Geophysical Research Abstracts, Vol. 9, 11681, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11681

Radiative Forcing from North American NO_X Emissions: dependence upon location and season of emission

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The 3D tropospheric Chemistry Transport Model (CTM) STOCHEM has been used to study the changes in the distribution of methane CH_4 and ozone O_3 due to NO_x emissions from a variety of sites in N. America. One month long NO_x emission pulses resulted in: (1) CH_4 deficits that lead to negative radiative forcings; these decay with e-folding times of 10-15 years; (2) excess O_3 mixing ratio (positive radiative forcing) in the short-term that decays over a few months to produce deficits; and (3) long-term O_3 deficits (negative radiative forcing) which decay away in line with the CH_4 deficits. The total time-integrated net radiative forcing from negative CH_4 and long-term O_3 contributions, and positive short-term O_3 leave a small negative residual. However, the net radiative forcing from NO_x emission pulses varies strongly with the season and location of the emissions.