The stratospheric meridional overturning circulation, so-called Brewer-Dobson circulation (BDC), is responsible for the mass transport of chemical tracers and the water vapor input into the stratosphere. The BDC is known to be driven primarily by the extratropical wave forcing. Previous modeling studies have revealed that the contribution of planetary waves to the BDC is about 70% and that of parameterized gravity waves is about 30% at 70 hPa, yet with a wide spread between the models. In this study, we estimate the contribution of each wave type to the BDC using a generalized downward-control principle and NCEP Climate Forecast System Reanalysis (CFSR) data from 1979 to 2010. The planetary wave drag is obtained by calculating Eliassen-Palm flux divergence (EPD) using CFSR, orographic gravity wave (OGW) drag is provided by CFSR, and convective gravity wave (CGW) drag is obtained from an offline calculation of a physically-based CGW parameterization (Kang et al. 2018). The imbalance in the transformed-Eulerian (TEM) equation is regarded as a residual term. At 70 hPa, the extratropical downwelling by EPD dominates the total downwelling except at 35°-60°N where the OGW and CGW forcings are strong. We set turnaround latitudes where the residual vertical velocity changes its sign, and calculate the NH and SH downward mass flux by integrating residual vertical velocities from turnaround latitudes to pole in each hemisphere. The tropical upwelling mass flux, the sum of the two, reveals that the contribution of planetary waves, orographic gravity waves, CGWs, residual, and zonal wind acceleration to the upward mass flux is 66(63)%, 9(3)%, 5(5)%, 13(23)%, and 7(6)%, respectively at 70 hPa during DJF (JJA).

**Key words:** Brewer-Dobson circulation, planetary waves, parameterized gravity waves, reanalysis data

※ This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018020233).