

Characterization of the OMI tropospheric NO₂ measurements in East Asia based on a robust validation comparison

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In the period from June 2006 to December 2008, satellite-independent measurements of the tropospheric nitrogen dioxide (NO₂) column were performed by the ground-based Multi-Axis Differential Absorption Spectroscopy (MAX-DOAS) at an urban site in China (Tai'an) and three sites in Japan, covering urban (Yokosuka), suburban (Tsukuba), and remote areas (Cape Hedo, Okinawa). This robust dataset taken from the four locations is used to characterize the Ozone Monitoring Instrument (OMI) tropospheric NO₂ column data (the standard product, version 3). Correlations between MAX-DOAS and OMI data show a correlation coefficient (R^2) as high as 0.9, indicating that relative percent changes seen in the OMI NO₂ data are reliable. However, OMI data have a negative bias of 19% on average for all locations except Yokosuka, where the spatial distribution of NO₂ is thought to be highly inhomogeneous. Correlations for Yokosuka show more underestimation and scatter, presumably due to the anticipated spatial-averaging effect in an OMI field of view. On the basis of these results, we find an increasing trend of about 5% per year on average in the industrial areas of China (30-40N and 110-123E) over 2005-2008 but its spatial distribution is highly inhomogeneous.