

Vertical Coupling from the Lower Atmosphere to the Ionosphere: Observations Inferred from Indian MST Radar, GPS Radiosonde, Ionosonde and SABER/TIMED Instrument over Gadanki

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Very few studies have focused on the extra-long period oscillations with periodicities varying in the range of ~20-40 days apart from the ~2-16 days oscillation. There have been diverse observational, numerical, and theoretical studies of tropical intraseasonal oscillation and its linkages with various physical processes occurring in the whole height region from the troposphere to mesosphere and lower thermosphere. Using Mesosphere Stratosphere Troposphere (MST) radar (53 MHz), Global Positioning System (GPS) Radiosonde launched at Gadanki daily at 17:30 LT, ionosonde and Sounding of the Atmosphere using the Broadband Emission Radiometry/Thermosphere Ionosphere Mesosphere Energetics and Dynamics (SABER/TIMED) data, the present work illustrates that planetary waves generated in the troposphere during these months (July-August) in 2009 propagated up to the lower thermosphere region without being affected by the strong upper tropospheric jet winds (tropical easterly jet) and the stratospheric winds associated with quasi-biennial oscillation and semiannual oscillation. Spectral analyses (both Fast Fourier transform and Morlet wavelet transforms) of the lower atmospheric (3.6-20 km) winds (measured by the MST radar and GPS radiosonde) and the middle to upper atmospheric (13-110 km) temperature (determined from SABER/TIMED data around the Gadanki region) and ionospheric parameters (ionosonde data at NARL) indicate that the lower atmospheric planetary waves can influence significantly the ionospheric plasma-physics phenomena. The interesting observation is that the long period oscillations like 64-, 32-, 21- and 16-day are present in the whole atmospheric heights up to the ionosphere. The vertical wavelength of these oscillations is comparatively higher near the transition zones (tropopause, stratopause and mesopause) of various atmospheric layers with the highest value of about ~400 km in the height region of 101-109 km.

Key words: MST radar, planetary waves, long period oscillations, vertical wavelength