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Mass changes revealed by continuous gravity measurements before and during the 2018 eruption at Kīlauea Volcano, Hawai‘i

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Gravity data from two continuously recording instruments, installed on the rims of the summit and Pu‘u ‘Ō‘ō eruptive vents at Kīlauea, Hawai‘i, tracked the phases of magma withdrawal that accompanied the onset of the volcano’s 2018 lower East Rift Zone eruption and caldera collapse. The gravity changes observed at the two locations amounted to as much as 2.5 milligal — by far, the largest changes ever observed through continuous gravity measurements.

The withdrawal of magma from summit and Pu‘u ‘Ō‘ō vents provided an opportunity to image their inner structures. These data, along with information on lava levels and surface deformation over time, provide insights into the processes that caused the observed gravity changes and controlled the onset of magma withdrawal from Pu‘u ‘Ō‘ō. The latter was the starting event of the 2018 eruption sequence that included, besides the collapse of the crater floor of Pu‘u ‘Ō‘ō, the opening of an eruptive fissure on the west flank of the cone. We show that continuous gravity supplies unique information on the most significant volcanic event at Kīlauea of the past several hundred years.