

VLF perturbations associated earthquake precursors using subionospheric VLF signals

Ajeet K Maurya^{1}, Rajesh Singh¹, Sushil Kumar², and B. Veenadhari³*

¹KSK Geomagnetic Research Laboratory, IIG, Chamanganj, Allahabad, India e-mail ajeetphoton09@gmail.com, email Rajesh Singh rajeshsing03@gmail.com

²School of Engineering and Physics, The University of the South Pacific, Suva, Fiji, e-mail: sushil.kumar@usp.ac.fj

³Indian Institute of Geomagnetism (IIG), New Panel, Navi Mumbai, India, e-mail bveena@iigs.iigm.res.in

Abstract

Statistical results on the detection of lower ionospheric perturbations due to recent great earthquakes with $M > 5.5$ during the year 2009 in India, China, Bhutan and Indonesian regions, have been presented. The amplitude of two navigational transmitters NWC (19.8 kHz) in Australia and JJI (---kHz) in Japan received at Indian low latitude station Allahabad (24.8° N, 81.9° E) have been utilized. EQs selected are those whose epicenters fall in the wave sensitive area between transmitter and receiver defined by 5th Fresnel zone. The EQs are termed as JJI-EQs and NWC-EQs depending on their epicenter location along JJI-Allahabad and NWC-Allahabad paths. To find out the earthquake related precursory signatures in sub-ionospheric signals the terminator time (TT) and nighttime amplitude fluctuation (NF) methods have been utilized. The TT and NF methods show significant sub-ionospheric perturbations for NWC EQs. Shift in evening TT was observed few days to weeks prior to the NWC EQs. NF method reveals significant precursory signatures with fluctuations over 2σ (σ =standard deviation) criterion from few days to weeks before both NWC and JJI EQs. The gravity wave associated with EQs seem responsible for the strong nighttime fluctuations whereas the changes in TTs are associated with the electric field and extra ionization due to radon gas associated with this EQs which change the ionospheric reflection height.