The Diurnal Variation of Clouds in Different Scale Environments

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Abstract

Japan's Geostationary Meteorological Satellite (GMS-5) was located at 140E above the equator and provided meteorological data over the Asia-Pacific Region. In this study, we use the 3-year(1998-2000) high resolution window (11.5 μm~12.5 μm) brightness temperature (Tbb) data from GMS-5 to investigate the diurnal variation of clouds in some selected strong convection regions. Our goal is to understand the diurnal variation patterns of convection over different regions/seasons and to understand its modulation by different large-scale environments.

We first focus on the most intensive adiabatic heat source regions: Borneo and New Guinea during boreal winter (DJF), and Bay of Bengal (BB), South China Sea (SCS), and tropical western North Pacific (TWNP) during boreal summer (JJA). Large diurnal variations over continents, islands and their adjacent ocean can be seen in our study which is consistent with previous studies.

In order to know the modulation of clouds by large scale circulation, we first make a distinction between active and inactive phases of disturbances embedding in large scale circulation. Over Borneo and New Guinea in DJF, Tbb decreases rapidly after noon and the cloud reaches its highest level during the night time both in the active and inactive phases. However, the amplitude of the diurnal variation of Tbb in active period is l.5~2 times to that in inactive period. On the other hand, there are two peaks of minimum Tbb over BB, SCS, and TWNP in JJA. The coldest cloud occurs at 3Pm and there is a secondary minimum Tbb occurs at 3 Am in the three ocean regions in JJA. The two peaks of minimum Tbb can be separated by active and inactive periods. During the active period, there is only one peak of minimum Tbb appearing at 3Pm. But there are two peaks (3Am and 3Pm) during the inactive period over three ocean regions in JJA. It may be implied that the diurnal variations of the three ocean regions in different phases are effected by different mechanisms. Also, the amplitude of the diurnal variation of Tbb in active period is 2~3 times to that in inactive period. It seems that the diurnal variation is enhanced during the active phase.

In the inter-annual scale, Borneo has the biggest difference from other regions we consider in the winter of El Nino year(1997). The brightness temperature is apparently higher in Borneo than other regions in 1997. The amplitude of diurnal variation is clearly smaller over Borneo in 1997. Further analysis needs to be investigated to find out the relationship between diurnal variation and ENSO.