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Innovation The Research Concept

CO_2 Level in Atmosphere: Preconditioning of Ice Age

Abstract

In past 400,000 years Data of atmospheric level of CO_2 showed glaciation and deglaciation cycle with ice ages. Global warming (increase in earth's temperature) with increasing CO_2 level became general opinion. It means as CO_2 increases temperature raises and vice-versa. At present the level of CO_2 is unlikely very high than any maxima in past. But the rise in temperature is not as much as predicted. Decreases in CO_2 level were reported before ice ages. Thus if CO_2 level reaches the maximum it would decline, consequently temperature will decline to move through ice age.

Keywords: Glaciation, Deglaciation, Albedo, Ice Cores.

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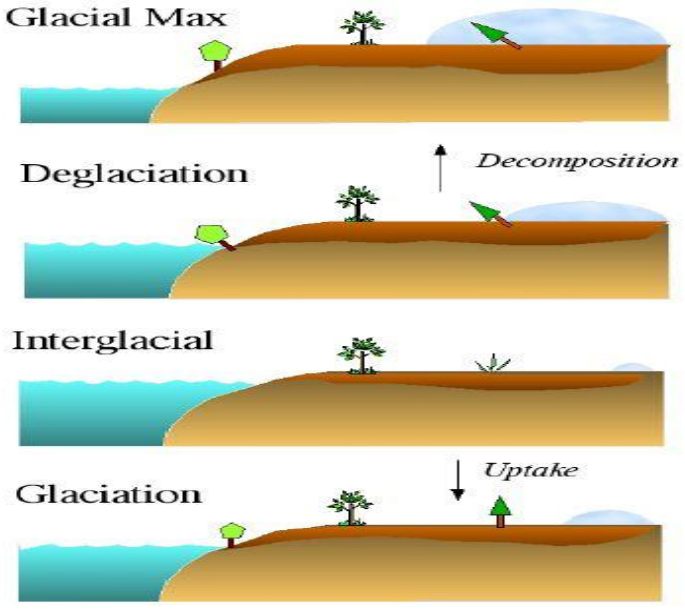
Introduction

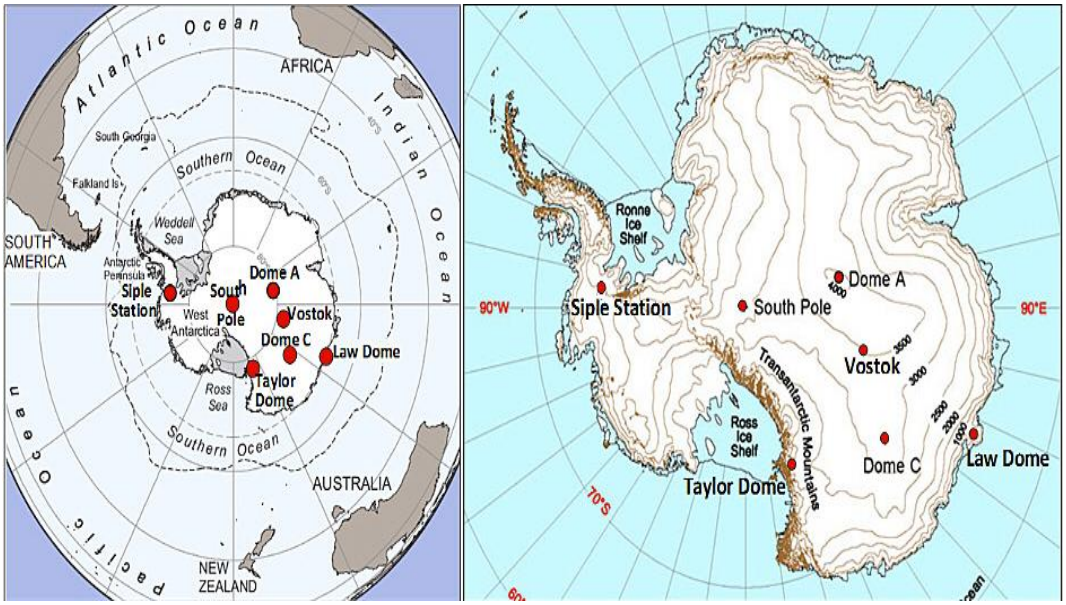
Global climate is determined by the radiation balance of the planet. There are three fundamental ways the Earth's radiation balance can change, thereby causing a climate change: (1) changing the incoming solar radiation (e.g., by changes in the Earth's orbit or in the Sun itself), (2) changing the fraction of solar radiation that is reflected (this fraction is called the albedo – it can be changed, for example, by changes in cloud cover, small particles called aerosols or land cover), and (3) altering the long wave energy radiated back to space (e.g., by changes in greenhouse gas concentrations). In addition, local climate also depends on how heat is distributed by winds and ocean currents. All of these factors have played a role in past climate changes.

