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First quantitative bias estimates for tropospheric NO2 columns retrieved from SCIA-MACHY, OMI, and GOME-2 using a common

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For the intercomparison of three different satellite sensors (SCIAMACHY, OMI, and GOME-2) currently observing global distributions of nitrogen dioxide (NO_2) vertical column densities (VCDs) in the troposphere, we use a common standard to quantify the biases for the respective data sets. As the standard, a regression analysis using a single set of collocated Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) observations at several sites in Japan and China in 2006-2010 is adopted. Examination of various coincidence criteria suggests that the slope of the regression line is biased when the distance between the MAX-DOAS and satellite observation points exceeds the satellite measurement pixel size. Using strict coincidence criteria we estimate biases in SCIAMACHY, OMI, and GOME-2 data (TM4NO2A and DOMINO version 1 products, with cloud fractions smaller than 10%) to be -19%, +6%, and +20%, respectively, compared to the MAX-DOAS data. The recently released new satellite products, version 2, show better agreement, with biases of -5%, -4%, and +9%, respectively. The estimates will enable analyses combining these satellite data for air quality studies that are more systematic and quantitative than possible previously.

Keywords: NO2, satellite data validation, MAX-DOAS