Global warming

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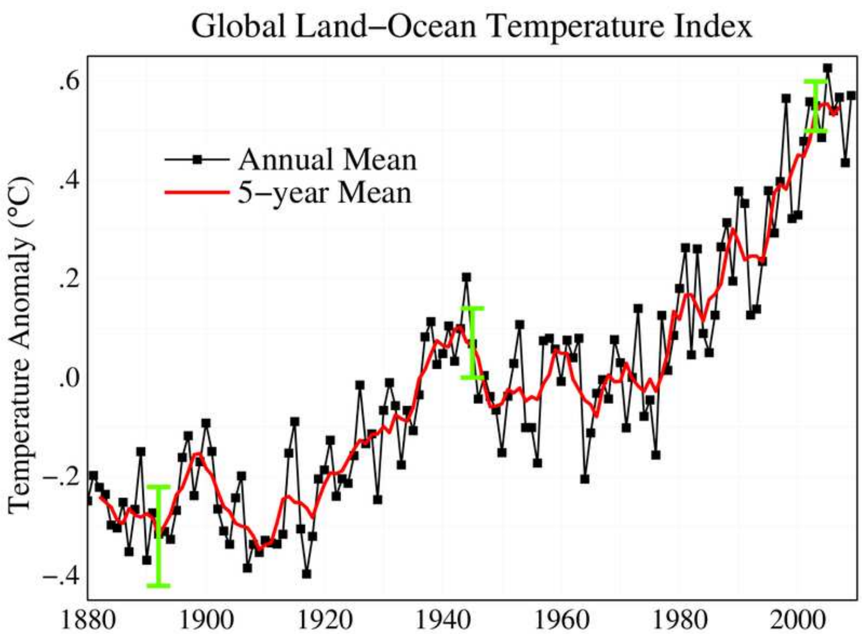
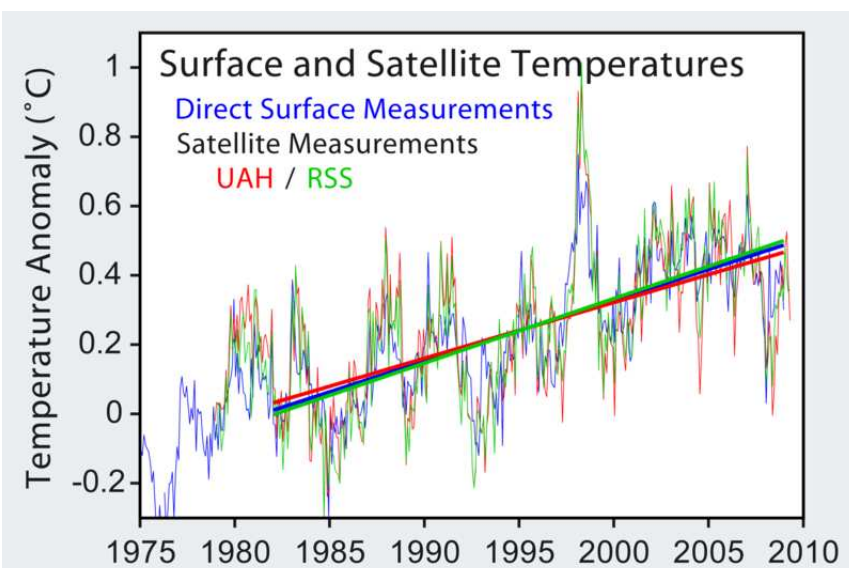
Global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) between the start and the end of the 20th century … Climate model projections summarized in the latest IPCC report indicate that the global surface temperature is likely to rise a further 1.1 to 6.4 °C (2.0 to 11.5 °F) during the 21st century.



