

Virtual ACOM Seminar

Dynamical and trace gas responses of the Quasi-Biennial Oscillation to historical and future climate change

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Links: <https://operations.ucar.edu/live-acom>

ABSTRACT

The Quasi-Biennial Oscillation (QBO) dominates the variability of the tropical stratosphere. The QBO can be seen in stratospheric zonal wind, temperature, and composition, but it also has a number of teleconnections—including to the polar vortices, extratropical surface winter climate, and the Madden-Julian Oscillation. Thus, its future trends will have a signature on the surface. Recent multi-model investigations (Richter et al. 2019, Butchart et al. 2020) suggest that a weakening of the QBO amplitude is very likely, but changes to QBO period and stability remain unclear, due in part to its highly parameterized nature.

We investigate these aspects using multiple configurations of the NASA Goddard Institute for Space Studies Model E2.2 (Rind et al., 2020; Orbe et al. 2020). As a high-top model with gravity wave drag partly sourced from (parameterized) convection, Model E2.2 includes key pathways for climate forcings to influence the QBO. Overall, both the period and amplitude decrease in response to increased CO₂, with convection feedbacks critical for the period response, and ozone feedbacks enhancing the amplitude response. We use these results to interpret QBO trends in the historical and SSP integrations. Lastly, we examine the effect of volcanic eruptions on the QBO.

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