Increase in the Global Burden of CH_4 During 2007

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Methane (CH_4), with a direct radiative forcing of ~0.48 W m^{-2}, is responsible for ~20% of the total forcing for long-lived greenhouse gases. Indirect effects, as a precursor to production of tropospheric O_3 and from stratospheric H_2O formed during its oxidation there, add another 0.2 W m^{-2} to its forcing. Tropospheric CH_4 also impacts background air quality through its effects on O_3.

From 1999 to 2006, the global burden of atmospheric CH_4 remained nearly constant (see Figure), except for a small increase resulting from increased boreal biomass burning during 2003. A simple explanation for the stabilization of atmospheric CH_4 remains elusive, and it is likely the result of many contributing factors. Despite the lack of understanding of CH_4 trends during 1999 to 2006, it seems reasonable that atmospheric CH_4 will begin to increase again as suggested by scenarios of future emissions (e.g., IPCC Special Report on Emissions Scenarios). Rapidly growing economies in Asia have likely resulted in increased emissions from two important CH_4 sources: coal production and waste processing. Coal production, which is responsible for nearly 10% of global CH_4 emissions, has increased by nearly a factor of two in China since 2000. Also, the impacts of climate change on natural wetland emissions, particularly in the Arctic where estimates suggest as much as 900 Tg is stored as labile carbon in permafrost, would eventually result in increasing CH_4 emissions there. Evolution of the observed latitude gradient in CH_4 over time suggests that while mid-latitude emissions are increasing because of economic growth in Asia, we have yet to see an increase in the global burden, because increasing Asian emissions have been canceled by decreasing anthropogenic emissions of CH_4 at high northern latitudes from the former Soviet Union and Europe.

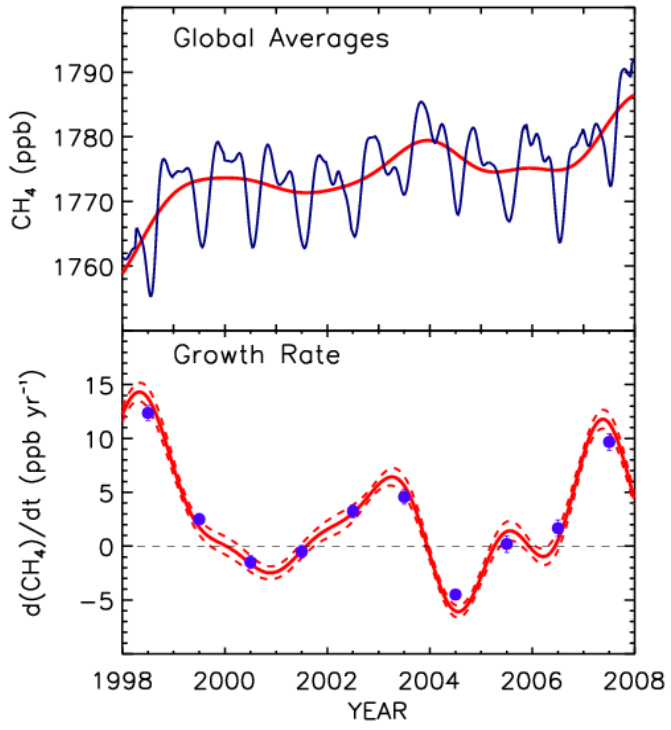

Figure 1. Preliminary globally averaged CH_4 mole fractions (blue) and trend (red) (top panel); instantaneous growth rate (red) and annual increase (blue) (bottom panel).

During 2007, globally averaged CH_4 increased by ~10 ppb, which is comparable to the observed increase in 1998 when anomalous wetland and biomass burning emissions contributed. NOAA CO data suggest there were no large biomass burning events in 2007, but measurements of $\delta^{13}C$ in CH_4 from Alert, Canada suggest greater than normal emissions from wetlands. Our data show clearly that CH_4 emissions in the tropics also increased. It is not yet clear if 2007 is anomalous, or it is the start of increasing emissions from Arctic ecosystems resulting from warm temperatures that increase emissions from wetlands and melting permafrost.