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A high-resolution modeling study of tropical cyclones (TC) over the Western Pacific under current and future warmer climate

Guangtao Dong (1), Baode Chen (2), Changhai Liu (3), and Yuhua Yang (2)

(1) Shanghai Climate Center,Shanghai,China (gtdong@163.com), (2) Shanghai Typhoon Institute,China Meteorological Administration,Shanghai ,China (baode@mail.typhoon.gov.cn), (3) National Center for Atmospheric Research, Boulder, Colorado

ABSTRACT: Simulations of 3 TCs by using the Weather Research and Forecasting (WRF) model with an outer domain of 9-km grid size and a moving nesting inner domain of 3-km grid size over the Western Pacific were carried out. The National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) was used to provide initial fields and lateral boundary conditions (LBC) for control experiments, which captured the most observed characteristics of each TC. Future warmer climate simulations were conducted by using a pseudo–global warming approach which consists of adding a mean climate perturbation to the CFSR initial and boundary conditions in which the climate perturbations are expected changes predicted by global climate model (GCM) runs. This method allows the LBC to retain realistic sub-daily variability present in CFSR data, but still include the climate change signal. Three simulated TCs under a warmer climate differ widely in their intensity in comparison with control experiments. Analysis shows that, on one hand, the projected upper atmospheric warming tends to weaken storm due to ever-increasing vertical thermal stability, and on the other hand, increased sea surface temperature (SST) acts to intensify storm under warmer climate, which results in quite different intensifications of TCs.