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A comparison study between two long-lasting synoptic-scale wave trains and associated tropical cyclogeneses

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Tropical cyclogenesis is closely related to the activity of convectively coupled equatorial waves over the western North Pacific. Previous studies usually focused on the role of single cyclonic disturbance on tropical cyclogenesis. From a view of continuously propagating wave train, this study compared two long-lasting synoptic-scale wave trains with distinct tropical cyclone activities in 2004 and 2006 for investigating the essential factors affecting low-level perturbations and tropical cyclone activities. By employing CFSR reanalysis data, JTWC best track, TRMM precipitation rate and ERSST sea surface temperature, analyses show that the long-lasting wave train during 2004 mainly occurs over the region from 130°E to 160°E, featuring enhanced synoptic perturbations in association with enhanced tropical cyclone activity. In contrast, during 2006, the wave train maintains over the region from 120°E to 150°E with more poleward propagation, and the tropical cyclone activity is relatively inactive. Furthermore, the substantial differences between these two wave trains are that the primary propagation occurring at mid-lower-troposphere with a nearly equivalent barotropic structure during 2004, but at upper- and lower- troposphere with significant westward tilt during 2006. This is essentially attributed to effects of different vertical wind shears. In 2004, affected by weak easterly shear, the synoptic-scale waves are confined at mid-low-level. However, in 2006, waves are usually trapped at upper-troposphere by weak westerly shear. Thus, different patterns of vertical wind shears fundamentally affect the structures of synoptic-scale waves and associated tropical cyclogeneses.