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Analysis of kHz-MHz pre-seismic EM Anomalies by means of Complexity - Diffusion Entropy

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In past publications we have shown a self-similarity in VLF-VHF Electromagnetic EM time series detected before strong surface earthquakes that occurred in land of Greece. The basic parameter calculated was the variance scale Hurst exponent H estimated via a Spectral Wavelet analysis. A new statistical method is introduced in the literature in the frame of the science of complexity called "Diffusion Entropy" (DE). This quantity provides an independent way to study the scaling properties of a time series. DE analysis calculates the associated scaling exponent δ directly from probability density function of a diffusion processes without using the moments of the distribution. The δ exponent in the tail of the precursory EM activity reveals that there is a correlation in the time distribution of the EM events of the form $\psi(t) \sim (\tau/t)^{\mu}$. The scaling parameter μ, which is a by-product of the scaling exponent δ, confirms that the underground fracto-electromagnetic mechanism has similarities to a super-diffusion process. This mechanism produces self-similar time-series with Hurst exponent $H > 0.5$ that indicates persistency. The authors, based on relevant theoretical arguments and laboratory measurements, claim that this behaviour is a signature of the last stage of earthquake preparation process in the focal area, namely, of the fracture of backbone of asperities in the focal area.

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