Monitoring Earthquake Activities Using Multi Parameter Electromagnetic Satellite and Ground Based Data

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The current paper presents latest results from a joint study of the ionospheric plasma and ground- atmosphere electromagnetic (EM) field variations, and their relationship to tectonic activity. This study is based on joint measurements of the ionospheric/

atmospheric plasma properties and several ground-based parameters (radon, air temperature, relative humidity, electric field measurements, ground conductivity, magnetic anomalies, ELF and ULF) being continuously recorded over several test sites. The satellite data used include thermal infrared TIR (NOAA/AVHRR, MODIS), surface latent heat flux (SLHF), and Total Electron Content TEC (GPS /TEC) data. A reference level was created from multi-year data (TIR and SLHF) by systematically registering polar-orbiting satellites and comparing them with recent satellite observations to determine the statistical meanings of the anomalous signals prior to an earthquake. Additionally we analyzed measurements from the DEMETER satellite [quasi-continuous electrical fields (ICE), plasma parameters (IAP) and thermal plasma (ISL)]. VLF electrical field (VLF/ICE spectrogram, 0-20KHz), ion temperature (IAP/Ti, 794-5800K), electron temperature (ISL/Te, 700-3700K) and electron density (ISL/Ne, 10^3-10^5) were analyzed for more than 50 earthquakes. The significance of satellite based EM signatures was defined through analyzing most recent major earthquakes (M>5, H<50km) - the USA, Mexico and South America during 2004-2007.

This joint approach provides an opportunity for a comprehensive study and analysis of EM phenomena associated with earthquakes, and can be used to understand the relationship between seismic-tectonic processes in the solid Earth and surface–atmospheric- ionospheric variability.