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How Tibetan Plateau affects Intra-Seasonal Oscillation?

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The Tibetan Plateau (TP) and Himalayas have been treated as the important external factor in shaping Asian monsoon and mid-latitude atmospheric circulation. Here we suggest, for the first time, that the eastward propagation of Madden-Julian Oscillation (MJO) is largely originated from the uplift of TP and Himalayas by performing numerical experiments with different altitudes of the uplift using the Nanjing University of Information Science and Technology Earth System Model (NESM3.0). Analysis of the experimental results with dynamics-based MJO diagnostics shows that the uplift of the TP and Himalayas considerably enhances mean westerly in the Indian ocean and convection in Maritime Continent, which contributes to the realistic eastward propagation of the MJO. The mean state change driven by lowering the uplift elevation inhibits the generation of the coupled Rossby-Kelvin wave which, in turn, reduces BL moisture convergence (BLMC) to the east of MJO convective center. The decreased BLMC leads to weaken the upward transport of moisture and heat from the BL to the free atmosphere and to reduce convective instability and lower tropospheric heating ahead of the MJO center. Consequently, the eddy available potential energy (EAPE) generation, which is the decisive factor to promote MJO eastward propagation, is decreased considerably. This study has an implication for better understanding of the MJO origin and will contributes to better simulation of the MJO propagation.

Northward propagation of the boreal summer intra-seasonal oscillation (ISO) has profound impacts on northern hemisphere extreme weather events. This study aims to test the hypotheses proposed in the previous studies to explain northward propagation of the ISO by drastically changing the climatological mean states through lowering the Tibetan Plateau (TP) with a fully coupled Earth system model, NESM3.0. The model reproduces realistic ISO over South Asia and the northern Indian Ocean. The results show that ISO northward propagations significantly weakens with decreased elevation of the TP. Lowering the TP reduces the vertical shear of the mean monsoon circulation over the northern Indian Ocean. The reduced vertical shear deteriorates the generation of positive vorticity anomalies and boundary layer moisture convergence to the north of ISO precipitation center, thereby weakening northward propagation of the ISO. On the other hand, the boundary layer moisture advection and air-sea interaction do not change appreciably when the TP elevation is reduced. These results suggest that the mean-state vertical shear is most critical for the ISO northward propagation.

School of Urban & Environmental Engineering

- **When : 2019.02.27.(Wed) 17:00**
- **Where: Bldg.110(EB4), Room.1007**
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