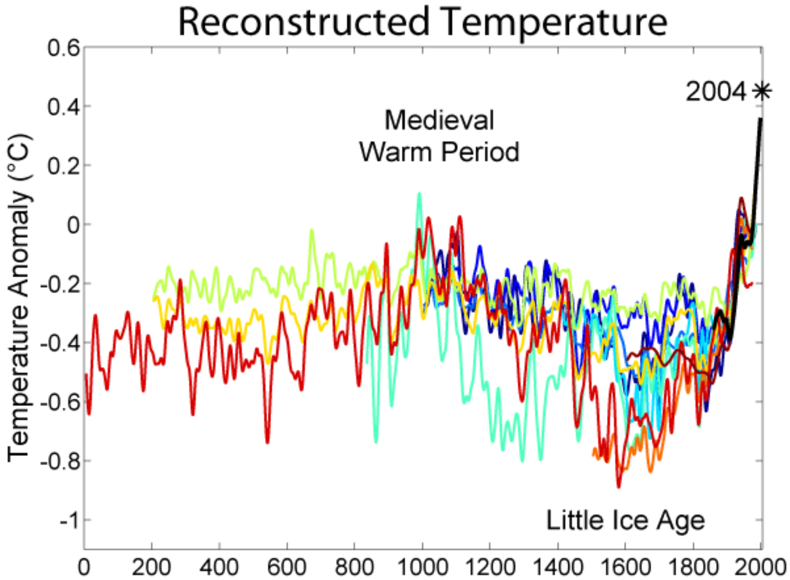
Global mean surface temperature difference relative to the 1961–1990 average



Comparison of ground based (blue) and satellite based (red: UAH; green: RSS) records of temperature variations since 1979. Trends plotted since January 1982.

(red: University_of_Alabama_in_Huntsville; green: Remote_Sensing_Systems)

Temperature is believed to have been relatively stable over the one or two thousand years before 1850, with regionally-varying fluctuations such as the Medieval Warm Period and the Little Ice Age.



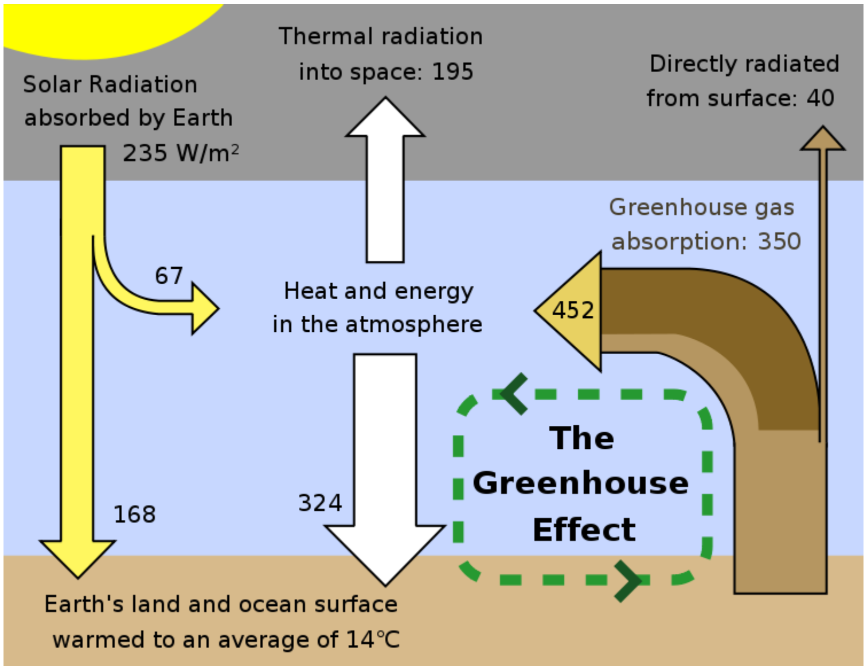
Two millennia of mean surface temperatures according to different reconstructions, each smoothed on a decadal scale. The instrumental record and the unsmoothed annual value for 2004 are shown in black.

Greenhouse gases

The greenhouse effect is the process by which absorption and emission of infrared radiation by gases in the atmosphere warm a planet's lower atmosphere and surface. It was discovered by Joseph Fourier in 1824. **Existence of the greenhouse effect as such is not disputed, even by those who do not agree that the recent temperature increase is attributable to human activity. The question is instead how the strength of the greenhouse effect changes when human activity increases the concentrations of greenhouse gases in the atmosphere.**

Naturally occurring greenhouse gases have a mean warming effect of about 33 °C (59 °F). The major greenhouse gases are water vapor, which causes about 36–70 percent of the greenhouse effect; carbon dioxide (CO_2), which causes 9–26 percent; methane (CH_4), which causes 4–9 percent; and ozone (O_3), which causes 3–7 percent. Clouds also affect the radiation balance, but they are composed of liquid water or ice and so are considered separately from water vapor and other gases.

