Since March 2008, an eruption has been ongoing at the summit of Kīlauea Volcano, Hawaiʻi, with persistent emission of steam, gas, and small amounts of ash, and a circulating lava column within the vent. In May 2010, two continuously operating gravimeters were installed at distances of 2 km and 150 m from the vent. The signal from both gravimeters is dominated by a component with a period of about 25 sec, attributed to inertial acceleration due to very-long-period volcanic tremor. Low-pass filtering of the data from both gravimeters reveals an additional component with a period of 2–5 minutes, which is stronger in the signal from the instrument closest to the eruptive vent. This signal could be due to variation in the magma/gas ratio in the upper part of the volcano’s plumbing system, suggesting that degassing from the summit eruptive vent might involve periods of gas segregation and release. Sudden 1–5-microgal changes in gravity are associated with cycles of lava column rise and fall within the eruptive vent. The gravity changes are less than expected given the lava level changes, which can exceed 20 m, and imply that lava column high stands are supported by a low-density material, such as exsolved volatiles. Finally, gravity data have been collected during small explosive eruptions that follow collapses of the vent rim into the lava column. The explosions are accompanied by very-long-period gravity and seismic events but little net change in gravity.