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Gravity Monitoring at Cotopaxi Volcano during the 2015-2016 Unrest Period

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In April 2015, Cotopaxi, one of the most active and dangerous volcanoes in Ecuador, began to exhibit signs of reawakening after 135 years of quiescence. The IGEPN (Quito- Ecuador) documented important changes in monitored parameters: seismicity increased from less than 30 to more than 150 events per day on average; an inflationary pattern of up to 100 $\mu\text{rad/d}$ was observed at the inclinometers located on the NE flank and GPS instruments detected horizontal displacements up to 1 cm on the W flank. SO₂ emissions increased from base level (non detectable to less than 500 t/d) to up to 3000 t/d, and fumarolic activity originating mainly from the crater became visible from Quito, 60 km from the volcano. Eruptive activity started on August 14, 2015 and was characterized by phreatomagmatic explosions with ash plumes that rose up to 8000 m above the summit, with subsequent ash emissions that affected the western part of the volcano and agricultural lands, and lasted until November. In an effort to improve the monitoring of the volcano, a gravimetric survey program was initiated in June 2015 in order to constrain the mechanisms responsible for the volcanic activity. Microgravity measurements were performed using a model Scintrex CG-5 on monthly intervals on a network of 6 sites on the volcano's edifice, at distances between 2.5 to 12 km from the crater. Abrupt gravity changes of about 30 microGal were observed at several stations on the E and W side of Cotopaxi before and after the August 2015 explosions. In this work, we address the significance of these gravity variations and their correlation with other geophysical parameters, such as seismicity and deformation. Gravity monitoring at Cotopaxi is still being performed, although major changes have not been seen in recent months in accordance with the decrease in its activity.