It is known today that for Earth's present climate water vapor is the principal green house gas with carbon dioxide playing a secondary role. Climate models nevertheless use carbon dioxide as the principal variable while water vapor is treated as a feedback.

Atmospheric carbon dioxide (CO_2) also plays an important role in the ice ages. Antarctic ice core data show that CO_2 concentration is low in the cold glacial times (~190 ppm), and high in the warm interglacials (~280 ppm); atmospheric CO_2 follows temperature changes in Antarctica with a lag of some hundreds of years. Because the climate changes at the beginning and end of ice ages take several thousand years, most of these changes are affected by a positive CO_2 feedback.

Stages of A Glacial-Interglacial Cycle





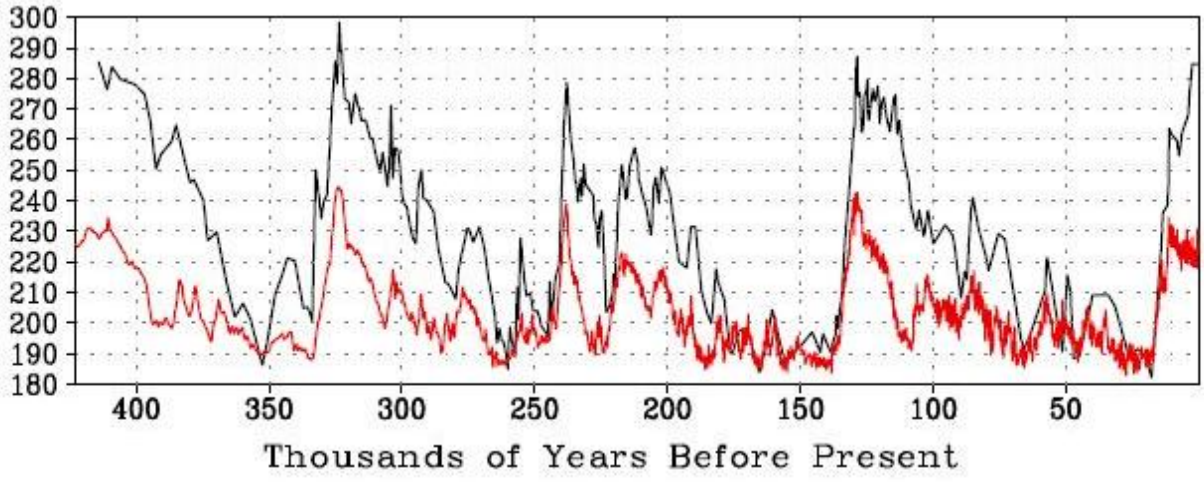
Antarctica contains 90% of the world's ice. The Antarctic ice sheet is the layer of ice up to 5,000m thick covering the Antarctic continent. It is formed from snow falling in the interior of the Antarctic which compacts into ice. The ice sheet slowly moves towards the coast, eventually breaking away as icebergs which gradually melt into the sea. The ice sheet covering East Antarctica is very stable, because it lies on rock that is above sea level and is thought unlikely to collapse. The West Antarctic is less stable, because it sits on rock below sea level. If glaciers and ice sheets shrink, ice that was held above sea level will find its way into the oceans. If ocean volume increases, global sea level will rise. This has happened many times in geological history.

