Disturbances in ionospheric sporadic E layer with a time scale of one minute in connection to earthquakes.

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Abstract:

It is well known that sporadic layer Es of the ionosphere is maid up of separate clouds with enhanced ionization density. The layer is significantly variable with a characteristic time of a few minutes. Time variations of Es parameters with this characteristic time were studied in connection to earthquakes. It was supposed that turbulent processes can arise in Es layer due to acoustic and electromagnetic disturbances coming from the earth surface and/or the near ground atmosphere. The parameters fbEs, foEs, and Es-spread of the night (from 22.30 till 01.30 LT) mid latitude ionosphere, registered by the Dushanbe vertical sounding station (j=38,5¡ãN; l=68,8¡ãE) once a minute during September-October 1988 and some other intervals of observation, were used. For thick sporadic layers critical frequency foEs~ , where nmax is the maximal plasma density, but for thin sporadic layers foEs depends on the presence of plasma in homogeneities. For thin sporadic layers Es frequency fbEs~. For these layers the value (foEs-fbEs) ¨C the so called semi transparency ¨C characterizes the plasma turbulence. The variability of (foEs-fbEs) was analyzed and anomalous increases were observed with a characteristic time of (20¡Â40) min before a close (R=90§Ü§Þ) earthquake with magnitude M=4 and with a characteristic time of (5¡Â10) min and (2¡Â5) min a day after earthquakes with M 5.5.
Spread-Es appears as diffusivity of the traces of sporadic E-layers on the ionograms of vertical sounding stations and is the consequence of the plasma turbulence. The probability of observation of spread-Es depends on the year of the Solar cycle, it is not large (usually a few percents) and is not routinely registered at the ionospheric stations.
It was found that the average observation time of the diffusive Es-layer trace is smaller than 3-4 minutes and that the probability of spread Es increased before earthquakes.
The conclusion on the activation of the ionospheric processes with character times of an order of a few minutes is consistent with the results of other authors, carried on various ionospheric sounders in Askhabad and Tbilisy in connection to earthquakes.
Mechanisms of lithosphere-atmosphere-ionosphere coupling based on the action of low-frequency acoustic and electrical disturbances on the Es layer are discussed.