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Development of aerosol retrieval algorithm for Geostationary Environmental Monitoring Spectrometer (GEMS)

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A scanning UV-Visible spectrometer, the GEMS (Geostationary Environment Monitoring Spectrometer) onboard the GEO-KOMPSAT2B (Geostationary Korea Multi-Purpose Satellite) is planned to be launched in geostationary orbit in 2018. The GEMS employs hyper-spectral imaging with 0.6 nm resolution to observe solar backscatter radiation in the UV and Visible range. In the UV range, the low surface contribution to the backscattered radiation and strong interaction between aerosol absorption and molecular scattering can be advantageous in retrieving aerosol optical properties such as aerosol optical depth (AOD) and single scattering albedo (SSA).

This study presents a UV-VIS algorithm to retrieve AOD and SSA from GEMS. The algorithm is based on the general inversion method, which uses pre-calculated look-up table (LUT) with assumed aerosol properties and measurement condition. To calculate LUT, aerosol optical properties over Asia [70°E-145°E, 0°N-50°N] are obtained from AERONET inversion data (level 2.0) at 46 AERONET sites, and are applied to VLIDORT (spur, 2006). Because the backscattering radiance in UV-Visible range has significant sensitivity to radiance absorptivity and size distribution of loading aerosol, aerosol types are classified from AERONET inversion data by using aerosol classification method suggested in Lee et al. (2010). Then the LUTs are calculated with average optical properties for each aerosol type. The GEMS aerosol algorithm is tested with OMI level-1B dataset, a provisional data for GEMS measurement. The aerosol types for each measured scene are selected by using both of UVAI and VISAI, and AOD and SSA are simultaneously retrieved by comparing simulated radiance with selected aerosol type and the measured value. The AOD and SSA retrieved from GEMS aerosol algorithm are well matched with OMI products, although the retrieved AOD is slightly higher than OMI value.

To detect cloud pixel, spatial standard deviation test of radiance is applied in the current algorithm, but advanced cloud removal method such as spectral ratio test can be applied to reduce cloud contamination error and improve retrieval accuracy. Also, simultaneous retrieval of aerosol height with AOD is required. In this study, O4 algorithm was adopted to retrieve aerosol height. The O4 algorithm retrieves aerosol height by using the O4 slant column densities at 477 nm from the DOAS fitting method. The aerosol effective height is proposed for the parameter of aerosol height. Theoretically, the error, which is caused by the variation of aerosol optical properties and instrument condition, ranges from 28% to 57%. Those error values also showed in the several case studies from the OMI observation.