Geophysical Research Abstracts
Vol. 16, EGU2014-15192, 2014
EGU General Assembly 2014

Contributions of equatorial planetary and gravity waves to the QBO evolution in a GCM with a parameterization of convective gravity waves

Young-Ha Kim and Hye-Yeong Chun

Dept. of Atmospheric Sciences, Yonsei University, Seoul, Korea, Republic Of (kimyh@yonsei.ac.kr)

The equatorial planetary waves and gravity waves (GWs) in the stratosphere and their contributions to the QBO evolution are investigated in a 54-year (1953–2006) AMIP-type simulation using a climate configuration of the Unified Model (HadGEM2). In order to take into account the internal GWs forced by cumulus convection, a convective GW parameterization is implemented in the HadGEM2 in addition to the existing GW parameterizations. The parameterized convective GWs account for about 40% of the total parameterized-GW momentum flux at 100 hPa in the low- to mid-latitudes. In the simulation, the equatorial QBO is reproduced with realistic periods (19–31 months) and amplitude ($\sim$19.8 m s^{-1}). The asymmetries between the QBO phases in the period, amplitude and descent rate of the shear zone are also captured, which is similar to observed. The simulated wind and temperature variables are spectrally decomposed, and the (model-resolved) equatorial waves are classified into Kelvin waves, Rossby waves, mixed Rossby-gravity waves, and inertia-GWs using the spectra. The Eliassen–Palm flux of each wave at the tropical tropopause and the stratosphere is calculated, and the propagation and attenuation of the resolved waves are investigated as well as those of the parameterized GWs. Among the resolved waves, only the Kelvin waves and the inertia-GWs propagate vertically into the equatorial stratosphere with substantial amplitudes. The Kelvin waves attenuate significantly in the lowermost stratosphere and contribute to the easterly-to-westerly transition of the QBO phase by 3–4 m s^{-1} month^{-1}. The contribution of the inertia-GWs is much smaller ($\sim$1 m s^{-1} month^{-1}) as their magnitude is smaller than that of the Kelvin waves. The parameterized GWs contribute predominantly (15–20 m s^{-1} month^{-1}) to the simulated QBO in both phases. Finally, the equatorial planetary waves in the reanalysis and their difference from the simulation are discussed.