



## **Coupling between strong warm ENSO events and the phase of the stratospheric QBO.**

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Although there in general are no significant long-term correlations between the QBO and the ENSO in observations we find that the QBO and the ENSO were aligned in the 3 to 4 years after the three strong warm ENSO events in 1982, 1997, and 2015. We study this possible connection between the QBO and the ENSO with a new version of the EC-Earth model which includes non-orographic gravity waves and a well modeled QBO. We analyze the modeled QBO in ensembles consisting of 10 AMIP-type experiments with climatological SSTs and 10 experiments with observed daily SSTs. The model experiments cover the period 1982-2013. For the ENSO we use the multivariate index (MEI).

As expected the coherence is strong and statistically significant in the equatorial troposphere in the ensemble with observed SSTs. Here the coherence is a measure of the alignment of the ensemble members. In the ensemble with observed SSTs we find a strong and significant alignment of the ensemble members in the equatorial stratospheric winds in the 2 to 4 years after the strong ENSO event in 1997. This alignment also includes the observed QBO. No such alignment is found in the ensemble with climatological SSTs. These results indicate that strong warm ENSO events can directly influence the phase of the QBO.

An open and maybe related question is what caused the anomalous QBO in 2016. This behaviour, which is unprecedented in the 50-60 years with data, has been described as a hiccup or a death-spiral. At least it is clear that in the last 18 months the QBO has been stuck in the same corner of the phase-space spanned by its two leading principal components. The possible connection to the ENSO will be investigated.