

Representation of tropical storms in the northwestern pacific by the Modern-Era Retrospective analysis for research and applications

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Abstract

This study examines the tropical storms simulated in the Modern-Era Retrospective analysis for Research and Applications (MERRA) global atmospheric reanalysis for the recent 12 years (1998–2009), focusing on the tropical storm activity over the Northwestern Pacific. For validation, the International Best Track Archive for Climate Stewardship (IBTrACS) dataset is used as an observational counterpart. Climatological-mean features of the tropical storm genesis, tracks and their maximum intensity are the primary interests in this study. Regarding the genesis location of tropical storms, MERRA is reasonable in resolving major development regions over the South China Sea and the Northwestern Pacific close to the Philippines. The seasonal variation of the number of storms is also reproduced in a realistic way in MERRA, with peak values occurring from July to September. In addition, MERRA tends to reproduce the observed interannual variation of the number of tropical storms during the 12-years, though with a limited accuracy. The simulated paths toward higher latitudes are also reasonable in MERRA, where the reanalysis corresponds well with the observations in resolving frequent paths of westward moving storms and recurving storms toward the northeast. Regarding the intensity, MERRA captures the linear relationship between the minimum center pressure and the maximum wind speed near the surface at the maximum development. Some discrepancies from the observed features are found in the reanalysis, such as less frequent development of storms over the South China Sea and less frequent paths over this region. The reanalysis also does not attain the observed maximum intensity for the resolved tropical storms, particularly underestimating the center pressure. These deficiencies are likely related to limitations in the horizontal resolution and the parameterized physics of the data assimilation system.

Key words Tropical storms – Northwestern Pacific – atmospheric reanalysis – data assimilation