Evaluation of Advantages in GCOM-C Polarization Observation for Estimating Aerosol Optical Thickness

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GCOM-C (Global Change Observation Mission -Climate) satellite, which is equipped with SGLI (Second generation GLobal Imager) sensor, is planned to be launched in the end of this year. It is designed to conduct optically-based measurements for monitoring global environmental change. The SGLI instrument has three major features: (1) global observation covering wavelengths from 380 nm to 12 μm, (2) 250 m spatial resolution for land and coastal areas, (3) polarization /multidirectional observations and near ultraviolet observation. With these features, GCOM-C will be able to provide many products covering a broad range of topics: land, atmosphere, ocean, and cryosphere. It is especially expected to enable to retrieve land aerosol by polarization (PL: 673.5 and 868.5 nm) and ultraviolet (UV: 380 nm) observations with higher accuracy than by the traditional method using blue and red bands because PL and UV observations have little dependeny on the surface reflectance unlike the traditional one.
In this study, we examined the advantage in the PL and UV observations of SGLI for the estimation of aerosol optical thickness (AOT) over land compared with the traditional method using the radiance at 443 and 673.5 nm.
Our method to evaluate the accuracy of estimated AOT by each method is described below. Monthly AOT and mode radius of aerosol of MODIS L3 products (MYD08_M3) are used as a benchmark. Then, radiance at the top of atmosphere (TOA) is calculated by the results of the radiative transfer model (PSTAR3, [Ohta et al., 2010]) for these input data. The surface reflectances of each wavelength is also estimated by using a month's radiation data of POLDER with the assumption that the minimum of the radiance at 490 nm has information of a clear day. We retrieve the AOT and the mode radius from the radiance of TOA considering the observation accuracy (=SNR) of SGLI and the estimation error of the surface reflectance. In this preliminary work, the aerosol type is fixed as the tropospheric aerosol, which is defined as mixture of a water-solble (0.7) and a dust-like (0.3) aerosol. The accuracy of estimated AOT is evaluated by the deviation from the benchmark AOT. We perform these procedures with both the PL + UV method and the traditional one.
As a results, the accuracy of the estimated AOT improved roughly 10 % by using the method of PL+UV compared the traditional one especially in high surface reflectance areas such as the Sahara desert. This would be because the effect of the estimation error of surface reflectance in the AOT accuracy is considerably large at the high reflectance area. In this presentation, we are going to show the dependency of the estimated AOT accuracy on the geometric condition, the benchmark AOT and its mode radius.

Keywords: GCOM-C, SGLI, Polarization observation, Aerosol optical thickness

