



## **3D observation of GWs in the ionosphere**

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3D propagation of gravity waves (GWs) in the ionosphere is presented. The analysis is based on measurements by multi-point continuous Doppler sounding (CDS) in the Czech Republic. There are three different multi-point CDS systems operating at frequencies of 3.59, 4.65, and 7.04 MHz in the Czech Republic; waves of individual frequencies reflect at different heights, provided that the sounding frequency is lower than the critical frequency. So, the propagation of GWs can be studied in 3D using the time (phase) delays between corresponding signatures observed on different signal paths (transmitter-receiver pairs) both in the horizontal and vertical directions. The height of observation depends on ionospheric conditions; usually it is above about 200 km. It is shown that the energy of the observed GWs propagated obliquely upward; it means that the wave vectors were directed obliquely downward. At the same time, the amplitudes of GWs usually decreased with height, which means that GWs deposited a part of their energy and momentum in the upper atmosphere. The azimuth of propagation differed case from case.