

Characteristics of Unusual Tropical Cyclone Tracks near Taiwan Island and Its Uncertainty in Forecasting

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Taiwan Island is one of areas with frequent unusual tropical cyclone (TC) tracks due to its complex topography. The statistical characteristics of unusual TC motion in the area of 116°E -126°E [U+FF0C] 19°N -29°N around Taiwan Island during the 66-yr period from 1949 to 2014 are examined by using the best track dataset from Joint Typhoon Warning Center. Then typhoon Morakot (2009) is taken as an example to investigate the causes of unusual track and its uncertainty in forecasting. Finally, a set of numerical sensitivity experiments are designed to explore the topography impacts on typhoon tracks.

Statistical analysis shows that TC anomalous changes on moving direction and speed often occur in Taiwan's eastern coast, northwestern coast and southern Taiwan Strait. About 33 percent of TCs approaching Taiwan Island are accompanied with terrain-induced secondary low pressure center (SC), and the centers of TCs and SCs generally distribute in the east and west side of CMR separately. About 36 percent of TCs making landfall in Taiwan can be replaced by SCs, resulting in discontinuous tracks.

Ensemble synoptic analysis is employed to investigate the change of Morakot moving motion across Taiwan Island based on the ECMWF ensemble forecasting products. Results indicate that the uncertainty of TC track forecasting presents high in the early and late periods of TC life span. The difference of track forecasting in early stage are mainly due to the various predictions on activities of Pacific subtropical high, westerly wind and the binary typhoon. In the later stage, SCs are more intense for good forecasting members and displace the original typhoon centers, resulting in discontinuous tracks. But for poor forecasting members, SCs are much weaker without replacements of the original typhoon centers, and remain in the eastern coast of Taiwan Island.

Sensitivity experiments results show that the blocking of terrain can slow down TC moving speed, resulting in a southward deflection and discontinuous tracks. When Taiwan terrain heights were cut 50 or 100 percent off, TC centers will pass through Taiwan Island with a faster moving speed without the generation of any SC.