Downward Influence of QBO-like Oscillation to Moist Convection in a Two-Dimensional Minimal Framework

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A self-sustained oscillation in zonal mean zonal winds that is analogous to the equatorial quasi-biennial oscillation (QBO) was first obtained in a radiative-convective equilibrium state of a two-dimensional model by Held et al. (1993). The robustness of the QBO-like oscillation was reconfirmed by Yoden et al. (2014; hereafter, YBN14) in a two-dimensional minimal framework. High temporal-resolution outputs from YBN14's framework were analyzed by Nishimoto et al. (2016) and revealed that there appear two types of precipitation patterns as squall line and back building, depending on the magnitude of vertical shear near the surface.

In this paper, we further investigate the influence of the QBO-like oscillation on convection using the minimal framework of YBN14 with two series of parameter sweep experiments. The first series, *Model top experiments*, change the height of model from 40 km to 15 km to examine the sensitivity of the precipitation modulation to the choice of model height. In the second series, *Low-level nudging experiments*, the zonal mean zonal wind is nudged towards zero in a certain depth from the surface to remove the effect of low-level wind shear. Two typical examples of the experiments are chosen for further composite analysis to reveal the convective structures in different conditions of precipitation.

The results show that the QBO-like oscillation modulates the convection via two mechanisms related to vertical shear of the zonal mean zonal wind. Large values of shear near the surface enhance the longevity and intensity of the convective systems in the form of squall line type. On the other hand, large values of shear near the cloud top disrupt the convective structure and leads to a smaller amount of precipitation. The first mechanism seems to be dominated as the second one only be revealed when the low-level shear is nudged to some certain levels.

Keywords: QBO-like oscillation, influence to moist convection, two-dimensional minimal framework

