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Investigation of simultaneous effects of aerosol properties and height on NO_2 SCD precision.

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Previous studies reported that NO_2 slant column density (SCD) retrieval is affected by cross section, atmosphere temperature, Ring effect, and instrument noise. However, in this present study, we, for the first time, investigate the simultaneous effects of aerosol properties and aerosol height on NO_2 SCD retrieval precision. The study was conducted based on 7290 synthetic radiance and calculated air mass factor (AMF) using Linearized pseudo-spherical scalar and vector discrete ordinate radiative transfer (VLIDORT) under the various NO_2 concentration, aerosol, and geometry conditions. Then NO_2 SCD including SCD errors was retrieved using synthetic radiance via the differential optical absorption spectroscopy (DOAS) method. NO_2 SCD errors increase in conditions of high values of aerosol optical depth (AOD), aerosol peak height (APH), solar zenith angle (SZA), and viewing azimuth angel (VAA), whereas large single scattering albedo (SSA) and high surface reflectance lead to a decrease in SCD errors. The NO_2 SCD errors rapidly increase by over 20% and 40% with an AOD of 0.1 and 1.0, respectively, when NO_2 concentration value is under 1×10^{15} molecules cm^{-2} and SNR of the synthetic radiance is 2000. Furthermore, high AOD and APH lead to the increase in NO_2 SCD retrieval errors. The NO_2 SCD errors at SZA of 70˚ have larger values than those at SZA of 20˚ and 40˚. Over bright surface, the NO_2 SCD errors decrease due to efficient reflectance of the sun light back to the satellite. We also investigated NO_2 SCD errors in various full width a half maximum (FWHM) of the slit function and SNR conditions. NO_2 SCD errors also increase with increasing FWHM and with decreasing SNR.