

The Relationship between Boreal summer Intra-seasonal Oscillation and the Stratospheric Circulation

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Boreal summer intra-seasonal oscillation (BSISO) is a phenomenon that active convective region migrate northward in the Indian Ocean and the western Pacific with a period of 30 –90 days. In this study, statistical relationships between BSISO and the stratospheric circulation are examined focusing on the variabilities of the zonal wind fields both in the troposphere and stratosphere. BSISO index based on Kikuchi et al. (2012) and the Japanese 55-year Reanalysis (JRA-55, Kobayashi et al. 2015) are used for composite analysis. To represent the zonal mean fields, the mass-weighted isentropic zonal mean (MIM) Method (Iwasaki 1989) is applied to JRA-55. The MIM method is suitable for the examination of zonal momentum budget, and enables analysis of a single hemispheric cell, such as Blewer-Dobson circulation in the stratosphere and the extra-tropospheric direct circulation. In order to extract variability synchronized with BSISO or lower (higher) frequent variability than BSISO, temporal filtering based on Duchon (1979) is also carried out to the zonal mean fields obtained by the application of the MIM method.

We found some characteristic features of the zonal wind field during the significant BSISO: Hemispheric symmetry westerly anomalies are observed from mid-troposphere up to the tropical tropopause layer (TTL) just after the northward migration of active convective region in BSISO region, and move poleward in both hemispheres in spite of meridional asymmetry of the convective activity: In the extra-tropical upper stratosphere of the Northern Hemisphere, both easterly anomalies and positive potential temperature anomalies are statistically significant during the northward migration of active convective region. Moreover, our results also reveal that the amplitude of BSISO is extraordinarily large during the strong low-frequency easterly anomalies at around the 20 hPa level associated with quasi-biennial oscillation (QBO) and suggest influence of the stratospheric circulation on the activity of BSISO in the troposphere.

Keywords: Boreal summer intra-seasonal oscillation, Mass-weighted isentropic zonal mean, Stratospheric circulation, Quasi-biennial oscillation