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An attempt for the 8-component retrieval from MAX-DOAS observations at Fukue in spring 2009

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We have been conducting a continuous observation by MAX-DOAS (Multi-Axis Differential Optical Absorption Spectroscopy) at the Fukue Island atmospheric environment observatory (32.8 N, 128.7E) since February 27, 2009. Here we present the inversion technique to retrieve lower-tropospheric vertical profile information for 8 components from UV/VIS spectra measured by MAX-DOAS. The components retrieved include aerosol extinction coefficients (AECs) at two wavelengths 476 and 357 nm, NO_2, HCHO, CHOCHO, H_2O, O_3 and SO_2 volume mixing ratios (VMRs). For the lowest layer of the retrieved vertical profiles (0-1 km), the MAX-DOAS-derived NO_2 VMR is correlated well with the surface data taken by the chemiluminescence technique at Fukue in May-June 2009. However, the absolute value of MAX-DOAS NO_2 is found to be only about 40% of the surface value, most likely due to a steep vertical profile shape at altitudes 0-1 km. MAX-DOAS AECs are well correlated with those from the nephelometer and PM2.5 data from the SHARP (Synchronized Hybrid Ambient Real-time Particulate Monitor) instrument. Differences between MAX-DOAS O_3 and surface values are within 50%. On the other hand, an enhancement in the surface ozone concentration was observed on May 7-9. The enhancement occurred in air masses that probably passed over both China and South Korea, suggested by satellite and backward trajectory analyses. For this period, MAX-DOAS indicates the daytime averages: AECs (476 and 357 nm) = 0.2 km^{-1}, NO_2= 0.4 ppbv, HCHO = 1.0 ppbv, CHOCHO = 0.07 ppbv, H_2O = 1.0%, O_3= 70 ppbv (SZA<55 degrees), SO_2= 2 ppbv. In this talk, validity of these values is discussed in detail by including analysis of diurnal and seasonal variations.

Keywords: MAX-DOAS, Fukue, inversion, ozone, transboundary pollution