Application of different statistical tools to investigate radon time-series data for earthquake precursory studies in Taiwan

*Vivek Walia[1], Arvind Kumar[1], Ching-Chou Fu[2], Shih-Jung Lin[1], Cheng-Horng Lin[1,2]

1. National Center for Research on Earthquake Engineering, NARL, Taipei, Taiwan , 2. Institute of Earth Sciences, Academia Sinica, Taiwan

For past few decades, anomalous temporal changes in radon concentrations have been reported in relation to earthquake occurrences. However, radon anomalies in all cases are not only controlled by seismic activity but also by meteorological parameters which make isolation of earthquake precursory signals complicated. The present study is an attempt to assess and quantify the influence of the meteorological and hydrological parameters on the soil gas radon emission at monitoring stations established along different active faults of Taiwan. Characteristics of temporal variability of soil-gas radon concentrations for the monitoring stations have been examined by using statistical tools e.g.Singular Spectrum Analysis. In order to make continuity and regularity of the data before applying the analysis, the radon data were carefully edited for rare duplicate sampling, gaps and discontinuous jump following intervals of malfunctioning of equipments. Digital filter has been applied in eliminating the long term trend in the data and retains variations of less than 30 days. The radon variations exhibit dominant daily variations, which are controlled by atmospheric temperature inducted evaporation in surface water saturated soil (Capping Effect). The decay of radon after the recession of rainfall is approximated by double exponential decay terms, one corresponding to the natural decay of radon with half life of 3.84 days and second representing slow weakening of capping effect. The effect related to internal loading due to rise and fall of groundwater modulates the propagation of radon in overlying strata, accounting for the long term variations in radon. The rainfall inflicted changes in radon look strikingly similar to earthquake related precursory or co-seismic perturbations, inferred by long term synotopic observations. It is surmised that unless radon variations are corrected for meteorological/hydrological contamination, some precursory signals are masked on one hand while on the other hand some anomalies are falsely viewed as earthquake precursors.

Keywords: Earthquake Precursors, Radon, Stasticial Tools, Taiwan

