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Correlation and Coherence Analysis of Paired Time-Series.

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Changes in radon and other soil-gas concentrations, and other parameters, before and after earthquakes have been widely reported. However, in the majority of such radon cases, changes in magnitude in single time-series have been reported, often large changes recorded using integrating detectors, and the majority of radon time-series analysis is reported for single time-series. With a single time-series, recorded at a single location, there is no measure of the spatial extent of any anomaly and, to a great extent, only anomalies in magnitude can be investigated. With two (or more) time-series from different locations, it is possible to investigate the spatial extent of anomalies and also investigate anomalies in time, i.e. frequency and phase components, as well as anomalies in magnitude.

Techniques for investigating paired time-series for simultaneous similar anomalous features, developed and adapted from techniques more familiar in the field of signal analysis, will be presented. A paired radon time-series dataset is used to illuminate these techniques. This is not a restriction to radon time-series: it is simply that the investigation at the University of Northampton has been conducted on radon datasets. The particular time-series are characterised by weak, intermittent, out-of-phase 24-hour cycles. The correlation analysis (Crockett et al., 2006) reveals two anomalous short periods where the time-series correlate, these periods temporally corresponding to UK earthquakes. The coherence analysis (Crockett, 2012) reveals anomalous short periods where the time-series cohere at 24-hour and 12-hour cycles: two of these periods confirm the periods revealed by the correlation analysis but there is a third period which also temporally corresponds to a UK earthquake.

References.

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