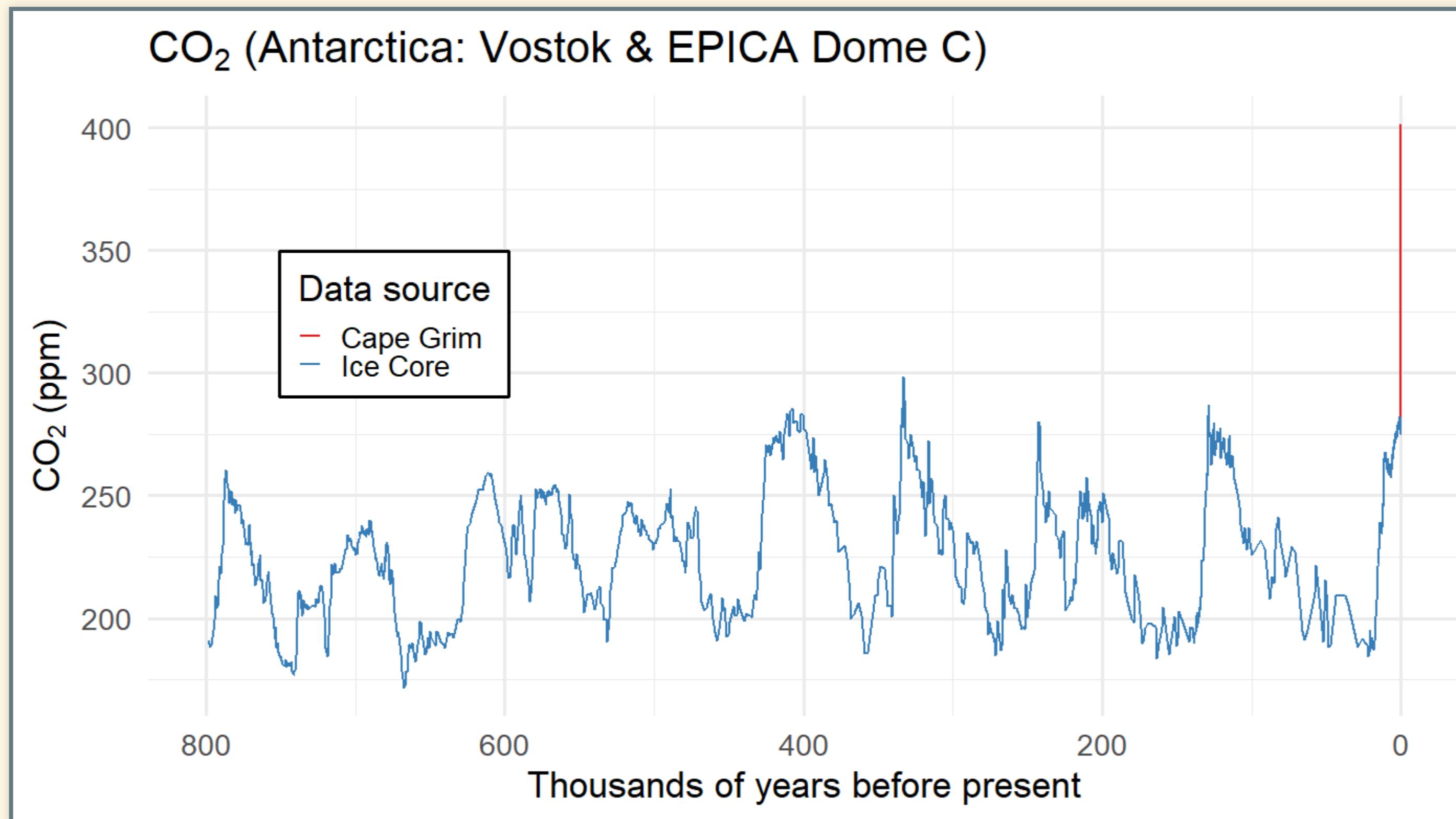
- How much has earth warmed in the last century or so?
  - About  $1.0^{\circ}\text{C}$  ( $1.8^{\circ}\text{F}$ )
- If  $\text{CO}_2$  emissions keep rising, how much do scientists expect it to warm in the next century?
  - Somewhere around  $3\text{--}6^{\circ}\text{C}$  ( $5\text{--}11^{\circ}\text{F}$ )
- What is the seasonal temperature change in Nashville (winter to summer)?
  - Around  $23^{\circ}\text{C}$  ( $42^{\circ}\text{F}$ )  $47^{\circ}\text{F}$  in January,  $89^{\circ}\text{F}$  in August.
- What is the average daily temperature range in Nashville (night to day)?
  - Around  $11^{\circ}\text{C}$  ( $20^{\circ}\text{F}$ )
    - **So why do people worry about global warming?**

