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A modeling analysis of the landfall of Hurricane Marty (2003) in Baja California, Mexico

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This study documents the life cycle of Tropical Cyclone Marty, which developed in late September 2003 over the eastern Pacific Ocean and made landfall on the Baja California Peninsula of northwestern Mexico. Observations and best-track data indicate that the center of circulation moved across the southern peninsula and Gulf of California. Satellite and radar imagery were used to analyze the structure of convective patterns. Rain gauges recorded precipitation over 300 mm. A network of surface meteorological stations in the vicinity of the storm track detected sustained winds up to 41 m/s and peak gusts up to 52 m/s. The storm was responsible for several deaths, major property damage, soil erosion and flooding, and evacuation from coastal communities.

Official, real-time forecasts issued by the United States National Hurricane Center prior to landfall were compared with the best track. This resulted in a westward bias of positions with decreasing errors during subsequent forecast cycles. Numerical simulations from the fifth generation Pennsylvania State University-National Center for Atmospheric Research Mesoscale Model (MM5) were used to examine the evolution of the cyclonic circulation over the southern peninsula. The model was applied to a nested grid with horizontal resolution as detailed as 3.3 km with a set of short-term simulations initialized at 9-34 hours prior to landfall. The output of the model provides a reasonable prediction of Marty's motion during landfall and the circulation characteristics are consistent with the information derived from observations. Additionally, the model was used to estimate the influence of the peninsular mountain ranges in a realistic simulation of the storm track over the Gulf of California.