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Recent Trends In Global Atmospheric Radiative Forcing Trace Gas Concentrations

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Carbon dioxide emitted from fossil fuel and biomass burning is partitioned into three reservoirs: atmosphere, oceans, and terrestrial biosphere. Global average atmospheric CO_2 has increased from about 280 ppm from the start of the industrial revolution to about 380 ppm today. Roughly, half the emitted CO_2 remains in the atmosphere and the remainder has gone into the oceans and biosphere. Interannual variations in the atmospheric increase of CO_2 (Figure 1a) are attributed to small changes in net fluxes between reservoirs. The smoothed, globally averaged atmospheric CH_4 concentrations are presented in Figure 1(b). Over the past 20 years, CH_4 has increased, but the rate of increase has slowed. A large increase in 1998 was likely the result of climatic conditions that resulted in increased emissions from wetlands and biomass burning. Globally averaged CH_4 then remained almost constant from 1999-2002. In 2003 CH_4 increased by about 5 ppb; this seems to be driven by increased emissions in the northern hemisphere, as there was little change in the southern hemisphere. Also increasing are the radiatively important trace gases nitrous oxide and sulfur hexafluoride (Fig. 2). Nitrous oxide is emitted to the atmosphere because of both natural processes and anthropogenic activities, and since the late 1980s, the rate of increase in N_2O has averaged 0.7 ppb yr^{-1}. Sulfur hexafluoride is a strong absorber of terrestrial IR, is anthropogenic in origin, and has a long lifetime. Global mixing ratios of SF_6 increased throughout the 1990s and early 2000s. The mean rate of increase from 2003 to 2004 was 0.2 ppt yr^{-1}; at the end of 2004, global surface mixing ratios of SF_6 reached 5.5 ppt.

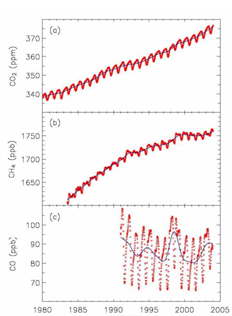

Fig 1: Average atmospheric concentrations of two greenhouse gases and carbon monoxide. Carbon dioxide and methane have the largest total radiative forcing due to their high atmospheric concentrations.

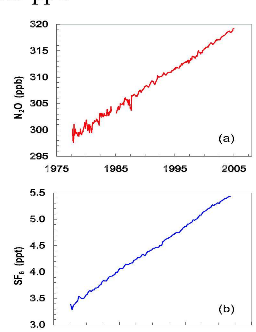

Fig 2: Nitrous oxide and sulfur hexafluoride, powerful greenhouse gases that have low atmospheric concentrations and thus low total