Retrieval of Atmospheric Aerosol Properties for geostationary and polar-orbital Satellite Imaging Sensors: GCOM-C/SGLI and Himawari8/AHI results

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Aerosols influence the energy budget of the earth's climate system through scattering and absorbing solar radiation. The Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC, 2014) reported that the radiative forcing of the total aerosol effect in the atmosphere, which includes cloud adjustments due to aerosols, is −0.9 W m−2 and results from a negative forcing from most aerosols with a positive contribution from black carbon absorption of solar radiation. However, the range of the uncertainties remains large (−1.9 W m−2 to −0.1 W m−2).

For a more precise estimation of the impact of aerosols on climate systems, investigation of the behavior of aerosols on a global scale is essential but challenging because aerosol amounts and characteristics vary over space and time.

Aerosol remote sensing studies have been carried out using polar-orbital Earth observation satellites. JAXA has launched Global Change Observation Mission-Climate (GCOM-C)/Second-generation GLobal Imager (SGLI) at the end of 2017, and Greenhouse gases Observing SATellite- 2 (GOSAT-2)/Cloud and Aerosol Imager 2 (CAI-2) in 2018. In several years, Earth Clouds Aerosols and Radiation Explorer (EarthCARE)/ Multi-Spectral Imager (MSI) will be launched.

In addition, the next-generation geostationary satellite of the Japan Meteorology Agency (JMA), Himawari-8, was launched on October 7, 2014. It carries the Advanced Himawari Imager (AHI), which has six bands from visible to near-infrared wavelengths. It is significantly different from the previous Himawari-6/7 having only one channel in the wavelengths, which made the estimation of aerosol difficult because the assumption of aerosol type is necessary. Himawari-8/AHI observes the top of atmosphere (TOA) visible and near-infrared radiance at a resolution of 0.5–2.0 km over Asia and Oceania at every 10 min, which enables frequent aerosol estimation over the same ground targets.

The synergistic uses of these various imaging sensors on both geostationary and polar-orbital satellites are helpful to understand a complete picture of aerosol distribution in the global scale. For this purpose, we developed the common retrieval algorithm of the atmospheric aerosol properties for various satellite sensors and over both land and ocean.

The method was applied to GCOM-C/SGLI and Himawari-8/AHI. The retrieved aerosol properties are validated using ground observation data, such as Aerosol Robotic Network (AERONET) and SKYNET.

In addition, we improved the retrievals by utilizing the forecast of aerosol transport model. The results showed that the spatially finer distributions than the model forecast and less noisy distributions than the

old algorithm.

Keywords: aerosol, remote sensing, GCOM-C, Himawari, aerosol transport model, algorithm