

Greenhouse Gases in the Earth's atmosphere: measurements, error bars, implications, perspectives

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Man-made emissions of the greenhouse gases carbon dioxide and methane are the main drivers of climate change. The two gases also play a key role in climate feedbacks since their atmospheric abundances are regulated by the carbon cycle which itself is sensitive to climate. Measuring concentration gradients of the greenhouse gases in the Earth's atmosphere can, in principle, inform on both, the man-made emissions and the biogeochemical processes by which the world's ecosystems remove anthropogenic carbon from the atmosphere. However, measurement techniques need to achieve an accuracy on the permille level since background levels are high and the informative concentration gradients are minute. Here, I will showcase some latest developments in the field of greenhouse gas remote sensing from satellites and ground-based platforms. I will highlight some of the insights gained into the functioning of carbon emissions and carbon uptake, and I will illustrate future perspectives.