

**Greenhouse Gases and Global Warming
General Assembly of North Carolina
Legislative Commission on Global Climate Change
March 7th, 2006**

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Recent reports conclude that increased greenhouse gas concentrations are warming the earth

“There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.

Intergovernmental Panel on Climate Change, 2001
synthesis report, >2,000 scientists

“Because human activities are contributing to climate change, we have a collective responsibility to develop and undertake carefully considered response actions.”

American Meteorological Society, Official statement,
>11,000 meteorologists, 2003

“Scientific evidence strongly indicates that natural influences cannot explain the rapid increase in global near-surface temperatures observed during the second half of the 20th century.”

American Geophysical Union, >42,000 Earth scientists,
Official climate change statement, 2005

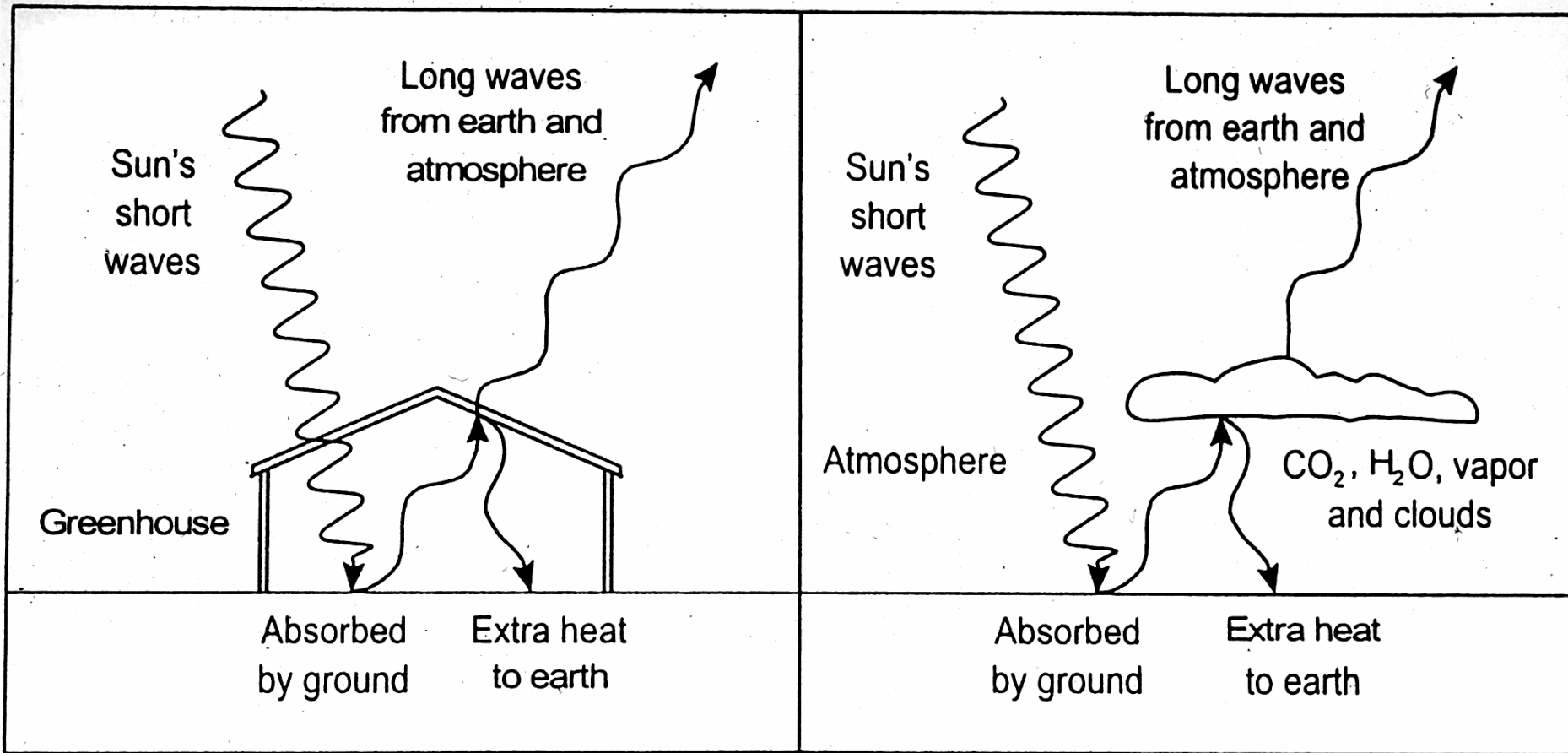


Figure 1.2 The greenhouse analogy (Gedzelman, 1980).

A brief history of greenhouse gases and global warming



1827 Jean Baptiste Fourier first describes how the atmosphere traps infrared radiation, using a greenhouse as his analogy

1890s Svante Arrhenius and P.C. Chamberlain independently propose that a build-up of CO₂ from fossil fuel burning would further warm the earth.

