Modeling of space-time typhoon tracks in the vicinity of Taiwan by generalized linear model

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Tropical cyclones are one of the most serious natural disasters in northwestern Pacific Ocean. In general, an average of three to four typhoons attacks the vicinity of Taiwan annually, which brings heavy rainfalls and strong winds resulting in disasters including flooding, mudflows, and landslides, leading to severe damage to economies and casualties. Studies show that different tracks of typhoon can cause distinct spatiotemporal patterns of rainfall events at different regions of Taiwan. As a result, understanding the trajectories of tropical cyclones and their relationship to climatic variables at global scale is crucial for hydrological modeling and disaster migration in Taiwan, especially under the conditions of climate change. This study applies a probabilistic curve clustering technique, which is based on a regression mixture model, to classify the best tracks of typhoons across the area within six degrees around Taiwan during the period 1951-2009. For the purposes of modeling and forecasting of typhoon trajectories, the track classification is performed separately in different seasons due to their distinct driving forces to typhoon movements. Generalized linear model is used to characterize the relationship between the identified typhoon tracks and the dominant climate features derived from NCEP reanalysis data. Results show that the dominant contributing climatic variables to typhoon tracks vary among seasons. Among them, the wind fields at different levels of geopotential heights commonly play the most important role to the trajectories of typhoons in the vicinity of Taiwan.