# Predictions

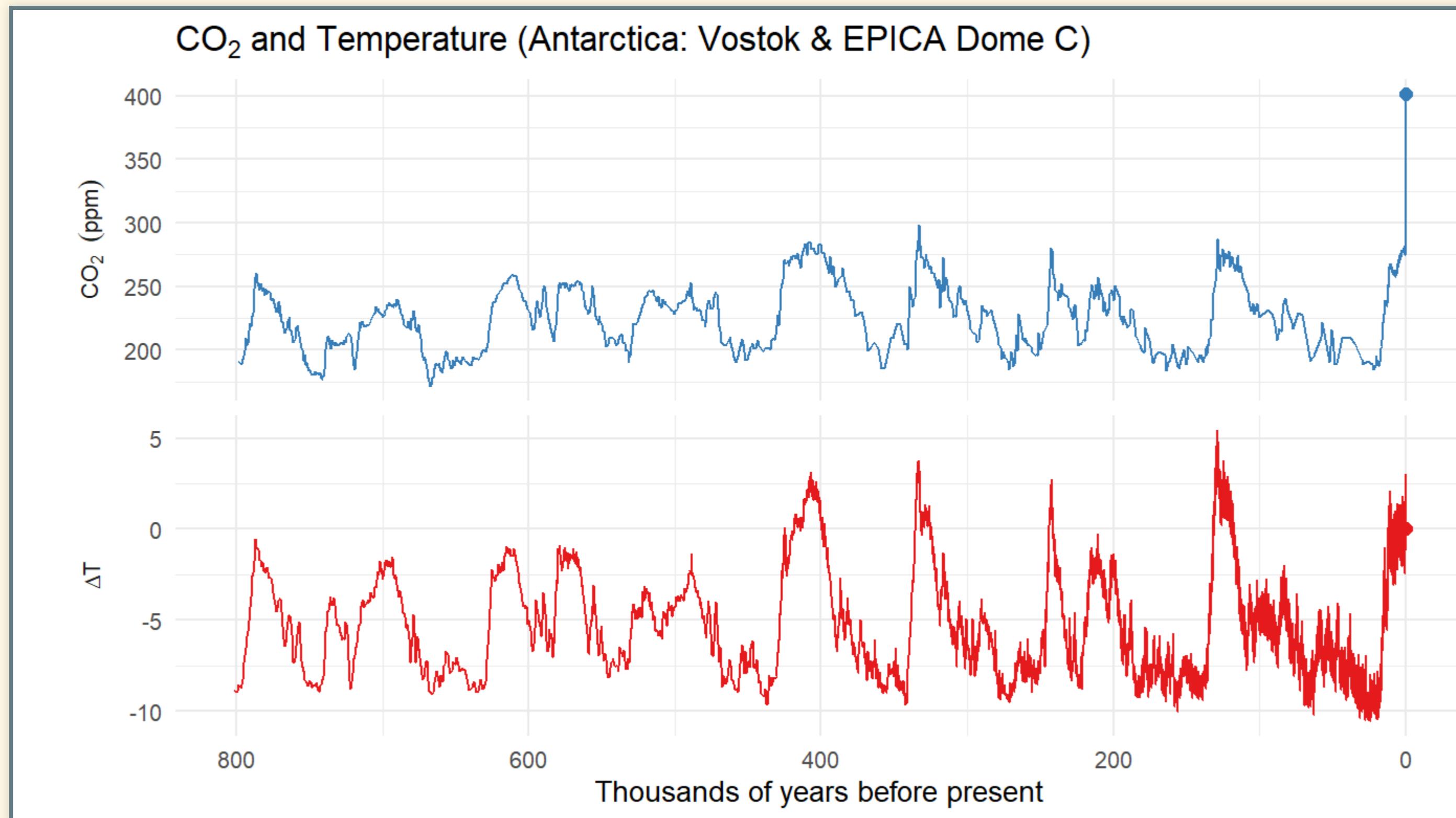
- Meteorologists can't predict whether it will rain three weeks from today with any confidence.
- So how can I trust predictions about the climate 100 years from now?

