Eastward-moving Cloud Clusters within a Super Cloud Cluster in December 2006

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Abstract:

The propagation speed and mechanism of MJO is still not fully understood. One of the hypotheses is that super cloud cluster is the key element of MJO (Nakazawa, 1988) and the phase speed of MJO is determined by the phase speed of "grouped" super cloud clusters. A super cloud cluster moves eastward with a phase speed of moist Kelvin waves, 15-20 $msec^{-1}$. If we have only one super cloud cluster, then it travels over the globe in 30 days. However, when there are several super cloud clusters simultaneously over the globe, then "grouped" super cloud clusters or MJO may propagate slower, although individual super cloud cluster propagates quicker with a phase speed of moist Kelvin wave.

Masunaga et al.(2005) proposed a hypothesis to explain the propagation speed of MJO. They indicated the importance of the equatorial westward-moving Rossby waves, which may interrupt the eastward-moving moist Kelvin waves, to reduce the phase speed of the MJO.

In both hypotheses, the essential component to maintain MJO is a super cloud cluster, which is coupled with a moist Kelvin wave. The fundamental question to be answered is why and how super cloud clusters are organized and what kind of atmospheric condition is governed to organize co-existing super cloud clusters.

In this poster we discuss eastward-moving cloud clusters within a super cloud cluster, observed in December 2006, using geostationary meteorological satellite data and QuikSCAT ocean surface data. The eastward-moving cloud clusters would be a manifestation of a moist-Kelvin wave, with a predominance of zonal wind components. Comparing infrared images with rainfall data of microwave radiometer data, the leading edge of the system is always observed in the eastern side and anvil-type cloud in the western side. The phase speed of the system differs in time. The speed is faster at the earlier period and getting gradually slower in time. This change may be related with the heating profile of the atmosphere over the region.