El Niño - Southern Oscillation effect on quasi-biennial oscillation of temperature diurnal tides in mesosphere and lower thermosphere

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The El Niño - Southern Oscillation (ENSO) is known as a periodic (2 to 7 years) planetary-scale ocean-atmosphere-coupled phenomenon that affects global climate and weather systems at various space and time frames. Studies in the recent decade suggested that the ENSO is a significant source of tides variability in the mesosphere and lower thermosphere (MLT). In this study, we examine the ENSO signals in the two dominant temperature diurnal tides of DW1 (diurnal westward wavenumber 1) and DE3 (diurnal eastward wavenumber 3) on the quasi-biennial oscillation (QBO) scale (18 to 34 months) in MLT. The tides are derived from the 21-year (1996 to 2016) GAIA (Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy) temperature simulations and the 15-year (2002 to 2016) TIMED (Thermosphere Ionosphere Mesosphere Energetics and Dynamics) / SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) temperature observations. The results show that the ENSO constrains the QBO not only in the stratosphere but also in the MLT. The anomalous stratospheric QBO in 2015–2016 enhances the DW1 in period from 1 to 1.5 years that is much shorter than the QBO period. The long-term decreasing trends in the DE3 QBO amplitude and the rainfall rate at low latitudes reveal the DE3 response to the climatological changes, of which the ENSO is one of the players.

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