# What Earth's History Tells Us

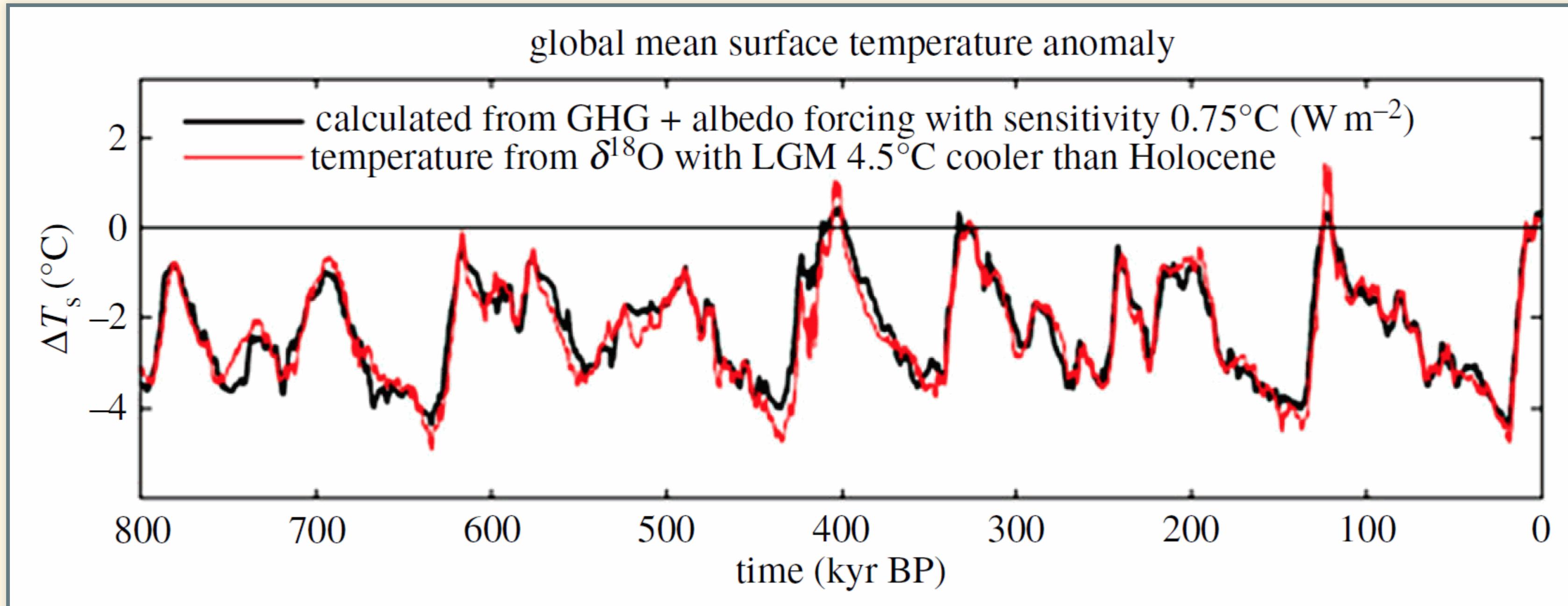
# 800,000 years of CO<sub>2</sub>



# 800,000 years of CO<sub>2</sub> and Temperature



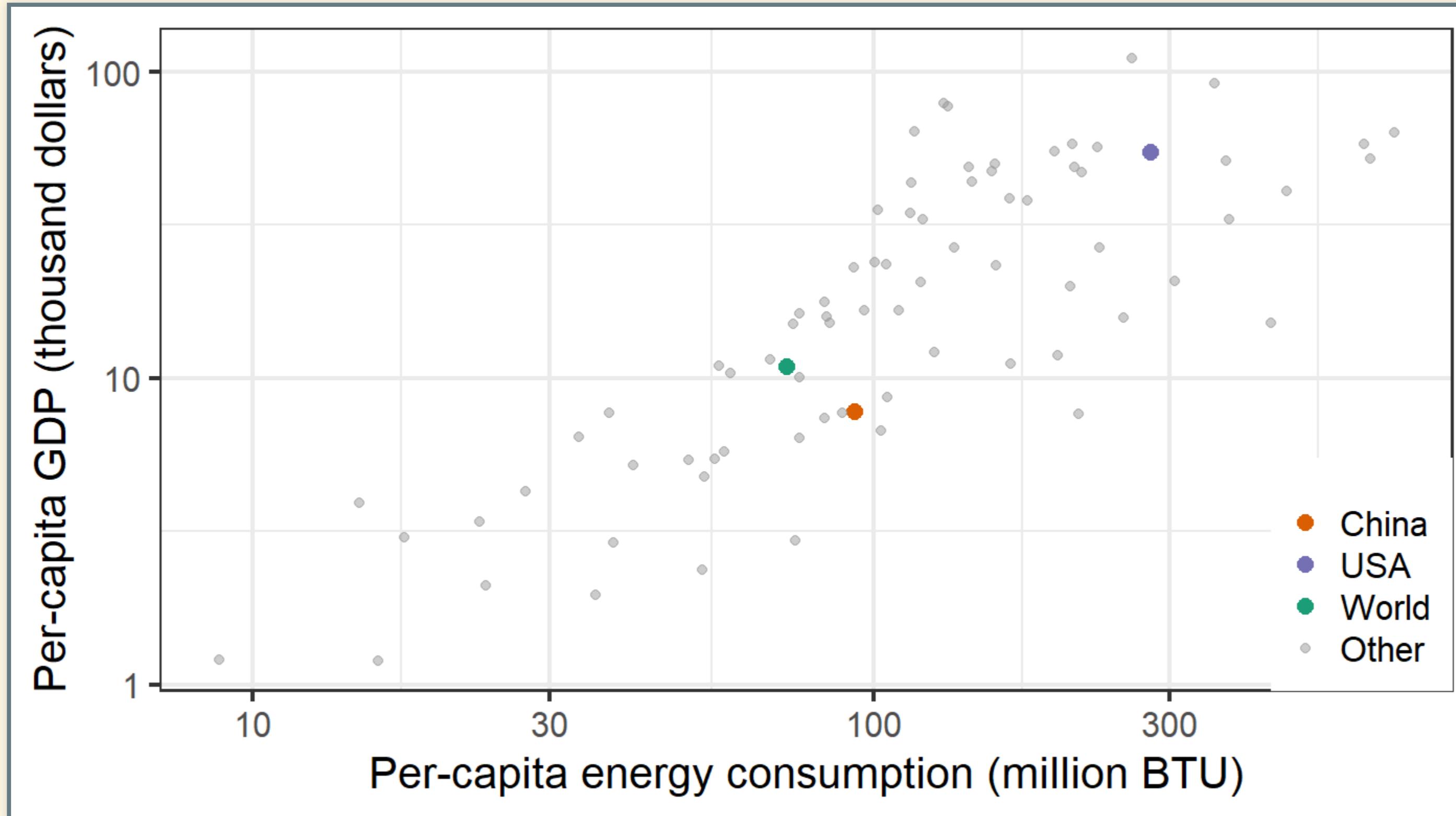
# Using Past Climates to Test Theory



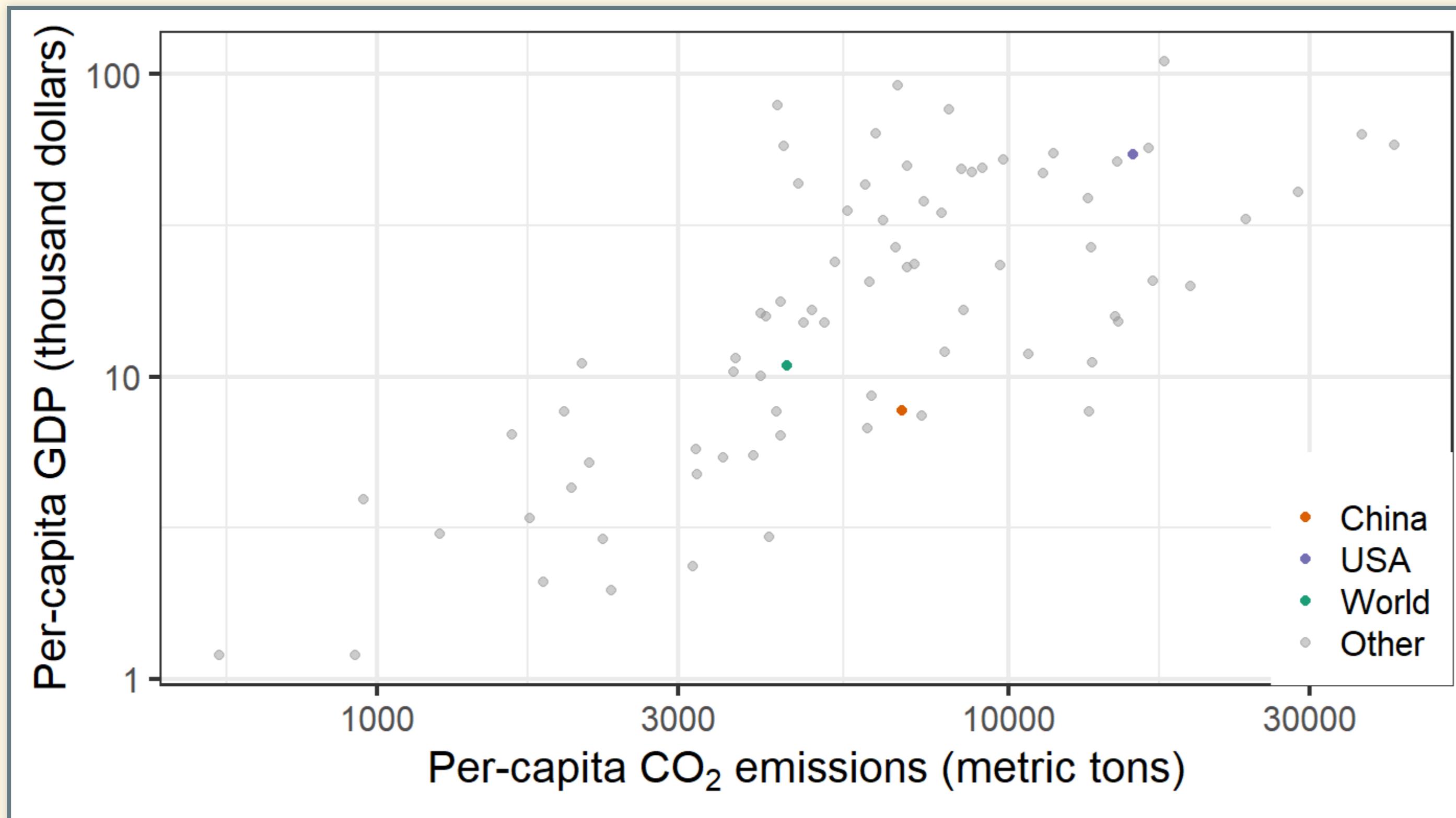
Source: J. Hansen et al., Phil. Trans. Roy. Soc. A **371**, 20120394 (2013).

# Economy-Energy-Environment

# Wealth & Energy Use



# Wealth & CO<sub>2</sub> Emissions



# Economics, Policy, Climate

- Why don't markets manage greenhouse gas emissions well?
  - Pollution is an **externality**
- How does Nordhaus propose to fix this problem?
  - Ronald H. Coase (1920–2013):
    - Solve externality problems by assigning property rights
    - Cap-and-trade: Permits
    - Emissions tax: Put price on emissions

# Economics and Vulnerability

- For an economist, what are the big dangers associated with climate change?
  - **Managed vs. unmanaged, unmanageable resources**