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Intensifying tropical cyclone-induced extreme precipitation in China and the related large-scale circulations

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As one of the most destructive hazards, tropical cyclones cause tremendous damage and loss in the society not only by strong wind but also by heavy rainfall and storm surge. About 7 TCs make landfall over China every year on average. Under global warming, the frequency of TCs is expected to decrease while the intensity is expected to increase which induces more intense precipitation extremes. Based on annual maximum (AM) and peak over threshold (POT) methods, we find that the contribution of TCs to extreme precipitation over China exceeds 60% over the coastal areas in China. The analysis of dependence of the TC contribution to extreme precipitation on the distance between stations and shorelines shows that when the distance is smaller than 250km, the contribution of TCs to extreme precipitation decreases precipitously with moving inland from shore; when the distance is beyond 250km, the fraction is small (about 8%) but the effects of TC extreme precipitation can penetrate hundreds of kilometers inland. We also examine the relationship between TC-induced precipitation extremes and ENSO using Logistic regression and Poisson regression. The results show that in La Niña years, TC-induced precipitation extremes tend to occur in higher frequency with higher magnitude in southeast China; while in El Niño years, TC-induced extremes tend to occur more frequently in the northern part of the Yangtze River. The extreme precipitation events caused by TCs increases by 10% per decade. Furthermore, under global warming, the atmospheric circulation weakens, which hence slows down TC's moving speed. The translation speed of TCs over land decreased by 25% in China during the past 50 years, which may raise the risks of precipitation extremes.