Exploration of Atmospheric Radio Noise Field Strength (ARNFS) at Tripura at Various Frequencies

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Abstract

The atmospherics abbreviated as sferics, the electromagnetic radiations originated by are very much cloud discharge are significant in regard to electric phenomenon going on in different types of cloud during meteorologically active periods. During clear period atmospheric radio noise field strength (ARNFS) measurement provides the study of ionospheric propagation .

The variation of electric field ΔE can be expressed as Fourier transform:

$\Delta E(d,t) = \int a(d,\nu) \exp(i\nu t)\, d\nu$, where the inverse FT is given by

$a(d,\nu) = \int \Delta E(d,t) \exp(-i\nu t)\, dt$ gives the amplitude of Fourier component due to thunder electric pulse at a distance d. Previous experiments showed that the peak of the Fourier components lies in very low frequency (VLF) range. The extra-low frequency (ELF) component, though smaller in magnitude compared to VLF component, exhibits more variations in dB scale during ionospheric irregularities. The received Fourier component at frequency ν at distance d can be expressed as

$a_r(d,\nu) = G(\nu)\, W(d,\nu)$

where $G(\nu)$ is the function of spectral source function $a(d,\nu)$ and $W(d,\nu)$ is the wave guide transmission function. $W(d,\nu)$ is dependent on the ionospheric conductivity parameter which is again dependent on electron density. Any variation in conductivity parameter will result in variation in attenuation of ELFLF radio waves.

As long as the receiver is placed well away from unintentional short range electro-magnetic interference, such as electrical power lines and electrical machinery, the spectrum is dominated largely by natural noise from cloud discharge. Moreover, The waveguide formed between the lower ionosphere and earth's surface is good for very low frequency (VLF) and extra-low frequency (ELF) propagation round the earth. The conductivity parameter determining the status of the ionospheric radio propagation is controlled by the solar conditions.

The geographical position of Tripura (North-East part of India, latitude: 23^{o}N) is in favour of investigating ARNFS from the local cloud discharge as well as from the distant sources of Australia, Japan and Africa

An *inverted-L type antenna* has been used to receive pre-dominantly vertically polarized *sferics* in the ELF band from near and far sources. It is then passed through a low-pass-filter (LPF) and buffer successively, and the is amplified with AC amplifier. This is followed by series resonant circuit tuned at 1, 3, 6, 9 and 12 kHz and another buffer. The selected sinusoidal sferics are then detected. The detected output is amplified by *quasi-logarithmic* DC amplifier. The data are stored in a computer by data-acquisition system, and can be monitored by audio system.

The ARNFS ARE characterized by *sunrise and sunset effects*. The diurnal pattern reveals higher level during afternoon period. This diurnal pattern is highly affected solar flares, meteor showers, thunderstorms and cyclones.

The perturbations in conductivity parameter of the lower ionosphere during solar and geophysical events are the causes various types of changes in ARNFS. The changes in relative phases of waveguide modes can give rise to change in interference patterns among first two modes.