

Studies of Thermospheric Wave Activity Using Dynasonde Techniques: Current State and the Future

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Dynasonde approach to ionospheric radio sounding capitalizes on high precision of physical parameters and rich statistics of recognized echoes phase-based methods can provide. As has been recently demonstrated, the Dynasonde profiles of the electron density and of the horizontal gradients, complemented with profiles of the Doppler speed, carry comprehensive quantitative information about Atmospheric Gravity Waves, a ubiquitous feature of the space weather that has become an important objective of atmospheric modeling. Being combined into a time series, the profiles, without additional processing, allow visualization of the time fronts of the Traveling Ionospheric Disturbances (TIDs). They also provide high-resolution input data for calculating the complete set of parameters (both vertical and horizontal) of TID activity in the upper atmosphere between the base of the E layer and the maximum of the F layer. Application of the Lomb-Scargle periodogram technique to the tilt data provides unique insight into the dynamics of spectral composition of the TIDs. A similar technique applied to longer time series allows determining characteristics of thermospheric tides. Single sounding sessions allow observations of ionospheric manifestations of acoustic waves produced by ground-based sources. All the mentioned products of the Dynasonde data analysis require a common, standard ionogram mode of radar operation. Therefore, information about standard parameters of the ionospheric E, F regions, possibility to obtain vector velocities characterizing movement of plasma contours, and quantitative parameters of the km-scale irregularity spectrum are not lost and contribute into comprehensive description of the ionosphere. We consider ways to adapt these techniques to provide an insight into the state of neutral atmosphere.