

Radon measurements at Aso volcano: an experimental automatic radon station operative within the proximal zone of Nakadake

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Radon measurements at Aso Volcano first started on May 2015 and persisted until January 2016. They were resumed on August 2017 and they are currently on-going. Radon data have been collected by means of an in-soil automatic station located at about 1.06 km from the active crater (crater 1) together with soil temperatures (measured at the sampling site and 1 m below) and local atmospheric parameters (JMA).

During earlier measurements Aso volcano was affected by a sporadic explosive activity, which marked the ceasing of a Strombolian phase, and was followed by moderate phreatomagmatic events. Radon measurements been compared with ground-based and satellite thermal data, the latter collected by the MIROVA system. Radon concentrations were fluctuating from 300 to about 1100 Bq/m³ during May-July 2015, and they reached a minimum two weeks before the strong degassing that occurred at the beginning of August. On August 8, 2015 the Volcanic Radiative Power (VRP) detected by MIROVA was slightly below 1 MW. Since then there has been an increasing trend in Radon emissions (up to about 900 Bq/m³) that preceded the strong phreatic explosion of September 14. By the end of September, a new increasing trend reached a relative maximum (up to 1900 Bq/m³) one week before the explosion of the 23 of October 2015. Then, radon data persistently fluctuated well above 900 Bq/m³. This time span was accompanied by a general decrease of the detected thermal anomalies which were nearly coeval with the replenishment of the crater lake.

During 2017 radon emissions reached their relative maxima (up to 1380 Bq/m³) during fall-winter, whereas in 2018 the higher peak reaches 1450 Bq/m³ during the early fall (October 3). Several peaks seems to be correlated with the thermal gradient at the measurement site. However, some other peaks appear somehow coeval with some thermal anomalies in the crater area detected by the MIROVA system. Among these the one that occurred on May 15 that touched 1250 Bq/m³ and preceded the drastic increase in temperature of the South wall (up to 715 °C, according to JMA data). Two other minor anomalous peaks were recorded on June 13 and July 29, both were well above 800 Bq/m³. A systematic analysis of all radon data shows that radon emissions, in absence of anomalous spikes, are inversely correlated with soil temperatures and that the contribution of atmospheric pressure marginally affect radon emissions. The spectrum of the radon signal shows the existence of both diurnal and semidiurnal peaks, typically observed during continuous radon measurements. Future work should be concentrated in the attempt to better correlate radon emissions with the changes in volcanic activity, including the effects of environmental parameters on the radon signal.

Keywords: Radon , radon signal, radon anomalies/peaks, environmental parameters