

Peculiar Gravity Change at the Kirishima Volcano during Vulcanian Eruption Phase in 2011

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1. Introduction

Mt. Shinmoedake of the Kirishima volcanoes woke from a 300 year long period of dormancy in 2011. Sub-Plinian eruptions on Jan. 26 and 27 were followed by formation of a lava dome and Vulcanian eruptions in February 2011. We carried out continuous absolute gravity measurement for 1 year since Feb. 8, 2011 and found peculiar gravity signals during the Vulcanian eruption phase in February 2011.

2. Absolute gravity measurement

We installed a gravimeter FG5 at the Kirisima Volcano Observatory, which is located just above the supposed inflation/deflation source before and after the 2011 eruption. FG5 is an absolute gravimeter that measures

acceleration of a free falling target in a vacuum chamber with a laser interferometer and a rubidium atomic clock. We usually average 50 measurements during a prescribed time window of 500 seconds to obtain a set gravity g_{set} ; the bunch of 50 measurements is called a set. The time window is separated by either 30 or 60 minutes. Standard deviation of each measurement within a set is 10-30 microgal in normal condition. The precision of g_{set} is thus estimated to be 1-4 microgal.

The gravity record shows peculiar temporal changes before the Vulcanian eruptions in February 2011; gravity started to decrease from 8-10 hours before Vulcanian eruptions followed by quick recovery 2 hours before the eruption. We applied the F-test on the statistical significance of the gravity changes and found that they are significant on 1 % significance level. We shall discuss how these gravity changes occur before Vulcanian eruptions.

Keywords: absolute gravity change, volcano, vulcanian eruption, continuous measurement