Space based inverse modeling of anthropogenic and natural emissions of nitrogen oxides over China: seasonal and interannual variability

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Nitrogen oxides ($NO_x \equiv NO + NO_2$) are important atmospheric constituents affecting the tropospheric chemistry and climate. They are emitted both from anthropogenic and from natural (soil, lightning, biomass burning, etc.) sources, and China has become a major region of increasing importance for anthropogenic sources.

In a series of studies, satellite remote sensing for the vertical column densities (VCDs) of tropospheric nitrogen dioxide (NO_2) is used to estimate anthropogenic and natural emissions of NO_x over China. Focus is set on variations of emissions over a variety of time scales in response to the economic development of China, from the general growth in recent years to the economic downturn during late 2008 – mid 2009 to the holiday associated with the Chinese New Year. An attempt is made to reduce the effect of potential systematic errors in satellite retrievals by coupling data from multiple satellite instruments flying over China at different time of day. For 2006, anthropogenic emissions are separated from lightning and soil sources over East China by exploiting their different seasonality. For the first time, a systematic evaluation is conducted to quantify uncertainties in various aspects of model meteorology and chemistry affecting emission inversion for China and implications for simulations of other air pollution (e.g., near-surface ozone).