The QBO, Gravity Waves Forced by Tropical Convection, and ENSO

by

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Abstract

By means of theory, a simplified cartoon illustrating wave forcing of the QBO, and general circulation modeling of the QBO, it is argued that the period of the QBO is controlled by the magnitude of the gravity wave momentum fluxes forcing the QBO, while the QBO amplitude is determined by the phase speeds of the gravity waves that make up this momentum flux. It is furthermore argued that it is the zonally averaged gravity wave momentum flux that determines the QBO period irrespective of the longitudinal distribution of this gravity wave momentum flux. These concepts are used to develop a hypothesis for the cause of a previously reported ENSO modulation of QBO periods and amplitudes. Some observational evidence is reported for the ENSO modulation of QBO amplitudes to have been different before the 1980s than after about 1990. A hypothesis is also given to explain this in terms of the different ENSO modulation of tropical deep convection that took place before the 1980s from that which occurred after about 1990. The observational evidence, while consistent with our hypotheses, does not prove that our hypotheses are correct given the small number of El Niños and La Niñas that occurred in the early and later periods. Further research is needed to support or refute our hypotheses.

Keywords: QBO, ENSO, Gravity Waves