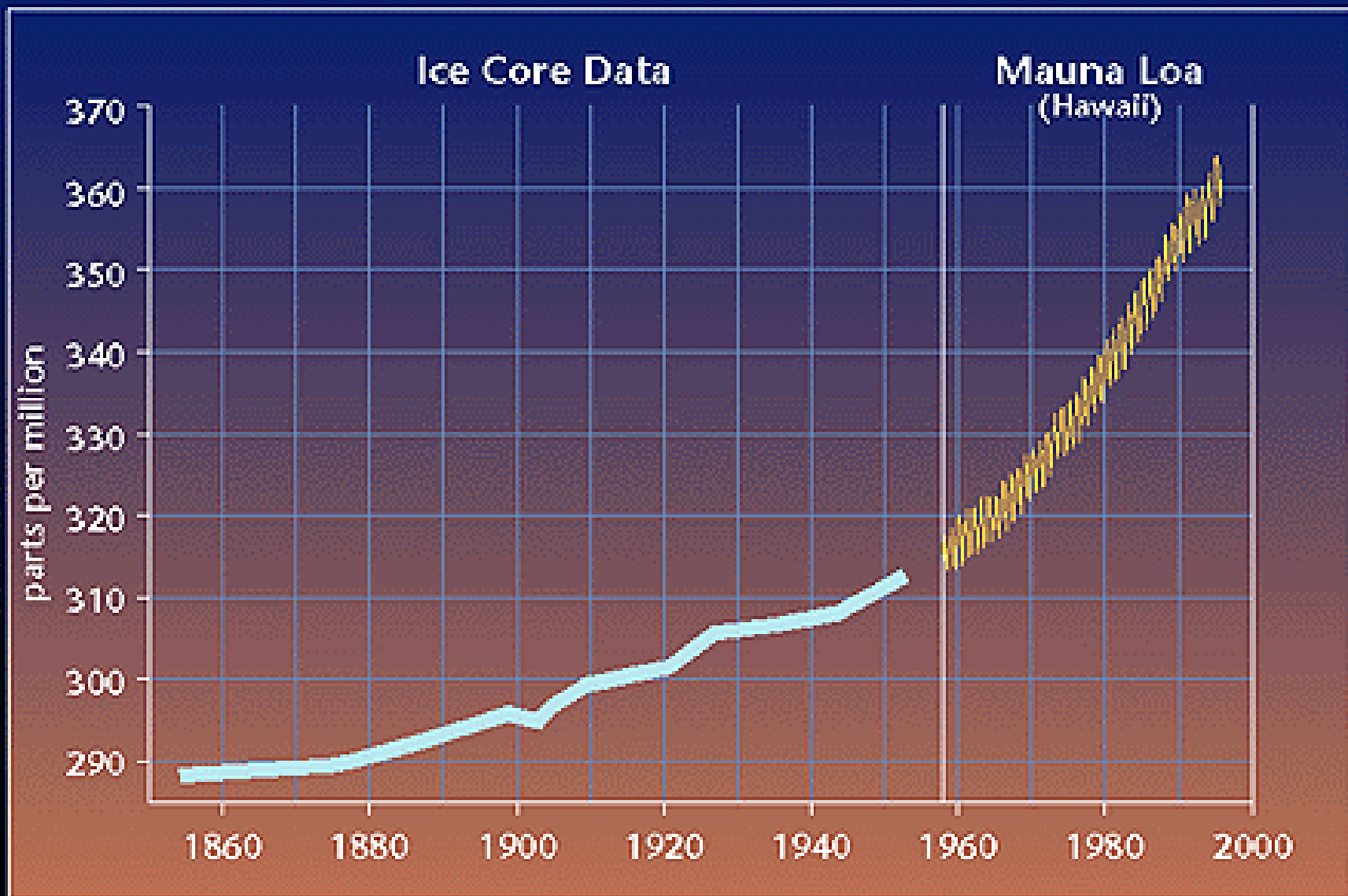


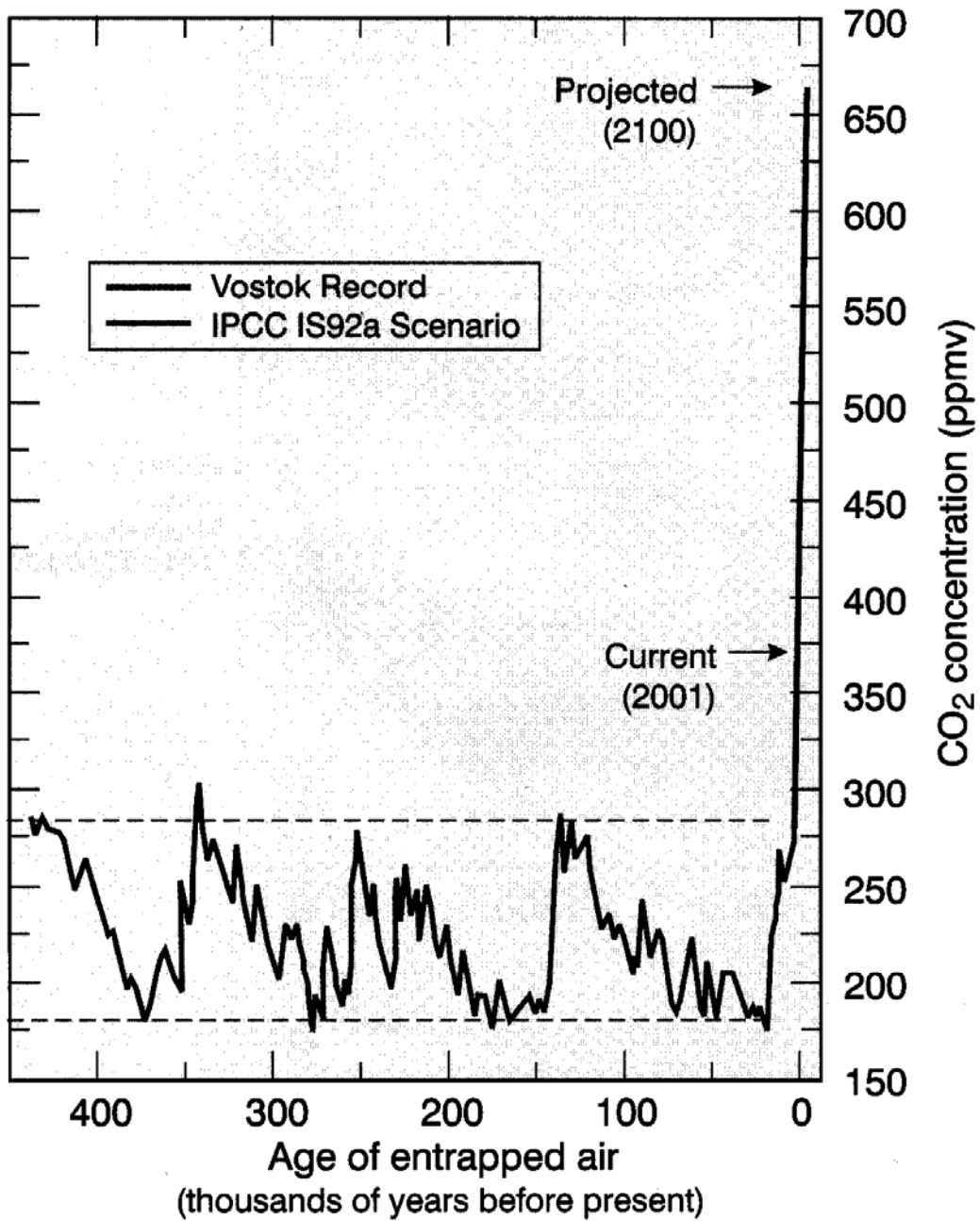
S. Arrhenius, Nobel Prize in Chemistry, 1903



