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Evaluation of ozone pro[U+FB01]le and tropospheric ozone retrievals from GEMS and OMI spectra

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South Korea is planning to launch the GEMS (Geostationary Environment Monitoring Spectrometer) instrument into the GeoKOMPSAT (Geostationary Korea Multi-Purpose SATellite) platform in 2018 to monitor tropospheric air pollutants on an hourly basis over East Asia. GEMS will measure backscattered UV radiances covering the 300–500nm wavelength range with a spectral resolution of 0.6nm. The main objective of this study is to evaluate ozone pro[U+FB01]les and stratospheric column ozone amounts retrieved from simulated GEMS measurements. Ozone Monitoring Instrument (OMI) Level 1B radiances, which have the spectral range 270–500nm at spectral resolution of 0.42– 0.63nm, are used to simulate the GEMS radiances. An optimal estimation-based ozone pro[U+FB01]le algorithm is used to retrieve ozone pro[U+FB01]les from simulated GEMS radiances. Firstly, we compare the retrieval characteristics (including averaging kernels, degrees of freedom for signal, and retrieval error) derived from the 270–330nm (OMI) and 300– 330nm (GEMS) wavelength ranges. This comparison shows that the effect of not using measurements below 300nm on retrieval characteristics in the troposphere is insigni[U+FB01]cant. However, the stratospheric ozone information in terms of DFS decreases greatly from OMI to GEMS, by a factor of ∼2. The number of the independent pieces of information available from GEMS measurements is estimated to 3 on average in the stratosphere, with associated retrieval errors of ∼1% in stratospheric column ozone. The difference between OMI and GEMS retrieval characteristics is apparent for retrieving ozone layers above ∼20km, with a reduction in the sensitivity and an increase in the retrieval errors for GEMS. We further investigate whether GEMS can resolve the stratospheric ozone variation observed from high vertical resolution Earth Observing System (EOS) Microwave Limb Sounder (MLS). The differences in stratospheric ozone pro[U+FB01]les between GEMS and MLS are comparable to those between OMI and MLS below∼3hPa (∼40km), except with slightly larger biases and larger standard deviations by up to 5%. At pressure altitudes above ∼3hPa, GEMS retrievals show strong in[U+FB02]uence of a priori and large differences with MLS, which, however, can be suf[U+FB01]ciently improved by using better a priori information. The GEMS-MLS differences show negative biases of less than 4% for stratospheric column ozone, with standard deviations of 1–3%, while OMI retrievals show similar agreements with MLS except for 1% smaller biases at middle and high latitudes. Based on the comparisons, we conclude that GEMS will measure tropospheric ozone and stratospheric ozone columns with accuracy comparable to that of OMI and ozone pro[U+FB01]les with slightly worse performance than that of OMI below∼3hPa