Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AHW29-01 Room:101A Time:May 21 09:00-09:15

Development of a cloud classification method by using satellite-observed brightness temperature

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Recently, there are some extreme meteorological phenomena such as heavy rain and drought all over the world. One of the extreme phenomena is 2011 Thailand floods which is used as the background of this study. There are some factors influencing the 2011 Thailand floods that are related to dynamic hydrological circulation and land-atmosphere-ocean system. To figure out the extreme phenomena such as heavy rain, the precipitation data is needed. However, there is a considerable shortage of meteorological stations in developing country and there is no precipitation forecasting models which work accurate enough both spatially and temporally. This is the reason why we need remote sensing observation that can comprehend rainfall data shortage. The reappearance of dynamic hydrological circulation is important for the resolution of extreme phenomena but -ship-observation is intermissive and it only cover some parts of the world. In general, cumulonimbus causes heavy intensity of rainfall. The convection cools down the moisture which remain lower layer and it becomes convective cloud. Furthermore, heavy rainfall is related to the cloud type distribution. This study is suggesting the cloud classification method which uses the infra-red data from remote sensing satellites. In this study we utilize meteorological satellite which is well known as Multi-functional Transport Satellite (MTSAT). The area of observation is from 80.02 degrees of east longitude to 160.02 degrees of west longitude and is from 59.98 degrees of north latitude to 59.98 degrees of south latitude. The MTSAT data as well as their calibration coefficient are downloaded from the database of Kochi University. MTSAT data has 4-5km spatial resolution and 1 hourly temporal resolution. When compared with the existing cloud classification method such as International Satellite Cloud Climatology Project (ISCCP), which has 200 to 300 km spatial resolution, and 3 hour temporal resolution. MTSAT has advantage for providing cloud type information in higher resolution. The method of analysis is by performing cloud type classification based on 10.8 micro-meter Infra-red (IR1) and 12 micro-meter Infra-red (IR2). The IR1 and IR2 are sometimes called split window and these are well known that they have different absorbing characteristics for water and ice particle. There are 6 cloud types used in the cloud classification, namely Cumulonimbus (Cb), Mature Cumulonimbus (MCb), Thick Cirrus (TkCi), Thin Cirrus (TiCi), Middle level cloud (MC) and Low level cloud (LC). We compared those of cloud type data with rainfall intensity derived from Tropical Rainfall Measuring Mission (TRMM) information. Result shows that Cb corresponds with high rainfall intensity over Bangkok in Thailand during flooding periods. We also perform the same analysis over larger coverage and time duration. The trend of heavy rainfall is also found not only in Southeast Asia but also in more global scale.

Keywords: cloud classification method, MTSAT, cumulonimbus