Causes of the Anomalous Atmospheric CH_4 Growth Rate During 2007

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Analysis of global temperature data has revealed that 2007 tied with 1998 for the warmest year on record. Temperatures were exceptionally warm in the Arctic, which experienced a record minimum in sea ice extent during September. It is noteworthy that last year coincided with the cool phase of the ENSO, unlike 1998 when an unusually strong El Niño occurred, bringing with it above average temperatures and precipitation to some northern wetlands, and drought, heat and fires to other wetlands, especially those in tropical Asia. The warm temperatures and above-average precipitation in 2007 appear to have had consequences for atmospheric methane, the growth rate of which increased abruptly in the Arctic, Tropics and southern temperate latitudes.

Since the late 1990s the abundance of atmospheric methane has stabilized with sporadic perturbations such as the 1998 El Niño. Using the TM5 atmospheric transport model, a parameterization of methane emissions from wetlands, and the Global Fire Emission Database v2, we demonstrate that the observed interannual variability in atmospheric methane (apart from long-term trends related to anthropogenic sources) can be explained by the responses of wetlands to climate variability and emissions from biomass burning. Even though biomass burning is a fairly small component of the atmospheric methane budget, its variability is quite large. We show that the methane growth rate anomalies in 2007 were due to anomalous wetland emissions, mainly from far northern Europe, and to a lesser extent from tropical latitudes, Boreal North America and Siberia. About 10 Tg of methane were emitted in the high northern latitudes and over 6 Tg were emitted from tropical wetlands.

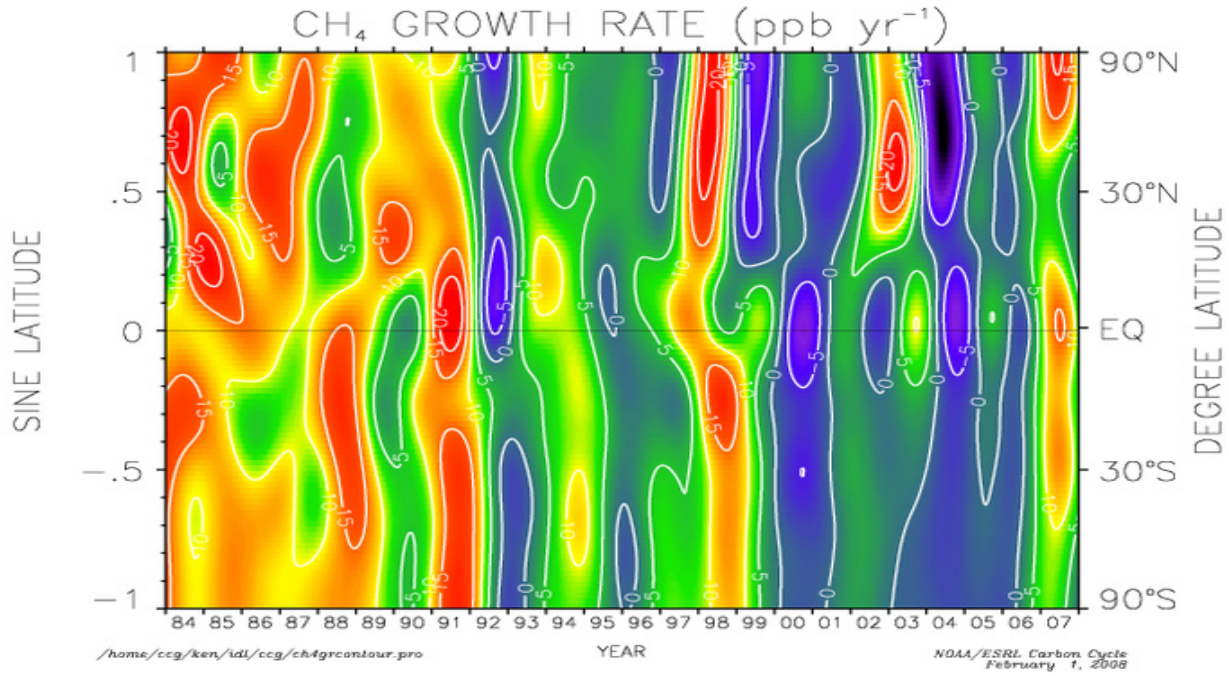

Figure 1. Contour plot of atmospheric CH_4 growth rate, where warm colors are large growth rate and cool colors represent small or negative growth rates. Maximum growth rates are ~20 ppb yr^{-1}; minimum values are ~-10 ppb yr^{-1}. The transition from yellow/orange to blue/green results from a decreasing trend in growth rate.