Retrieval accuracy of SO_2 vertical column density from Ground-based Direct-sun measurement and SO_2 column using Pandora

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In the present study, we inquire into the effects of signal to noise ratio (SNR), full width at half maximum (FWHM), aerosol optical depth (AOD), ozone (O_3), and solar zenith angle (SZA) on the accuracy of sulfur dioxide (SO_2) vertical column density (VCD) using the ground-based direct-sun synthetic radiance based on differential optical absorption spectroscopy (DOAS). In SO_2 precision test, When SNR = 325 (1300), FWHM = 0.6, AOD = 0.2, O_3 = 300DU, and SZA = 30, the Absolute percentage difference (APD) between the true SO_2VCD values and those retrieved ranges from 126% (28%) to 41% (5%) for the SO_2VCD of 8.1 x 1015 and 2.7 x 1016 molecules cm-2, respectively. In general, when FWHM, SZA, AOD, and O_3 values increase, APDs show high values. However, we found that the effects of FWHM and SZA on SO_2 retrieval accuracy were larger than those of O_3 and AOD, showing lower sensitivities of SO_2 retrieval. Interestingly, the maximum SZA effects on the SO_2 accuracy was found for the SO_2VCD of 2.69×1016 molecules cm−2. In addition, the SO_2 VCD was retrieved using data from the ground-based direct-sun measurement (Pandora) located in Seoul since Seoul is affected by anthropogenic SO_2 from China. The retrieved SO_2VCD was compared with SO_2 VCDs from space-borne measurements (Ozone Monitoring Instrument (OMI) and TROPOspheric Monitoring Instrument (TROPOMI)).