Modulation of MJO propagation speed by the fluctuation of large-scale zonal circulation

Tamaki Suematsu*[1], Hiroaki Miura[2]

1 Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan

2 Department of Earth and Planetary Science, The University of Tokyo, Tokyo, Japan

*Correspondence to: suematsu@aori.u-tokyo.ac.jp

Eastward progression of convectively active region is one of the distinguishing characteristics of the Madden-Julian Oscillation (MJO). However, understanding on the mechanisms of their eastward propagation and what determines their propagation speeds is still limited. Taking this into consideration, this study investigated how the boreal winter MJO propagation speed is modulated by the background environment, and sought for an intrinsic relationship of the MJO with the background atmospheric states.

MJO events were identified by application of the real-time-multivariate MJO index (RMM). Propagation speed, consistent with the angular phase speed on the RMM phase space, was calculated for each of the detected events by constructing a MJO convection tracking method. Then, building onto our recent finding of MJO enhancement with background zonal SST gradient, we examined how MJO propagation speed was influenced by the background SST. The analysis revealed a tendency of the MJO to propagate slower under low-frequency SST distribution with zonal gradient that peaks over the western Pacific. In contrast, there was little dependency of MJO propagation speed to the high-frequency SST distribution. To further investigate the influence of low-frequency SST, relationship between MJO propagation speed and large-scale zonal circulation. The results showed that MJO tended to propagate slower when the background large-scale zonal circulation was stronger. The findings of this study points to a view that MJO is an integral part of the large-scale zonal circulation, and that slower and stronger MJO events manifests with intensification of the large-sale zonal circulation.

Key words: Madden-Julian Oscillations, Walker Circulation

References

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