Contribution ID : **91** Type : **Poster**

Continuous measurement of radon exhalation rate from soil surface around active volcano

Monday, 26 September 2016 12:01 (0:01)

Content

There are many active volcanos in Japan. In particular, the Sakura-jima volcano, which is located at southern Japan, has been very active since 2009. High 210Po activity concentrations have been observed in air samples from Sakura-jima volcano collected in the 1980s. 210Po is one of the decay products of 222Rn which is a radioactive noble gas. 222Rn is normally generated by radioactive decay from 226Ra in materials such as soil and rocks. Thus, high 222Rn may have been observed from Sakura-jima volcano when the high activity concentrations of 210Po were measured. Radon inhalation, which includes 222Rn, 220Rn and their decay products, is believed to increase the risk of lung cancer and is second only to tobacco smoking as a risk factor. It has been previously reported by Darby et al. that the relative risk of lung cancer increases 16% per 100 Bq m-3 indoor radon activity concentration. Recently, the WHO proposed a reference level for indoor radon gas ranging from 100 to 300 Bq m-3. On the other hand, the phenomenon of increasing outdoor 222Rn activity concentrations before earthquakes associated with diastrophism has been reported by many researchers. This phenomenon was explained as follows: the micro-crack was generated by stress to the crust, and radon in the rocks was reached to the ground surface through the micro-crack. That is, increases in 222Rn activity concentrations from the soil surface might be associated with the diastrophism caused by the volcanic activity. This may suggest that the increases in 222Rn activity concentrations associated with the activity of the Sakura-jima volcano may be increasing the lung cancer risk for people living nearby. Thus, continuous measurement of 222Rn activity concentrations from the soil surface may be useful from the viewpoint of health physics and the prediction of volcanic activity. For this monitoring, a continuous measuring system of 222Rn exhalation rate from the soil surface was developed using a ventilation-type accumulation chamber and pulse-type ionization chamber. This system was set at Tarumizu City in Kagoshima Prefecture which is located at approximately 10 km south-southwest of Sakura-jima. 222Rn exhalation rate is in[U+FB02]uenced strongly by the water content in soil. Thus, the volumetric water contents in depth from the ground surface of 10, 20, 30, 40, 60, and 100 cm were also measured continually at the same measurement site. The soil temperature is one of the main in[U+FB02]uences on the emanation and di[U+FB00]usion of 222Rn in soil. Thus, the soil temperatures in depth from the ground surface of 10, 40, and 100 cm were also measured continuously. Furthermore, meteorological data such as temperature, humidity, atmospheric pressure, wind speed and precipitation were also observed in the present study. We will present the relationship between the 222Rn exhalation rate from the soil surface and the meteorological data. This work was supported by JSPS KAKENHI Grant Number 15K08766.

About the Presenter

Masahiro Hosoda, Ph.D. is a lecturer at Hirosaki University in the Department of Radiation Science and specializes in radiation measurements. In 2007, Dr. Hosoda earned his Ph.D. in health sciences from Tokyo Metropolitan University of Health Sciences. Throughout his career he has been involved with radiation research at Chuoh College of Medical Technology, the National Institute of Radiological Sciences, and Hirosaki University. In addition, he worked in the Office of Radiological Protection, Environmental Protection Agency, Ireland as a visiting researcher from April 2015 to March 2016. He is also a member of several local committees for environmental radiation monitoring. Dr. Hosoda has developed radon diffusion coefficient and exhalation rate measuring system. After the Fukushima nuclear accident, he developed new technique to evaluate the thyroid equivalent dose for the residents.

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Session Classification : Radioactive Noble Gases

Track Classification : Radioactive Noble Gases