Taiwan typhoon rain and climate change

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Abstract

We examine the effect of topographically phase-locked convection on the motion of typhoons across the island of Taiwan. Data for 84 typhoons that reached Taiwan's eastern coast from 1960 to 2010 are analyzed, with motions compared to the long-term average overland translation speed. For 61 continuous track typhoons among all cases, 77% of the slow-moving tropical cyclones (TCs) made landfall on the northern end of Taiwan's eastern coast, while 60% of the fast storms had southeastern coastal landfalls. This geographic asymmetry with respect to typhoon translation speeds widened after landfall, as the slow movers typically decelerated during the overland period, whereas the faster TCs sped up. In particular, the average overland duration was 16 h for the slow class, compared to only 3 h for the fast-moving typhoons. The combination of slower translation with longer duration for the northern class of TCs led to large rainfall on the southwestern slope of the island's Central Mountain Range. Weather Research and Forecasting model experiments are used to find that the topographically phase-locked convection acts to slow down (speed up) the northern (southern) landfalling typhoons. The model results also suggest that a positive feedback mechanism exists for the slow storms, in which the convective heating pattern forced by topography acts to reduce the TC motion, leading to even more prolonged precipitation and heating, yielding further speed reductions.