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A Novel Method to Estimate Surface NO_2 Concentrations from the Space-borne Ozone Monitoring Instrument

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Atmospheric NO_2near the surface has notable health effects and is precursor of tropospheric ozone. In this work, we propose a novel method to estimate daily surface NO_2 concentrations from the Ozone Monitoring Instrument (OMI) with improved accuracy. Two chemical transport models GEOS-Chem and WRF/CMAQ are used to simulate converting factors between OMI column densities and surface concentrations. GEOS-Chem is found to better capture the distribution of converting factors, while CMAQ has advantage in simulating the magnitude. We combine the two models to calculate optimal values of converting factors and further constrain them by using colocated boundary layer heights (BLH) derived from fine-resolution sounding observations made at OMI overpass time. Calculated converting factors over Chinese Mainland vary by more than three orders of magnitude (10^{-18} $\sim 10^{-15}$ $\mu g \cdot cm^{-1} \cdot molecule^{-1}$), indicating complexity of NO_2 vertical structure over large spatial extent. We generate a map of surface NO_2 mass concentrations during June 2013 from OMI retrievals at $0.1^{\circ} \times 0.1^{\circ}$ grids. Estimated concentrations from our novel method show reasonable spatial agreement with in situ chemiluminescent measurements (R = 0.70, Slope = 0.58, N = 353), which significantly outperform estimations using only GEOS-Chem (R = 0.60, Slope = 0.20, N = 353) or WRF/CMAQ (R = 0.19, Slope = 0.52, N = 353) to simulate the converting factor. Preliminary results show that the novel method developed in this study could improve capability of satellite sensors to quantify surface NO_2 pollution.