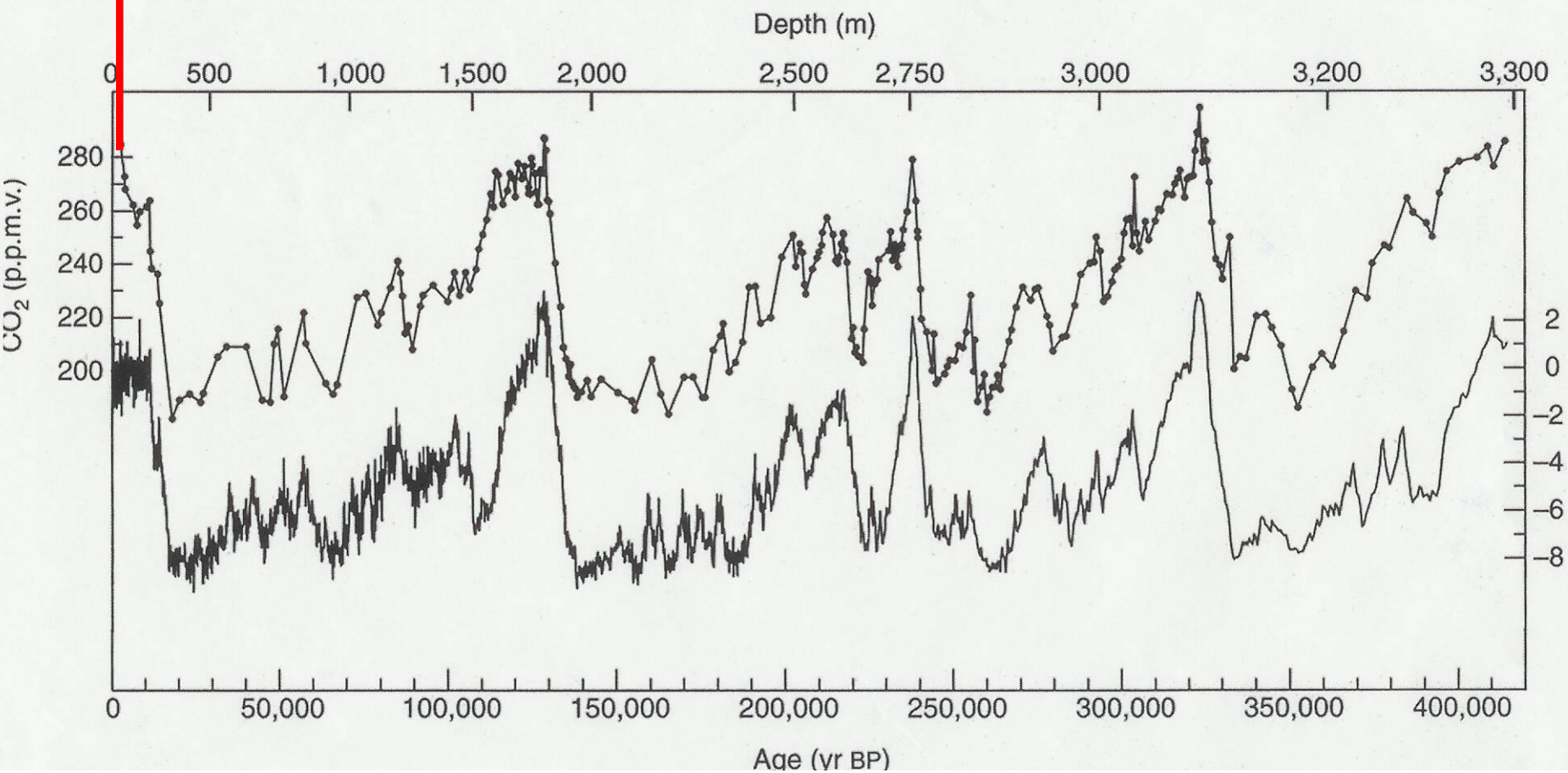
1958 Charles David Keeling begins his measurements at Mauna Loa showing a steady increase in atmospheric CO₂

