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Solar Cycle and QBO Effects in the Stratosphere

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We present results from a comprehensive set of experiments made with NCAR's Whole Atmosphere Community Climate Model (WACCM3), a state-of-the-art chemistry climate model that incorporates the whole atmosphere up to the thermosphere. 110-year sensitivity experiments with WACCM3, in which we included only a realistic time varying solar cycle, only a synthetic, time varying QBO, or both the solar cycle and the QBO, have been analyzed to investigate how the QBO affects the solar signal in the stratosphere. It turns out that the QBO determines the vertical structure of the tropical solar signal in the middle to lower stratosphere. The signal is opposite for QBO east and QBO west conditions in the tropical and extratropical stratosphere. This is in qualitative agreement with observations and other mechanistic model studies. We show results from a multiple linear regression analysis as well as from a composite analysis and discuss how the results depend on the definition of QBO east and west regimes. The good agreement in the stratosphere motivates us to look for processes and possible signals in the troposphere.