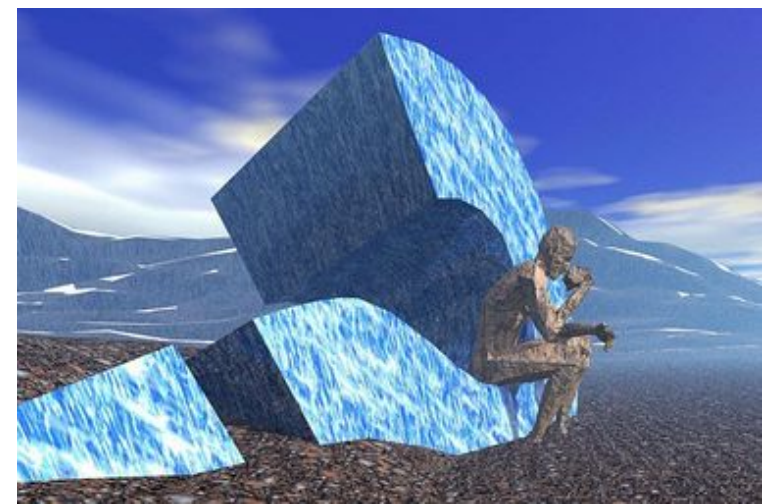


Consensus among scientists as to whether humans are dominant cause of 20th century warming?

- The much vaunted '97% consensus' was based on a deeply flawed study that examined the abstracts of published papers.
- Actual surveys of scientists found:
 - American Meteorological Society (2014): **52%**
 - Verheggan et al. (2014) survey of climate scientists: **85%**

Summary of major uncertainties

- Deep ocean heat content variations and mechanisms of vertical heat transfer in the ocean
- Uncertainties in aerosol impact
- Sensitivity of the climate system to CO₂
- Clouds: trends, feedbacks, & aerosol – cloud interactions
- Nature and mechanisms of multidecadal natural ‘internal’ variability (ocean-atmosphere circulations)
- Unknowns – solar indirect effects, magnetic and electric field effects, orbital (tidal and other) effects, core-mantle interactions, etc.



Q7: Statements about the veracity of climate change have only gotten stronger in the last 50 years



Air pollution is no longer confined to isolated places. This generation has altered the composition of the atmosphere on a global scale through radioactive materials and a steady increase in carbon dioxide from the burning of fossil fuels.

President Lyndon Johnson

February 8, 1965

Special Message to the Congress on Conservation and Restoration of Natural Beauty

Q7: Statements about the veracity of climate change have only gotten stronger in the last 50 years



We now have incontrovertible evidence that the atmosphere is indeed changing and that we ourselves contribute to that change. Atmospheric concentrations of carbon dioxide are steadily increasing, and these changes are linked with man's use of fossil fuels and exploitation of the land.

When it is assumed that the CO₂ content of the atmosphere is doubled...the more realistic of the modeling efforts predict a global surface warming of between 2°C and 3.5°C, with greater increases at high latitudes...It is significant, however, that none of the model calculations predicts negligible warming.

***National Research Council
Carbon Dioxide and Climate: A Scientific Assessment
1979***

Q7: Statements about the veracity of climate change have only gotten stronger in the last 50 years



Climate change is occurring, is very likely caused by human activities, and poses significant risks for a broad range of human and natural systems. Each additional ton of greenhouse gases emitted commits us to further change and greater risks.

In the committee's judgment there are many reasons why it is imprudent to delay actions that at least begin the process of substantially reducing emissions.

***National Research Council
America's Climate Choices
2011***

Q7: Statements about the veracity of climate change have only gotten stronger in the last 50 years



Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.

Anthropogenic greenhouse gas emissions have increased...driven largely by economic and population growth...Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.

***IPCC Synthesis Report, Summary for Policymakers
2014***

- **Improved understanding of factors (like El Niño) that drive year-to-year and decade-to-decade variations in climate**
- **Better understanding of changes in the jet stream that can be tied to greenhouse gases (in other words, linking weather to climate)**
- **More knowledge about ice (the cryosphere)**
- **Better translation of climate information at the regional scale, especially for adaptation/resilience planning**