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Spatial-temporal variations of surface diffuse CO_2 degassing from Cumbre Vieja volcano, La Palma, Canary Islands

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La Palma Island is located in the northwest of the Canary Islands. Volcanic activity at La Palma in the last 123 ka has taken place exclusively at Cumbre Vieja volcano located at the southern part, which is characterized by a main north–south rift zone 20 km long and up to 1950 m in elevation. Cumbre Vieja covers an area of 220 km2 with vents located also at the northwest and northeast. Cumbre Vieja is the most active basaltic volcano in the Canaries with 7 historical eruptions being San Juan (1949) and Teneguía (1971) the most recent ones. Since no visible degassing (fumaroles, etc.) at Cumbre Vieja occurs, our geochemical program for the volcanic surveillance of Cumbre Vieja is mainly focused on diffuse degassing monitoring. Diffuse CO_2 emission surveys have been yearly performed in summer to minimize the influence of meteorological variations. On 7-9 and 13-14 of October 2017 two intense seismic swarm occurred beneath Cumbre Vieja. In response to this volcanic process, a continuous surveillance diffuse CO_2 campaign has been carried out in the area since then. Seismological and geochemical evidences that these swarms were linked to a deep-seated magmatic intrusion were found. Measurements are performed following the accumulation chamber method in about 600 sites. Spatial distribution maps are constructed following the sequential Gaussian simulation (sGs) procedure and, to quantify the total CO_2 emission from the studied area, 100 simulations are performed for each survey. Since 2001, the diffuse CO_2 output released to the atmosphere from Cumbre Vieja volcano measured on a yearly basis has ranged between 320 to 1,544 t•d-1. After the October 2017 seismic swarms, diffuse CO_2 output showed an increasing trend from 788 t•d-1 up to 3,251 t•d-1 in March 2018, to decrease gradually until 852 t•d-1 in September of that same year, and begin to gradually increase again to 2,371 t•d-1 in November 2018. Seismic swarms occurred at Cumbre Vieja were possibly caused by an upward magma migration from an ephemeral magmatic reservoir, located in the upper mantle (about 25 km depth), and toward another reservoir located close to the Moho beneath Cumbre Vieja (12-15 km). The consequent depressurization of the magma batch was the source of the volatiles observed at the surface coherent with the expected geochemical behavior of CO_2.