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A study of satellite remote sensing algorithm for aerosol using multi-wavelength and multi-pixel data

HASHIMOTO, Makiko[1*] ; NAKAJIMA, Teruyuki[1] ; MORIMOTO, Shotaro[1] ; TAKENAKA, Hideaki[1]

[1]Atmosphere and Ocean Research Institute, the University of Tokyo

Aerosol is an important atmospheric constituent for determining the earth's radiation budget, especially perturbation by the human activity, so accurate aerosol retrievals from satellite is useful.

We have developed a new satellite remote sensing algorithm to retrieve the aerosol optical characteristics using multi-wavelength and multi-pixel information of satellite imagers (MWP method), and directly combining with the radiation transfer calculation, Rstar (Nakajima and Tanaka, 1986, 1988), numerically solved by each iteration step of the non-linear inverse problem, without using LUT (Look Up Table) with several constraints. Retrieved parameters in our algorithm are aerosol optical properties, such as aerosol optical thickness (AOT) of fine and coarse mode particles, a volume soot fraction in fine mode particles, and ground surface albedo of each observed wavelength. We simultaneously retrieve all the parameters that characterize pixels in each of horizontal sub-domains consisting the target area.

Then, we applied this algorithm to GOSAT/CAI imager data. The sensor has a characteristic band at wavelength 380nm, whose surface reflectance is low at land, and that is useful to distinguish aerosol from cloud by aerosol absorbing property over land and ocean. For the retrieval over ocean, it is necessary to correct the observed radiance at 380nm, because the observed radiance at the wavelength is affected by water leaving radiance by the light scattering in water and chlorophyll fluorescence. We added a process of radiative transfer in water including an effect of chlorophyll-a (Ota et al., 2009) into Rstar (done by Morimoto in 2015). For land, we compared retrieved and surface-observed AOTs at the CAI pixel closest to an AERONET (Aerosol Robotic Network) or SKYNET site in each region. Comparison at several sites including urban area indicated that AOTs retrieved by our method are in agreement with surface-observed AOT within 0.07. As for ocean cases, the retrieved AOTs were positively correlated with those also retrieved from GOSAT/CAI by 2-channel method (Higurashi and Nakajima, 1999). Our future work is to extend the algorithm for analysis of AGEOS-II/GLI and GCOM/C-SGLI data.

Keywords: Satellite remote sensing, Aerosol