Geophysical Research Abstracts, Vol. 8, 00655, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00655

UHF signal structure changes during strong solar proton events

Yu. Goncharenko (1), F. Kivva (1) and V. Gutnik (3)

(1) Institute for Radiophysics and Electronics NAS of Ukraine, (2) Institute of Radioastronomy NAS of Ukraine (ygonch@ire.kharkov.ua, Tel: +38057-7203358)

Nowadays there are many experimental facts showing the solar activity influence on atmospheric parameters. Nevertheless, a comprehensive model, explaining all problems of solar-terrestrial connections, has not been proposed. Refractive index, which plays a significant role in radiowave propagation, is related to the main meteorological parameters such as temperature, pressure, vapor pressure [1] in the troposphere, electron and ion concentration in the ionosphere. So, statistical studies of the signal level variation processes can give some information about meteorological processes in atmosphere.

We present some experimental results, obtained by some experiments in 1967-70 and 2002-2003. There were 3 kinds of experimental radiolinks: the first one used mechanism of far tropospheric propagation in HF range (150MHz) [2], the second one used solar radiation at sunrise and sunset in UHF (10GHz) range, the third type of data was obtained from telecommunication line “AsiaSat-3S – Kharkov, Ukraine” at frequency 3.6GHz.

The first experiment was carried out in 1969-1970. It was found that during strong solar flare the signal intensity was increased from -110..-120dB to -10..-20dB.The analyse of signal spectrum and properties of transmitter and receiver antennas shows, that the observed phenomena was concerned with reflective layer located at h=7-10km.

Receive of UHF solar radiation at sunrise and sunset (experiment No. 2) showed, that during and after strong solar flare the structure of signal was of interference character. But we can not determine locations of objects which were origins of the interference fadings.

The last experiment was carried out from May, 2002 to November, 2003 at the frequency 3.6GHz. More than 20 solar flare events were analyzed. It was found that during strong solar flare with proton flux units (p.f.u.) $>$200..250 a deep rapid fading appears. The fading rate of the signal increased in 10-15 times at the level -6dB and in 5-10 times at the level -4dB from the signal mean value in 3-6 hours after solar flare had begun. It is necessary to note that during solar flare with p.f.u $<$200..250 these effects are not registered. The duration of the signal fading increased too. Two to three days later the behavior of the received signal returns to the normal, non-flare state. This fading can be connected with the phenomena of the interference between few signals originating at different sources like atmospheric inhomogeneousness and the satellite.

It is well known [1], that the processes in troposphere usually have an influence on radiowave propagation at frequency more than 2..3GHz. So the experiments NN 2 and 3 show, that during solar flare the structure of troposphere is essentially changed.

References

1. Francois Du Castel “Tropospheric Radiowave Propagation beyond the Horizon”, Oxford: Repgamon Press – 1966.

2. A. A. Shapiro, Yu. V. Goncharenko. Experimental study of radiowave propagation in the troposphere during solar flare events. Geomagnetism end Aeronomy, Vol 43, N5, 2003, pp. 624-626