

"It is difficult to get a man to understand something, when his salary depends upon his not understanding it!"

-Upton Sinclair

# The Climate of Man *(and woman)*

discussion of Elizabeth Kolbert's article in the New Yorker

# Plan ...

- Key points
- Context
- Scientific issues/terms
- Discussion points

# Shishmaref









## Direct Impact of Climate Change



## Direct Impact of Climate Change

before







# Direct Impact of Climate Change

before



after





# Historical Context

- First rigorous study of climate change by National Academy of Science in **1979**.  
Global temperatures could rise between 2.5-8 degrees Fahrenheit
- “We may not be given a warning until the CO2 loading is such that an appreciable climate change is inevitable.”
- GFDL (Princeton) + NASA GISS (above Tom’s Restaurant -- Broadway and 112th)

# Updates on Science

- 1998 hottest year on record, but 2010 on pace to break it
- 2005 and 2009 tied for second warmest years ever
- top 10 warmest years have all occurred since 1998

# Permafrost

- permafrost = permanent frost (> 2 years, Alaskan permafrost has been frozen since start of last glacial cycle = 120,000 years!!!!)
- thermokarsts (holes formed by melting)
- talik - technical term for melted permafrost
- “active layer” melted region on top, supports life
- cryoturbation - organic matter pushed down into frozen region = carbon reservoir
- drunken trees

# Drunken Trees



# Why is permafrost important?

- permafrost is an integrating thermometer, averaging out weather noise, so revealing slow changes
- permafrost carbon storage = 450 Gtons (1.4 million Empire State Buildings)
- cumulative anthropogenic carbon emissions to date are about 270-500 Gtons
- could substantially amplify climate change (possible climate time bomb)

# Climate Feedbacks

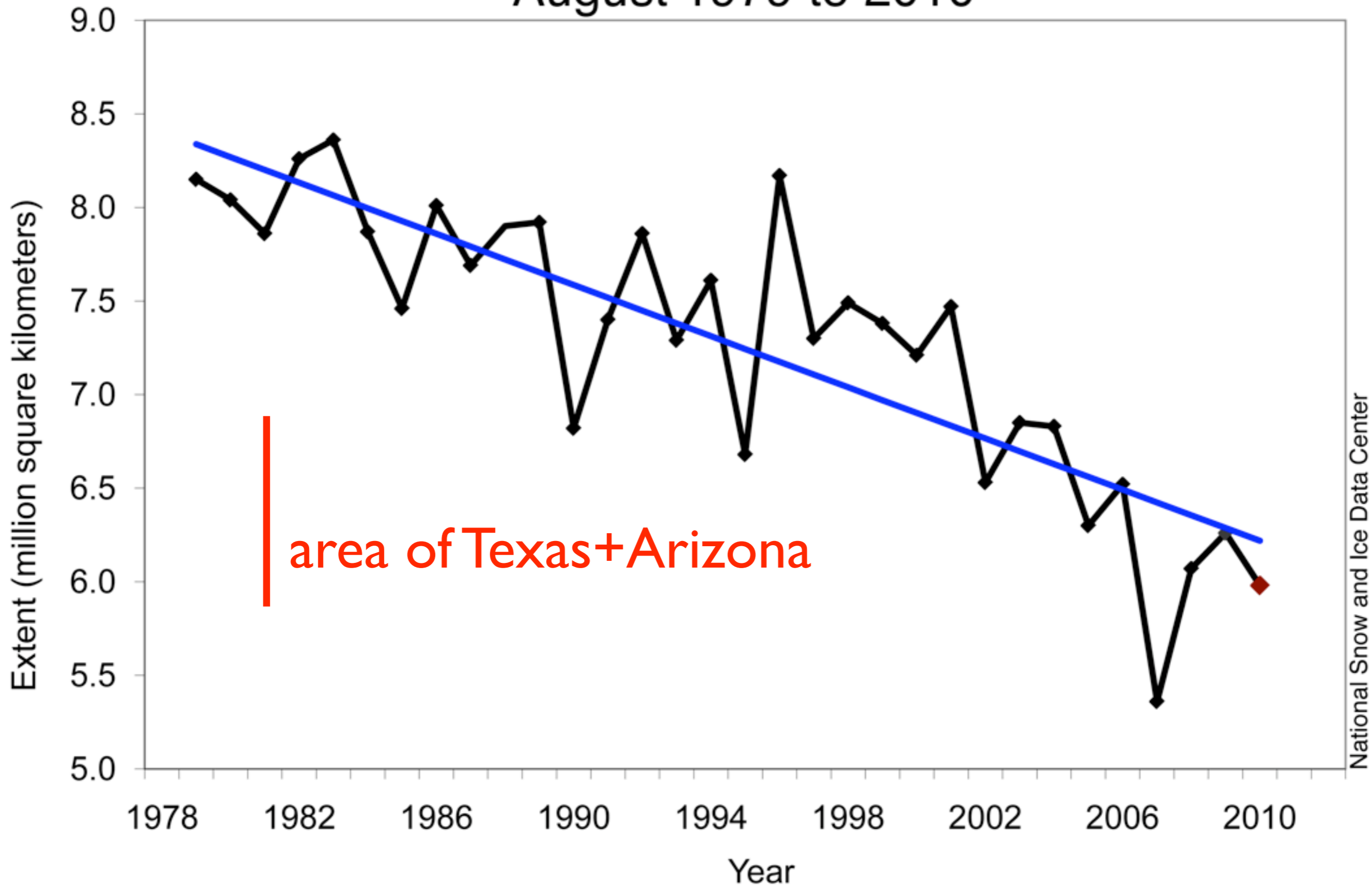
- positive:
  - permafrost melting - carbon release
  - ice albedo
- negative:
  - if climate change kills us all, no more anthropogenic forcing
  - CO<sub>2</sub> induced plant growth
  - lapse rate feedback



