



Diffuse CO₂ and ²²²Rn degassing monitoring of Ontake volcano, Japan

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Mt. Ontake (3067 m.a.s.l.) is a stratovolcano located in central Honshu and around 100 Km northeast of Nagoya, Japan, with the last eruption occurring on September 27, 2014, killing 57 people, and creating a 7-10 km high ash plume (Kagoshima et. al., 2016). There were no significant earthquakes that might have warned authorities in the lead up to the phreatic eruption and at the time of the eruption there was no operational geochemical surveillance program. In order to contribute to the strengthening of this volcanic surveillance program, the Disaster Mitigation Research Center of Nagoya University and the Volcanological Institute of Canary Islands started a collaborative program in 2016. An automatic geochemical station was installed at Ontake volcano and soil diffuse degassing surveys of CO₂ efflux and other volatiles at the surface environment of selected areas of the volcano were established with a periodicity every two years. The station was installed 10.9 km east away from the eruptive vent, where some earthquakes occurred, and consists of a soil radon (Rn) monitor (SARAD RTM-2010-2) able to measure ²²²Rn and ²²⁰Rn activities. Monitoring of radon is an important geochemical tool to forecast earthquakes and volcanic eruptions due to its geochemical properties. The volatile and short-lived nature of ²²²Rn means that variations in ²²²Rn activity can be used to map fluid flow along active faults and fractures in volcanic areas. Regarding to the soil diffuse gas surveys, the first survey was carried out in August 2016 and the last one in October 2018, with 194 and 197 measurement points respectively, covering in an area of 91 km². Measurements of soil CO₂ efflux were carried out following the accumulation chamber method by means of a portable soil CO₂ efflux instrument. To estimate the total CO₂ output, sequential Gaussian simulation (sGs) was used allowing the interpolation of the measured variable at not-sampled sites and assess the uncertainty of the total diffuse emission of carbon dioxide estimated for the entire studied area. The total emission rate of diffuse CO₂ efflux was expressed as the mean value of 100 equiprobable sGs realizations, and its uncertainty was considered as one standard deviation of the 100 emission rates obtained after the sGs procedure. During the last survey of 2018, soil CO₂ efflux values ranged from non-detectable up to 86 g•m⁻²•d⁻¹ with an average value of 19.00 g•m⁻²•d⁻¹. The average value of soil CO₂ efflux for 2016 survey was in the same order, 22 g•m⁻²•d⁻¹. The estimated average value for the total diffuse CO₂ released for the Mt. Ontake volcanic complex during this study of 2018 was 1,755 ± 56 t•d⁻¹ vs. the 2,107 ± 69 t•d⁻¹ estimated in 2016. Periodic diffuse CO₂ emission surveys are a powerful volcanic surveillance geochemical tool. It is expected for future surveys to obtain a long-term evolution to understand the dynamics of diffuse CO₂ emission and its relationship with the volcanic activity of Mt. Ontake.

Kagoshima et. al., 2016 J. Volcanol. Geotherm. Res. <http://doi.org/10.1016/j.jvolgeores.2016.06.013>