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Diffuse CO_2 emission from Quilotoa volcanic crater lake, Ecuador

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Quilotoa volcanic lake (3,914 m.a.s.l.) is located in the Cotopaxi province approx. 100 km SW of Quito, Ecuador. It consists on a stratovolcano truncated by a subcircular 2.4–2.8 km diameter caldera with steep-sided walls that rise 400 m above the surface of a 240-m-deep lake. The last eruption occurred in the XII century producing 14 km^3 of pyroclastic fall, surge and flow deposits (Barbieri, 1996). Fumaroles are present on the lake floor and a strong bubbling is visible near the southern coast of the crater lake. In order to contribute to the volcanic monitoring of this volcanic system, a CO_2 efflux survey was carried out on September 2017 with 79 measurement points performed in an area of 3.5 km^2. The CO_2 measurements were carried out following the accumulation chamber method (Parkinson, 1981) by means of a portable LICOR soil CO_2 efflux instrument. To estimate the total CO_2 output, sequential Gaussian simulations (sGs) were used. Also temperature, pH and conductivity were measured in each point and the corresponding maps were constructed using sGs. Additionally one vertical profile was surveyed reaching depths of 170 m. Water temperature, pH and electric conductivity (EC) were measured by means of a multiparametric probe at different depths and water samples were also taken at different depths. Samples were collected and stored in glass flasks and then analyzed by micro-chromatography by a 490 micro-GC system for the dissolved gas content. An echo-sounding survey was carried out in the same period to better understand the dynamic of the lake. Surface lake CO_2 efflux values ranged from 5.2 $g{\cdot}m^{-2}{\cdot}d^{-1}$ to 101 $kg{\cdot}m^{-2}{\cdot}d^{-1}$ with an average value of 1,609 $g{\cdot}m^{-2}{\cdot}d^{-1}$. The estimated diffuse CO_2 emission released from Quilotoa crater lake during this study was 314 ± 20 $t{\cdot}d^{-1}$ with the main contribution arising from the southwest shore, where the bubbling area is located. In February 2014, a similar survey was carried out with a diffuse CO_2 emission release estimated on 536 ± 35 $t{\cdot}d^{-1}$. Data from the multiparametric probe showed some stratification at some depths due possibly to observed changes in temperature, pH and conductivity. Similar changes were observed in some of the gaseous species dissolved in water. The echo-sounding data are being evaluated at the time of writing this abstract. It is expected to perform future geochemical surveys in order to understand the behavior of the volcanic system and as a forecast of future volcanic activity.

References

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