Popular Summary of

Sensitivity of the mid–winter Arctic stratosphere to QBO width in a simplified chemistry–climate model

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In the stratosphere, equatorial winds continually alternate between easterly (westward) and westerly (eastward). This phenomenon is called the quasi–biennial oscillation (QBO). The average QBO cycle (i.e. easterly to westerly to easterly) lasts approximately 27 months. Large–scale 'planetary' waves can only travel upward through the atmosphere when equatorial winds are westerly, and below a critical threshold. Thus, the amount of wave energy that reaches the middle atmosphere depends on the wind direction. When equatorial winds are easterly, wave energy is concentrated at higher latitudes, weakening the high–latitude eastward wind feature known as the 'polar jet' during the Northern Hemisphere winter season. Holton and Tan (1980) used atmospheric observations to show the dependence of the strength of the northern polar jet on the phase (easterly vs. westerly) of the QBO.

This modeling study finds that the width of the quasi–biennial oscillation (QBO) varies from one cycle to the next, and that variation in QBO width may exert equal influence on the Arctic stratosphere as does the QBO wind direction. High latitude winds are weaker and ozone values are higher in a wide–QBO model simulation, as compared with a realistic simulation. This result implies that a relatively wider QBO acts like a preferential shift toward the easterly phase of the QBO.