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Orographic Controls on Extreme Precipitation Associated with a Mei – Yu Front

Abstract

Taiwan is often subject to extreme rainfall events driven by seasonal mei-yu fronts, which are significantly affected by the island's complex terrain. A particularly intense event took place from June 1–3, 2017, when a mei-yu front delivered over 600 mm of rain within 12 hours in the Taipei Basin and over 1500 mm in two days across the Central Mountain Range (CMR), resulting in major flooding and landslides. This study used the Weather Research and Forecasting (WRF) Model with a reduced-terrain sensitivity test to analyze how topography influences the intensity, duration, and spatial distribution of rainfall during such events. Lowering the terrain in the WRF model led to shorter rainfall duration and lower accumulation in northern Taiwan, as well as reductions in rainfall duration, intensity, and accumulation over the CMR. These effects were attributed to a weakened orographic barrier jet from reduced terrain height in northern Taiwan and diminished orographic enhancement of frontal convergence near the CMR. Additionally, the lower terrain affected the redirection of postfrontal westerly winds, which usually support the mei-yu front through orographic deformation (terrain-induced flow alteration). In both areas, reduced topography increased the front's speed, leading to shorter rainfall duration. Future analysis will build on these findings using data from the 2022 Prediction of Rainfall Extremes Campaign in the Pacific (PRECIP) field campaign.

Keywords

Orographic effects, barrier jet

Reference

Lan C. Cornejo, Angela K. Rowe, Kristen L. Rasmussen, and Jennifer C. Dehart (2024): Orographic Control on Extreme Precipitation Associated with a Mei – Yu Front, *J. Atmos Sci* 152 (2): 531 – 551