

Concept of small satellite UV/visible imaging spectrometer optimized for tropospheric NO₂ measurements in air quality monitoring

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Satellite observations at nadir can potentially facilitate a better understanding of the emissions and distribution of tropospheric nitrogen dioxide, NO₂. The identification of emissions requires adequate spatiotemporal resolution measurements of the total column amounts of NO₂. The spatial resolution of previous and current observations is insufficient for the identification of NO₂ hot-spots. Switching to a spatial resolution of ~1 km x ~1 km can improve the identification of local sources of NO₂ and their emissions. To investigate the feasibility of observations with such a high spatial resolution, we simulated radiance spectra for different cases under varying parameters, such as area, season, satellite altitude, and surface reflectance by using the radiative transfer model SCIATRAN. We subsequently retrieved NO₂ slant column densities (SCDs) using the differential optical absorption spectroscopy (DOAS) technique with several fit windows. For test cases associated with polluted conditions, we found that the conceptual nadir-observing instrument on a satellite at an altitude of ~300 km involved the lowest retrieval errors for signal-to-noise ratios of around 1000 with accuracy better than the required 5% for tropospheric NO₂ SCD and that the fit window of 425--497 nm met the scientific requirements for both surface reflectance cases.

キーワード : Nitrogen dioxide、Earth observation、Radiative transfer model、Remote sensing

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