Studies on Atmospheric Gravity waves over a tropical station, Gadanki

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ABSTRACT

Atmospheric gravity waves play a significant role in controlling middle and upper atmospheric dynamics. Having generated through various mechanism viz., frontal systems, convection, wind shear topography etc., they can transport energy and momentum to longer distances both vertically and horizontally and can modify the middle atmospheric dynamics. There has been a lot of curiosity in the scientific community to understand the generation, propagation and climatology of gravity waves. In conjunction with the world scientific community, several campaigns using Indian MST radar have been carried out to explore the gravity wave activity in the troposphere and the lower stratosphere. It is observed that zonal, meridional and vertical velocities are increasing with increasing height in the troposphere and lower stratosphere indicating that the gravity waves are generated at lower heights and they can propagate in to upper atmosphere through various mechanisms (viz., wind shears, jet streams and convection in the present study). The seasonal and diurnal wave activity has been studied and it is observed that during summer and monsoon seasons the gravity wave activity is more prominent than other seasons. The large wind fluctuations are more prominent above 10 km during summer and monsoon seasons. The observations show that different time period of waves (ranging 10– 140 min) exist in troposphere and lower stratosphere. The zonal velocity power spectral densities (PSDs) are more than meridional velocity because the zonal velocity perturbations are more than meridional velocity. However PSDs of vertical velocities are small compared to zonal and meridional velocities except during convection events. In the power spectral density spectrum it is observed that the spectral peaks repeat at different heights indicating the propagation of internal gravity waves. The gravity waves associated momentum fluxes are also calculated using three and four beam methods. The estimated momentum flux measured by the two methods are almost the same for wind fluctuations in a fairly long-period range (~ 6hours). The results suggest that due to their persistent south ward direction of propagation, long period waves make a contribution to the momentum flux in the lower stratosphere which is comparable to that of short period waves during summer and winter seasons. The vertical wavelength and the propagation direction of gravity waves are estimated using hodograph analysis and it is observed that both downward and upward propagating waves are found with a maximum vertical wavelength of 3.6 km. More details will be presented in the full paper.