Notable scientific and societal landmarks: 1985-present

- 1985 Ozone Hole Discovered: center-stage the human influences can have global environmental consequences (sudden discovery?)

- 1988 US Action
  - Drought and extreme heat wave in mid-west US
  - Jim Hansen (climate scientist, NASA) testifies to congress that he is “99% sure” that global warming is upon us
  - Pres Bush (I) establishes US Global Change Program; similar action in UK by Thatcher

- 1989 IPCC is established; first consensus science report issued in 1990

Notable landmarks (cont.)

- 1992 “Earth Summit” sponsored by the UN held in Rio de Janeiro (“Rio conference”). Discussions and negotiations led to the Kyoto Protocol (more later)

- 1995 Second IPCC assessment published (SAR)
  - Concluded “The Balance of Evidence suggests that humans have had a discernable influence on climate”
  - The strength of this statement made many climate scientists uneasy, and galvanized research to re-evaluate the science (models and data)

- 2000: The end of the 20th Century
  - Global annual average temperature continues to increase
  - The warmest decade in the instrumental record
  - Rate of temperature increase is greatest in the instrumental record
Notable landmarks (cont.)

- 2000 - Present: Third and fourth IPCC assessments published
  - TAR and AR4 reaffirm and strengthen conclusions from AR2 report

- 2000 - Present:
  - Stakeholders mobilize campaigns of disinformation and fear (on both sides)
  - Bush administration censors highly-outspoken US climate scientists (and scientists in other sciences) and suppress or misrepresents science
  - Examples, Dr. James Hansen (NASA), Dr. Ben Santer (Lawrence Livermore National Laboratory)

- 2009
  - Copenhagen, 7-18 December 2009
    - meeting to craft international policy concerning emissions of greenhouse gases (2013-2020)
    - follow up to Kyoto Protocol, which expires in 2012.

Examples of Censorship

An Editor in the White House

Handwritten revisions and comments by Philip A. Cooney, chief of staff for the White House Council on Environmental Quality, appear on two draft reports by the Climate Change Science Program and the Subcommittee on Global Change Research. Mr. Cooney's changes were incorporated into later versions of each document, shown below with revisions in bold.

"STRATEGIC PLAN FOR THE U.S. CLIMATE CHANGE SCIENCE PROGRAM," DRAFT TEXT, OCT. 2002

"The challenge for the USGCRP is to provide the best possible scientific basis for documenting, understanding, and projecting changes in the Earth's life-support systems, and the role for CGF is to reduce the significant remaining uncertainties associated with human-induced climate change and facilitate full use of scientific information in policy and decisionmaking on possible response strategies for adaptation and mitigation."

FINAL REPORT, 2002

The paragraph does not appear in the final report.

"OUR CHANGING PLANET," DRAFT TEXT, OCT. 2002

"Our Earth's climate is changing..."
Extremists: who are they?

• Potential losers with singular priorities (i.e., of direct financial interests, or local in space, or immediate in time)
  – Examples:
    • Coal companies fear a carbon tax will make coal less attractive than renewables (e.g., solar, wind)

• People with priorities not directly related to human welfare, socially or economically
  – Examples: polar bear advocates, etc

Extremists are almost always motivated by issues not related to (uncertainty in) the science

Extremists: who are they?
The non-scientists

• Stakeholders who feel they have a lot to lose if mitigation strategies are invoked
  – Often disseminate disinformation (lies) or use information (right or wrong) for the purpose of instilling fear
  – Examples: Global warming will cause the sea level to rise 20 feet, placing most of Florida underwater

• Non-scientists with political or ethical bents that are at odds with mitigation. Lots of examples:
  – Libertarian societies and orgs and their followers
  – A pop-culture example is Glenn Beck (Fox ‘news’). Another is Michael Crichton, novelist and author of “State of Fear”. A novel written w/ footnotes and graphs (to give a look like it was a story backed by science). Information grossly distorted (for a full science critique, see www.realclimate.org and references therein)

Extremists are almost always motivated by issues not related to (uncertainty in) the science
Extremists: who are they?
The scientists

- Scientists with no training or research experience in climate that distort the science for unknown reasons
  - A fair number in this category. For example, W. Soon and S. Baliunas, who contrary to the scientific evidence, inflate the solar insolation changes associated with sunspot cycles and claim 20th Century temperature trends are due to solar forcing.

