Development and acceleration of aerosol remote sensing algorithm and its application to GOSAT/TANSO-CAI data

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Aerosol in the atmosphere is an important atmospheric constituent for determining the earth’ s radiation budget, especially perturbation by the human activity, so the accurate aerosol retrievals from satellite is useful. We have developed a satellite remote sensing algorithm to retrieve the aerosol optical properties using multi-wavelength and multi-pixel information of satellite imagers (MWPM). The method simultaneously derives aerosol optical properties, such as aerosol optical thickness (AOT) and single scattering albedo (SSA), by using spatial difference of surface reflectance. Thus, the method is useful for aerosol retrieval over spatially heterogeneous surface like an urban region. We apply an optimal method and spatial smoothness constraint for aerosol properties, and directly combining with the radiation transfer calculation/model (RTM), Rstar (Nakajima and Tanaka, 1986, 1988), numerically solved by each iteration step of the non-linear inverse problem, without using Look Up Table. The merit of direct use of RTM is that: more accurate multiple scattering calculations in more realistic atmospheric conditions are available; it is easy to change retrieval parameters or wavelengths. Therefore, more accurate and flexible retrievals can be expected. However, it has also weak point that it takes a large computation time compared to that with LUT method. To accelerate the calculation time, we replace the RTM with an accelerated RTM solver learned by neural network-based method (Takenaka et al., 2011), EXAM, using Rater code. We apply MWPM with EXAM to GOSAT/TANSO-CAI (CAI) imager data. CAI has four bands, 380, 674, 870 and 1600 nm, and observes in 500 meters resolution for band1, band2 and band3, and 1 km for band4. The retrieved parameters are fine and coarse mode AOTs, SSA and surface reflectance at each wavelength by combining a minimum reflectance method and Fukuda et al. (2013). As a result, the calculation time was shortened from about 10 second to 0.01 second per pixel. And also, the similar retrieval results are obtained compared with MWPM with RTM over Beijing region.

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