Investigation of Interrelation of Disturbances of the Geophysical Fields and the Ionosphere by Ground-Based Observations in Mid-Latitude Russia

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One of the fundamental problems of the geophysics is revealing of coupling between the dynamic processes occurring in various geospheres. The Mikhnevo geophysical observatory near Moscow (54^{o}56' N, 37^{o}44' E) elaborates the simultaneous measurements of magnetic and electric fields, ionosphere parameters and ionospheric manifestation of seismic events as well.

Optical observations of the atmosphere and ionosphere airglow are evaluated by a scanning photometer. The device provides temporal records of the basic airglow emissions of the night sky in four bands (4278, 4861, 5577 and 6300 A) along the meridian at the range of 2000 km. The scans processing allows recovering of the airglow volume structures and morphological studying of the night sky properties as well as the control of the atmosphere transparency. The scanning photometer allows recording of the SAR arcs appearance and evolution under the explosive phase of auroral substorms. As SAR arc can occur at the equatorward wall of the main ionospheric trough, the SAR arc uniquely defines the spatial location of the border of the soft particle precipitation. Simultaneously, the remote observations of the ionospheric effects of the substorms are evaluated using GPS receivers by means of pseudorange oscillations. Up to date we use coincide data on TEC and positioning error. After the postprocessing, the TEC data are used for studying of the ionospheric storms and geomagnetic disturbances coupling. The latter are used in terms of Ap-index and the data from the mid-latitude magnetic measurements. Our approach allowed to trace the dynamics of separate ionospheric disturbances, and compare it with the geomagnetic activity. It was shown that at development of positive ionospheric disturbances the value of Ap-index increase.

Radiophysical observations are evaluated by means of inclined and back-inclined Doppler sounding of the ionosphere and by studying the properties of HF radiowave propagation through the ionosphere area under analysis. The latter allows to analyze the effects of HF heating. Additionally, the magnetometer complex allowed observing of the heating effect impact on the magnetic field at the distance of about 2000 km.

Recent field and satellite measurements validated the appearance of ionospheric and electromagnetic phenomena prior to the great earthquakes. These effects are observed

at the Mikhevo observatory by means of the ionosphere Doppler sounding and ground magnetic field measurements as well. In investigation of correlation between the ionospheric perturbations and seismic events, the heliogeophysical conditions at the moment of earthquake are taken into account. Only earthquakes with the significant magnitude that had occurred at quiet geomagnetic conditions have been chosen. The impact of earthquakes on the geomagnetic variations and the ionosphere at the distance of thousands km is very weak. Meanwhile, such consequences are revealed by the simultaneous radiophysical, magnetometric, optics and other measurements. The results of investigation of the ionosphere and mid-latitude geomagnetic field disturbance during the Pakistan earthquake on October 8, 2005 are presented.