0.1 Wave disturbances in the ionosphere under quiet and disturbed conditions

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The characterization of the various waves reaching the thermosphere region is of importance because of a multitude of applications rooted in the Earth and space sciences, spanning magnetospheric interactions from above and earthquake cycles from below. The dataset of more than 2000 hr of Kharkiv incoherent scatter (49^o40'N, 36^o18'E) and HF Doppler (49^o38'N, 36^o20'E) radar data have been employed to study wave disturbances (WDs) in the electron density during quiet and disturbed conditions, a few magnetospheric and ionospheric storms and two solar eclipses. The observations of the 15 – 180-min period WDs have usually been taken between 100 and 500 km altitude region. The WDs are shown to occur in the ionosphere actually always; however, the impact of energy released during disturbed conditions gives rise to variations in the character of WDs, in their spectral distribution, and in amplitude. The amplitude exhibits significant variations with the time of day and the level of ionospheric disturbance, and its relative values vary from a few percent to tens of percent. The magnetospheric storms are associated with the rearrangement of the spectral content of WDs. Daytime measurements in the bottomside ionosphere up to 200 km, and sometimes to 300 km, show that the amplitude of WDs increases with altitude, while at higher altitudes up to 500 km the amplitude gradually decrease by an order of magnitude. Nighttime observations, when the amplitude of WDs is smaller than during sunlit hours by a factor of 2 to 10 times, do not confidently display a similar effect. The nighttime relative amplitude of WDs in the bottomside ionosphere exceeds the daytime amplitudes and attains a value of tens of percent. The strong height dependence of WDs displays the background height variation in the F region density, on the one hand, and apparently indicates that the waves with 15 – 180 min periods are guided by the thermosphere, on the other hand. The waveguide is usually centered at approximately 200 km, and its effective thickness varies between 150 and 200 km. The model for WDs in the electron density invokes obliquely propagating harmonic acoustic-gravity waves and takes into account recombination, ambipolar diffusion, and electron-ion collisions.