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Discrete chorus emissions observed at Varanasi

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Key words: Wistler – Radiation belt – VLF radiation

In an earlier paper Khosa et al. (1981) have reported the successful recording of VLF hiss at their ground based observation station at Srinagar (geomag. lat., 24°10′N). In another paper Khosa et al. (1983) have presented sonograms of discrete chorus emissions recorded at Nainital (geomag. lat., 19°1′N). In this short communication we present the analysis of the whistler data collected in March/April 1976 at Varanasi (geomag. lat., 14°55′N).

The broad features of the emissions recorded during the entire period under report were found to be mostly similar to each other. We therefore reproduce here some of the emissions recorded on the second of April 1976 as representative of our recordings over the entire period.

On this day which was magnetically a quiet day with the sum of K_p indicies 13, we observed around twenty discrete chorus emissions between 00.00 and 00.100 h local time. Some of these emissions are reproduced in Fig. 1. All the recorded emissions occurred in a narrow frequency range of 2 kHz to 6 kHz. The rate of change of frequency with time of the recorded emissions is found to lie between 2 kHz/s and 3 kHz/s. Figure 1 a shows discrete chorus emissions of rising and falling tones in the frequency range of 2–6 kHz. The emissions are also accompanied by a continuum of hiss in the low frequency range of 1–2.5 kHz. Figures 1 b and 1 c show discrete chorus emissions in the frequency range of 2–6 kHz besides containing combinations of rising and falling tones. This is in sharp contrast to the observed discrete chorus emissions reported from Nainital (Khosa et al., 1983) which are of rising tones only, having single or double trace of short and long duration.

These low latitude discrete chorus VLF emissions are generated in the equatorial plane in the inner zone radiation belt ($L \sim 1.2$) by the cyclotron resonance between whistler mode waves and the inner Zone radiation belt electrons as explained in our earlier communication (Khosa et al., 1983). We have calculated the resonant energy of the high energy interacting electrons and growth of the whistler waves at $L = 1.2$ in the equatorial plane. The resonant energies for various frequencies of the emission were found to be in the range 3–5 MeV and the growth rates for various frequencies of emissions were found to be about 3 rad s^{-1} indicating significant wave amplification for observation as discrete chorus emissions at our low latitude ground station Varanasi.

Further the band width of the recorded VLF hiss as shown in Fig. 1 a lies in a narrow range of 1 Hz–2.5 kHz in sharp contrast to the auroral hiss which generally has a much broader band width from a few kHz to 0.5 MHz.

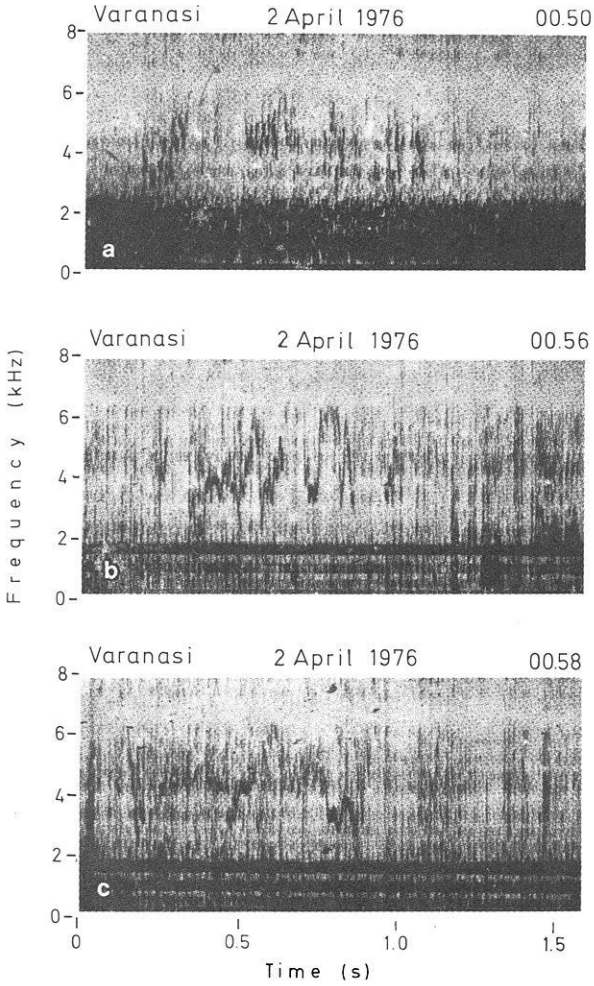

Fig. 1. Sonograms of Discrete Chorus Emissions recorded at Varanasi

The possible source mechanism of the VLF hiss reported here is the Cerenkov radiation process from low energy electrons (Khosa et al., 1983).

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