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The 2003 atmospheric CO_2 growth-rate: was it anomalous? was it climate change?

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This study examines the facts behind the growth-rate of atmospheric CO_2 in 2002 and 2003 which received much media interest. Observations for 2002 and 2003 show consecutive increases of greater than 2 ppmv yr^{-1} for the first time on the Mauna Loa record (which extends back to 1958).

Increasing anthropogenic emissions account for the ever-upwards trend in atmospheric CO_2 growth rate, but are insufficient to explain the large interannual variability. Previous rapid CO_2 rises have coincided with large El Nino events (such as in 1998). However, 2002 and 2003 did not show the strong El Nino signals normally associated with anomalously large rates of CO_2 increase.

Our statistical analysis finds that 2003 was indeed anomalous, but in terms of the mechanisms producing the rise rather than the magnitude of the rise itself. Increased forest fires in the northern hemisphere, consistent with remote-sensing and carbon monoxide measurements, seem likely to have contributed significantly. We hypothesise that hot and dry summers in 2002 and 2003 led to an increase in forest fire emissions, and may also have directly suppressed European land-carbon uptake, producing the CO_2 growth-rate anomalies of 2002 and 2003. To what extent this can be attributed to anthropogenic climate change is still a matter of some debate.