Climatological Cloud Database Estimated by Geostationary Satellite Split-Window Measurements

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We extended our cloud-top database spatially to the midlatitude and temporally to new satellite Himawari-8. We have already released a database of cloud top height and visible optical thickness (CTOP) with one-hour resolution over the tropical western Pacific and Maritime Continent, using infrared split-window data of the geostationary satellites (MTSAT-1R and MTSAT2) (http://database.rish.kyoto-u.ac.jp/arch/ctop/). By comparing MT-SAT IR observation and the direct observation of the cloud top height by CloudSat radar, we can construct a lookup table (LUT) with which the cloud top height is estimated by using only MTSAT data. Unfortunately, now in the age of Himawari-8 that has been available since July 2015, the CloudSat observations are limited in the daytime and the precise direct comparison with the data cannot be conducted to construct LUT. Therefore, we proceeded an alternative way by constructing a calibration table based on the comparison between MTSAT-2 and Himawari-8 observations during July 2015 when both geostationary satellites were in operation. By using the similar approach repeatedly, it will be possible to construct LUT for the past geostationary satellites that had been in operation before the launch of CloudSat in 2006.
We also tried to extend the targeted region to the mid-latitude. In our present scheme applicable for only tropics, the vertical profile of temperature is assumed to be almost constant in whole tropics and all the year. However, since the temperature variability is much larger in mid latitude, it is not plausible to assume that the same IR radiance comes from the clouds with a certain top height. Therefore, we proposed a new method to use temperature data of the global analysis together. The temperature of the cloud top is estimated through the altitude of the cloud top observed by CloudSat as well as the temperature profile deduced from the global analysis data. Then we constructed LUT of cloud top temperature (not height) by the regression of the MTSAT IR radiance with respect to cloud top temperature. We can get the cloud top height at any point at any time by converting the cloud top temperature to cloud top height, with using global analysis data. A preliminary estimate using this method indicated that the cloud top height is estimated within allowable error even in the mid latitude.

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