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Assessment of the POEM2 model for simulating tropical intraseasonal oscillation

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The intraseasonal oscillation (ISO) of the atmosphere is closely related to weather and climate systems and is also an important aspect of extended numerical weather forecast research. This phenomenon is significant in tropical regions and is one of the key indices for assessing the simulation capability of a climate model. To better evaluate numerical model simulations of the tropical ISO using the 10-year historic data calculated by the POEM2 climate system model developed by the University of Hawaii in the U.S., we utilized the methods of variance and power spectral analysis to compare and assess the simulation ability of this model for the ISO in tropical regions. Our results showed that the simulated variance results for the 850 hPa zonal wind and outgoing long-wave radiation (OLR) by POEM2 are overall consistent with the observed distribution pattern, and the simulated variance is relatively larger than the observed in the North Indian Ocean and West Pacific regions. With respect to the summer model, the winter model can better simulate the eastward propagation motion of the Madden–Julian oscillation (MJO) and the 850 hPa zonal wind. In comparison, the summer model can better simulate the northward propagation motion of MJO and precipitation than the winter model. The high frequency region for the power spectra of meteorological element anomalies are concentrated in wavenumber 2-3 in the simulation and in wavenumber 1-2 in the observation. The multivariate combined empirical orthogonal function (EOF) results showed that this model can simulate the relationship between high-low level wind distributions and precipitation over the East Indian Ocean and the West Pacific, but the simulated signal is weaker than the observed. The lagging correlation of time coefficients between the first two EOFs from observation and simulation shows a similar cycle. Thus, these results indicate that in the future, the POEM2 climate system model needs to optimize the involved physical processes and parameterization scheme, strengthen the dynamic description of the mixed Rossby gravity wave, and improve the simulated ability of wavenumber 1.