- Climate scientists with political or ethical values that supersede the constraints levied by the ethics of science (testing hypotheses, ignoring the overwhelming evidence against a belief they hold)
  - A few in this category. For example, Roy Spencer (NASA), Prof. Patrick Michaels (Cato Institute) and Dr. John Christy (who with Spencer initially published the data using the bad algorithm for determining temperatures from satellite observations that was responsible for most of the apparent inconsistency between the surface and atmospheric temperature trends). [Christy was one of the authors of the 2000 NRC report that concluded the (ie, his) satellite data were in error and the surface and atmospheric trends both showed warming that is not inconsistent with what is expected from increasing GH gases. Nonetheless, he continues to claim there is an inconsistency, in public and to Congress.]

Extremists are almost always motivated by issues not related to (uncertainty in) the science

Extremists: who are they?
The scientists

- Climate Scientists that hold on to views that are at odds with the overwhelming scientific consensus arrived at by the cannon of scientific literature on global warming.
  - Few and far between. The only person I know in this category is Prof. Richard Lindzen at MIT
    - Recall it was Lindzen who proposed that increased CO₂ will decrease water vapor in the upper troposphere (a negative feedback) -- an idea that has been examined and shown to be incorrect.
Global Warming and Glaciers

- The CEI commercial claims glaciers are growing
  - The paper cited refers only to interior Greenland

**Recent Ice-Sheet Growth in the Interior of Greenland**

Ola M. Johannessen,1,2,* Kirill Khvorostovsky,3 Martin W. Miles,4,5 Leonid P. Bobylev6

A continuous data set of Greenland Ice Sheet altimeter height from European Remote Sensing satellites (ERS-1 and ERS-2), 1992 to 2003, has been analyzed. An increase of 6.4 ± 0.2 centimeters per year (cm/yr) is found in the vast interior areas above 1500 meters, in contrast to previous reports of high-elevation balance. Below 1500 meters, the elevation-change rate is −2.0 ± 0.9 cm/yr, in qualitative agreement with reported thinning in the ice-sheet margins. Averaged over the study area, the increase is 5.4 ± 0.2 cm/yr, or −50 cm over 11 years, or −54 cm when corrected for isostatic uplift. Winter elevation changes are shown to be linked to the North Atlantic Oscillation.

- Interior Greenland and Antarctica are accumulating more snow in the high interior where it is always well below freezing. This is expected as the earth warms: higher temperature -> more water vapor -> more snow
- These ice sheets are losing mass on the edges, where ice is flowing faster into the oceans, likely due to sea level rise.
- In the net, Antarctic is presently gaining mass.

Glaciers

- Add states that “Global Warming Alarmists claim that the glaciers are melting because of the carbon dioxide from the fuels we use
  - Sierra Club, Greenpeace, etc
  - What does the IPCC conclude, in their summaries of the state of the science? Most of the glaciers in the world are melting, largely due to increased temperature.
Most glaciers in the world are receding due to increased temperature (which has been attributed to burning fossil fuels)

Central Antarctic is increasing in mass (also expected and projected due to global warming)
Hurricanes and Global Warming

• Hurricane strength depends mainly on sea surface temperature (SST) and wind shear (the change in wind speed and direction as you go up in the atmosphere)
  – The energy for a hurricane comes from condensation of water vapor. Hence, warmer water in general translates to more intense hurricanes
  – Hurricanes like low wind shear environments (too much wind shear and they are torn apart)
• Hurricane Katrina was featured in Gore’s movie. Was it due to global warming?
  – Impossible to say anything about a single hurricane, but the odds of an intense hurricane are increased when the water is warmer (which it was for Katrina)

Hurricanes and Global Warming

• What about the hurricane off Brazil in March 2008? Hurricanes are unusual because the wind shear is large in that area.

• Cyclone (SH) Catarina had winds of 100mph. It formed in unusually low wind shear for that region, and SST was slightly above normal.
• Was it due to global warming? Again, a meaningless question for a particular storm.
Hurricanes and Global Warming

- Strongest relationship between warming and hurricanes should be in the frequency of intense storms. What have we seen so far?

![Graph showing relationship between SST and hurricanes](image)

- PDI: a measure of the destructive potential of hurricanes
- Sea Surface Temperature in the tropical Atlantic

The intensity of hurricanes in the tropical Atlantic tracks SST closely

How will Global Warming affect hurricanes?

- Warmer water should cause more frequent intense storms
- Changes in wind shear are uncertain (sign) but likely small in magnitude

![Projected change in hurricane intensity distribution](image)

- Knutson et al 2004

- Intense hurricanes should be more frequent, but it is uncertain what will happen to number of hurricanes and pathway of hurricanes