

CARBON EMISSIONS AND ATMOSPHERIC CO₂

A concise, scientific explanation

Saturday, September 13, 11:17 AM PDT

The following is a concise, scientific explanation of the email recently sent to the Canadian Prime Minister. The email's subject line is "The Misguided Narrative on Carbon Emissions".

Thorpe

Carbon Emissions and Atmospheric CO₂

This email addresses a critical question regarding carbon emissions from fossil fuels and their impact on atmospheric CO₂ levels. It provides a clear and concise explanation based on scientific principles.

Question

Do carbon emissions (commonly referred to as carbon dioxide or CO₂) increase the CO₂ content of the atmosphere?

Answer

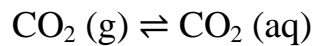
No, the impact is negligible. From a practical perspective, the increase in atmospheric CO₂ due to carbon emissions is so small—approximately 0.0006 parts per million (ppm) annually—that it is effectively inconsequential and cannot be measured with precision. Below, I explain why this is the case.

Explanation

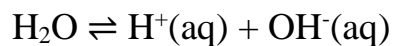
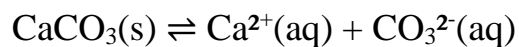
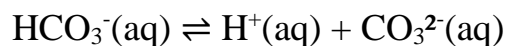
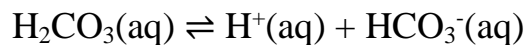
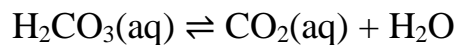
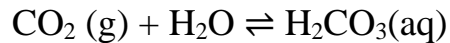
The Earth's carbon cycle involves a complex system where CO₂ is stored primarily in the atmosphere and oceans, collectively referred to as the "System." The oceans contain approximately 50 times more CO₂ than the atmosphere, with a total carbon content of roughly 40,000 gigatons of carbon (GtC).

CO₂ in the System interacts through both physical and chemical processes:

Physical Interaction (Henry's Law): CO₂ in the atmosphere (CO₂ (g)) is in equilibrium with dissolved CO₂ in the ocean's surface layer (CO₂ (aq)), as described by:



Chemical Reactions: CO₂ reacts with highly buffered seawater, striving for chemical equilibrium through the following reactions:



These processes ensure that the System continuously adjusts to maintain equilibrium. When CO₂ is added to the System, whether from natural or anthropogenic sources, the carbon distributes across all subsystems (atmosphere, oceans) in proportion to their existing carbon content at equilibrium.

Calculation

Annual CO₂ emissions from fossil fuels are approximately 10 GtC.

The total carbon in the System is 40,000 GtC.

The proportional increase in the System's carbon content due to fossil fuel emissions is:

$$(10 / 40,000) \times 100 = 0.025\%.$$

Applying this percentage to the atmosphere, where the annual CO₂ increase is approximately 2.4 ppm, the contribution from fossil fuel emissions is:

$$0.025\% \text{ of } 2.4 \text{ ppm} = 0.0006 \text{ ppm}.$$

Thus, fossil fuel emissions account for only 0.0006 ppm of the annual atmospheric CO₂ increase, with the remaining 2.3994 ppm attributable to other factors, such as rising sea surface temperatures (SST).

Conclusion

The contribution of carbon emissions from fossil fuels to atmospheric CO₂ levels is negligible, at approximately 0.0006 ppm per year. This minimal impact underscores the dominant role of natural processes, such as ocean-atmosphere interactions, in driving observed changes in atmospheric CO₂ concentrations.

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