Teleconnections of the quasi-biennial oscillation (QBO) in a multi-model ensemble of QBO-resolving models

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Observations indicate that the quasi-biennial oscillation (QBO) in tropical stratospheric winds can influence the extratropics during winter in both hemispheres. The Northern Hemisphere response consists of a modulation of the strength of the stratospheric polar night jet, with an associated tropospheric response that exhibits the pattern of the North Atlantic Oscillation (NAO). QBO signatures in the subtropical jets and tropical precipitation are also observed. Due to the high predictability of the QBO, these teleconnections may potentially improve the skill of seasonal and decadal forecasts if they are accurately represented in climate models, but their robustness remains an open question. Uncertainties arise not only from the limited length of the observational record, during which the QBO co-exists with numerous other sources of low-frequency variability, but also from ambiguity concerning the mechanism(s) through which the QBO influence extends outside the tropical stratosphere. Here we examine model uncertainties in the representation of QBO teleconnections using a multi-model ensemble of QBO-resolving atmospheric general circulation models that have carried out a set of coordinated experiments designed by the SPARC QBO initiative (QBOi) activity. During Northern Hemisphere winter, the stratospheric polar vortex in most of these models strengthens during the QBO westerly phase in a manner similar to the observed teleconnection, although the strength of the response varies widely among models and is generally weaker than the observed response. The corresponding NAO response is much less consistent among the models. The weak stratospheric response may be due to model error, but uncertainty in the strength of the observed signal implies that the model responses may in fact be consistent with the observations.

Key words: teleconnection, QBO, polar vortex, NAO