Mechanisms for northward propagation of boreal summer intraseasonal oscillation

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The 20-90-day Intraseasonal Oscillation (ISO) is one of the dominant modes of tropical variability. In boreal summer northward propagation (NP), which occurs on ISO time scales, originates near the equator and extends to India and western North Pacific Ocean. Understanding the NP of the boreal summer ISO (BSISO) is of vital importance to extended-range weather prediction. Hence, several mechanisms of the NP have been examined. However, they are still incompletely understood. The purpose of this study is to investigate the importance of vertical shear and sea surface temperature (SST) for the NP of the BSISO. In order to obtain a basic structure of the BSISO, we have conducted JJA-perpetual experiments using the Non-hydrostatic Icosahedral Atmospheric Model (NICAM) with a 56-km horizontal mesh.
Although the perpetual experiment has strong Indian monsoon over Arabian sea due to the bias of surface temperature on land, it is found that the NP of the BSISO from Indian Ocean (IO) has two abovementioned mechanisms. One warm SST anomaly north of convection destabilize the lower troposphere, while another tilted vertical shear can generate positive barotropic vorticity to the north of convection. In order to assess the effect of the former mechanism, we made an experiment using fix SST (SSTFIX) obtained from CTL experiment. SSTFIX experiment reproduces the NP of the BSISO from IO, although the amplitude became lower. Therefore, it suggests that the NP of the BSISO from IO doesn’t need warm SST anomaly. To Improve the bias related to basic state like vertical shear, we conducted an experiment using nudging method for surface temperature on land (LNDADJ). In LNDADJ experiment the NP of the BSISO from IO isn’t reproduced due to reduction of column water vapor over Bay of Bengal. Thus, tilted vertical shear can just begin the NP. On the other hand, it is suggested that the NP needs SST and column water vapor to maintain its strength.

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