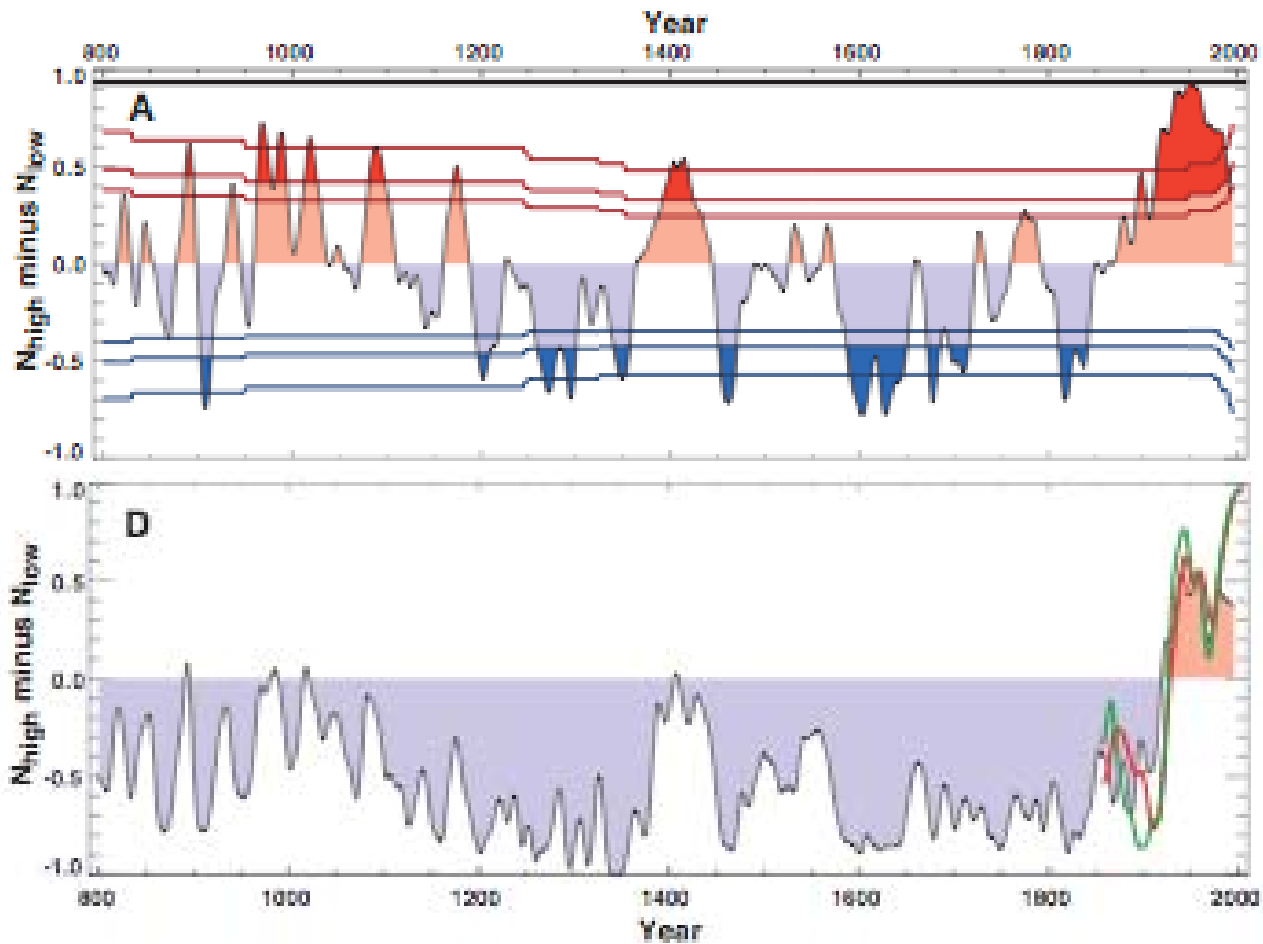
Carbon Dioxide Concentrations





380 — this year (2006)

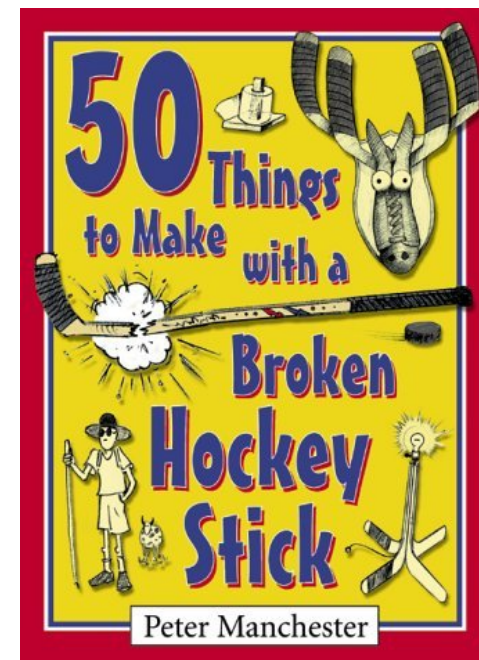




Hot off the press:

“The most significant and longest duration feature during the last 1200 years is the geographical extent of warmth in the middle to late 20th century.”

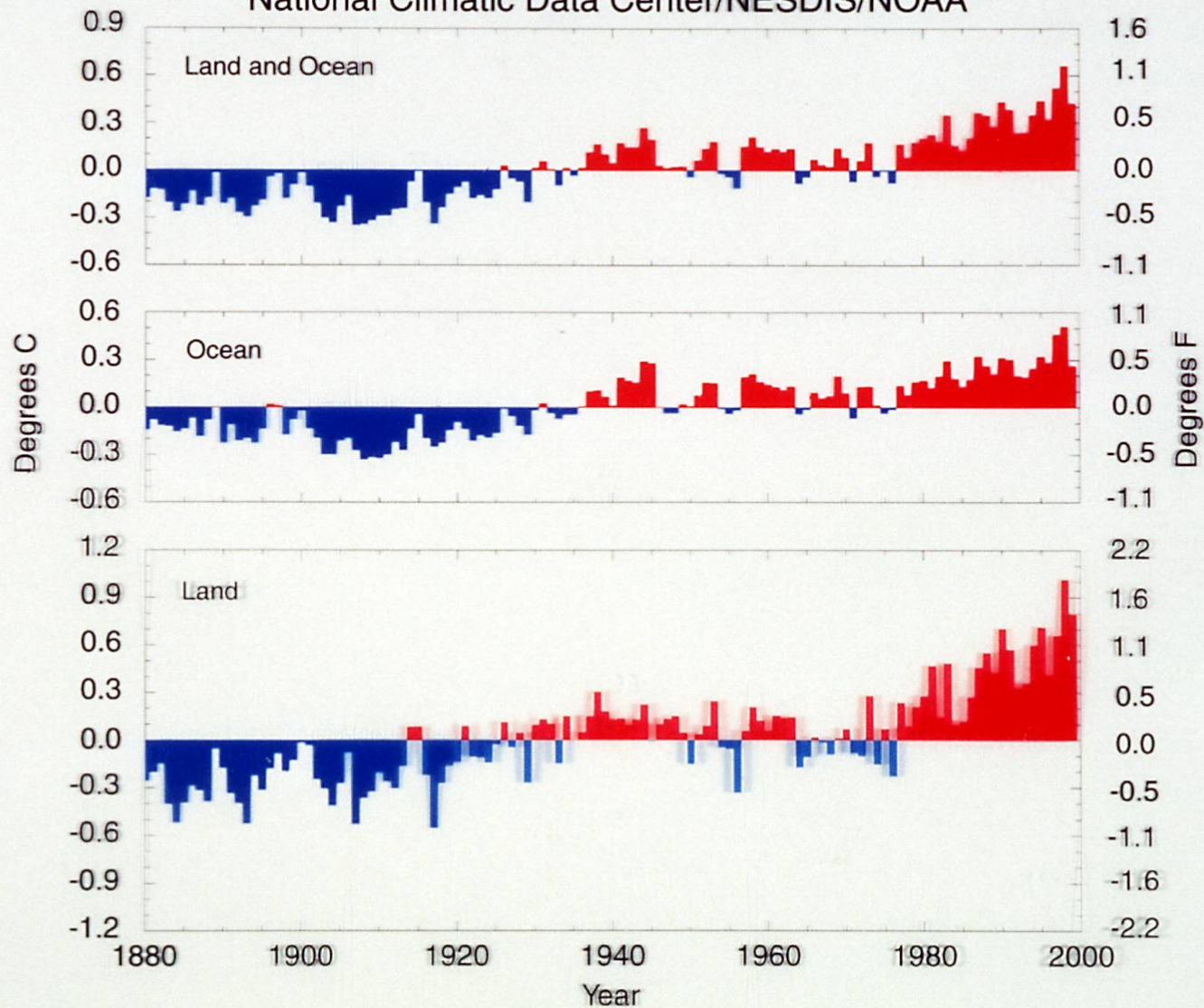
Osborn and Briffa, February 10th, 2006, *Science*