Cylinder of ice drilled out of an ice sheet or glacier. Most ice core records come from Antarctica and Greenland. The ice encloses small bubbles of air that contain a sample of the atmosphere – from these it is possible to measure directly the past concentration of gases in the atmosphere. Ice cores contain information about past temperature, and about many other aspects of the environment. Most ice core records come from Antarctica and Greenland, and the longest ice cores extend to 3km in depth. The oldest continuous ice core records to date extend 123,000 years in Greenland and 800,000 years in Antarctica.

Atmospheric CO_2 concentration has varied throughout Earth's history, often in synchrony with temperature and other climate variables. Measurements of air trapped in Antarctica ice cores have revealed large CO_2 variations over the last four 100-kyr (thousands of years) glacial-interglacial cycles, in particular, the 80-100 ppmv increase from glacial maxima to interglacials.

Numerous attempts have been made over the last two decades to explain the lower atmospheric CO_2 at glacial times.

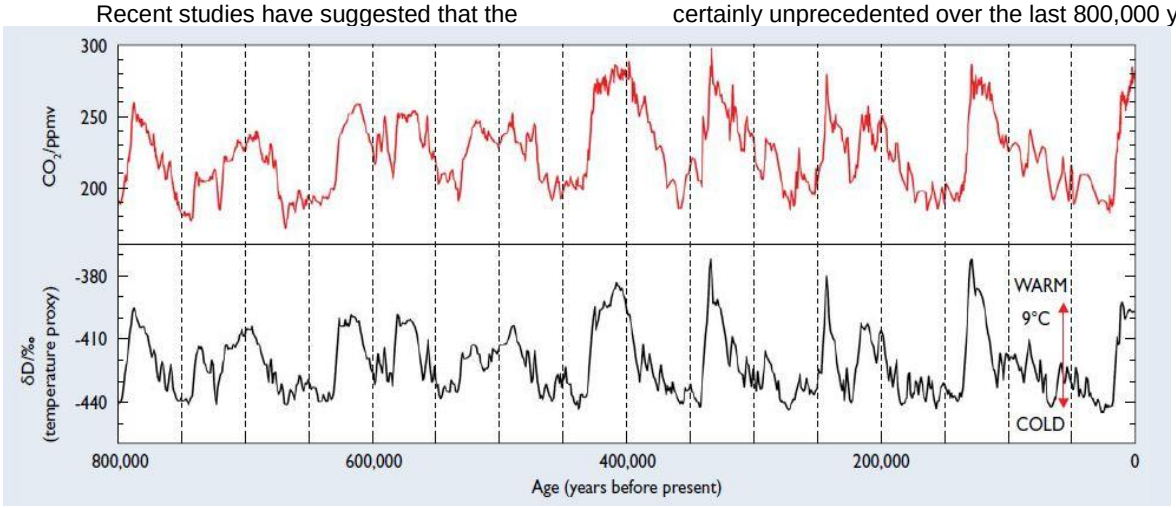
History of Atmospheric CO_2 (Black Line, in ppmv) and Temperature (Red, in Relative Units) over the Last 420,000 Years from the Vostok Ice Core; After Petit et al. (1999)



