

# Probing of Magnetosphere with Whistler Waves using Simulation Technique

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Using WKB solutions, a simulation technique is developed and tested for the analysis of recorded signals (whistlers) at low latitude ground stations in India. The potential use of the whistler in deriving medium parameters involve the knowledge of path of propagation, which can be obtained, with the help of nose frequency. However, the dynamic spectra of low latitude whistlers do not contain nose frequency, which is high (~100 kHz). The nose extension methods are not suitable in the analysis for the low latitude observed whistlers because nose frequency lies in the range of hundred kHz whereas the observed dynamic spectra mostly lie in the frequency range of 1-10 kHz. Due to errors involved in the estimation of the nose frequency, the low latitude observed whistlers are seldom used in probing of medium.

We have derived the expression of wave electric field for the whistler mode signal [1], which is written as

$$E_w(x, t) = -\frac{Z_0}{4\pi} \int_0^\infty I_{x0} \sqrt{\frac{k_1(x_0, \omega)}{k_1(x, \omega)}} \frac{k_0(\omega)}{k_0(\omega) + k_1(x_0, \omega)} e^{j[\omega t - \int_{x_0}^x k_1(\xi, \omega) d\xi]} d\omega$$

the parameters are defined in [1], the source current is taken as Dirac delta excitation with  $I_{x0}$  is amplitude of current.

In the simulation process, physical parameters (L-value and plasma number density) are varied to make a replica of the observed whistler traces at Varanasi using the lower frequency range for computation. Thereafter, keeping the parameters fixed for which perfect matching is found; frequency range is enhanced to obtain the full dynamic spectra including nose and higher frequency trace as shown in Fig. [1].

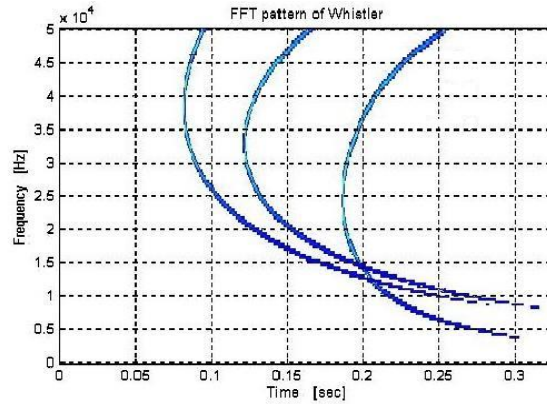


Fig.1 Simulated whistlers for observed whistlers at Varanasi [3] and extended to higher frequency including nose frequency.

By calculating the nose frequency with computational technique for successively recorded whistlers, we can calculate the change of the L-value with time along which a whistler has propagated assuming the frozen in field concept this rate of change is supposed to be caused by large-scale electric fields. The latter is estimated, the derived electric field for simulated whistlers of Varanasi comes out be 0.19-0.33 mV/m, which is in close agreement with the reported  $|E| \sim 0.2-0.3$  mV/m [2,3]. The computational technique discussed in this paper appropriately reproduces the full dispersion curve showing the nose appearance and increases the accuracy in the determination of nose frequency.

## REFERENCES

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