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Diffuse volcanic degassing and thermal energy release 2015 surveys from the summit cone of Teide volcano, Tenerife (Canary Islands, Spain)

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The summit cone of Teide volcano (Spain) is characterized by the presence of a weak fumarolic system, steamy ground, and high rates of diffuse CO_2 degassing all around this area. The temperature of the fumaroles (83°C) corresponds to the boiling point of water at discharge conditions. Water is the major component of these fumarolic emissions, followed by CO_2, N_2, H_2, H_2S, HCl, Ar, CH_4, He and CO, a composition typical of hydrothermal fluids. Previous diffuse CO_2 surveys have shown to be an important tool to detect early warnings of possible impending volcanic unrests at Tenerife Island (Melián et al., 2012; Pérez et al., 2013). In July 2015, a soil and fumarole gas survey was undertaken in order to estimate the diffuse volcanic degassing and thermal energy release from the summit cone of Teide volcano. A diffuse CO_2 emission survey was performed selecting 170 observation sites according to the accumulation chamber method. Soil CO_2 efflux values range from non-detectable ($\sim$0.5 g $m^{-2}d^{-1}$) up to 10,672 g $m^{-2}d^{-1}$, with an average value of 601 g $m^{-2}d^{-1}$. Spatial distribution maps were constructed following the sequential Gaussian simulation (sGs) procedure. Measurement of soil CO_2 efflux allowed an estimation of 162 $\pm$ 14 t d^{-1} of deep seated derived CO_2. To calculate the steam discharge associated with this volcanic/hydrothermal CO_2 output, we used the average H_2O/CO_2 mass ratio equal to 1.19 (range, 0.44-3.42) as a representative value of the H_2O/CO_2 mass ratios for Teide fumaroles. The resulting estimate of the steam flow associated with the gas flux is equal to 193 t d^{-1}. The condensation of this steam results in a thermal energy release of 5.0×10^{11}J d^{-1} for Teide volcano or a total heat flow of 6 MWt. The diffuse gas emissions and thermal energy released from the summit of Teide volcano are comparable to those observed at other volcanoes. Sustained surveillance using these methods will be valuable for monitoring the activity of Teide volcano.