Multi-position complex for HF Doppler sounding of travelling ionospheric disturbances in Ukraine: results of two years of operation

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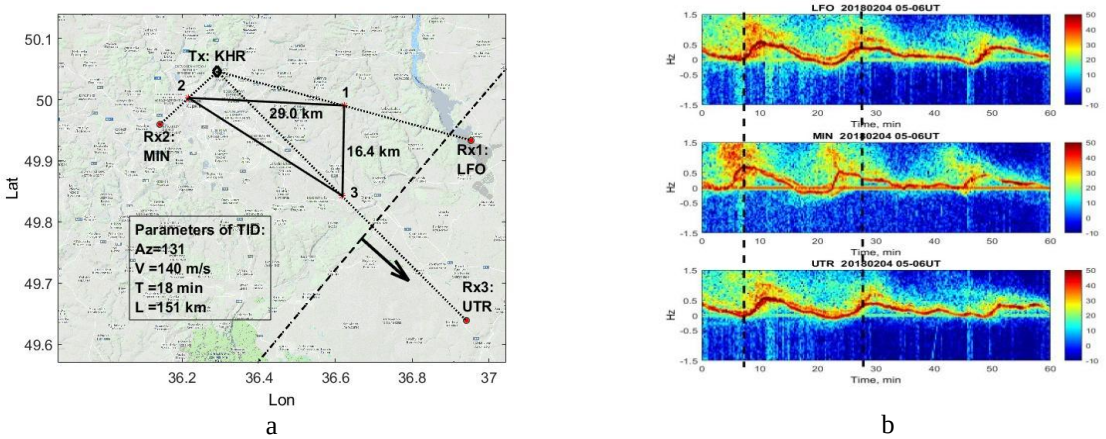
Propagation of travelling ionospheric disturbances (TID) results in quasi-periodic variations of ionospheric plasma parameters leading to significant modification of RF signals propagating through ionosphere. It has long been established that the TID parameters can be derived from the dispersion equation for atmospheric gravity waves (AGWs) at the thermosphere heights. AGWs efficiently transport energy between different regions and contribute significantly to energy balance in the near-Earth space. In that way, AGWs act as an important factor forming space weather. Although a large number of works had explored TIDs, their impact on the ionosphere is still determined unsatisfactorily. Therefore, round-the-clock monitoring of TIDs in various regions of the planet is an important objective of ionospheric research. This work presents statistical results obtained during two years of TID observations using multi-position Doppler measurements of test HF signals. This diagnostic system was deployed in the Kharkiv region of Ukraine since January 2018. A transmitter located in the city of Kharkiv was continuously emitting a monochromatic signal of a ~20 W power at a frequency slightly lower than foF2. The receiving sites make almost a right triangle with catheti of 32.8 and 58 km (Fig. 1a). Spacing between the mean positions of the reflecting points are 16.4 and 29 km, respectively. Spectrograms in Figure 1b exemplify quasi-periodic variations of the Doppler frequency shift of the test signal received at three separated sites. The seasonal and diurnal variations of the TID parameters including their period, wavelength, velocity, and motion direction, and their dependence on solar and geomagnetic activity will be presented. Notably, such regular long-term measurements in the Eastern Europe have been carried out for the first time.



a b

Figure 1. (a) Layout of three-point observations with the TID parameters indicated. (b) Spectrograms of the test signal detected at the receiving points.