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Results from 10 years of absolute gravity measurements at Mt. Etna volcano (Italy)

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We analyze gravity and GPS measurement collected at Mt. Etna between 2009 and 2018, with the aim of understanding the dynamics of magmatic sources over time-scales of months to years, during an interval characterized by tens of lava fountain events from the summit craters. Gravity and GPS measurements complement each other in various ways. Gravity measurements at volcanoes are performed to understand processes that induce bulk mass/density changes, while GPS measurements, through the recording of the deformation patterns, are able to constrain the position and the shape of the magmatic sources. Both techniques pursue the goal to provide a clear contribution to understanding of magma ascent processes both during the preparatory and [U+FB01]nal stages leading to the eruptions. The absolute gravity and GPS campaign measurements were repeated roughly once a year; in order to improve the time resolution of gravity data, we performed measurements through relative spring gravimeters at intervals shorter than 1 year and continuous measurements through a superconducting gravimeter, installed at SLN station (1740 m a.s.l.) in 2014.
After being corrected for the effect of elevation changes, gravity data (maximum variation of approximately 100 μGal) are highly correlated with vertical deformation (maximum variation of about 10 cm), showing some cycles of positive and negative variations.
Our results provide new insight into the processes that controlled the phases of magma accumulation and withdrawal within the plumbing system of Mt. Etna volcano, in periods preceding/accompanying the eruptive activity during 2009–2018.