

Absolute gravity variation at Sakurajima volcano from April 2009 through January 2011 and its relevance to the eruptive activity of Showa crater

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We describe continuous absolute gravity measurements performed from April 2009 through January 2011 at Sakurajima volcano. The results clearly show significant gravity variations of as large as 30 microgal during the observation period. Hydrological simulations reveal that about half of the gravity change is attributable to groundwater disturbance. After correcting for this disturbance, the observed variations in gravity can be divided into 5 separate phases. Phase 2 is a period with few eruptions, which extends from April to late June 2009 when an abrupt 10 microgal gravity decrease was observed. During the succeeding phase 2, from July 2009 to May 2010, gravity oscillated about a mean value with an amplitude of 5 microgal, while the monthly number of explosions at Showa crater dramatically increased from 50 to about 150. In phase 3, which was a transient quiescent period, gravity increased by as much as 10 microgal in a single month. This was followed by phase 4, during which there was a steady gravity decrease until November 2010. During the final phase 5, gravity remained almost constant until at least January 2011. These five phases are closely linked to the eruptive activity at Showa crater. In fact, excellent correlations are found among the records of absolute gravity, ejected weight of volcanic ash, ground tilt, and infrasound air shock amplitude. The gravity data are transformed into changes in magma head height using a simplified line mass model.