Geophysical Research Abstracts
Vol. 18, EGU2016-11216-2, 2016
EGU General Assembly 2016

Multi-day convective-environmental evolution prior to tropical cyclone formation from geostationary satellite measurements

Minhee Chang (1), Chang-Hoi Ho (1), and Myung-Sook Park (2)

(1) School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea, Republic Of (minheechang90@gmail.com), (2) School of Urban and Environmental Engineering, UNIST, Ulsan, Korea, Republic Of (mngsk.park@gmail.com)

Tropical cyclones (TCs) are developed through persistent latent heating taken from deep convective process. By analyzing aircraft and polar-orbit satellite observations, distinct upper-level warm-core induced by strong updraft was found in pre-TCs while vertically uniform temperature profile is found in non-developers. Precipitation is also broader and more frequent in developing disturbances than in nondeveloping ones. However, large uncertainties remain in determining which disturbance will develop into TC by using observation snap-shots. Here, five-day systematic evolution of deep convection and environments in developing (80) and non-developing (491) disturbances are examined over the western North Pacific for 2007[U+F02D]2009 by using geostationary satellite observation. Daily, positive tendencies in the hourly time series of the area of the MTSAT-1R infrared (IR) and water vapor (WV) brightness temperature difference < 0 are used to define single diurnal convective burst (CB) event. In terms of single CB properties (duration, expanded convective area, maximum convective area, and expanding rate), developing and nondeveloping disturbances shows significantly different mean values in the statistics, but it is not effective to estimate TC genesis. The presence of continuous CB events more than two days (i.e. multi-day CB; mCB), however, is generally found in developing disturbances. Based on the presence and absence mCB in the IR-WV time series, two different evolutions from Day 1 to Day 5 of TC formation (non-development) are explored, in which Day 6 is set to be a TC formation day (Day5 as non-development vortex decaying day).
The majority of developing disturbances with mCB (83 %) initially have stronger large-scale vorticity with low-level maxima, tend to have gradually increasing deep convective area and vorticities at low-to-upper troposphere. By contrast, few developing disturbances (17 %) without mCB are pre-conditioned by much weaker large-scale vorticity. Due to adjacent dry air, resultant intensification was driven only after from Day 3 with rapid increase in relative vorticity and abrupt convective burst. There also exist many non-developing cases with mCB (54 %), which appear to candidates of TC formation as gradually increasing their convective area from Day 1 to Day 4. Due to the initially weak large-scale vorticity, they eventually decay on Day 5. For nondeveloping disturbances without mCB (46%), initially weak large-scale vorticity as well as dry atmosphere resulted in one-time deep convection and decay. Thus, this study suggests that the multiple days of convective burst, which initially accompanies strong low- to mid-troposphere large-scale vorticity, is important in TC formation.