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A development of an algorithm for atmospheric aerosol remote sensing with use of near ultraviolet band of GOSAT/TANSO-CAI

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As shown in the IPCC-AR4, the uncertainty of aerosol radiative forcing is large even now, but aerosols in the atmosphere have non-negligible role in the climate system. We propose in this study a satellite remote sensing algorithm of aerosol for use with band-1 (380nm) of the Thermal And Near-infrared Sensor for carbon Observations – Cloud and Aerosol Imager (TANSO-CAI), which is a pushbroom type imager onboard Greenhouse gases Observing SATellite (GOSAT). At near ultraviolet wavelengths, the surface reflectance over land is smaller than that at visible wavelength; therefore, it is thought to be possible to reduce the retrieval error by use of radiances in the near ultraviolet spectral region. Firstly, a cloud shadow correction algorithm was developed. In this algorithm, 1st minimum and 2nd minimum reflectance pixels of band-1and band-3 (870nm) of CAI are used. Rayleigh scattering contributions for these two bands are largely different, so that the difference between 1st minimum and 2nd minimum of band-3 becomes large when the pixel of 1st minimum contains the cloud shadow. Secondly, we developed a new surface reflectance correction algorithm, “modified Kaufman method”. This algorithm uses minimum reflectance data of band-1 and band-2. These minimum data are composed of selected minimum reflectances during 31 days, which can be regarded as radiances without significant aerosol path radiances in a clear sky condition. It is found, however, an aerosol effect cannot be neglected even in these minimum reflectance data. This is because the orbit of GOSAT is with exact 3-days recurrence, so most of the land area is observed once every 3 days, different from other general purpose imagers such as MODIS. In this situation, we made a parameterization of the ratio of band-1 and band-2 reflectance in terms of Normalized Difference Vegetation Index (NDVI) is used to implement this modified Kaufman method to several surface types, instead of using a near-infrared wavelength such as 1600nm in the original Kaufman method. The retrieved aerosol optical thickness (AOT) with and without the modified Kaufman method correction were compared with that of AErosol RObotic NETwork (AERONET). The result shows that AOT with the modified Kaufman method has better agreement with the AOT of AERONET than those without the method. In most cases, the correlation coefficient between the AOT with the modified Kaufman method and the AOT of AERONET is larger than that between the AOT without modified Kaufman method and the AOT of AERONET. These results show modified Kaufman method works well. We will also show not only the AOT by use of band-1 only, but also that by use of both band -1 and band-2 (680nm).