

Meteor radar observations of non-linear wave-wave interactions in the low-latitude Mesosphere-Lower Thermosphere: Bispectral approach

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Abstract

Non-linear wave-wave interactions in the Mesosphere-Lower Thermosphere (MLT) region using meteor radar observations over Trivandrum (8.5°N , 77°E) during March 2006 to February 2007 are discussed. The spectral analysis of daily averaged zonal and meridional winds revealed the presence of planetary waves with time periods ranging from \sim 2-30 days in the height region of 82-98 km. The hourly zonal and meridional wind measurements are then used to estimate the day-to-day diurnal tide amplitudes in the MLT region for the first time over this latitude. Spectral analysis of zonal and meridional diurnal tide amplitudes revealed the tidal modulations at time periods ranging from \sim 2-30 days. Further, during a strong episode of tidal modulation, which is identified from the wavelet spectra, a bunch of subsidiary spectral components around the diurnal tide is observed. The presence of subsidiary spectral components around the diurnal tide has given the evidence for non-linear interaction between tides and planetary waves. To substantiate this result, bispectral analysis is carried out, which insistently showed the non-linear tide-planetary wave interactions by revealing the presence of secondary waves exactly at the anticipated time periods. The significance of the present results lies in showing the tidal modulations at planetary wave scales and estimating the bispectrum to further confirm the possibility of such a modulation for the first time over this latitude. As the present observational site is very near to dip equator the present results assumes immense importance as the subsidiary spectral components around the diurnal tide as well as tidal modulations at planetary wave scales may play a vital role in controlling the day-to-day variabilities in the equatorial ionosphere, which will be the topic of research for near future.