

Application of Inversion Technique to Quick Update of Anthropogenic NO_x emission over East Asia with Satellite Observations and Chemical Transport Model

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We developed a quick update system for an emission inventory with an inversion technique, and extended NO_x emission in Regional Emission inventory in the ASia version 2.1 (REAS 2.1) through 2009–May 2013 with satellite-observed tropospheric NO₂ vertical column densities (VCDs) and a chemical transport model. The observed NO₂ VCDs over the eastern Chinese region exhibited a drastic inter-annual variation over the eastern Chinese region due to the socioeconomic condition. During 2008–2009, the growing of the NO₂ VCD became sluggish because of pollutant controls by the 2008 Beijing Olympic game and the global depression, but revived in 2010 with a growth rate of 37.3%/year. The modeled NO₂ VCD with the updated emission successfully followed the inter-annual variation, and reproduced the observed seasonal cycle in which summer and winter have the seasonal bottom and peak, respectively. We estimated the updated Chinese anthropogenic NO_x emissions during 2009–2012 to be 25.7, 27.3, 28.2, 28.4 Tg/year; they fell within the range of the various estimates in the literatures. An annual growth rate during 2009–2012 and 2005–2012 was estimated to be 3.5%/year (0.9 Tg/year) and 5.3%/year (1.1 Tg/year), respectively. The system has the capability of updating NO_x emission in near real-time (NRT) for air quality forecasting. Figure shows annual anthropogenic NO_x emission from China. Numbers in the panels represent annual Chinese anthropogenic NO_x emission. Other estimates of Chinese NO_x emission are also shown by symbols.

Keywords: Inversion, Emission inventory, Chemical transport model, Satellite observation, NO_x emission

