The relationships between the upstream wind and orographic heavy rainfall in southwestern Taiwan for typhoon cases

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Abstract Typhoon Morakot (2009) landed on northern Taiwan and then moved toward the northwest. Extreme heavy rainfall occurred in the mountainous region of southwest Taiwan. It was noticed that there were very strong horizontal westerly flows upstream of the mountain in southwest Taiwan. The relation between this upstream horizontal westerly wind and the heavy rain over the mountain is the major focus of this study. The 24-h maximum rainfall produced by Morakot was >1500 mm, and >20 stations in the area measured rainfall >1000 mm in 24 h. An algorithm was proposed to predict the extreme orographic heavy rain over southwestern Taiwan using radar-derived low-level horizontal winds. The Chigu radar is located 80 km upstream (westerly wind) of the mountainous regions. The EVAD technique was applied to retrieve the horizontal winds. The averaged horizontal winds between 0.5 and 3.0 km height are treated as the upstream low-level flow impinging on the mountain. A very good relationship between the low-level averaged speed and the hourly rainfall amount was achieved and the linear correlation coefficient is near 0.88. A similar algorithm was applied to two other typhoons: Haitang and Talim both in 2005; linear correlation coefficients of 0.80 and 0.84 were obtained, respectively. It is suggested that the upstream velocity of the flow determined the amount of heavy rainfall over the mountainous region in the strong wind regimes.

Key words typhoon; orographic heavy rain; Doppler radar; horizontal wind speed upstream of the mountain