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Fast and first detection of atmospheric composition with color ratio of near-UV measurements by GCOM–C/SGLI

Sonoyo Mukai (1), Itaru Sano (2), and Makiko Nakata (2)
(1) KCGI, REESIT, Kyoto, Japan (s_mukai@kcg.ac.jp), (2) Kindai University, Higashi-Osaka, Japan

The Japanese mission JAXA/GCOM–C (SIKISAI in Japanese) has been successfully launched on 23 December 2017 from Tanegashima Space Center (TNSC). The second global imager (SGLI), which is a successor of ADEOS–2/GLI, has been boarded on the GCOM–C. The SGLI has multiple (19) channels including near-UV (0.380 μm) and violet (0.412 μm) wavelengths, and polarization channels in the red and near-IR wavelengths. In other words, near-UV and polarization bands are the advantages of SGLI for aerosol remote sensing. In this work these two kinds of advantages of SGLI are utilized for aerosol detection and characterization. It is too well known to be mentioned here that aerosol observation via satellites is useful and effective, and also the characteristics and distributions of atmospheric aerosols are complicated. Therefore characterization of aerosols from satellite data is evitable difficulties in both quality and quantity especially in a global scale. Therefore efficient strategy is required for attempting to retrieve aerosol properties.

At first, the ratio of reflectance (R), which denotes the upward radiance from the top of the atmosphere, at 0.412 μm to that at 0.38 μm is proposed and named as the absorbing aerosol index (AAI) defined as AAI = R (0.412) / R (0.38) for detecting absorbing particles such as BBA or mineral dust. Vice versa it can also be used to detect non-absorbing type aerosols. Usual aerosol retrieval is made via three- or two-channel algorithms in the visible to near-infrared wavelengths, and hence distinguishing absorbing aerosols from non-absorbing ones is difficult. Our AAI index comes from in a similar manner to TOMS, which has demonstrated that UV radiation could easily detect absorbing particles.

The first understanding of aerosol types using AAI values facilitated the subsequent aerosol retrieval. Then, the characterization for classified aerosols is made based on the radiation simulations with multi-spectral radiance and polarization measurements in the red and near-IR. The case study results, providing the detection and characterization of typical absorbing aerosol as biomass burning aerosols (BBA), were examined using ADEOS–2/GLI measurements, simplified aerosol model, numerical model simulations by SPRINTARS and ground measurements of the NASA/AERONET [1].

In this work we propose AAI for detection of absorbing aerosols and provide effective algorithms of radiative transfer simulations with/without polarization fields for flexible characterization of aerosols.

[1] Mukai, S., I. Sano, M. Nakata and T. Fujito, “Detection and characterization of absorbing aerosols based on multi-spectral radiance and polarization measurements with satellite”, Frontier Environmental Informatics (in press).