Geophysical Research Abstracts,
Vol. 11, EGU2009-5960, 2009
EGU General Assembly 2009

Spectral-decomposition techniques for the identification of radon anomalies temporally associated with earthquakes occurring in the UK in 2002 and 2008.

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During the second half of 2002, the University of Northampton Radon Research Group operated two continuous hourly-sampling radon detectors 2.25 km apart in Northampton, in the (English) East Midlands. This period included the Dudley earthquake (22/09/2002) which was widely noticed by members of the public in the Northampton area. Also, at various periods during 2008 the Group has operated another pair of continuous hourly-sampling radon detectors similar distances apart in Northampton. One such period included the Market Rasen earthquake (27/02/2008) which was also widely noticed by members of the public in the Northampton area.

During each period of monitoring, two time-series of radon readings were obtained, one from each detector. These have been analysed for evidence of simultaneous similar anomalies: the premise being that big disturbances occurring at big distances (in relation to the detector separation) should produce simultaneous similar anomalies but that simultaneous anomalies occurring by chance will be dissimilar.

As previously reported, cross-correlating the two 2002 time-series over periods of 1-30 days duration, rolled forwards through the time-series at one-hour intervals produced two periods of significant correlation, i.e. two periods of simultaneous similar behaviour in the radon concentrations. One of these periods corresponded in time to the Dudley earthquake, the other corresponded in time to a smaller earthquake which occurred in the English Channel (26/08/2002).

We here report subsequent investigation of the 2002 time-series and the 2008 time-series using spectral-decomposition techniques. These techniques have revealed additional simultaneous similar behaviour in the two radon concentrations, not revealed by the rolling correlation on the raw data. These correspond in time to the Manchester earthquake swarm of October 2002 and the Market Rasen earthquake of February 2008. The spectral-decomposition techniques effectively ‘de-noise’ the data, and also remove lower-frequency variations (e.g. tidal variations), revealing the simultaneous similarities.

Whilst this is very much work in progress, there is the potential that such techniques enhance the possibility that simultaneous real-time monitoring of radon levels – for short-term simultaneous anomalies – at several locations in earthquake areas might provide the core of an earthquake prediction method.

Keywords: Radon; earthquakes; time series; cross-correlation; spectral-decomposition; real-time simultaneous monitoring.