

ASTROPHYSICS AND PARTICLE PHYSICS

November 13-15, 2017 San Antonio, USA

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The influence of M7.3 class solar x-ray burst on the disturbance of the lower ionosphere as well as HF propagation characteristics

Earth's ionosphere is a plasma state of the atmospheric gas at altitudes above 60 km of the ground. The radiation from solar flares causes ionospheric disturbances. X-rays are the high-energy radiation. It changes a state of the plasma in the lower ionosphere. This effect is called a sudden-ionospheric disturbance (SID). X-ray flares are classified as: A, B, C, M, X. As a result, the SID electron concentration in lower ionosphere (mainly in the area D) increases quickly (a few minutes), and has a slower decline (generally within one or two hours). There is maximum absorption of HF radio waves due to the large number of the collision in the lower ionosphere at these altitudes. Strong perturbations can lead to full absorption of HF in a wide frequency band (called blackout effect). Blackouts are categorized depending on the power flares: R1-R5. The study of perturbations caused by X-ray flares is perhaps of different ways. We have used a passive LFM sounder on the path Cyprus - Yoshkar-Ola. We obtained variations of frequency dependences of signal power in the HF range. Figure 1 shows variation of the current frequency dependencies of power with SID for blackout of class R2. We found a synchronous variation of signal power ratio following the variation of X-ray intensity in the case of blackout at frequencies below 16 MHz. We assumed that the relaxation of the considered events is described by the exponential law for the relaxation time as well as obtained the following values:

Thus, the relaxation time of the blackout is 1.7 times more relaxation time of the X-ray radiation of a sun flare. Thus, the blackout effect reduces the frequency capacity of the multidimensional HF channel. Let us assume that the band pass of a partial channel is 3 kHz then we could organize ~ 7660 channels in the case of absence of disturbance at the radio path Cyprus - Yoshkar-Ola. Class R2 blackout could lead to their reduction to the number of ~ 5056, i.e. decreasing by 34%.

Biography

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