

Acceleration of the Rate of Growth of Atmospheric Carbon Dioxide.

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When Dave Keeling started continuous measurements of CO₂ on Mauna Loa in 1958 the observed mean growth rate for 1959 through 1963 was approximately 0.76 ppm/year, while the average rate of fossil fuel consumption was 2.5 GtC (billion metric tons of carbon)/year. The mean growth rate for 2001 through 2005 is 2.1 ppm/year, and a preliminary estimate for the rate of fossil fuel burning is 7.3 GtC/year. It appears that over several decades the atmospheric increase maintains an almost constant proportion to the rate of fossil fuel burning, except during the early 1990s. This is actually surprising given what we expect the ocean response to the historical atmospheric CO₂ increase to be.

We have compiled a second growth rate estimate based on global marine air data since 1980. Mauna Loa tracks the global rate well. One standard deviation of the differences between the two is 0.26 ppm/year. There is considerable year-to-year variation in the atmospheric increase measured at Mauna Loa, with a standard deviation of 0.46 ppm/year. The interannual variation is visibly related to global temperature anomalies. We have constructed from the data a delayed response curve of the CO₂ growth rate to temperature. The response changes sign at a delay of about 0.5 year. We could not detect a response to other global or regional climate anomalies such as precipitation. Subtraction of the calculated response of CO₂ to temperature anomalies significantly decreases the “unexplained” part of the interannual variation of the CO₂ growth rate.

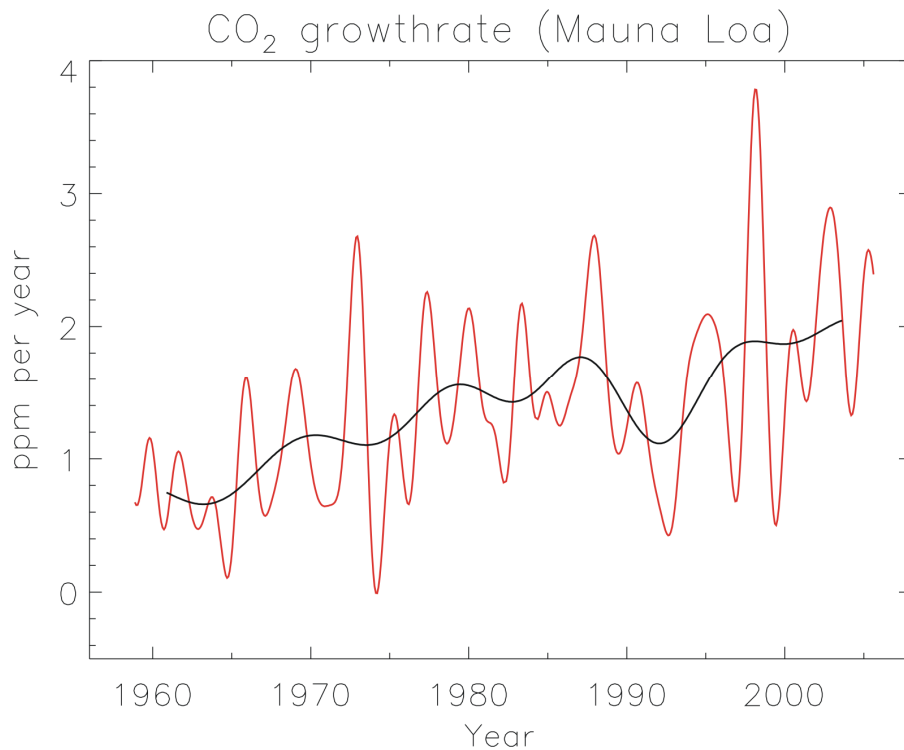


Figure 1. After removal of the seasonal cycle the rate of growth of carbon dioxide at Mauna Loa has been smoothed with a digital filter with a width of approximately one year (red line). The black line represents a similar filter with a width of five years.