Abstract

This study investigates why OLR plays a small role in the Real-time Multivariate MJO (RMM) index and how to improve it. The RMM index consists of the first two leading principal components (PCs) of a covariance matrix, which is constructed by combined daily anomalies of OLR and zonal winds at 850 hPa (U850) and 200 hPa (U200) in the tropics after being normalized with their globally averaged standard deviations of 15.3 W m^{-2}, 1.8 m s^{-1}, and 4.9 m s^{-1}, respectively. This covariance matrix is reasoned mathematically close to a correlation matrix. Both matrices substantially suppress the overall contribution of OLR and make the index more dynamical and nearly transparent to the convective initiation of the MJO. A covariance matrix that does not use normalized anomalies leads to the other extreme where OLR plays a dominant role while U850 and U200 are minor. Numerous tests indicate that a simple scaling of the anomalies (i.e., 2 W m^{-2}, 1 m s^{-1}, 1 m s^{-1}) can better balance the roles of OLR and winds. The revised PCs substantially enhance OLR over the Eastern Indian and Western Pacific Oceans and change it less notably in other locations, while they reduce U850 and U200 only slightly. Comparisons with the original RMM in spatial structure, power spectra, and standard deviation demonstrate improvements of the revised RMM index.