## Ultra- Low- Frequency (ULF) and Total Electron Content (TEC) anomalies observed at Agra and their association with regional earthquakes

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Employing a 3- component search coil magnetometer (f=0.01-30 Hz) the Ultra Low Frequency (ULF) magnetic field observations have been taken in a noise free rural site at Bichpuri, Agra, India since 20 April, 2007. We have analysed 7 months of night time data from 1 May to 30 November 2007. The data show seven occurrences of ULF bursts with periods ranging from a few minutes to an hour in a wide frequency range up to 15 Hz. The occurrence of such ULF bursts has been statistically analysed. The polarization parameter analysis shows that two of these bursts occurred from sources in the ionosphere and magnetosphere (Z/X<1). It is further seen that four bursts are correlated very well with some regional earthquakes (M>4.5), which occurred at distances less than 628km from the observation site at Agra. In some cases the bursts occurred 1 to 3 days prior to the main shocks.

Since earthquakes are also known to perturb the ionosphere, we have analysed Total Electron Content (TEC) data obtained from a GPS receiver stationed at Agra since June, 2006. Analysis of the data for the same period as the magnetic field observations shows that there existed TEC anomalies on all the days when ULF bursts occurred. The TEC anomalies show enhancement and depletion in the data in all cases. While the mechanisms of the ULF and TEC anomalies are not well known, it is expected that the ULF bursts occurred due to microfracturing of the Earth's crust during stress accumulation and that the TEC anomalies occurred as a result of the electric field induced in the ionosphere during such processes.

Keywords: ULF emissions; Search coil Magnetometers; GPS-TEC; Earthquakes