Annual Global Surface Mean Temperature Anomalies (1880-1998 base period)

National Climatic Data Center/NESDIS/NOAA



(d) Annual temperature trends, 1976 to 2000

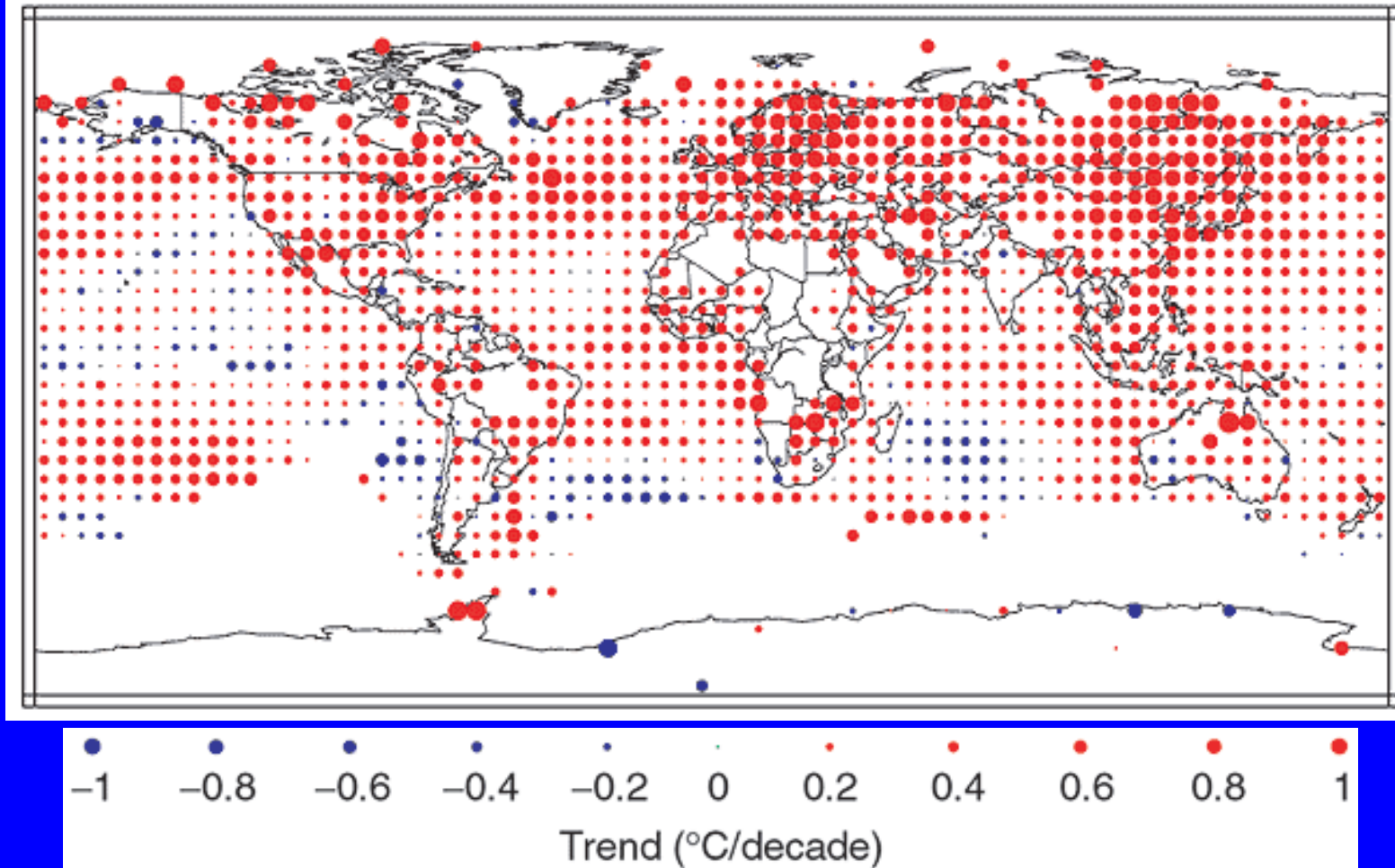
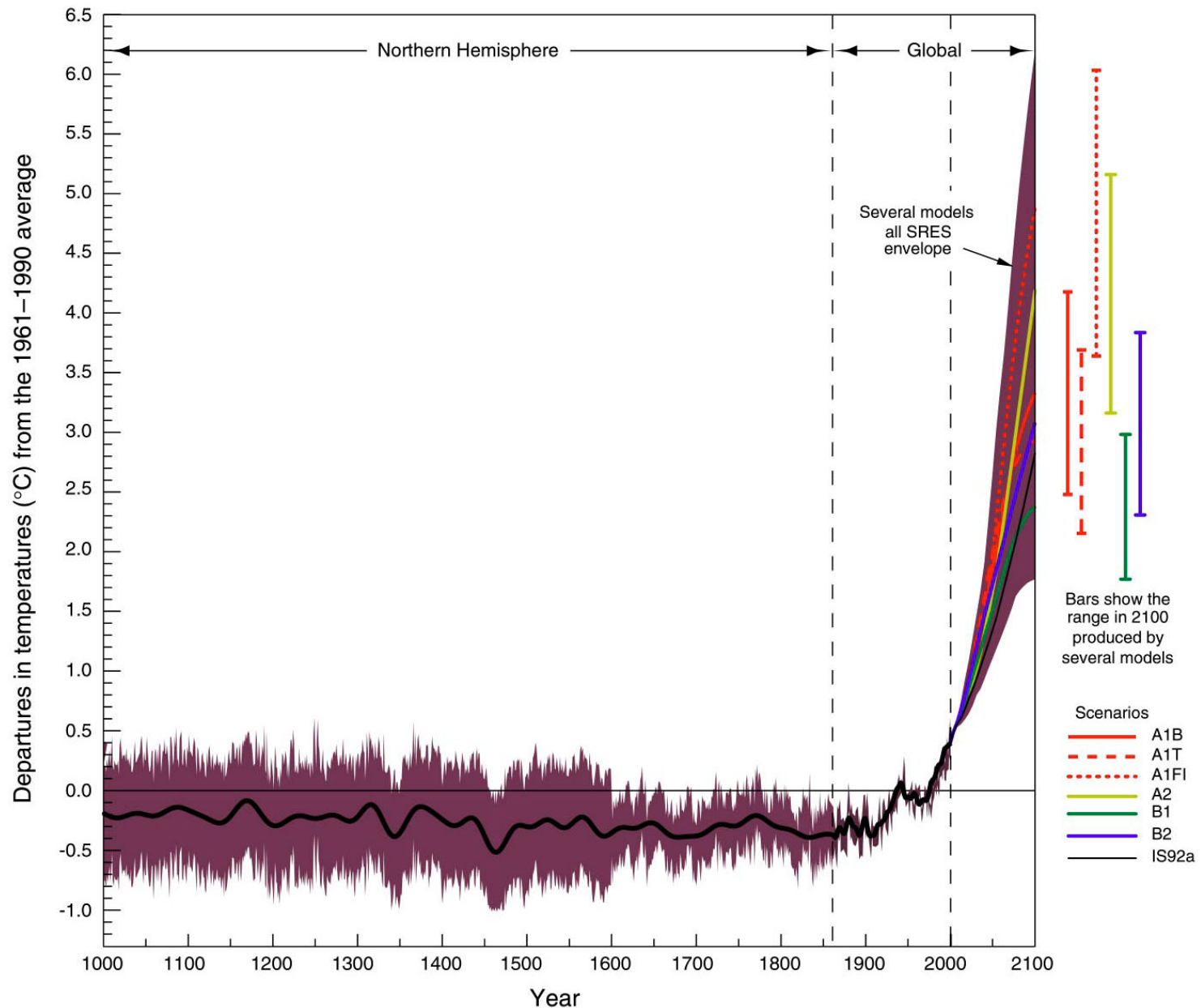


