Modulation of the QBO on the Impact of ENSO on the South Asian High in the Following Summer

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Previous studies have demonstrated the influence of boreal winter El Niño–Southern Oscillation (ENSO) on the following summer's South Asian high (SAH) variability. Here we provides observational evidence that the boreal winter quasi-biennial oscillation (QBO) has a significant modulation effect on the relationship between winter ENSO and the variability of the following summer's SAH by using European Centre for Medium-Range Weather Forecasts Interim Reanalysis data for the period 1979–2013. The results suggest that the boreal summer SAH is more significantly influenced by preceding ENSO events in the easterly phase of the QBO than in the westerly phase. The change in the ENSO–SAH relationship in different QBO phases may be attributable to the change in the ENSO-induced sea surface temperature (SST) anomalies over the tropical Indian Ocean (TIO). Specifically, ENSO's influence on the following summer's TIO SST is more significant when the QBO is in its easterly phase than westerly phase. Further analysis showed that the change in the connection between ENSO and the TIO SST in the different QBO phases may be attributable to change in the anomalous tropical Indian Ocean cell (IOC) associated with ENSO. In particular, the anomalous IOC induced by anomalous Walker circulation over the tropical Pacific is stronger and located further west in QBO easterly than westerly phase. This leads to stronger descending motion and larger SST anomalies over the TIO in the QBO easterly phase. These larger SST anomalies over the TIO in the QBO easterly phase could exert a more significant influence on the tropospheric temperature through moist adjustment, which subsequently results in stronger SAH variability.

Key words: QBO, South Asian high, ENSO, Tropical Indian Ocean, SST