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Spectral-decomposition techniques for the identification of periodic and anomalous phenomena in radon time-series.

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Building on independent investigations by research groups at both IPGP, France, and the University of Northampton, UK, hourly-sampled radon time-series of durations exceeding one year have been investigated for periodic and anomalous phenomena using a variety of established and novel techniques. These time-series have been recorded in locations having no routine human behaviour and thus are effectively free of significant anthropogenic influences.

With regard to periodic components, the long durations of these time-series allow, in principle, very high frequency resolutions for established spectral-measurement techniques such as Fourier and maximum-entropy. However, as has been widely observed, the stochastic nature of radon emissions from rocks and soils, coupled with sensitivity to a wide variety influences such as temperature, wind-speed and soil moisture-content has made interpretation of the results obtained by such techniques very difficult, with uncertain results, in many cases.

We here report developments in the investigation of radon-time series for periodic and anomalous phenomena using spectral-decomposition techniques. These techniques, in variously separating ‘high’, ‘middle’ and ‘low’ frequency components, effectively ‘de-noise’ the data by allowing components of interest to be isolated from others which (might) serve to obscure weaker information-containing components. Once isolated, these components can be investigated using a variety of techniques.

Whilst this is very much work in early stages of development, spectral decomposition methods have been used successfully to indicate the presence of diurnal and sub-diurnal cycles in radon concentration which we provisionally attribute to tidal influences. Also, these methods have been used to enhance the identification of short-duration anomalies, attributable to a variety of causes including, for example, earthquakes and rapid large-magnitude changes in weather conditions.

Keywords: radon; earthquakes; tidal-influences; anomalies; time series; spectral-decomposition.