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Quick unrest and renew of eruptive activity at Piton de la Fournaise in 2014-2016

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Identifying and providing an unequivocal identification of volcano reawakening remain challenging problems in volcanology. At Piton de la Fournaise, sudden volcano reawakening was detected in 2014 after 41 months of rest. Even if since march 2014, deep seismic activity (> 16 km depth) and high soil CO₂ fluxes were recorded far from the summit (up to 15 km), the June 20-21, 2014 eruption was preceded by only 11 days of summit precursors (inflation, seismicity, change in fumarole composition). This shows that the reactivation of the shallow plumbing system of a volcano can be extremely elusive and fast, even after long lasting non-eruptive phases. This short-lived eruption marked the start of a new eruptive cycle and involved a shallow source (1.3–1.9 km depth below the summit). The following activity (four eruptions in 2015) was associated with long-term continuous edifice inflation, and involved a larger depth range of fluid accumulation (3.9 to 1.2 km depth). In mid-April 2015, a deep seismic migration (9.5 to 3 km depth) concomitant with summit inflation acceleration, and CO₂ enrichment in the summit fumaroles revealed the acceleration of deep recharge. On May 26-27, 2016 and after 7 months of quiescence, a short-lived eruption (<28 hours) was again preceded by only 10 days of precursors. Immediately after, summit inflation renewed at a high rate (2-2.5 mm/day) as in 2014-2015. This evolution suggests that the pressurization of the plumbing system first triggers the expulsion of the top of the plumbing system, leading to low volume eruptions such as those observed in June 2014 and May 2016, and then induces the progressive vertical transfer of a larger portion of the plumbing system. These results highlight that this progressive fluid transfer can be heralded by fast pressurization of shallow source, leading to “early birds” eruptions preceded by only little warning.