

ATMOSPHERIC CARBON DIOXIDE

Atmospheric CO₂ is a non-toxic, colorless, odorless trace gas that constitutes a tiny, tiny portion of the Earth's atmosphere, making up only ~0.038% of the Earth's atmosphere (Fig. 10). In every 100,000 molecules of air, 78,000 are nitrogen, 21,000 are oxygen, 2,000 to 4,000 are water vapor, and only 30 are carbon dioxide.

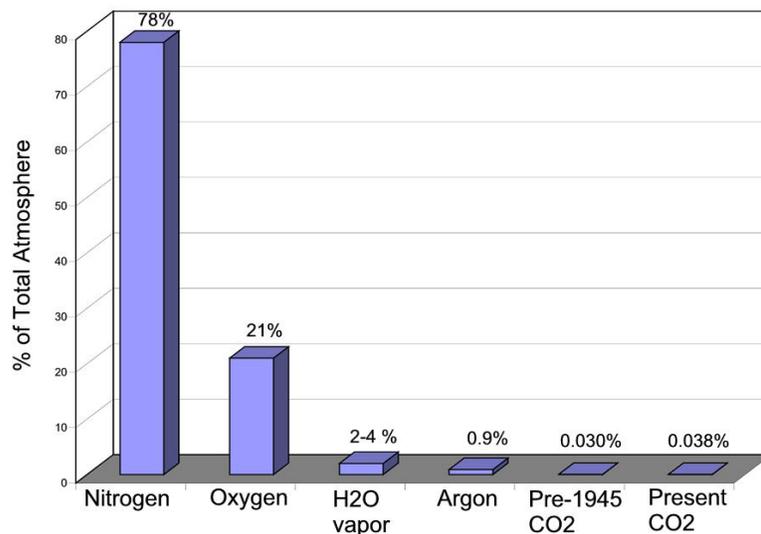


Figure 10. Composition of the atmosphere. CO₂ makes up only 0.038% of the atmosphere.

CO₂ is soluble in water in amounts that vary with the temperature of the water. Cold water can hold more CO₂ than warm water and sea water contains about 75 times as much CO₂ as fresh water. As water temperature increases, the solubility of CO₂ decreases and CO₂ gas is given off into the atmosphere until a new equilibrium is established between the air and water. At 25° C, sea water contains about 50 times as much CO₂ as air. The high solubility and chemical reactivity of CO₂ permits ready exchange of CO₂ between the atmosphere and oceans. When global temperatures rise, as during interglacial periods, atmospheric CO₂ content increases, and when temperatures decline, as during Ice Ages, atmospheric CO₂ declines. Measurements of CO₂ from air trapped in polar ice cores over tens of thousands of years shows that atmospheric CO₂ concentrations typically vary from about 260 to 285 ppm, averaging about 280 ppm. Claims that higher CO₂ during interglacial periods indicates that CO₂ is the *cause* of the warmer interglacials are scientifically indefensible because the CO₂ increase *lagged* Antarctic deglacial warming by 600 to 800 ± 200 years (Fischer et al., 1999; Caillon et al., 2003).

CO₂ as a greenhouse gas

Water vapor accounts for about 95% of the greenhouse gas, with CO₂, methane, and a few other gases making up the remaining 5%. The greenhouse effect from CO₂ is only about 3.6% (Fig. 11). The greenhouse effect of CO₂ decreases exponentially, so the rise in atmospheric CO₂ from about 0.030% in 1950 to .038% in 2008 could have caused warming of only about 0.1° C. The total increase in CO₂ of the atmosphere since about 1945 has been 0.008%, which amounts to less than 1 molecule of CO₂ per 10,000 molecules of air.

