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An Assessment of Multi-model Simulations on the Variability of Western North Pacific Tropical Cyclones and Its Association with ENSO

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An assessment on the simulations of interannual variability of tropical cyclones (TCs) over the western North Pacific (WNP) and association with El Niño–Southern Oscillation (ENSO), as well as a subsequent diagnosis for possible causes of the model biases generated from simulating the large scale climate conditions, are documented in the paper. The model experiments are carried out by the Hurricane Work Group under the U.S. Climate Variability and Predictability Research Program (CLIVAR) using five global climate models (GCMs) with a total of 16 ensemble members forced by the observed sea surface temperature, and spanning 28-yr period from 1982 to 2009. The results show GISS and GFDL model ensemble means best simulate the interannual variability of TCs and the multi-model ensemble mean (MME) follows. Also, the MME has the closest climate mean annual number of WNP TCs and the smallest root-mean-square error to the observation.

Most GCMs can simulate the interannual variability of WNP TCs well, with stronger TC activities during two types of El Niño, namely eastern Pacific (EP) and central Pacific (CP) El Niño, and weaker activity during La Niña. However, none of models captures the differences in TC activity between EP and CP El Niño as shown in observations, which may be due to the bias of the circulations in models in response to the westward shift of tropical heating associated with CP El Niño. In addition, a general unrealistic scene exists in model simulations with the underestimated intensities of the convection anomaly over the maritime continent in the western tropical Pacific during each ENSO phase of whatever warm or cold, which may be the important source of biases in simulating WNP TC associated with the ENSO events.