サブピクセル雲水平不均質性がマルチスペクトルイメージャでの雲特性パラメータ推定に与える影響
Investigating impact of subpixel horizontal inhomogeneity on retrieval of cloud microphysical parameters from multi-spectral imagers

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The importance of cloud in terrestrial atmospheric dynamics and radiative transfer as key elements of the water and energy cycles have motivated development of various remote sensing technics for monitoring cloud microphysical parameters by using satellite-borne multispectral imagers (e.g. MODIS/Aqua). We have been developed a cloud retrieval algorithm for the Second Generation Global Imager (SGLI) onboard a new earth observation satellite, the Global Change Observation Mission-Climate (GCOM-C), that Japanese Aerospace Exploration Agency (JAXA) is scheduling to launch in Japan fiscal year 2016. The SGLI instrument is a radiometer providing near-ultraviolet-to-thermal-infrared multi-spectral measurements at 250 m, 500 m or 1 km resolutions. The algorithm can retrieve cloud optical thickness (COT), cloud particle effective radius (CER), and cloud top temperature (CTT) simultaneously from visible and infrared measurements at three spectral bands of the SGLI. And then, we are also working on applying our algorithm to the measurements from the Advanced Himawari Imager (AHI) onboard the Japan Meteorological Agency's geostationary meteorological satellite, Himawari-8.The AHI is also a radiometer providing visible-to-thermal-infrared multi-spectral measurements of every 2.5 minutes for Japan area and 10 minutes for full disk at 500 m, 1 km or 2 km resolutions. Therefore, retrievals of cloud parameters derived from both SGLI's global high-resolution observations and AHI's high-frequency observation will be obtained. However, there may be discrepancies between retrievals from the SGLI and AHI. As pointed out by previous studies, cloud retrievals are impacted significantly by vertical and horizontal distribution of cloud properties. And the impact on retrievals depends on the spectral characteristics, the spatial resolution and the observation angles of the instruments. This study focuses on bias in cloud retrievals caused by both horizontal inhomogeneous cloud properties and clear-region-contamination at subpixel scale. First, we introduce our cloud retrieval algorithm for the SGLI and show the comparison of cloud retrievals obtained by applying our algorithm to the MODIS's (instead of SGLI's) 1 km resolution observations and the AHI's 2 km resolution observations. Second, we simulate biases in COT, CER and CTT retrievals for various spatial resolution observations including SGLI's and AHI's observations by using high-spatial resolution (30 m) measurements of the Landsat-8. The simulation result explains the relationship between cloud horizontal inhomogeneity and clear-region-contamination and retrieval bias, and also suggests that the bias can be estimated by using co-variance matrix of multi-spectral radiances within the target pixel. Finally, the possibility of estimating the bias from SGLI's and AHI's observation themselves is discussed.

キーワード：GCOM-C、ひまわり8号、雲特性
Keywords: GCOM-C, Himawari-8, Cloud property