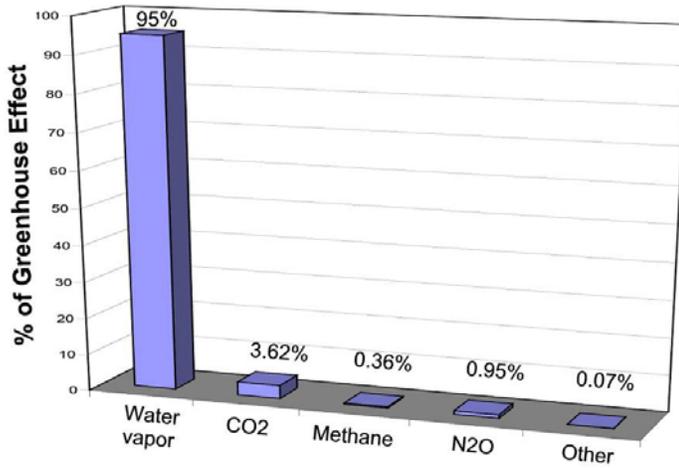


Figure 11. Percentage of total greenhouse effect of atmospheric gases.

Is Global Warming Caused by Rising CO₂?

No tangible, physical evidence exists for a cause-and-effect relationship between changing atmospheric CO₂ and global temperature changes over the last 150 years. The fact that CO₂ is a greenhouse gas and that CO₂ has increased doesn't prove that CO₂ has caused the warming phases observed from 1915 to 1945 and 1977 to 1998. As shown by isotope measurements from ice cores in Greenland and Antarctica and by measurements of atmospheric CO₂ during El Nino warming, oceans emit more CO₂ into the atmosphere during climatic warming. The ice core records indicate that after the last Ice Age, temperatures rose for about 600–800 years *before* atmospheric CO₂ rose, showing that climatic warming caused CO₂ to rise, not vice versa. The present high level of atmospheric CO₂ may be the result of human input, but the contribution that it makes to global warming is very small.

Global warming of ~0.4° C occurred from about 1910 to 1940 without any significant increase in atmospheric CO₂. Global cooling occurred from the mid 1940s to 1977 despite soaring CO₂ in the atmosphere (Fig. 12A,B). Global temperatures and CO₂ both increased from 1977 to 1998 but that doesn't prove that the warming was caused by increased CO₂. Although CO₂ has risen from 1998 to 2008 no global warming has occurred. In fact, the climate has cooled. Thus, global warming bears almost no correlation with rising atmospheric CO₂.

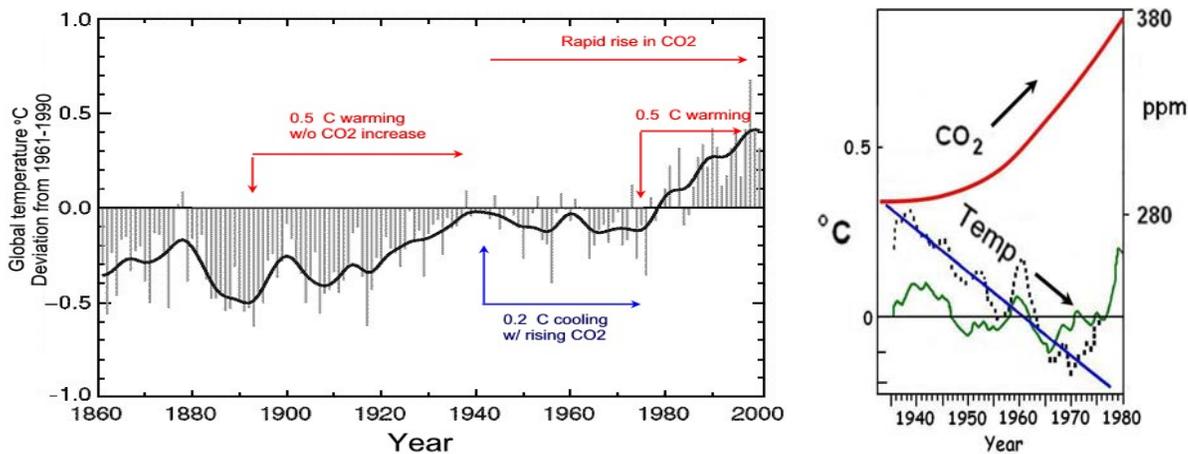


Figure 12A. Global cooling during soaring atmospheric CO₂ emissions ~1945 to 1977. (Modified from IPCC data) **B.** Global cooling during rapid increase in atmospheric CO₂ from 1940 to 1977.