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Superconducting gravimeters reveal unprecedented details of changes related to volcanic processes

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Continuous gravity measurements have been successfully carried out at a number of volcanoes around the world using spring gravimeters. Nevertheless, these instruments do not provide reliable measurements when used in continuous mode for weeks or more, because they are influenced by environmental factors and are subject to instrumental drift. Accordingly, most studies of continuous gravity at active volcanoes have focused on the analysis of changes over time-scales of minutes to a few days.
An alternative to spring gravimeters for continuous measurements is given by superconducting gravimeters (SGs) that feature a much higher precision and stability than spring gravimeters. However, even the most portable SGs (e.g., the iGrav® by GWR) are not ideal for installation in the vicinity of active volcanic structures. Indeed, they require AC power at the installation site and some kind of hut or vault to house the instrumentation.
At Mt. Etna, the installation of a mini-array of three SGs (distances of 3.5 to 15.5 km from the active craters) was begun in September 2014. To our knowledge, these are the first SGs ever installed on an active volcano. Signals from these instruments show hydrologically-induced components superimposed on small (a few microGal) gravity changes that are related to volcanic processes. Such changes, occurring over periods of minutes to weeks, would not be observable by spring gravimeters due to their intrinsic limitations regarding precision and long-term stability.