# Arctic Sea Ice Loss

- seasonal ice versus perennial ice (different characteristics, saltiness, albedo ....)

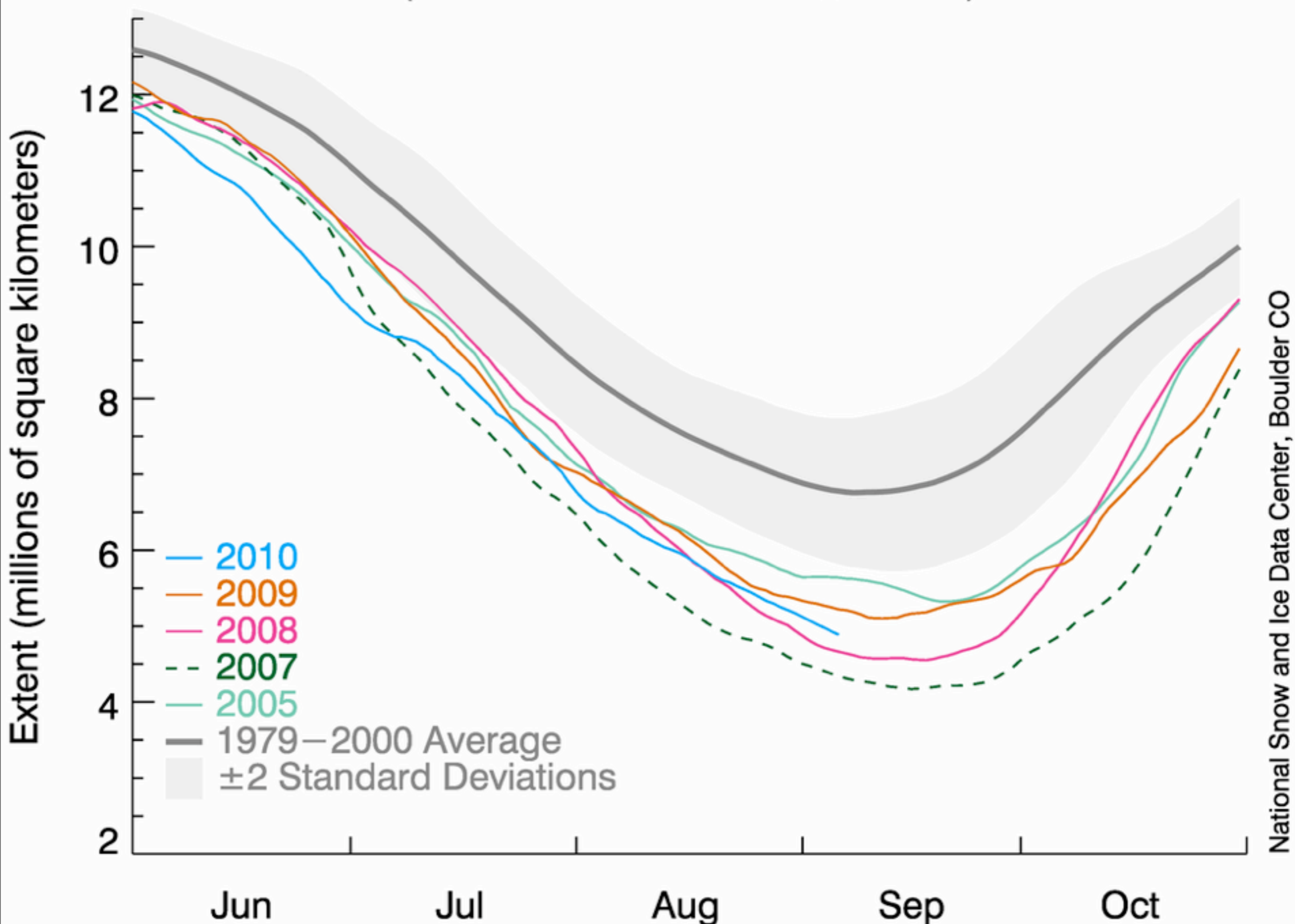
# Average Monthly Arctic Sea Ice Extent August 1979 to 2010



National Snow and Ice Data Center

# Arctic Sea Ice Extent

(Area of ocean with at least 15% sea ice)



National Snow and Ice Data Center, Boulder CO

# Natural Climate Variability

- could current changes be natural (not driven by anthropogenic forcing)?
- climate has varied a great deal in past
- concern of a tipping point -- glacial cycles caused by relatively small changes in Earth's orbit
- Holocene = today, Eemian = last interglacial sea level was 15 feet higher then (why? not sure, could be collapse of West Antarctic Ice Sheet, runoff from Greenland)
- Younger Dryas (named after plant!) 12,800 years ago the earth rapidly refroze, stayed there for 1200 years) afterwards, rapid warming, Greenland warmed 20 degrees in a decade!

# Are these changes reversible?

- last time Earth was this warm, Greenland was ice free -- the ice sheet is maintained by thermal inertia
- albedo makes Arctic very sensitive

# Typo!

- Glaciers don't move at rates of miles per hour! Jakobshaven glacier is fast at 20 m/day. It accelerated to 34 m/day (8 miles/year)!
- Has since slowed down ... driven by warm water pushed by winds. But may be case study for the BIG ice sheets of West Antarctica.

# What to Do?

- Awareness? This isn't new!
  - dramatic impacts far away
  - long term problem
  - direct misinformation campaigns
- Political problem
  - What does climate change have to do with abortion? Is it anti-corporation?
  - Global issue. Requires global solution.

# Climate Reparations

- Should you be responsible for your parents emissions?



# External Costs: Failure of the Markets

- cost of goods and services should reflect all costs
- put a price on carbon, the price it will cost future\* generations to remediate effects

\*future = you

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