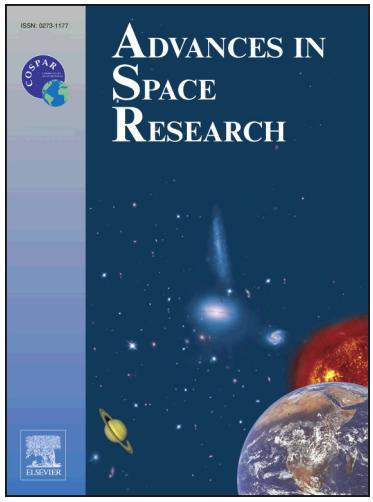


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Anirban Guha, Kumarjit Saha, Barin Kumar De, Kandula Venkata Subrahmanyam, P.R. Shreedevi

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# Space weather effects on lower ionosphere: First investigation from Bharati station during 34th Indian scientific expedition to Antarctica

Anirban Guha[1*], Kumarjit Saha[1], Barin Kumar De[1], Kandula Venkata Subrahmanyam[2] and Shreedevi P. R.[2]

[1] Department of Physics, Tripura University, Tripura-799022, India

[2] Space Physics Laboratory, Virkam Sarabhai Space Center, Trivandrum-695022, India

**Email*: *anirban1001@yahoo.com*

**Abstract**

We investigate the solar flare effects on the D-region of the ionosphere with the help of VLF (Very Low Frequency) radio waves using a portable E-field system from Antarctica during the summer period of 34th Indian scientific expedition. Two GPS time synchronized VLF receivers, one located at Bharati, Antarctica (geographical latitude $69.40^0$S, longitude $76.18^0$E) and another located at Tripura, India (geographical latitude $23.84^0$N, longitude $91.28^0$E) were operated simultaneously to infer common mode changes in the lower ionosphere for a number of solar flares events. The two systems constantly monitored the carrier amplitude and phase of the MSK (Minimum Shift Keying) modulated navy transmitter located in Australia (Callsign: NWC, 19.8 kHz, geographical latitude $21.88^0$S, longitude $114.13^0$E), around 5.6 Mm great circle distance from the two receivers. The results are interpreted in terms of Earth-ionosphere wave-guide characteristics. A Long Wave Propagation Capability (LWPC) model study is also performed to infer the changes in the daytime electron density in polar D-region ionosphere during the solar flares. The exponential fit of the modeled electron density change with average X-ray flux change shows an excellent correlation ($R^2$ value 0.95). The exponential fit is utilized to infer daytime electron density change in the polar ionosphere during solar flare events. The analyses indicate that small solar flares of class 'C' can be very effectively detected with the portable