

Friday, February 22

GLOBAL CLIMATE CHANGE:

1. CAUSES
2. EVIDENCE
3. CONSEQUENCES

Paradox

- There is a paradox because we wonder how global warming can occur when we have such strong winter snowstorms. It seems contradictory.
- Actually, this isn't a paradox.
 - Global warming has caused greater evaporation, resulting in more water vapor in the atmosphere.
 - As temperatures drop below the dew point, more precipitation falls. This means more intense rainfall.
 - In winter, temperatures below freezing results in intense snowstorms, also known as "noreasters" along the coast.
 - This is all consistent with global warming according to climate model predictions, and we can expect more severe storms to come.

The Working Group 1 Report

- IPCC 2007
- Started in 2004
- Written by 152 authors
 - about 450 contributors, 600 expert reviewers, and over 30,000 review comments
- 85% of world's glaciers are retreating.
- The majority of Greenland and Antarctica ice caps are melting twice as fast as expected only five years ago.
- 0.5 degree C rise in SST means a 40% increase in hurricane activity.

What's Driving the Rapid and Large Increase in Global Temperatures?

- The monthly mean carbon dioxide pattern is in a sawtooth pattern and has dramatically increased since the mid-1950s.
- The sawtooth pattern has to do with the varying temperatures and carbon dioxide levels that correspond with the different seasons of the year.

GHG

- GHG = greenhouse gases
- There have been rapid increases in GHG since the Industrial Revolution.

- The Copenhagen Report gives further evidence for the rise of GHG in the atmosphere.
 - The globe has experienced many global temperature trends (both rising and falling) in history. (The graph shows since the year 200 AD.) However, the increase that has happened in the most recent years (since the 1900s and now) is more incremental than before.
 - Emissions from fossil fuels have increased since 1980 as well.
 - Additionally, sea levels have risen at the upper boundary of models that the researchers have observed.

Why Is Climate Changing Faster Than the Models Have Predicted?

- Some important forcing factors have been ignored.
- The main one is likely our failure to recognize the significance of black carbon (soot).
 - This comes from diesel smoke and incomplete coal combustion.

Soot: Both a Cause of Global Warming and a Health Risk

- Second largest cause of global warming
- Health risk in the U.S. (especially from diesel soot)
- 23,000 premature deaths (2005)
- Major cause of cardiovascular and respiratory diseases

Soot Particle Size

- Fine soot scatters light and cools the atmosphere.
- Larger soot particles absorb solar energy and heat the atmosphere.

Soot Production

- China is the major producer.
- This soot and carbon dioxide comes from coal production.

Indicators (Not Models) That Give Evidence for Global Warming

- All of the following are increasing right now:
 - air temperature near surface (troposphere)
 - humidity
 - ocean heat content
 - sea level
 - sea-surface temperature
 - temperature over oceans
 - temperature over land

Global Temperature Change Decade Averages

- 1980s was warmest decade on record at the time.
- 1990s was even warmer. Every year was warmer than 1980s average.
- 2000s was even warmer. Every year was warmer than the 1990s average this time.

How Do We Know We Are the Cause? How Do We Know the Models Are Right?

- Volcanic eruptions have been used to test model effects of particulates and aerosols.
- Aerosols, especially sulfur dioxide, reflect incoming radiation, thereby acting against global warming.
- Only models that include human releases of GHG match the actual historic temperature trend.

Too Many Worrisome Positive Feedback Loops

- This means that changes happening now can cause even more climate change.
- It's not just carbon dioxide.
- Warming releases methane and water vapor.
- Melting ice also increases warming.