



Study of earthquake precursors using Very Low Frequency (VLF) signals received at Cooch Behar in eastern India.

Bakul Das¹, Prabir Kumar Haldar^{1*}, Chiranjib Barman² Arnab Sen³

(1) Department of Physics, Cooch Behar Panchanan Barma University
Vivekananda Street, Cooch Behar, West Bengal, India 736101

(2) CAPSS, Bose Institute, Block EN, Sector V, Bidhannagar, Kolkata, India 700091

(3) North East Regional Institute of Education, NCERT, Shillong, India

*prabirkrhaldar@gmail.com

With an aim to monitor the sub-ionospheric changes a Very Low Frequency (VLF) signal receiving station has been installed at Cooch Behar in Eastern India [26.334⁰N; 89.326⁰E]. VLF signals transmitted from different navy transmitter e.g. VTX [8.433⁰N; 77.733⁰E], NWC [21.816⁰S; 114.165⁰E], NDT [32.082⁰N; 130.827⁰E] around the world are received by an E-field whip antenna and a computer records the amplitude of the amplified signals at the rate of 4 data points per second. Diurnal variation of the data is analyzed and it is observed that the shifts of the Terminator Time during both the sun rise and sunset time are very prominent. Interestingly these perturbations are followed by several moderate size earthquakes. Primarily the VLF signals appear to be very promising for short time earthquake precursor study.

Keywords: VLF, Terminator Time, earthquake, perturbations.

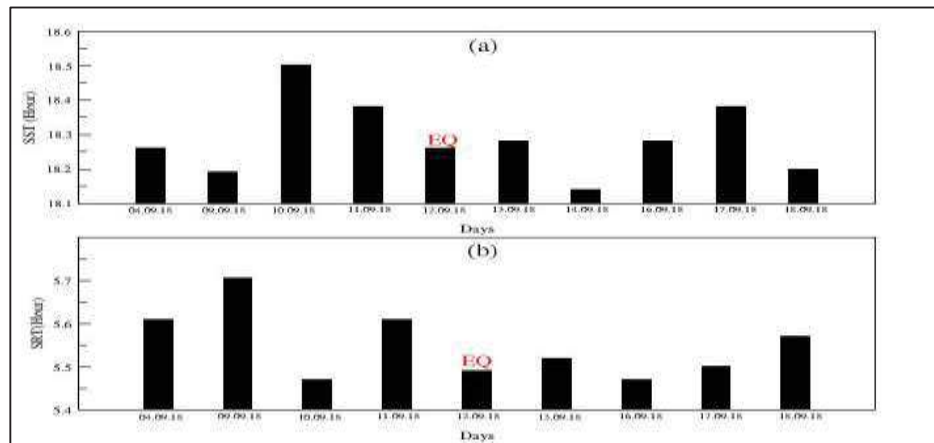


Figure1. Anomalous shift in the Terminator time both at the time of sunrise and sunset for the earthquake at Sapatgram, Assam, India (M5.4) on 12th Sept, 2018.

References:

1. Hayakawa M, Molchanov OA, Ondoh T, Kawai E (1996b) Anomalies in the sub-ionospheric VLF signals for the 1995 Hyogo-ken Nanbu earthquake. *Journal of Physics of the Earth* 44(4): 413-418
2. Hayakawa, M., Molchanov, O. A., Ondoh, T., and Kawai, E.: The precursory signature effect of the Kobe earthquake on VLF subionospheric signals, *J. Comm. Res. Lab.*, Tokyo, 43, 169–180, 1996.
3. Pal S, Hobara Y (2016) Mid-latitude atmosphere and ionosphere connection as revealed by very low frequency signals. *Journal of Atmospheric and Solar-Terrestrial Physics* 138: 227-232