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Dynamic Mechanisms on the Track Changes of Typhoon Hinnamnor (2022)

Abstract

This study uses the WRF model to simulate the track evolution of Typhoon Hinnamnor (2022) and explore the dynamic processes associated with the track changes. At the initial stage, the track moves westward as influenced by the steering flow southwest of the subtropical high. Then due to interactions with a tropical depression (TD) to the southeast, as a result of Fujiwhara effect, the track of Hinnamnor is shifted southwestward. The TD merges with Hinnamnor at the end, leading to the typhoon's stagnation and intensification. The typhoon circulation is gradually enlarged with stronger flow to the south and east of the vortex, resulting in a noticeable northward component that drives the typhoon northward.

The study explores the horizontal circulation and vertical structure of interaction with the TD. Potential vorticity (PV) budget analysis indicates that contributions from diabatic heating increase to counteract the horizontal PV advection, as a primary factor for the typhoon to move southward, and the mean radial advection of eddy PV by eddy motions dominate the PV tendency. Sensitivity experiments with removal of nearby terrain and changes the water vapor in south side of typhoon are conducted to identify their different impacts on the typhoon's northward turn.