Fossil Fuel Emissions and Fossil CO_2 in the Atmosphere

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The comparison of fossil fuel emissions (6.4 GtC/yr) with the growth rate of atmospheric CO_2 (3.2 GtC/yr) suggests that about half of the anthropogenic CO_2 has not remained in the atmosphere: it has dissolved in the ocean or has been taken up by the land. The isotope ratio C_{13}/C_{12} of atmospheric CO_2 has been measured over the last decades using mass spectrometry. From these data the fraction of fossil CO_2 in atmospheric CO_2 is straightforwardly calculated: 5.9 %(1981) and 8.5 %(2002). These results indicate that the amount of past fossil fuel and biogenic CO_2 remaining in the atmosphere, though increasing with anthropogenic emissions, did not exceed in 2002 66 GtC, corresponding to a concentration of 31 ppm, that is 3 times less than the CO_2 increase (88 ppm, 24 %) occurred in the last century. This low concentration (31 ppm) of anthropogenic CO_2 in the atmosphere is consistent with a lifetime of t(1/2) = 5.4 years, that is the most reliable value among other in the range 2-13 years, obtained with different measurements and methods. Contrary to the above findings on the concentration of fossil CO_2 and its residence time in the atmosphere, in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change it is stated that almost 45 % of anthropogenic emissions, corresponding to 88 ppm or 24 % of the total CO_2, have remained in the atmosphere with a mean lifetime of t(1/2) = 30.5 years. On these assumptions are based both the theory of Anthropogenic Global Warming and the climate models.