Investigation of correlation between the ionospheric perturbations with seismic activity, as detected by subionospheric VLF signals

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As the target to find correlation between the VLF propagation anomaly (average nighttime amplitude, nighttime fluctuation, and atmospheric gravity wave modulation) and earthquakes we have analyzed a long period of data over 5 years from 2010 to 2014. VLF data analysis is done for the propagation path from NWC (in North West Cape, Australia) to Agra(geograph lat. 27.2^{o}E long. 78.0^{o}N) India. The local nighttime VLF amplitude data are extensively investigated during the period of earthquake occurrence, in which the trend (nighttime average amplitude), and nighttime fluctuation are analyzed. Further superimposed epoch analysis has been undertaken, in order to find the correlation of the ionospheric perturbations with seismic activity. Analysis results show that there occur significant anomalies in VLF propagation 3 and 5 days before the earthquake, indicating significant correlation with the earthquakes. However, it seems that the depletion in the trend becomes more prominent for shallow EQs with depth tentatively smaller than 40 km. While, the nighttime fluctuation (NF) is found to be very much dependent on EQ depth. That is, only when the EQ depth is smaller (shallow EQs), we have a very significant enhancement in the nighttime fluctuation, exceeding the 2σ criterion. As the latest advancements in the VLF method analysis we have used the fluctuation power spectra in the frequency range of atmospheric gravity waves (period = 10 min to 100 min) to confirm the presence of seimo-ionospheric perturbations. One of the important finding of this result is a strong correlation between ionospheric anomalies and total number of pre/after shocks relative to an earthquake.