# Observations of Inertia-gravity wave from long-lasting meteor trail echo with hodograph analysis

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## Abstract

The mesospheric horizontal winds from the drift of long lasting meteor trail were presented. The meteor trail was positioned by using interferometry technique implemented at the Chung-Li VHF radar. The meteor trail echoes lasting more than 23 seconds in height region between 95 and 108 km were analyzed to estimate the horizontal wind velocity variation with heights. Hodograph analysis of the horizontal wind velocities showed that the wind vectors rotated clockwise with increase of heights. This feature is a clear evidence to indicate the existence of upward propagating inertia-gravity wave. The characteristics of the gravity wave are as following: the intrinsic period is about 6 hours, the vertical wave length is 11.3 km and the horizontal wave length is 1038 km. The observed vertical wind shear combined with the Brunt-Vaisala frequency from MSIS-E-90 model can help us to calculate the height variation of the Richardson number $R_i$. At the height range 98 to 99 km, the enormously large wind shear ( > 50 m/s/km ) caused ~~the~~ $R_i < 0.25$ which implies that nature turbulence would be generated. Comparing the positions of the enormous wind shear region with atmospheric stability zones induced by the upward propagating gravity wave reveals that the convective unstable induced by the gravity wave leads to the generation of the turbulences. This deduction suggests that the wave is very likely to be broken in this height region, and the wave-breaking turbulences presumably induce the corresponding plasma irregularities in the meteor trail.