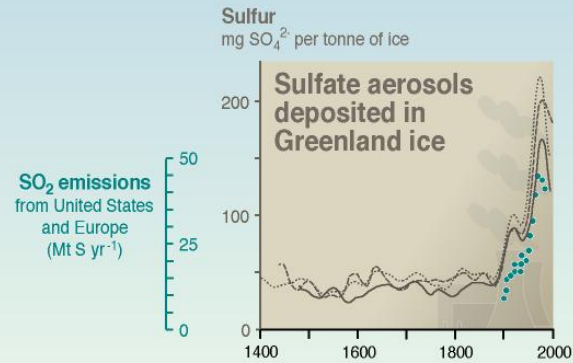
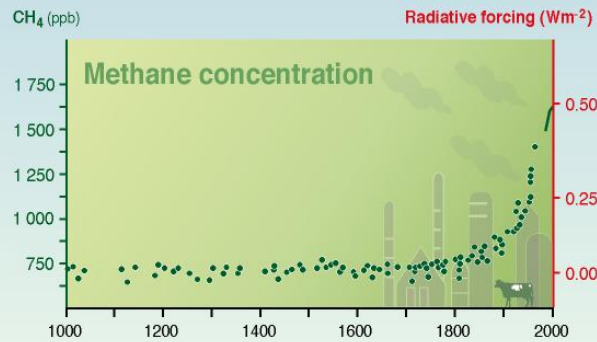
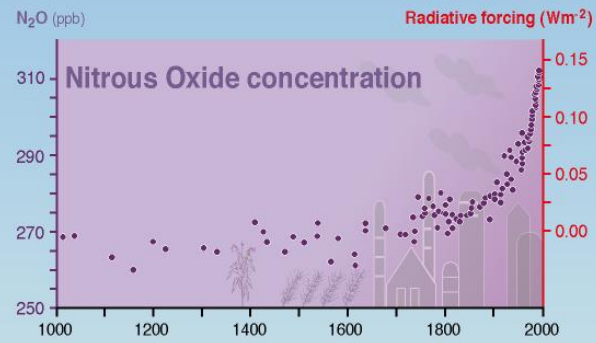
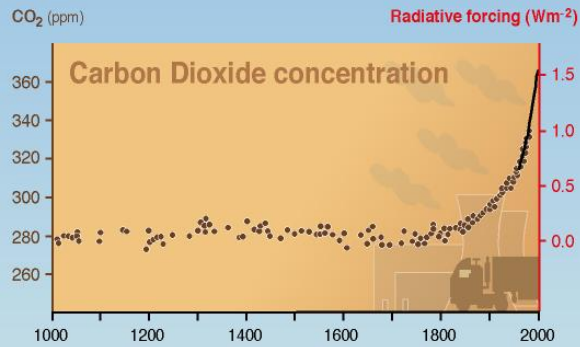
Figure 2.9: (d) Annual surface temperature trends for 1976 to 2000 ($^{\circ}\text{C}/\text{decade}$), calculated from combined land-surface air and sea surface temperatures adapted from Jones et al. (2001). The red, blue and green circles indicate areas with positive trends, negative trends and little or no trend respectively. The size of each circle reflects the size of the trend that it represents. Trends were calculated from annually averaged gridded anomalies with the requirement that annual anomalies include a minimum of 10 months of data.

Variations of Earth's surface temperature; 1000 to 2100 A.D.

1000 to 1861, N.Hemisphere, proxy data; 1861 to 2000 Global, instrumental; 2000 to 2100, SRES projections