Human activity since the Industrial Revolution has increased the amount of greenhouse gases in the atmosphere, leading to increased radiative forcing from CO_2, methane, tropospheric ozone, CFCs and nitrous oxide. The concentrations of CO_2 and methane have increased by 36% and 148% respectively since 1750. These levels are much higher than at any time during the last 650,000 years, the period for which reliable data has been extracted from ice cores.



Greenhouse effect schematic showing energy flows between space, the atmosphere, and earth's surface. Energy exchanges are expressed in watts per square meter (W/m^2).

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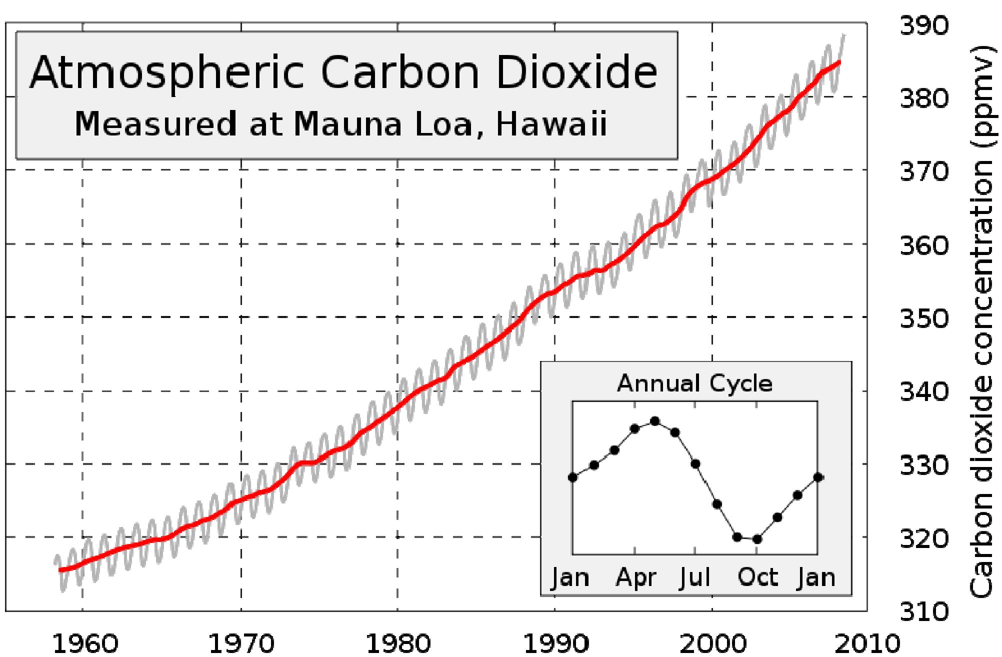

Recent atmospheric carbon dioxide (CO2) increases. Monthly CO2 measurements display seasonal oscillations in overall yearly uptrend; each year's maximum occurs during the Northern Hemisphere's late spring, and declines during its growing season as plants remove some atmospheric CO2.

CO_2 climate sensitivity has a component directly due to radiative forcing by CO_2 (or any other change in Earth's radiative balance), and a further contribution arising from feedbacks, positive and negative. "Without any feedbacks, a doubling of CO_2 (which amounts to a forcing of 3.7 W/m2) would result in 1°C global warming, which is easy to calculate and is undisputed. The remaining uncertainty is due entirely to feedbacks in the system, namely, the water vapor feedback, the ice-albedo feedback, the cloud feedback, and the lapse rate feedback."[3]

3. ^ a b c Rahmstorf, Stefan (2008). "Anthropogenic Climate Change: Revisiting the Facts". in Zedillo, E. (PDF). Global Warming: Looking Beyond Kyoto. Brookings Institution Press. pp. 34–53. http://www.pik-potsdam.de/~stefan/Publications/Book_chapters/Rahmstorf_Zedillo_2008.pdf.

Vandegrift's Personal Notes (not on Wikipedia)

I must look into the following to check this out. Reference 3 is not conclusive.

http://www.aip.org/history/climate/co2.htm

http://www.pewclimate.org/about

http://motls.blogspot.com/2008/01/why-is-greenhouse-effect-logarithmic.html

Translation of orginal paper:

http://web.lemoyne.edu/~giunta/arrhenius.html