HCHO column density retrieval using Pandora measurements in Seoul, Korea: Temporal characteristics and comparison with OMI measurement

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We, for the first time, retrieved the Formaldehyde (HCHO) vertical column density (VCD) using Pandora instruments in Seoul, a megacity in northeast Asia, for the period between 2012 and 2014. We retrieved HCHO slant column density (SCD) using the differential optical absorption spectroscopy (DOAS) method. Then HCHO SCD was converted to HCHO VCD using geometric Air Mass Factor (AMF), since Pandora is the direct-sun measurement. The HCHO VCDs were generally highest at 12:00 local time (LT) and were low at the 10:00 (LT) and 14:00 (LT) throughout all seasons. The mean HCHO VCDs at 12:00 LT were 1.57×10^{16}, 2.29×10^{16}, 9.94×10^{15}, and 8.33×10^{15} molecules cm^{-2} in the spring, summer, autumn, and winter, respectively, whereas those at 10:00 (14:00) LT were 1.22×10^{16} (8.68×10^{15}), 1.25×10^{16} (1.54×10^{16}), 1.13×10^{16} (1.33×10^{16}), and 6.58×10^{15} (5.11×10^{15}) molecules cm^{-2} in the spring, summer, autumn, and winter, respectively. In terms of seasonal variations, HCHO VCD was highest in summer due to the photo-oxidation whereas it showed the lowest value in winter during the entire measurement period. The Pandora HCHO VCDs range from 4.10×10^{15} molecules cm^{-2} to 2.89×10^{16} molecules cm^{-2}. In comparison with the Ozone Monitoring Instrument (OMI) measurements, the HCHO VCDs obtained from the OMI were higher than those were the Pandora HCHO VCDs. We found a correlation coefficient of 0.74, with slop of 0.35 between the Pandora HCHO VCDs and the OMI HCHO VCDs. Furthermore, to investigate HCHO mixing ratio level within Planetary Boundary Layer (PBL), we converted Pandora HCHO VCDs to HCHO mixing ratio in the PBL using an empirical linear model with the inputs of PBL data obtained from the Atmospheric InfraRed Sounder (AIRS) and other meteorological data.