2011 年東北地方太平洋沖地震（Mw = 9.0）前の大気中ラドン濃度変動

長濱 裕幸 [1]; 安岡 由美 [2]; 鈴木 俊幸 [3]; 本間 好 [3]; 武藤 潤 [4]; 多鹿 優佳里 [2]; 関 明日香 [5]
[1] 東北大・理・地学; [2] 神薬大; [3] 福島県立医大・医・放射性同位元素研究施設; [4] 東北大・理・地学; [5] 東北大・理・地学

Atmospheric radon variation before the 2011 Tohoku Earthquake (Mw = 9.0)

Hiroyuki Nagahama[1]; Yumi Yasuoka[2]; Toshiyuki Suzuki[3]; Yoshimi Homma[3]; Jun Muto[4]; Yukari Tajika[2]; Asuka Seki[5]
[1] Earth Sciences, Tohoku Univ.; [2] KPU; [3] RI center, Fukushima Med. Univ.; [4] Dept. Earth Sci., Tohoku Univ.; [5] Dept. Earth Sci., Tohoku Univ

The Tohoku Earthquake (M_W = 9.0) occurred in 11 March 2011. From the continuous GPS measurement of the northeastern Japan before the earthquake, Suito et al. (2011) reported that the significant post-seismic deformation of three GPS sites in Fukushima M7-class interplate earthquakes occurred along the Japan trench in 2005, 2008 and 2010, indicating the decreases in the coupling rate of the Tohoku Oki region. Using an air flow ionization chamber (the exhaust monitor at Radioisotope Center, Fukushima Medical University; outside air from about 7m), we obtained the atmospheric radon (Rn-222) concentration. The daily minimum radon concentration in the air in Fukushima has remarkably changed before the 2011 Tohoku Earthquake. The radon data is considered to be a value reflecting the radon concentration in wide area of the atmosphere, and has been linked to the fluctuations in the crustal strain of the order of 10^{-6} to 10^{-8} before the 1995 Kobe Earthquake (Yasuoka et al., 2009). The radon concentration in the air in Fukushima has decreased from 2003, and has departed from the annual variation calculated by the data from 2003 to 2007. In 2010, the radon level before the earthquake peaked for a long period, and then the radon concentration decreased rapidly just three-months before the 2011 Tohoku Earthquake. The seasonal variation during the normal period, which was calculated by using the daily minimum for the period from 2003 to 2007, was smoothed with exponential smoothing.

Residual value was calculated to exclude the effects of seasonal variation, (if changes in daily minimum radon concentration follow the normalized seasonal variation, the residual value should be zero) (Yasuoka et al., 2012). The residual radon variation in Fukushima had 3 peaks. From the comparison with the GPS time series before the 2011 Tohoku Earthquake (Suito et al., 2011), it is possible that the 3 peaks in Fukushima could be linked to the coseismic and postseismic deformation of the earthquakes that occurred along the Japan trench in 2008 and 2010 as pre-seismic crustal deformation of the Tohoku Earthquake (Suito et al., 2011). Using the data from exhaust monitors in radiation facilities, the radon concentration in the atmosphere can be measured in the whole country, and the crustal deformation may be observed before massive earthquakes from the atmospheric radon concentration change. Radon is a potential candidate to ionize aerial gases leading to changes in the atmospheric conductivity and the electric field. Therefore, it is important to estimate the alteration of the atmospheric electrical conditions through the use of radon data in response to the crustal deformation for the understanding of preseismic electromagnetic phenomena.