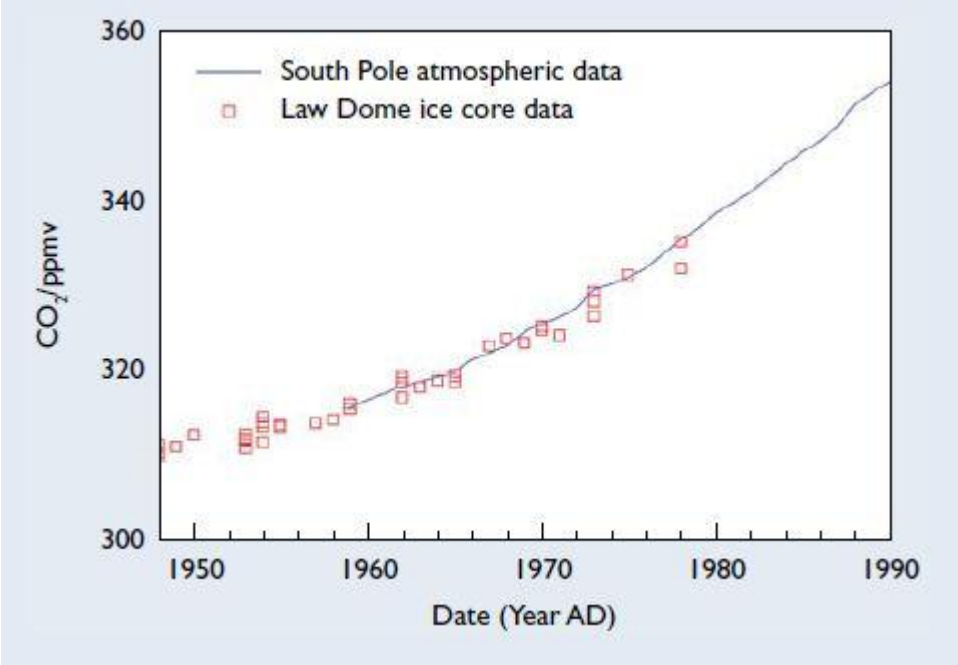
The concentration of carbon dioxide (CO_2) in the atmosphere has varied in step with glacial/interglacial cycles. During interglacial times, such as the Holocene (roughly the past 10,000 years), the atmospheric partial pressure of CO_2 (pCO_2) is typically near 280 parts per million by volume (ppmv).

During peak glacial times, such as the Last Glacial Maximum about 18,000 years ago, atmospheric pCO_2 is 180±200 ppmv, or roughly 80±100 ppmv lower. CO_2 is a greenhouse gas, and model calculations suggest that its changes play a significant role in the energetics of glacial/interglacial climate change.

Recent studies have suggested that the observed atmospheric warming on the Antarctic Peninsula is the result of human activities. Atmospheric CO_2 levels are now 40% higher than before the industrial revolution. This increase is due to fossil fuel usage and deforestation. The magnitude and the rate of the recent increase are almost certainly unprecedented over the last 800,000 years.



Data Source:*Jouzel, J., and others: Orbital and millennial Antarctic climate variability over the last 800,000 years, Science, 317, 793-796, 2007 Lüthi, D., and others: High-resolution carbon dioxide concentration record 650,000-800,000 years before present, Nature, 453, 379-382, 2008*



Data Source: *MacFarling Meure, C., and others: Law Dome CO_2, CH_4 and N_2O ice core records extended to 2,000years BP, Geophys. Res. Lett., 33, L14810, doi:10.1029/2006GL026152, 2006*
Atmospheric data supplied by NOAA/ESRL

