

Characteristics of Convective Gravity Waves in Asian Summer Monsoon Region

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Characteristics of convective gravity waves (CGWs) in Asian summer monsoon (ASM) region (EQ-40°N, 60°E-150°E) from cloud-top to lower stratosphere are investigated through an off-line parameterization of CGWs, using 1-hourly NCEP Climate Forecast System Reanalysis (CFSR) data with a horizontal resolution of $1^{\circ} \times 1^{\circ}$ during 9 years (2002-2010) for June-July-August (JJA). The CGW parameterization used in this study is an updated version of Choi and Chun (2011) by including nonlinear forcing effects in the cloud-top momentum flux (CTMF) spectrum. The gravity-wave momentum flux (GWMF) in the stratosphere is calculated from the CTMF spectrum, considering columnar wave propagation. Eastward component of the CTMF is much bigger than westward component in EQ-30°N, due to filtering of westward CGWs by the easterly background wind in the upper troposphere, whereas it is opposite in 30°N-40°N. Zonal CTMF shows its peak at phase speed of 10 m/s (-5 m/s) in EQ-30°N (30°N-40°N). Magnitudes of northward and southward CTMF are nearly the same, but with slightly larger value for the northward component. The GWMF in the stratosphere is much smaller than the CTMF, by various wave dissipation processes (critical-level filtering, breaking, and radiative damping) from the cloud top to the stratosphere. The critical-level filtering is dominant wave dissipation process in ASM region, and consequently at $z = 25$ km westward GWMF is reduced more than eastward GWMF under the easterly background wind in the summer stratosphere. In EQ-10°N wave breaking is also an important source of wave dissipation, especially in the westerly phase of quasi-biennial oscillation (QBO). As a result, positive zonal GW drag (GWD) is dominant in EQ-10°N and negative zonal GWD is dominant in 10°N-40°N. The magnitude of the positive zonal GWD near equator is large for the westerly QBO phase.

Key words: convective gravity waves, Asia summer monsoon

References

Choi and Chun, 2011: Momentum flux spectrum of convective gravity waves. Part 1: Validation of a parameterization using mesoscale simulations. *J. Atmos. Sci.*, **68**, 739-759.