Abstract

Some MJO features were previously diagnosed in the MRI-20km60L AGCM that uses the Arakawa-Schubert cumulus parameterization. This study continues to document the detail characteristics of the tropical intraseasonal variability (TISV) in this model based on a 27-year AMIP-type run output. Mean states, power spectra, propagation features, leading EOF modes, vertical structure, and seasonality associated with the TISV are analyzed using the standardized software package provided by the US CLIVAR MJO Working Group. Results show that the model produces very realistic long-term-mean winds compared to the reanalysis product. In particular, the low-level westerly during boreal winter in south equatorial areas from the Indian Ocean to the date line corresponds well with that in the reanalysis. This westerly package has been suggested essentially necessary for the eastward propagation of MJO while it can be hardly simulated realistically by GCMs with much coarser resolutions. The zonal wind shear associated with the Asian summer monsoon is also simulated realistically. Mean states in the simulated convection are comparable to observations too. However, these realistic mean states do not correspond to a realistic TISV. The simulated TISV shows very low amplitude in both convection and dynamical signals at 30-60-day band. Filtered anomalies have apparent standing structures. Power spectra and lag correlation of the signals do not show dominant propagations in either eastward direction during boreal winter or northward direction during boreal summer. Seasonality of the TISV is not well produced. The first two leading EOFs in dynamical and convection variables take only 4-6% of the total variance, about half of the observations. Consequently these leading modes cannot be separated from the rest with statistical significance. A combined EOF (CEOF) analysis of winds and convection shows a loose coupling among these fields thus the coupled pattern cannot sustain the TISV as prominent as observed. A composite of modeled phase 3 of MJO in DJF season is formulated with the events selected by projecting the modeled anomalies in 200 hPa zonal winds onto the observed first two CEOFs. The vertical moisture anomaly in this phase does not show apparent westward tilt as in observations, indicating that boundary layer moisture anomaly does not lead convection thus neither favors the eastward propagation. This vertical structure corresponds to relatively uniform diabatic heating due to convection which is over dominant in precipitating partition. The weak and irregular TISV signals in this model suggest that an AGCM using a previously proved cumulus scheme at very high resolutions does not guarantee to improve the TISV simulation.