The Mesoscale Features associated with Tropical Cyclone Formation in the Western North Pacific

Jenny S. N. Hui[1], Cheng-Shang Lee[1], Kevin K. W. Cheung[2]
[1]***Department of Atmospheric Sciences, National Taiwan University***
[2]***National Science and Technology Center for Disaster Reduction, Taiwan***

Abstract

A total of 124 Tropical Cyclone (TC) formation cases in the Western North Pacific (WNP) during September 1999–December 2004 are examined. To identify the mechanisms associated with TC formation under different major large-scale circulation patterns, these 124 cases are classified into six categories according to their surrounding flow patterns: monsoon shear (MS), monsoon confluence (MC), southwesterly flow (SW), southwesterly and northeasterly flow (SW-NE), northeasterly flow (NE), and easterly wave (EW). These patterns are defined based on European Centre for Medium-Range Weather Forecasts (ECWMF) 850-hPa and 925-hPa analyses and QuikSCAT oceanic winds.

To understand how convections develop and distribute before the formation reference time (when Vmax reaches 25 knots), the characteristics of convection development in these 124 cases are discussed by analyzing Infrared channel 1 (IR1) satellite imageries. The distribution of convection agreed well with the low-level large-scale forcing. Whereas MCSs activities are much affected by the diurnal variation, one to several MCSs is identified in most of the 124 formations in this study except two cases that belong to the NE and SW-NE types. On average, more MCSs are found 48 h before formation in the monsoon-related patterns (MS, MC and SW). For the EW pattern, only one MCS is identified in each case and the MCS only appeared within 24 h prior to formation, and usually did not develop until the formation time. In addition, longer-lived MCSs existed in the SW-NE, MS and MC categories. Such results reveal that disturbance embedded in these three type environments has a higher opportunity to form a TC because longer-lived MCSs would have better chance to interact or even merge with others. The probability of TC formation thus is increased.

Key word: tropical cyclone formation, mesoscale features