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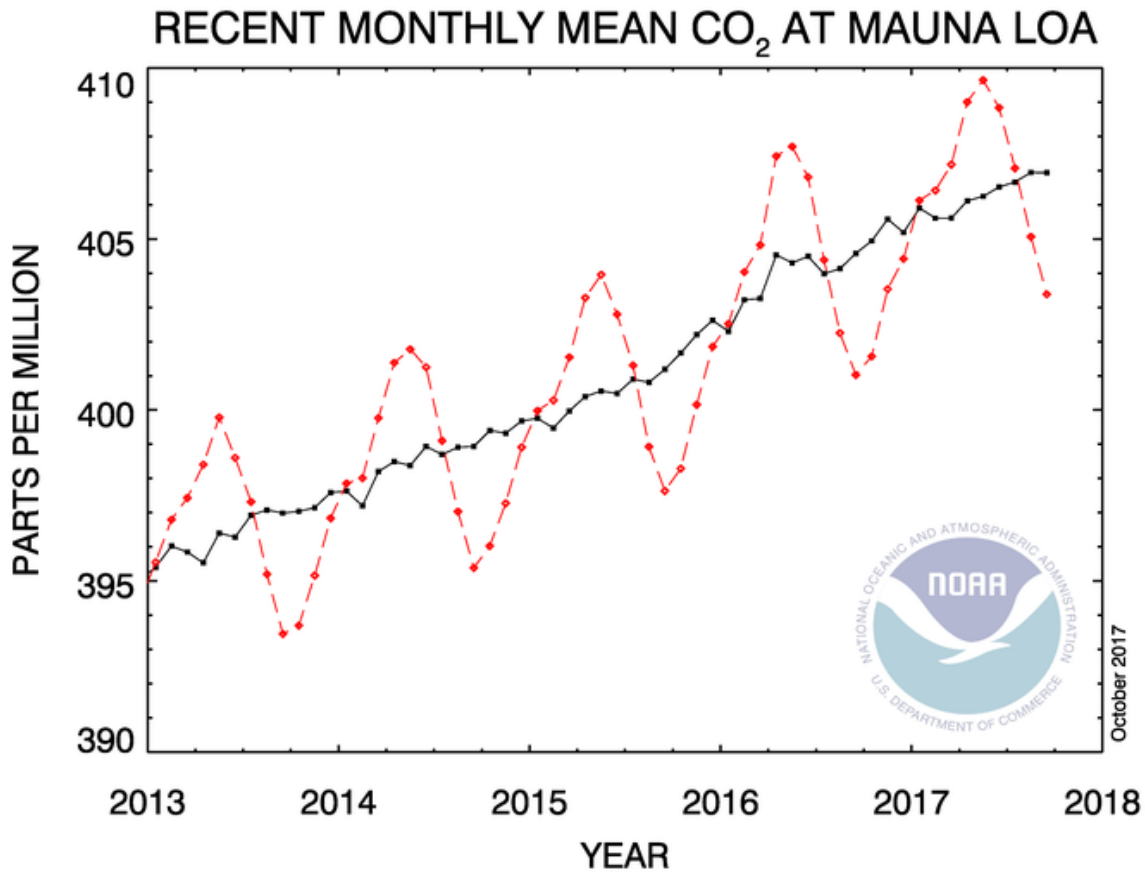
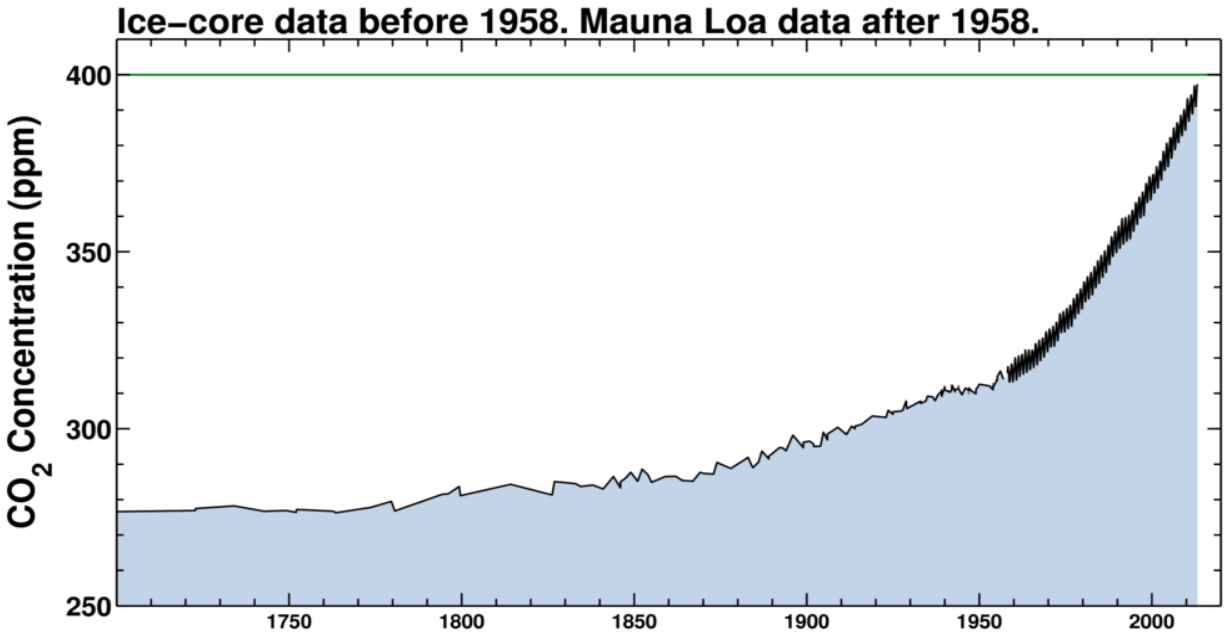
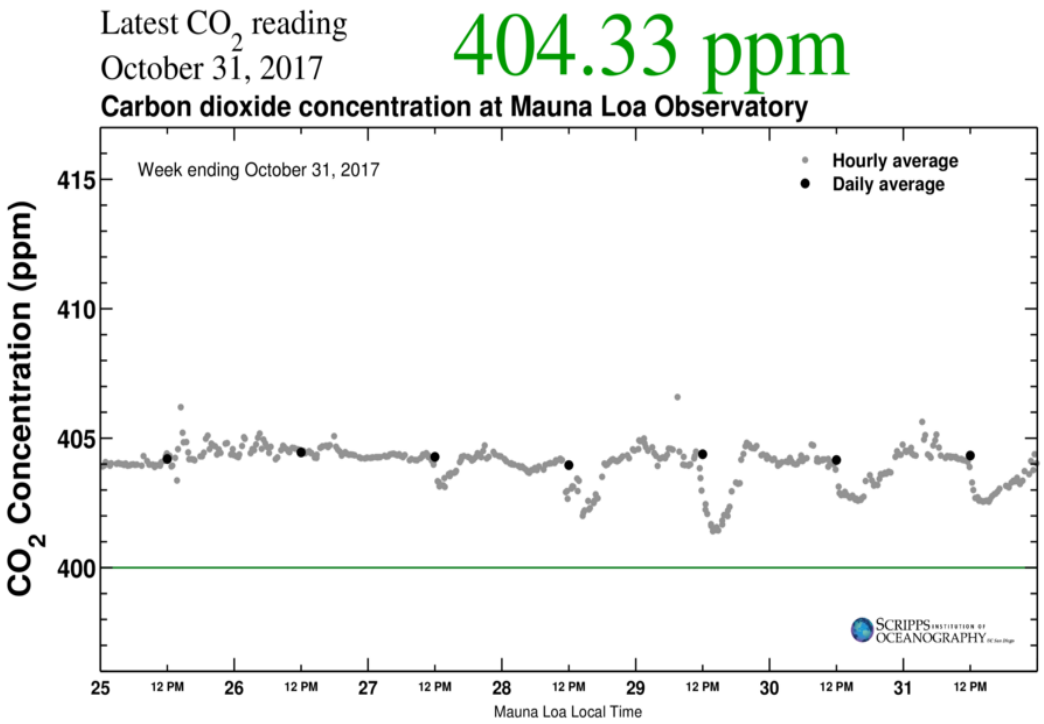


Graphic via UNC Charlotte



Sime, *et al*. have found that past interglacial climates were much warmer than previously thought. Their analysis of the data shows that the maximum interglacial temperatures over the past 340 kyr were between 6 ^{o}C and 10 ^{o}C above present day values. It can be seen that past interglacial carbon dioxide concentrations were not higher than that of the current interglacial, and therefore carbon dioxide could not have been responsible for this warming. In fact, the concentration of carbon dioxide that would be needed to produce a 6-10 ^{o}C rise in temperature above present day values exceeds the maximum.



Aim of the Study

To study the history of CO2 level in atmosphere & its consequence on variation of global temperature.

Discussion and Result

The latest reported value close to 400 ppm. Getting back to the 400 ppm, we can expect this value to be drawn down as the biosphere – plants – breathe in the CO_2 during the summer growth period. This happens every year, but our fossil fuel emissions are over whelming that breathing cycle. CO_2 concentrations are much higher than anything ever seen in since human civilization emerged.

Conclusion

Now if the CO_2 level is reaching at the highest, then it will be controlled by nature preferably through Ice age. Thus, this Global warming is precondition of Ice age.

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