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A Simulation Study on the Torrential Rainfall over Plain Area of Southwestern Taiwan During the Invasion of Typhoon Fanapi (2010)

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Tropical cyclone Fanapi was named on 15, September 2010. The storm then moved westward and then landed Taiwan on 19, September. During the invasion of Typhoon Fanapi, torrential rainfall occurred in Taiwan area. The maximum accumulated rainfall reaches 1,100 mm in mountainous area of southern Taiwan. The rainfall amount over mountainous area is not particular large comparing to those of other events such as the 2,800 mm of Typhoon Morakot (2009) and 1,500 mm of Typhoon Sinlaku (2008). However, the 6-hour accumulated rainfall amount 626 mm at Marjar township and the daily rainfall amount 872 mm at Kaohsiung city set the new record for Taiwan area and Kaohsiung city, respectively. Where Marjar township locates at the southern Central Mountain Range of Taiwan, and Kaohsiung city locates near the coast and is the major city in southern Taiwan. The intensive rainfall from Typhoon Fanapi, particularly heavy rains over plain area, is exceptional and is worth to do further investigation for improving forecast.

In this study, detail observations from radars and local stations were collected and documented. Numerical simulations from a version of WRF model, called TWRF at the Central Weather Bureau, were conducted and analyzed. The TWRF was able to simulate the track of Typhoon Fanapi without large error when Typhoon Fanapi was near and moved over Taiwan. Large rainfall with intensive narrow band over southern Taiwan was simulated. From the simulations, we found that the topography and the structure of the storm caused such a record-breaking rainfall event. Stronger and boarder area of convergence were found on the southern portion of Typhoon Fanapi. The topography of Taiwan enhanced the rainfall over the upwind side of the flow approaches mountain. The slow down of the moving speed after the center moved over and reorganized on the western side of the mountain ridge prolonged the rainfall over Kaohsiung area. The speed, size and strength of the storm are crucial for Typhoon Fanapi to reorganize and maintain persisted heavy rains over the southwestern Taiwan.