

The Diurnal Variation of the atmospheric frequency 59.5 kHz observed at Agartala

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Abstract:

The height of D region is between 60 & 90 km, so this region is difficult to study by Ionosonde. The D region is to be monitored only with signals- it may be man-made or natural signal of cloud discharge. The problem with the cloud discharge is that source parameters do not remain constant, whereas source characteristics of man-made signals are always constant. Propagation parameters can be well-studied using man-made signal. There are a lot of studies with the help Very Low Frequency (VLF), work with frequency above 40 kHz is still very less, so we selected a frequency of 59.5 kHz as a part of wide experimental observation in the Department of Physics, Tripura university.

Introduction:

The electromagnetic radiation from cloud discharge is called atmospheric or sferics & it extends from extremely low frequency (ELF) to high frequency (HF). The contribution is mostly from very low frequency (VLF) band. During severe thunderstorms contribution to the radiation field from ELF band is also remarkable. The atmospheric are very much 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 atmospheric radio noise depends on two factors, strength of source and propagation. During local cloud activity radiation field from distant sources is suppressed by the induction field of the nearby charged cloud. So, rate of growth of charge in the nearby clouds can be investigated by radio noise during meteorologically active period in the locality of the receiver. On the other hand, during locally clear periods, radio noise from distant sources contributes more

In this paper we report some events observed at the frequency of 59.5 kHz. The observed events are sunset minima, gradual rise & sudden fall and gradual rise & gradual fall. Although many papers have been published in this area so far, still we are interested since our study region is in the vicinity of Himalayan forest region yet to be explored. Again we have selected this particular frequency, as this shows remarkable characteristics out of a large number of atmospheric at different frequencies monitored at our laboratory round the clock.

2. Experiment:

The electromagnetic radiation from cloud discharge (distant and near clouds) is the source of the atmospheric radio noise. The sferics is being recorded round the clock at the Department of Physics, Tripura University, Agartala, Tripura (23° N, $91^{\circ} 24'$ E). An *inverted-L type antenna* has been used to receive pre-dominantly vertically polarized *sferics* in the LF band from near and far sources. The effective height of this inverted L-type vertical antenna is 7.85m and the terminal capacitance is 35.42 pF.

The receiving system has been designed and constructed in the laboratory using IC 741 of gain-bandwidth product 1MHz. The tuned circuit consists of ferrite core of high magnetic permeability in order to obtain narrow bandwidth. The induced voltage at the antenna has been passed through a low pass filter (LPF) then applied to the input of a tuned radio frequency amplifier tuned at 59.5 kHz. The alternating voltage is then detected to convert it into DC voltage which is the measure of induced AC at the antenna. This DC voltage has been recorded round the clock in computer through Data Acquisition System (DAS) Card. The schematic diagram of the receiving system is shown in the Fig.1

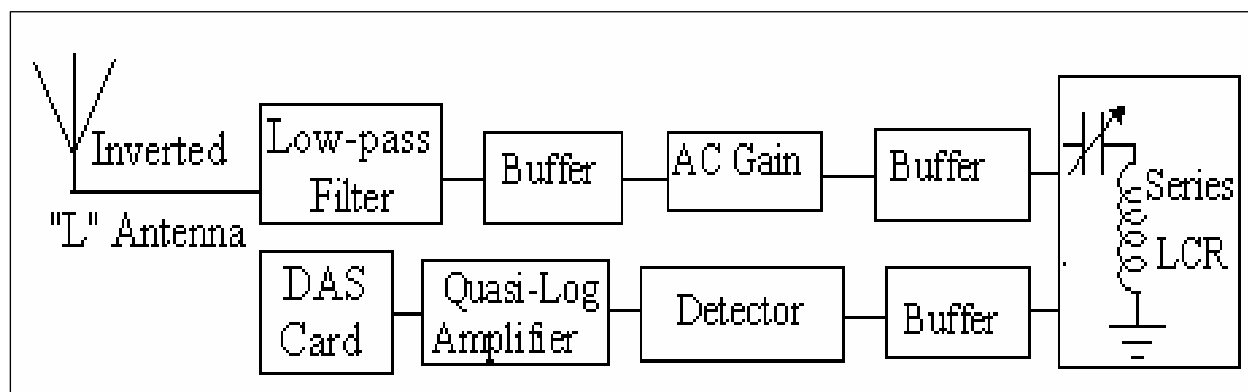


Fig.1— The block diagram of the receiving system

3. Observations and Results:

For the study of VLF band propagation continuous monitoring of 59.5 kHz have been done for the period for December 2005 to May 2006 except the power failure and maintenance period. Apart from the normal variation viz. diurnal and seasonal variations, the ARNFS exhibits minima at the time of local sunrise, and then there is a gradual rise of the ARNFS followed by sudden fall on some days and also gradual rise followed by gradual fall on few days. Fig. 2 shows the normal diurnal behaviour of the received sferics i.e., the fading of the amplitude during local sunrise time and sunset hour on a clear day.

