



## Monitoring CO<sub>2</sub> emission from Cuicocha Volcanic Lake, Ecuador

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Cuicocha (4.7 km<sup>2</sup>) is a volcanic lake located in the province of Imbabura, about 110 km north of Quito, and is one of the two active volcanic lakes of Ecuador. Cuicocha volcano is part of Ecuador's Western Andean volcanic cordillera together with some 16 other active volcanoes as result of interaction of the Nazca oceanic plate with the Caribbean and South American continental plates. Cuicocha represents the fourth most dangerous active volcano in Ecuador with its volcanic activity is represented by the upheating of its waters and a fumarolic activity expressed by gas bubbles and some dead vegetation due to the emission of CO<sub>2</sub> through the soils. Monitoring Cuicocha volcanic crater lake has been a priority task due to the presence of a considerable amount of population living within a 20 km radius of Cuicocha caldera rim. We report herein the results of a CO<sub>2</sub> efflux survey carried out at this crater lake during October 2018, with the aim of evaluating temporal variations of CO<sub>2</sub> efflux and their relationships with volcanic activity since 2006. In the 2018 survey, a total of 113 CO<sub>2</sub> efflux measurements were performed on the lake surface by means of a floating accumulation chamber. At each sampling site pH, temperature and conductivity were measured at 15 cm depth from the water surface. To study the possible water stratification and CO<sub>2</sub> accumulation in the lake, a dissolved gases were analysed at several depths in a vertical profile was performed reaching 80 m depth. The CO<sub>2</sub> efflux values ranged between 4 and 70 g•m<sup>-2</sup>•d<sup>-1</sup> with an average value of 19 g•m<sup>-2</sup>•d<sup>-1</sup>. In order to compute the diffuse CO<sub>2</sub> emission at the studied area, the CO<sub>2</sub> emission spatial distribution map was constructed averaging results of the 100 simulations following the sequential Gaussian simulation algorithm. The highest values of diffuse CO<sub>2</sub> efflux and water temperature were observed close to one of the domes located inside the crater lake. The diffuse CO<sub>2</sub> output was computed as 76 ± 3 t•d<sup>-1</sup>, being released through an area of 4.7 km<sup>2</sup>. Temporal evolution diffuse CO<sub>2</sub> output presents a range from 76 to 652 t•d<sup>-1</sup>, being the 2018 survey the lower value. During March 2012, more than a hundred of earthquakes (M<3) were recorded in the southwestern zone of the Cuicocha volcanic lake, coinciding with the maximum value of diffuse CO<sub>2</sub> emission of 652 t•d<sup>-1</sup>. Periodic diffuse CO<sub>2</sub> emission surveys will be tremendously useful to improve the early warning system of future magmatic reactivations.