CHAPTER VI

Conclusion and future projection

6.1 Summery

The first chapter gives the introduction of how an EQ could modify the near earth environment even up to the upper atmosphere. For this purpose this chapter provides the fundamental aspects of the atmosphere from the troposphere to ionosphere and probable role of an atmosphere in propagation of signal. The discussion includes both tropospheric and ionospheric mode of signal propagation.

The second chapter gives the basic description about different techniques with main focus on electromagnetic mode in the precursor study of earthquake. With emerging evidences of EM emission prior to earthquakes, importance of utilizing the relevant frequency spectra of EM radiation for uncovering earthquake precursor has gained momentum. A few such methods brought under discussion are monitoring technique of Low and Very Low Frequency (LF and VLF) signal, Very High Frequency (VHF) noise observation, Anomalous Propagation and Reception of over-horizon VHF signals propagation character and TEC measured by ground based GPS observation.

In chapter III the design and development of a receiving setup consisting of a 12 element steerable cross Yagi antenna of gain 15.5 dB with data logger and analyzer for monitoring reception of VHF anomalous signal from stations beyond the normal LOS path distance are presented. In this study the VHF signal source is the Chukha FM radio transmitter (frequency 98 MHz) of Bhutan (27.05°N, 89.58°E), and receiving station is at Gauhati University, Gauhati (GU, 26.15°N, 91.66°E), height above the sea level is
55m. A few events of anomalous reception received from the setup were represented in this chapter. The analysis shows that anomalous FM signal strength increase up to 15 dB, one or two days prior to an earthquake (EQ) around the EQ preparatory zone and after the event the signal strength comes into normal value. The phenomenon of trans-horizon LOS radio signal reception at GU from FM transmitter is shown to be due to EQ induced processes in the troposphere but not by ionospheric scattering or reflections. This process explained as a consequence of increase in RRI gradient as a sequel to interception of at least a part of the link path by EQ preparatory radius. Further, the topography of the trans-receiver path is observed to play a significant role in such mode of reception.

In chapter IV the structure constant parameter, Cn², an index of atmospheric turbulence has been used as a predictor parameter of an impending earthquake. This parameter has wide fluctuations from -14 m²/³ to -18.5 m²/³ in summer and autumnal season indicating turbulences are high with increase in temperature. Relatively low Cn² values around -15 m²/³ to -18 m²/³ in winter and vernal equinox season result to increase in RRI and hence favouring beyond LOS propagation. The observations are explained in terms of modifications of temperature and humidity and their consequent role in beyond the LOS propagation is explained. It was also shown that Cn² value decreases by 13% before and during the earthquake resulting increase in RRI and hence favouring beyond LOS propagation. Thus, Cn² can be used as a predictive cursor parameter of an impending earthquake. This interesting finding may be used as a precursive parameter, if further studies on this finding is taken for the validation of the possibility.
In the chapter V the equatorial anomaly effect as seen on TEC profiles are examined in association with impending EQ. For this purpose global TEC data from Australian meteorological department and GPS TEC data received at Guwahati, an appleton anomaly station have been utilised. Along with the TEC data satellite azimuth status seen by the GPS antenna within a EQ preparatory zone are analysed. The analysis was made by taking a few events of EQ occurring in west pacific zone. The growth of equatorial anomaly and its association with EQ can be adopted not only as a EQ precursor, but also this features along with azimuthal status of GPS can be utilised for understanding basic physics and dynamics in enhancement of FOV of trans-receiver system. Further the modification of satellite azimuthal status prior to EQ is associated with changes in tropospheric variables leading to modification in RRI even by 12.66% and thereby generating favourable situation for anomalous propagation of VHF and GHz signal. This analysis thus leads to the conclusion that in TEC observed at a distance more than 1000 km from an epicentre can provide possible modification in VHF and GHz signal propagation

6.2 Future prospect

In future, it is planned to examine the coupling process between lower and upper atmosphere prior to EQ through VHF anomalous signal strength features along with TEC data received at Gauhati University. The association between beyond the horizon propagation of VHF signal and the role of topography of a location in relation to beyond the LOS signal will be taken up as a future project by monitoring signal propagation characters from number of FM station.