



## **Numerical studies on Heavy Rainfall Events over Northern Taiwan in Mei-Yu Season**

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Two unusual heavy rainfall events occurred in northern Taiwan from late evening of 11 June to the early morning of 12 June 2012 and late evening of 2 June to the early morning of 3 June 1984. In a few hours, more than 400 mm rainfall were recorded over northwestern Taiwan in these two events. The mechanisms for the commencement and maintenance of this localized heavy rainfall events over northern Taiwan are investigated using the NCEP global grid data, satellite imageries, radar reflectivities, and simulations from the Weather Research and Forecast (WRF) model. These events occurred under favorable large-scale environment that included: upper-level divergence; low-level high equivalent potential temperature; low level of free convection (LFC); and subsynoptic-scale ascending motion over the northern Taiwan Strait and northern Taiwan. In the late night of 2 June, the main heavy rainfall area is simulated to the southeast of the low-level windshift line associated with a trough axis, which is located in the southeastern China coast. The simulated heavy rainfall area moves eastward toward northeastern Taiwan Strait and the northwestern coast of Taiwan as the windshift line continues to propagate eastward.

The heavy convective rainfall is enhanced in the eastern Taiwan Strait by orographic blocking where the prevailing southwesterly wind within the Taiwan Strait converges with the orographically deflected flow with a southerly wind component off the western/northwestern Taiwan coast. As the simulated convective area continues to move toward northern Taiwan, it intensifies in a localized low-level convergence area over the northeastern Taiwan Strait and northwestern coast of Taiwan where a barrier jet along the coast converges with the northwesterly winds behind the surface front. Furthermore, in the early morning of 3 June, the simulated rainfall is heavier where the barrier jet encounters the leading edge of the cold pool caused by rain evaporative cooling. As the convective systems drift inland, the orographic lifting of the pre-frontal southwesterly flow helps to produce higher simulated rainfall intensity in the southern slopes of the Taipei Basin. The simulated daily accumulated rainfall over the Taipei Basin and northwestern coast of Taiwan is about 200 and 400 mm, respectively, about 50 mm less than observed. In an experiment without Taiwan's topography (the NT run), the simulated rainfall intensity over the northern Taiwan Strait and the northwestern coast of Taiwan is much less. In contrast to the control run, despite the presence of favorable large-scale settings, no convective systems move to the northern part of Taiwan from the northern Taiwan Strait in the NT run without heavy rainfall simulated over northern Taiwan. Two events will be comparatively investigated by WRF on the formation and maintenance of heavy rainfall in Mei-Yu season.