

Database of cloud top height and its application to the tropical disturbances

NISHI, Noriyuki^{1*}, HAMADA, Atsushi², OHIGAWA, Masanori³

¹Graduate School of Science, Kyoto Univ., ²AORI, Tokyo University, ³RISH, Kyoto University

Lookup tables for estimating the cloud-top height (CTOP) and visible optical thickness of upper-tropospheric clouds by the infrared brightness temperature (TB) at 10.8 micro m (T11) and its difference from TB at 12 micro m (DT11-12) measured by geostationary satellites are developed (Hamada and Nishi 2010, JAMC). These lookup tables were constructed by regressing the cloud radar measurements by the CloudSat satellite over the infrared measurements by the Japanese geostationary multifunctional transport satellite MTSAT-1R and MTSAT-2. The CTOP of the last two years is available at <http://database.rish.kyoto-u.ac.jp/arch/ctop/>, and the previous data is also available at the website linked there. The data have good precision for cirrus clouds (optical depth > ~3) that have large DT11-12 values and are suitable for analyses of cloud systems with well-developed cirrus clouds. We made a correction for the satellite view angle and can offer the data over almost all tropical regions where the satellites can observe (20S-20N, 80E-160W for MTSAT-1R and 85E-155W for MTSAT-2).

We introduce applications of this data to tropical large-scale cloud system.

(1) We analyzed zonally elongated cloud bands extending 3000 km around ITCZ during 2007. It was first concentrated in the ITCZ, then spread meridionally into the two parallel zonal cloud bands and kept moving meridionally away. We examined detail of the separation with our CTOP data and Global Satellite Mapping of Precipitation (GSMaP; Kubota et al. 2007, IEEE Trans. Geosci. Remote Sens.) data: precipitation estimation dataset made with microwave radiometers including TRMM/TMI. In order to investigate the relation between clouds and large-scale circulation, the information of the cloud height is indispensable. We succeeded to find out that the cloud top is kept in the high altitude while moving meridionally.

(2) Cloud clusters with 1000-km scale in the tropics mainly consist of nimbostratus and cirriform clouds adjacent to cumulonimbus and their top height is very high: 12-16 km. However, the clusters with rather large TB value but having 1000-km scale are sometimes observed around the dateline in the ITCZ region. They keep their cloud top height during 1-2 days. From ordinary TB images, it is not sure whether they have thinner optical depth or they have lower cloud top. Here, we analyzed, with CTOP data, the lifecycle of such a cloud cluster of which CloudSat fortunately observed a part. CTOP estimation and CloudSat direct observation have similar top height at that part of the cluster. As our CTOP data have continuous time coverage, we traced the cluster and found that the cloud cluster kept 5-9 km top height during the lifetime over one day.

Keywords: cloud top height, MTSAT, CloudSat, IR split window