

Kelvin waves and gravity waves observed in UTLS region during CPEA campaign using Radiosonde and CHAMP/GPS data

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The interaction between large-scale atmospheric circulation and convection has been recognized as crucial in understanding the perturbations ranging from meso-scale to planetary spatial scales in the tropical lower atmosphere (especially in UTLS region). Hence it is very important to understand various atmospheric processes that lead to tropical convection and its scale of affecting small scale (gravity waves) to large atmospheric circulation (Kelvin waves). In order to understand these processes, so many collocated simultaneous observations were necessary. Coupling Processes in Equatorial Atmosphere (CPEA) campaign conducted over Indonesia during April-May 2004 will provide good opportunity to find the link between these various atmospheric processes.

The spatial and temporal variations of Kelvin waves and gravity waves were studied using upper air soundings over seven tropical stations. In order to see their global features, CHAMP-GPS observations were utilized. The peak variance (for the waves greater than 3 days) in the temperature and zonal wind occurs over Indian Ocean and into western pacific within the broad region of equator. These fluctuations clearly show eastward phase propagation in this time-longitude section and eastward phase tilts with height in altitude-longitude section. The period of these waves were found to be 10-12 days with vertical wavelengths 6-7 km. The phase speed of these waves is found to be in between 30 and 40 m/s (from GPS measurements). Observed vertical wavelength is closely matching with that of theoretical for wave number 2.

Dominant oscillations for the gravity waves with periods 1-2 days and vertical wavelengths of about 4-5 km were detected in all the three components. The gravity wave energy is significantly enhanced around 20 km. The variance in all the three components (T, U and V) is found to be enhanced when there is cloud convection and/or divergence-convergence over respective sites. Clear downward phase propagation with respect to height is seen in lower stratosphere indicating upward propagating wave and there exists mixed upward and downward phase propagation in lower troposphere. The processes behind the observed phenomena will be discussed.