Gravity wave analyses using three meteor radars in northern high latitudes

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Results of atmospheric gravity wave analysis using operational three meteor radars in Northern high latitudes (Tromsoe(69.6N, 19.2E), Bear Island(74.5N, 19.0E),Longyearbyen(78.2N,16.0N)) are presented.

The targets of the radar are ionized meteor trails produced at 70-110 km altitude by meteor bodies, which impinge onto Earth's atmosphere, collide with atmospheric molecules and ionize them along their paths. After its formation, the meteor trail follows the motion of the ambient neutral atmosphere, that is, winds. The trail also expands rapidly due to molecular diffusion, which is a function of atmospheric temperature and density. Wind velocity and diffusion coefficient are estimated from Doppler frequency shift and echo power decay involved in observed radar meteor echoes, respectively. Atmospheric temperature fluctuation due to gravity waves can be further estimated from the diffusion coefficient under an assumption called Boussinesq approximation, which is known to be mostly valid for waves with relatively short vertical scales such as gravity waves.

Using a theoretical phase relation between the horizontal winds and temperature fluctuation, horizontal propagation characteristics of gravity waves can be studied. In the present study we report latitudinal variations and dependence of gravity wave propagation characteristics using the meteor radar chain.