



ON THE SPECTRUM OF VERTICALLY PROPAGATING GRAVITY WAVES GENERATED BY TRANSIENT HEAT SOURCES

J. Holton (1), M. Alexander (2)

(1) University of Washington, (2) Colorado Research Associates
(holton@atmos.washington.edu)

It is commonly believed that cumulus convection preferentially generates gravity waves with vertical wavelengths approximately twice the depth of the convective heating. Individual cumulonimbus, however, act as short term transient heat sources (duration 10 to 20 minutes). Gravity waves generated by such sources have a broad frequency spectrum and a wide range of vertical scales. The high-frequency components tend to have vertical wavelengths much greater than twice the depth of the heating. Such waves have large vertical group velocities, and are only observed for a short duration and at short distances from the source. At longer times and longer distances from the source the dominant wave components have short vertical wavelengths and much slower group velocities, and thus are more likely to be observed even though their contribution to the momentum flux in the upper stratosphere and mesosphere may be less than that of the high frequency waves. These properties of convectively generated waves are illustrated by a linear numerical model for the wave response to a specified transient heat source. The wave characteristics are documented through Fourier and Wavelet analysis, and implications for observing systems are discussed.