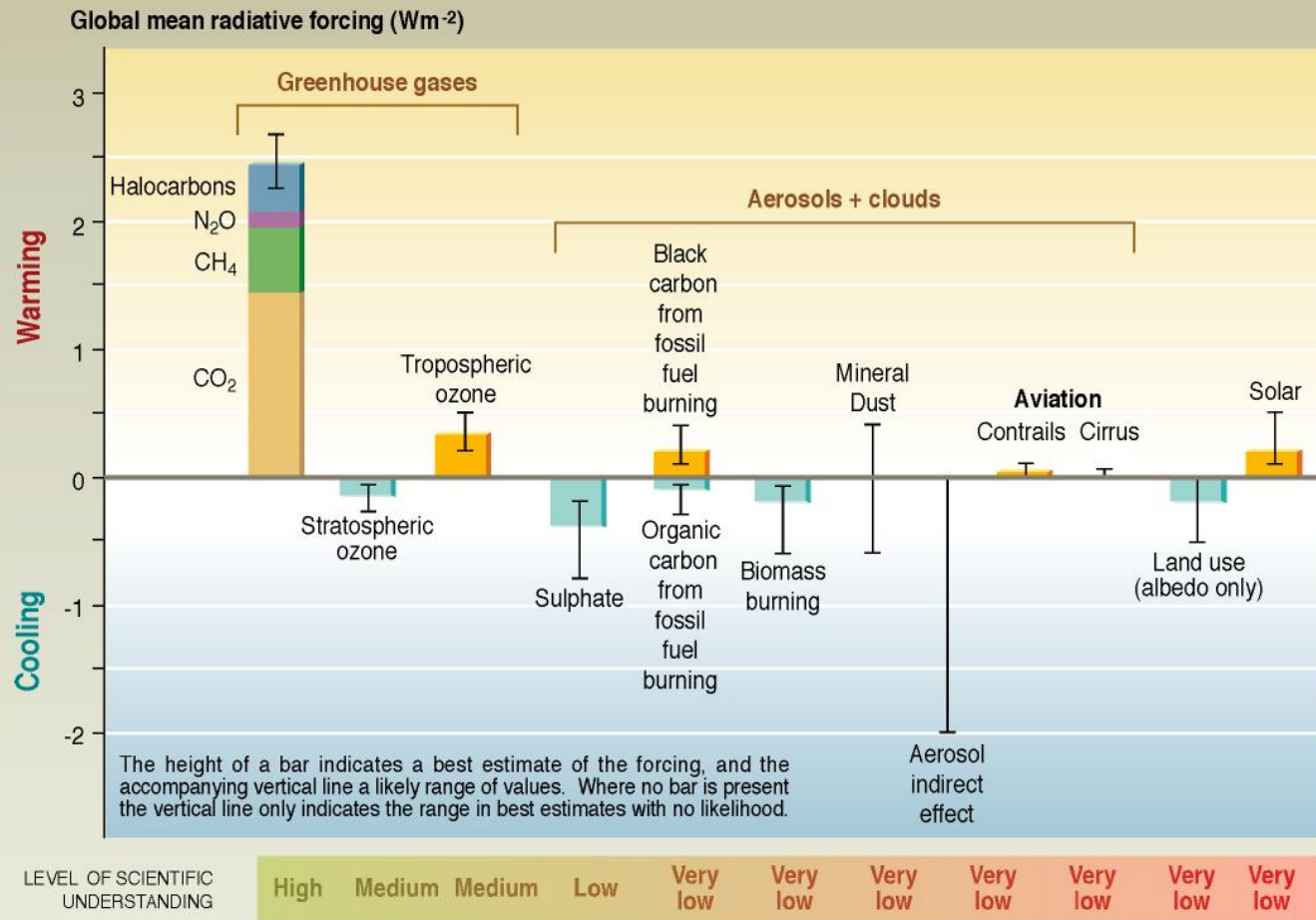


Indicators of the human influence on the atmosphere during the Industrial era



SYR - FIGURE 2-1
WG1 FIGURE SPM-2

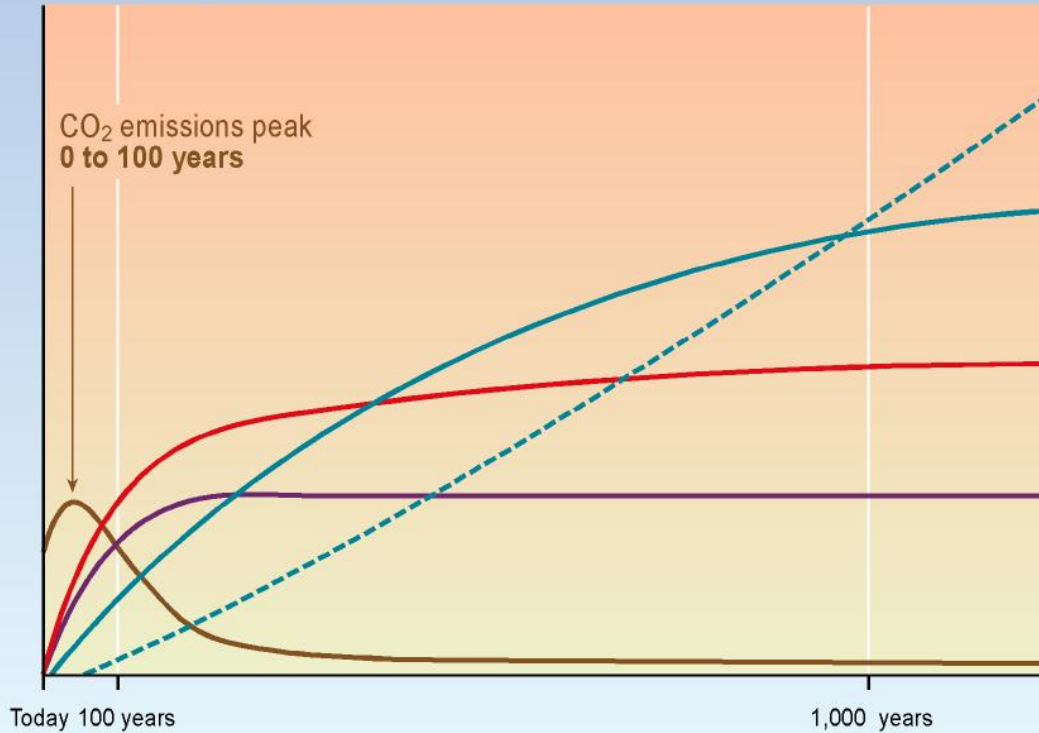
Anthropogenic and natural forcing of the climate for the year 2000, relative to 1750



SYR - FIGURE 2-2

CO₂ concentration, temperature, and sea level continue to rise long after emissions are reduced

Magnitude of response



Time taken to reach equilibrium

Sea-level rise due to ice melting:
several millennia

Sea-level rise due to thermal expansion:
centuries to millennia

Temperature stabilization:
a few centuries

CO₂ stabilization:
100 to 300 years

CO₂ emissions

SYR - FIGURE 5-2

Recent reports conclude that increased greenhouse gas concentrations are warming the earth

"Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise."

