



Short period ionospheric perturbations from continuous Doppler sounding

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Results of recent observations of ionospheric perturbations on short time scales obtained by international network (Czech Republic, Argentina, Taiwan and South Africa) of multipoint continuous Doppler sounders with time resolution about 10 s are presented. Examples of observation and analysis of propagation of gravity waves (GWs), equatorial spread F (ESF), infrasound from earthquake and large convective systems, as well as ionospheric perturbations caused by solar flares will be shown. It is documented that roughly poleward propagation of GWs dominates in the local summer, whereas mainly equatorward propagation is observed in the local winter. The analysis of occurrences and zonal drifts of ESF based on Doppler sounding are consistent with optical and satellite measurements. The observations of co-seismic perturbations by Doppler sounders in the vicinity of ionosondes and seismic sensors proved that the co-seismic perturbations are caused by approximately vertically propagating infrasound waves triggered by vertical motion of the ground surface. Numerical simulations and Doppler measurements confirmed that in the vicinity (up to about 1000 km) from epicenters of strong earthquake, the infrasound propagates in nonlinear regime in the upper atmosphere, which results in the formation of N-shaped pulse. Solar flares are observed both as sudden frequency deviations and amplitude attenuations of Doppler signal.