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'Understanding volcanoes and society: the key for risk mitigation'



Unrest activity at Piton de La Fournaise volcano (La Reunion Island) inferred by soil CO₂ flux variations along an active tectonic structure

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Piton de la Fournaise (PdF) is one of the world's most active volcanoes, with an average of one eruption every nine months since 1930. However quiescent periods are also recorded (1966-1972; 1992-1998). Likewise, after 41 months of quiescence, short-lived and small volume eruptions resumed in June 2014 and February 2015. In mid-April 2015, unusual migration-path of seismic swarm from 7.5 km b.s.l. to sea level below volcano summit together with change in summit fumaroles composition heralded an acceleration in volcano inflation (Peltier et al., 2016), leading in August 2015, to the fifth largest and longest eruptions of PdF in 150 years. Using dynamic concentration and accumulation chamber methods, surveys of soil CO₂ fluxes were carried out across the NW rift zone of the volcano. Our results have revealed anomalous soil CO₂ emissions with a magmatic isotopic (d13C) contribution along a main N135° structure (here named the Songit fault) under which the deep seismicity (>16 km b.s.l.) clusters. Therefore soil CO₂ concentration and fluxes at the Songit fault have regularly been monitored since 2015 along a transect 4 km distant from the summit crater. This transect was also carefully imaged using self-potential and electrical resistivity tomography. We discuss here a one-year dataset of soil CO₂ fluxes along this structure, corrected from environmental influence, from 4 to 15 km from the volcano summit (PNRN permanent station), and its correlation with time evolution of CO₂/H₂S and CO₂/H₂O ratios in summit fumaroles (DSON MultiGas permanent station). We demonstrate



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for the first time that increase in soil CO₂ fluxes and relative CO₂ enrichments in summit fumaroles are reliable precursors of magma transfer at Piton de la Fournaise leading volcano reactivation and time evolution of volcanic activity. Evidences of recent magma transfer along the Songit fault, which cuts populated areas raises also critical protection issues.