

Modulation of the Organized Tropical Deep Convections by the Stratospheric Quasi-Biennial Oscillation

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Tropical deep convections are largely controlled by sea surface temperature. For example, during El Nino winters, deep convections over the western Pacific become weaker than normal but those over the central to eastern Pacific become stronger. Here, we show that such a relationship does not hold for the organized tropical deep convections that are associated with the Madden-Julian Oscillation (MJO). The boreal-winter MJO convections, which affect precipitation and surface air temperature not only in the tropics but also in the extratropics, are not correlated with El Nino on interannual time scale. Instead, they are highly correlated with the equatorial stratospheric mean state that is modulated by the Quasi-Biennial Oscillation (QBO). When zonal wind in the tropical lower stratosphere is easterly (or the easterly phase of the QBO), MJO convections are generally stronger than normal. Such a modulation of MJO convections by the QBO explains about 30% of total interannual variance of the MJO amplitude. This relationship is further observed in the operational seasonal prediction models. All five models show a higher MJO prediction skill during the easterly phase of the QBO. This result indicates that stratosphere may play an important role in improving subseasonal-to-seasonal prediction of MJO convections and the associated tropical-extratropical teleconnection.

Key words: QBO, MJO