

EGU24-2862, updated on 13 Jul 2024

<https://doi.org/10.5194/egusphere-egu24-2862>

EGU General Assembly 2024

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Robust Relationship between Mean State Moisture and Interannual MJO Activity in Observations and CMIP6 Models

Daehyun Kang¹, Daehyun Kim², and Seon-Yu Kang¹

¹Climate and Environmental Research Institute, Korea Institute of Science and Technology, Seoul, Korea, Republic of

²School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea, Republic of

The Madden-Julian Oscillation (MJO) is the dominant intraseasonal variability of eastward propagating atmospheric disturbances in the tropics. From its vast impacts on the sub-seasonal extreme events and predictability, the mean states controlling the MJO activity have been investigated. For example, the robust relationship between the Quasi-Biennial Oscillation (QBO) and the MJO has been suggested in the past several years. In the easterly QBO winters, the MJO exhibits stronger activity than the westerly QBO winters.

Our study suggests another crucial factor that affects the MJO: a meridional humidity gradient of the atmospheric column in the vicinity of the Maritime Continent. With the change in the shape of the column humidity distribution, MJO variance shows a robust interannual modulation regardless of the QBO. The northward (southward) extension of the moisture increases (decreases) the mean state meridional humidity gradient, which leads to MJO development (decay) over the MC with increasing (decreasing) horizontal moisture advection. This robust relationship between mean state humidity and MJO activity is investigated in the CMIP6 models as two aspects: i) interannual variation of MJO and ii) future change in MJO. Both simulated MJO activities are largely affected by the mean state MHG, supporting the robust role of mean state moisture on the MJO shown in the observations. The results of this study provide a further understanding of seasonal MJO activity and sub-seasonal predictability. MJO activity and sub-seasonal predictability.