

Precursory Change of Radon Concentration in Groundwater before 2011 Tohoku Earthquake

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We will report characteristics of radon concentration changes in groundwater at the Nakaizu observatory around the Tohoku earthquake, 2011.

Radon concentration in groundwater sometimes responds to crustal deformation before the earthquakes. The phenomenon was well known in 1980, and many scientists tried to detect such anomalous signals in order to find a chemical indicator of earthquakes. However few researches have studied a mechanism of the phenomenon. Nonetheless a lot of anomalies of the radon concentration relating to earthquakes are reported every year, thus it is important to clarify the fundamental process of radon concentration change in an aquifer. We would like to report the characteristics of radon concentration change around the 2011 Tohoku earthquake, and to discuss a fundamental model of the radon concentration change in an aquifer.

An anomalous increase in radon concentration was measured at the Nakaizu observatory on the Izu Peninsula prior to the 2011 Tohoku earthquake using a custom-made radon counter. Since the increase was more than three times the standard deviation of radon concentration variations over 35 years of recorded data, it is considered likely that it is a precursor to the earthquake. Following the earthquake, the radon concentration decreased exponentially to the background level. The anomalous increase is explained using a modified volatilization model containing three important aquifer parameters: the groundwater saturation ratio, the fracture surface area per unit volume, and the porosity. The modified model can also explain the radon concentration behavior prior to the 1978 Izu-Oshima-Kinkai earthquake.

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