Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03786, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03786
EGU General Assembly 2008

Decadal-scale changes in the effect of the QBO on the northern stratospheric polar vortex

H. Lu (1)**,** M. P. Baldwin (2), L. J. Gray (3), M. J. Jarvis (1)

(1) British Antarctic Survey, Cambridge, UK, (2) Northwest Research Associates, Seattle, USA, (3) Reading University, Reading, United Kingdom (hlu@bas.ac.uk)

Decadal-scale changes in the Holton and Tan (HT) relationship, $i.e.$, the influence of the lower stratospheric equatorial quasi-biennial oscillation (QBO) on the northern hemisphere (NH) extra-tropical circulation, are detected statistically. Using a combination of ECMWF Re-Analysis-40 and Operational data from 1958-2006, we find that the Arctic winter stratosphere is indeed warmer under easterly QBO and colder under westerly QBO. The dominant feature is a poleward and downward transfer of wind and temperature anomalies from the mid-latitude upper stratosphere to the high-latitude lower stratosphere. In general, the HT relationship is stronger in early winter and weaker in late winter.

For the first time, a statistically significant decadal-scale change of the HT relationship during 1977-1997 is diagnosed. The main feature of the change is that the extratropical QBO signals reverse sign in late winter, resulting in fewer and delayed major stratospheric sudden warmings (SSWs), which occurred more often under westerly QBO. Consistent with earlier studies, it is found that the HT relationship is significantly stronger under solar minima overall, but the solar cycle does not appear to be the primary cause for the detected decadal-scale change. Possible mechanisms related to changes in planetary wave forcing are discussed.