

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, caused by ground water flashing to steam in a hydrothermal explosion. At the time of the eruption there was no operational geochemical surveillance program. In order to contribute to the strengthening of this program, the Disaster Mitigation Research Center of Nagoya University and the Volcanological Institute of Canary Islands started a collaborative program. To do so, an automatic geochemical station was installed at Ontake volcano and a survey of diffuse CO₂ efflux and other volatiles was carried out at the surface environment of selected areas of the volcano. 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. Rn ascends from the lower to the upper part of earth's crust mainly through cracks or faults and its transport needs the existence of a naturally occurring flux of a carrier gas. Regarding to the soil gas survey, it was carried out in August 2016 with 183 measurement points performed in an area of 136 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. Soil CO₂ efflux values ranged from 0.266 gm⁻²d⁻¹ up to 66.238 gm⁻²d⁻¹ with an average value of 23.350 gm⁻²d⁻¹. The estimated average value for the total diffuse CO₂ released for the Mt. Ontake volcanic complex during this study was 3,149 ± 98 td⁻¹, with the main contributions arising from the NE zone of the complex. It is expected for future surveys to increase the density of sampling points and to sample the areas near the crater in order to obtain a better approximation of the diffuse CO₂ efflux emission as well as obtain a long-term evolution to understand the dynamics of diffuse CO₂ emission and its relationship with the volcanic activity of Mt. Ontake.