National Academy of Sciences, 2001

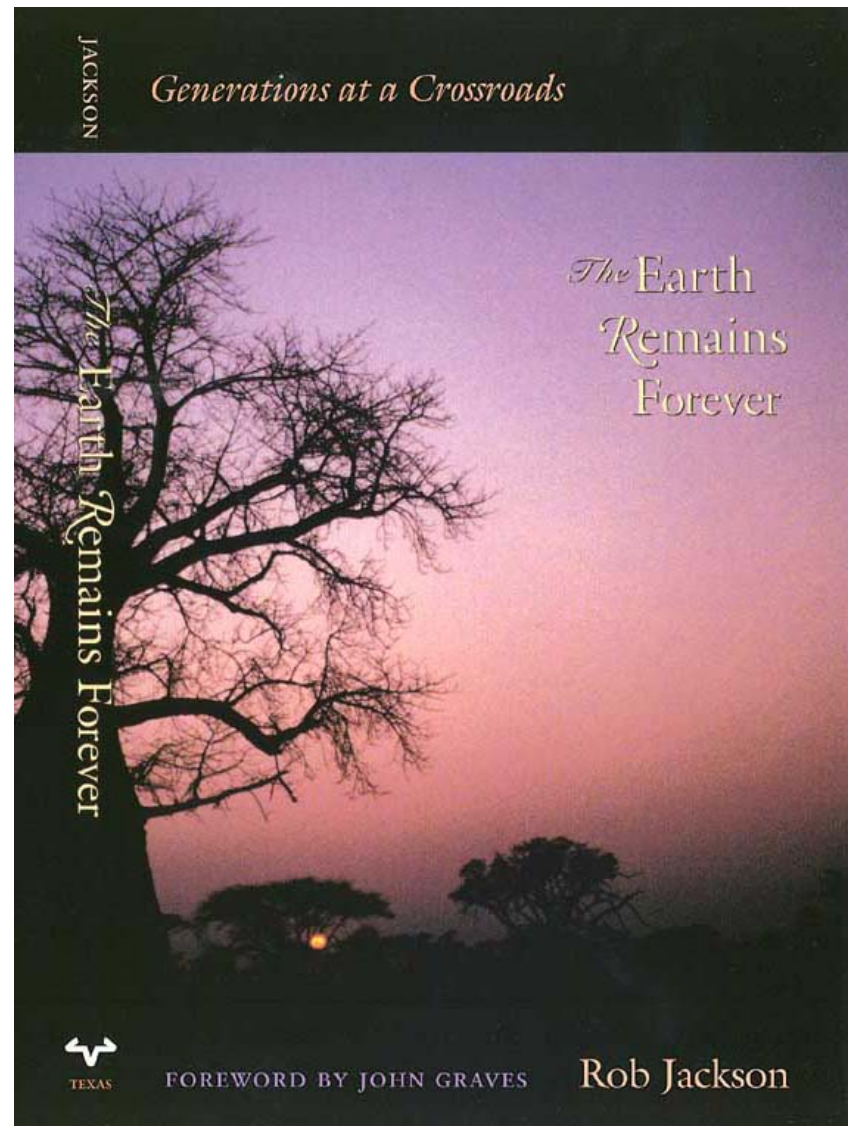
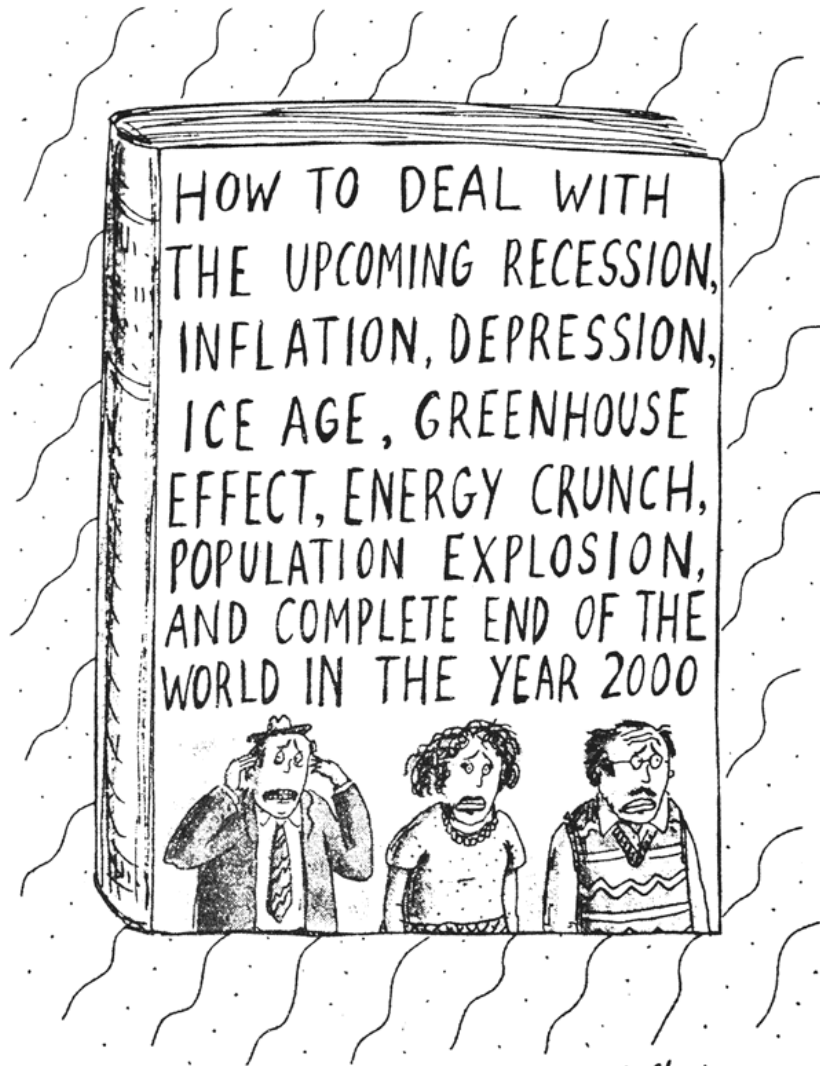
The world is warming up. ... Pollution from "greenhouse gases" such as carbon dioxide (CO₂) and methane is at least partly to blame "

American Association for the Advancement of Science, 2000

And hot off the press:

"The most significant and longest duration feature during the last 1200 years is the geographical extent of warmth in the middle to late 20th century."

Osborn and Briffa, February 10th, 2006, *Science*



“The world was scheduled to end today, but something must have gone wrong.”
Robertson Davies, *The Papers of Samuel Marchbanks*.