Statistical analysis of the correlation between earthquakes and atmospheric radon concentration

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ABSTRACT

Radon is a radioactive, colorless, odorless and noble gas element, which belongs to uranium series and has a half-life of about 3.8 days. Radium (^{226}Ra) in crustal rock decays to radon (^{222}Rn) by emitting an alpha particle, then radon gas (^{222}Rn) is released to the ground through cracks. Therefore, atmospheric radon concentration is thought to be an indicator of deformation of crustal rock related to large earthquakes. Before the 1995 Kobe earthquake, precursory anomalous increase in atmospheric radon concentration was observed about 20 km far from the epicenter [1]. Although anomalies in atmospheric radon concentration related large earthquakes have been reported, the quantitative analysis of the correlation between them is unclear because of difficulty in comparison among different time-series and the ambiguity of anomaly detection.

In this study, we applied singular spectrum transformation (SST) to time series of atmospheric radon concentration and cumulative seismic moment and estimated the degree of anomalous change in those time series. We used data of atmospheric radon concentration measured at the radioisotope institutes of Sapporo Medical University and Fukushima Medical University [2], and data of earthquake occurred near the radon observation site. To evaluate the correlation between them, we generated random shuffled data of earthquake that follow the same seismic activity probability density. As a result, a correlation between radon and the cumulative seismic moment has quantitatively evaluated by comparing the anomalousness calculated using SST.

REFERENCES

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