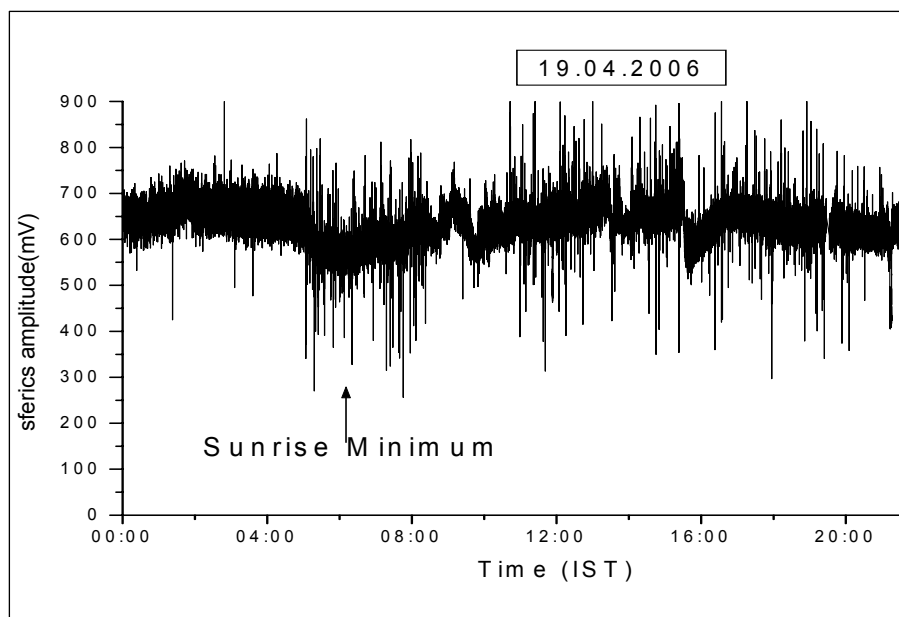


Fig.2— Diurnal behaviour of the sferics on a clear day

Actually to study the cloud activity of a region, it requires a lot of data for a long period continuous observation. Although the data here established are not adequate to conclude the behaviour of the nearby or distant cloud activity, yet they show some interesting phenomenon. It is being characterized by gradual rise and sudden fall, sudden rise and gradual fall, gradual rise and gradual fall. The night time amplitude is generally less than the day time amplitude. These are shown in Fig. 2 and in Fig. 3. The attenuation of amplitude is appreciable at night rather than the day time. The rate of rise and rate of fall of different types of variation are tabulated in Table 1.

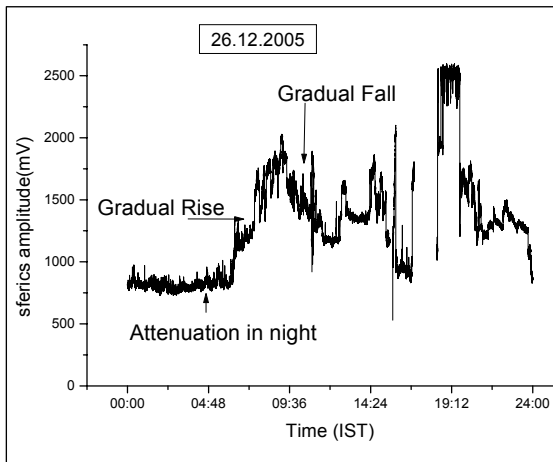


Fig.2— gradual rise and gradual fall

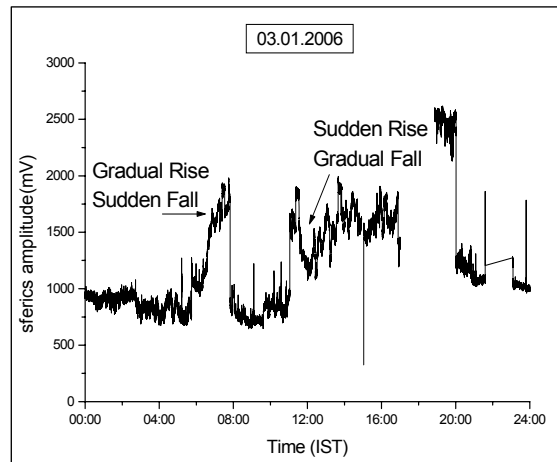


Fig.—3. gradual rise and sudden fall followed by sudden rise and gradual fall

Table 1: Rate of rise and rate of fall of ARNFS at 59.5 kHz

| Type | Average rate of rise in terms of output voltage (mV/min) | Average rate of fall in terms of output voltage (mV/min) |
|---------------------------|--|--|
| Gradual rise-gradual fall | 4.4 | 4.7 |
| Gradual rise-sudden fall | 5.87 | Sudden Fall |

4. Discussion

It is found that in case of gradual rise-gradual fall the rate of fall is higher than the rate of rise. Also the rate of rise in case of gradual rise-sudden fall type is higher than that of gradual rise-gradual fall type. It is noteworthy here that such type variation is not found on all over the months and days but whenever these occur, the both type variations are observed at around 08:00 IST in majority cases. It is also observed that in winter months the signal strength is attenuated remarkably.

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