Radar Observations of Gravity Wave Motions in the Equatorial MLT Region

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The predominant semiannual variability of zonal wind and temperature in the equatorial mesosphere and lower thermosphere is believed to be caused mainly by gravity waves. However, much information on the gravity wave climatology and the wave parameters over equatorial region is lacking, though the importance of these waves in the equatorial mean circulation has been recognized much earlier. The wind observations of equatorial MLT region by ground based radars (Meteor or MF) established over a few sites, namely, Koto Tabang (0.2S, 100.3E), Pameungpeuk (7.5S, 107.5E), Pontianak (0, 109.3E) over Indonesia and Tirunelveli (8.7N, 77.8E) over India, provide an opportunity to examine the gravity wave variability in the equatorial region. Since the data quality is reasonably good for Pameungpeuk radar data set, in particular, so that a detailed study about high frequency gravity waves has been carried out. Different band-pass filters have been used to separate high and low frequency gravity wave intensities. From the preliminary results, it can be inferred that the gravity wave intensities are equally shared between zonal and meridional winds over Pameungpeuk in both high and low frequency spectra. Gravity wave intensities show semiannual variation with maximum variance before spring and fall equinoxes. The analysis of Koto Tabang meteor radar data shows that the time variation of mean square amplitudes of horizontal perturbation velocities corresponding to gravity waves of period 2-24 hour maximize during June-July. They show large interannual variation with larger variances in the years 2003 and 2005, when compared to the year 2004. The spectral slope computed from gravity wave spectrum also shows similar interannual variability. It is found that the variability is due to the enhancement of high frequency waves during summer months of northern hemisphere (June-July). A comparison with background wind shows that the maximum gravity wave variance coincides with the reversal of zonal wind from westward to eastward. The meteor wind observations over Koto Tabang is particularly important, since temperature information can be obtained from the diffusion coefficient of meteor echoes. The combination of horizontal wind and temperature data are used to infer the direction of horizontal propagation using the estimates of covariance between the wind and temperature perturbations. It is found

that the direction of propagation of gravity waves is predominantly southward or eastward during northern hemispheric winter. With these preliminary results, an extensive analysis is being carried out to study the wave parameters. The results obtained will be presented during the meeting.