Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AAS006-17 会場: 202 時間: 5月28日16:15-16:30

QBOにおける赤道波と慣性内部重力波の役割

The roles of equatorial trapped waves and internal inertia-gravity waves in driving the QBO

河谷 芳雄[1*], 佐藤 薫[2], Timothy J Dunkerton[3], 渡辺真吾[1], 宮原三郎[4], 高橋 正明[5]

Yoshio Kawatani[1*], Kaoru Sato[2], Timothy J Dunkerton[3], Shingo Watanabe[1], Saburo Miyahara[4], Masaaki Takahashi[5]

[1]独立行政法人海洋研究開発機構, [2]東京大学大学院理学系研究院, [3]ノースウェスト研究所, [4]九州大学大学院理学研究院, [5]東京大学気候システム研究センター

[1]JAMSTEC, [2]University of Tokyo, [3]Northwest Research Associates, [4]Kyushu University, [5]CCSR, University of Tokyo

The roles of equatorial trapped waves (EQWs) and internal inertia-gravity waves in driving the quasi-biennial oscillation (QBO) are investigated using a high-resolution atmospheric general circulation model with T213L256 resolution integrated for 3 years. The model, which does not use a gravity-wave drag parameterization, simulates a QBO. Although the simulated QBO has a shorter period than that of the real atmosphere, its amplitudes and structure in the lower stratosphere are fairly realistic. In the eastward wind shear of the QBO, eastward EQWs including Kelvin waves contribute up to about 25-50% to the driving of the QBO. On the other hand, westward EQWs contribute up to 10% to driving the QBO during the weak westward wind phase but make almost zero contribution during the relatively strong westward wind phase. Extratropical Rossby waves propagating into the equatorial region contribute about 10-25%, whereas internal inertia-gravity waves with zonal wavelength less than 1000 km are the main contributors to the westward wind shear phase of the simulated QBO. In both the eastward and westward wind shear phases of the QBO, nearly all Eliassen-Palm flux (EP-flux) divergence due to internal inertia-gravity waves results from the divergence of the vertical component of the flux. On the other hand, EP-flux divergence due to equatorial trapped waves (EQWs) results from both the meridional and vertical components of the flux in regions of strong vertical wind shear. Longitudinal dependence of wave forcing is also investigated by three-dimensional wave activity flux applicable to gravity waves. Near the top of the Walker circulation, strong eastward (westward) wave forcing occurs in the Eastern (Western) Hemisphere due to internal inertia-gravity waves with small horizontal phase speed. In the eastward wind shear zone associated with the QBO, the eastward wave forcing due to internal inertia-gravity waves in the Eastern Hemisphere is much larger than that in the Western Hemisphere, whereas in the westward wind shear zone, westward wave forcing does not vary much in the zonal direction. Zonal variation of wave forcing in the stratosphere results from (1) zonal variation of wave sources, (2) the vertically sheared zonal winds associated with the Walker circulation, and (3) the phase of the QBO.

Keywords: gravity wave, equatorial wave, Rossby wave, QBO