

USNC/URSI Radio Science Meeting

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On strong thunderstorms affecting the ionospheric D-region parameters, characteristics of noise and partially-reflected signals

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In the paper there are given results of our experimental investigation of possible effects of strong thunderstorms on the middle latitude ionospheric D-region parameters and characteristics of sounding SW radio waves by means of the partial reflection and vertical sounding (ionosonde) techniques. The total number of observation series having duration of ~ 1-10 hr over the periods of strong thunderstorms was 26.

Analyzing the experimental data has allowed to find the following features.

1. Over the periods of strong thunderstorms at $h = 87-105$ km, the occurrence probability of sporadic layers becomes ~ 2-4 times larger;
2. Strong thunderstorms may cause in the atmosphere infra-acoustic waves with $f > 0.5$ Hz, which penetrate into the lower ionosphere with their vertical velocities being $V > 300$ m/sec;
3. For thunderstorms in the lower D-region ($h < 70$ km) in 40 % of the events, the background ionization has been found to become several times larger up to $N < (5-7) 10^2 \text{ cm}^{-3}$;
4. In the upper D-region ($h > 75$ km), no marked (> 30 %) changes in N during thunderstorms have been found;
5. The electron-molecule collision frequency ν at $h = 63$ km for some events has become 1.7-1.8 times larger if compared with that for the undisturbed conditions.

Possible reasons of such changes in N and ν at $h < 70$ km may be precipitation of charged particles from the magnetosphere or variations of the ionosphere electric potential due to changes in the near-Earth atmosphere, conditioned by the strong thunderstorms.