



## **Effects of Past Climate Change on Tropical Cyclone Rainfall near Taiwan: Case Studies using A Cloud-Resolving Model**

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To quantify the effects of long-term climate change on tropical cyclone (TC) rainfall near Taiwan, cloud-resolving simulations of four typhoons: Morakot (2009), Mindulle (2004), Sinlaku (2008) and Jangmi (2008), all ranked in the top-ten list of most rainfall, are performed and compared with sensitivity tests where these same cases are placed in the climate background of 1950-1969, which is slightly cooler and drier compared to the modern climate of 1990-2009 computed using NCEP/NCAR reanalysis data.

Using this strategy, largely consistent responses are found in the model among the four cases. In control experiments, the modern-day typhoons yield more rainfall than their counterpart in the sensitivity test using past climate, by about 4-8% within a radius of 300-400 km from the center of the tropical cyclone, throughout much of the periods simulated. In most cases, the frequency of more intense rainfall (20 to over 50 mm per hour) also increases by about 5-25% and the increase tends to be larger toward higher rain-rates. Results from the water budget analysis, again quite consistent among the cases, indicate that the increased rainfall from the typhoons in the modern climate is attributable to both a moister environment (by 2.5-4%) as well as, on average, a more active secondary circulation of the storm. For paired samples, the above changes in mean daily rainfall are about one standard deviation, and tested as statistical significant with high confidence. Thus, a changing climate may already have had a discernible impact on TC rainfall near Taiwan. While an overall increase in TC rainfall of roughly 5-6% may not seem large, it is certainly not insignificant either, considering that the long-term trend observed in the past 40-50 years, whatever the causes might be, may continue for many decades in the foreseeable future.