Evaluation of resolved equatorial waves and wave-driving of the QBO in the QBOi models

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The SPARC Quasi-Biennial Oscillation initiative (QBOi) aims to improve the representation of the QBO in global climate models. For the QBOi, several coordinated model experiments have been performed, and output is available from at least 17 different models and/or model versions. As part of phase 1 of the QBOi, we have evaluated equatorial Kelvin and Rossby-gravity waves in the stratosphere and investigated the role of equatorial waves in driving the QBO in the QBOi models. All of the QBOi models have robust Kelvin and Rossby-gravity wave modes in winds and temperatures at 50 hPa, although there is a large spread in the QBOi models in the representation of both Kelvin and Rossby-gravity waves. We attribute the considerable variability in equatorial waves among the QBOi models in part to the varying horizontal and vertical resolutions of the QBOi models, which also vary considerably. We have also evaluated tropical precipitation in the QBOi models and related precipitation variability to tropical waves in the stratosphere. Kelvin and Rossby-gravity wave modes in precipitation spectra are even more variable than in the winds and temperatures among the QBOi models. Furthermore, only roughly half of the QBOi models have realistic Kelvin waves in precipitation compared to observations, and only a couple models have Rossby-gravity wave modes in precipitation comparable to observations. The models with stronger convectively- coupled waves produce larger zonal mean forcing due to resolved waves in the QBO region.