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Ten years of monitoring diffuse CO_2 degassing from Taal volcanic crater lake, Phillippines

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Taal volcano is one of the most active volcanoes in the Philippines and has produced some of its most powerful historical eruptions. Located on the southwestern part of Luzon Island, Taal consists of a 15-22-km prehistoric caldera, occupied by the Taal Lake, the active vent complex of Volcano Island and the Crater Lake (TCL), 1.9 km in diameter. Six of 24 known eruptions at Taal since 1572 have caused many fatalities, and several million people live within a 20-km radius of Taal's caldera rim, making the volcano the largest threat to the Philippine population. An alarming increase in seismicity, gas emission, deformation and temperature of the TCL from March 2011, was interpreted as the result of a new magma intrusion (Arpa et al., 2013; Hernández et al., 2017). Between 2008 and 2014, ITER/INVOLCAN has collaborated with PHIVOLCS and from 2015 to the present with the University of the Philippines, also counting with the support of the Spanish Agency for International Development Cooperation (AECID), to perform diffuse CO_2 ef[U+FB02]ux surveys at the surface of the TCL. In total, 18 surveys have been undertaken since 2008. Last survey was performed in November 2018, with 75 sites distributed homogenously along the surface of TCL. Together with diffuse CO_2 ef[U+FB02]ux measurements, at each sampling site, water temperature and pH were measured. The CO_2 measurements were carried out following the accumulation chamber method by means of a portable LICOR soil CO_2 ef[U+FB02]ux instrument. To estimate the diffuse CO_2 output, sequential Gaussian simulations (sGs) were used. The CO_2 ef[U+FB02]ux values ranged from 231 to 20,920 gm-2•d-1. Main CO_2 contributions were always observed at those areas where bubbling activity occurs. The estimated diffuse CO_2 emission released from the Taal crater lake during 2018 survey was 3,050 $\pm$ 107 t•d-1. Observing the time series, the results reveal signi[U+FB01]cant variations from 2008 to 2018 and do not seem to be masked by external variations, showing a temporal correlation with the onsets of high frequency seismic events recorded by PHIVOLCS at Taal. The above observations suggest subsurface magma movement as the cause for the observed changes in the total output of diffuse CO_2 emission at the Taal crater lake, and CO_2 ef[U+FB02]ux surveys become an effective volcanic surveillance tool for Taal volcano.

Arpa et al., 2013. 2013. BullVolcanol. 75, 1–13.
Hernández et al., 2017. J Geol. Soc. Lon. doi.org/10.1144/SP437.1.