Evolution of Inner Core Structure of Typhoon Chanthu (2021) Observed by Taiwan Radar Network

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As Typhoon Chanthu (2021) moved along the east coast of Taiwan, a noticeable intensification was observed by the dense radar network on Taiwan. In this study, the reflectivity data from multiple radars are analyzed to discuss the evolution of inner-core structure. The horizontal winds retrieved by the Ground-Based Velocity Track Display (GBVTD) method from multiple radars are used to examine the kinematic features. Horizontal wind analysis at 3-km altitude shows that the maximum wind speed rapidly increased ~16 m s^{-1} within 16 hours, a feature of rapid intensification (RI), and the speed reached a peak of more than 65 m s^{-1} with a radius of maximum wind (RMW) of only 15 km. During the RI period, Typhoon Chanthu experienced an apparent eyewall replacement cycle (ERC). Before the ERC, the eyewall reflectivity asymmetry was highly dominated by the wavenumber-1 feature, with the reflectivity maximum located in the eastern semicircle. After the ERC was completed, the high reflectivity region rotated from the eastern to northern semicircle cyclonically. Simultaneously, a terrain blocking-induced southerly near the surface in the south of the typhoon vortex was observed when the typhoon moved closer to the southern-east coast of Taiwan. The RI was suspected to be associated with the southerly inflow through the boundary layer dynamics. In addition, it is noteworthy that outward radially-propagating Vortex Rossby Waves (VRWs) driven by the eyewall convection asymmetry episodically emanated in Chanthu's developing, mature and decaying stages during the passage along the east coast of Taiwan. This implies that the interaction between VRWs and mean flow might partly contribute to Chanthu's RI.

Keywords:typhoon, rapid intensification, radar wind retrieval, GBVTD