Detection of haze and/or cloud

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It is highly likely that large-scale air pollution will continue to occur because air pollution becomes severe due to both the increasing emissions of the anthropogenic aerosols and the complicated behavior of natural aerosols, especially in Asia. It is natural to consider that incident solar light multiply interacts with the atmospheric aerosols due to dense radiation field in such a heavy haze. Accordingly efficient and practical algorithms for radiation simulation are indispensable to retrieve aerosol characteristics in a hazy atmosphere. It has been shown that aerosol retrieval in the hazy atmosphere is achieved based on MSOS (method of successive order of scattering) [1].

The satellite polarimetric sensor POLDER-1, 2, 3 has shown that the spectro-photopolarimetry of the terrestrial atmosphere is very useful for the observation of the Earth, especially for atmospheric particles. JAXA has been developing the new Earth observing system, GCOM satellite. GCOM-C will board the polarimetric sensor SGLI (second-generation global imager) in 2017. The SGLI has two polarization channels at near-infrared wavelengths of 670 and 870 nm. Furthermore, EUMETSAT plans to collect polarization measurements with a POLDER follow on 3MI/EPS-SG in 2021. Then the efficient algorithms for radiation simulation in the optically thick atmosphere by using polarization information denoted by Stokes parameters are shown in this work.

It is of interest to mention that multi-spectral data are available for detection and/or distinction of hazy aerosol and/or cloud. In this work our MSOS is expected to be available for atmospheric particle retrieval in a mixture case of cloud and haze. The MSOS is available for the radiation simulation reflected from the optically semi-infinite atmosphere.[1]. Here we intend to improve MSOS-scalar into more efficient and practical form, and further into MSOS-vector form. We show here that a dense aerosol episode can be well simulated by a semi-infinite radiation model. For an example it is shown that the biomass burning haze observed by Parasol/POLDER and Aqua/MODIS in Asia is well interpreted with our code [2].

[1] Mukai, S., T. Yokomae, I. Sano, M. Nakata, and A. Kokhanovsky,2012:Multiple scattering in a dense aerosol atmosphere," Atmospheric Measurement Techniques Discussions, vol.5, 881-907.

[2] Mukai, S., M. Yasumoto and M. Nakata, 2014: Estimation of biomass burning influence on air pollution around Beijing from an aerosol retrieval model. The Scientific World Journal, Article ID 649648.