

Effects of Tropical Cyclones on ENSO

*Tao Lian¹, Hongli Ren²

1. State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, Ministry of Natural Resources, Hangzhou, China, 2. Laboratory for Climate Studies, National Climate Center, China Meteorological Administration, Beijing, China

Numerous studies have investigated the role of the El Niño–Southern Oscillation (ENSO) in modulating the activity of tropical cyclones (TCs) in the western Pacific on interannual timescales, but the effects of TCs on ENSO are less discussed. Some studies have found that TCs sharply increase surface westerly anomalies over the equatorial western–central Pacific and maintain them there for a few days. Given the strong influence of equatorial surface westerly wind bursts on ENSO, as confirmed by many recent literatures, the effects of TCs on ENSO may be much greater than previously expected.

Using recently released observations and reanalysis datasets, it is found that the majority of near-equatorial TCs (TCs hereafter) are associated with strong westerly anomalies at the equator, and the number and longitude of TCs are significantly correlated with ENSO strength. When TC-related wind stresses are added into an intermediate coupled model, the simulated ENSO becomes more irregular, and both ENSO magnitude and skewness approach those of observations, as compared with simulations without TCs. Adding TCs into the model system does not break the linkage between the heat content anomaly and subsequent ENSO event in the model, which manifest the classic recharge–discharge ENSO dynamics. However, the influence of TCs on ENSO is so strong that ENSO magnitude and sometimes its final state—i.e. either an El Niño or a La Niña—largely depend on the number and timing of TCs during the event year. Our findings suggest that TCs play a prominent role in ENSO dynamics, and their effects must be considered in ENSO forecast models.

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