

Micro-gravity change at Mt. Fugen

Yasuhiro Fujimitsu[1]; Koichiro Fukuoka[1]; Jun Nishijima[1]; Sachio Ehara[1]

[1] Earth Resources Eng., Kyushu Univ.

<http://geothermics.mine.kyushu-u.ac.jp/>

We are conducting some investigations about the cooling process of the conduit after the 1990-95 eruption and the possibility of development of the hydrothermal system by the conduit in the mountain body, in the Unzen Scientific Drilling Project. As one of the investigations, a repeat gravity measurement has been continued since 1999.

A reference station is installed in front of Nita-pass Ropeway Station, and in addition to the reference point, 14 measurement stations are set up along the mountain trail which reaches from Nita-pass to Azami-dani, Momiji-jaya and the summit of Mt. Fugen. Although the measurement is performed at the same time (the beginning of August) every year, the measurement is not completed by all stations caused by the weather conditions in the investigation period. We use a Scintrex CG-3M gravity meter, and the two-way measurement is performed for the drift compensation with the standard deviation within 10 micro gals for 120 times measurement at each station. Although changes of altitude difference between three stations and the Nita-pass reference station are also measured by using GPS, any remarkable changes are shown at the stations.

When we see the gravity values of each station on the basis of Nita-pass reference station from 1999 to 2002 in perspective, the gravity change of the stations in the comparatively higher place of altitude shows the pattern that decrease from 1999 in 2000, increase from 2000 to 2001 and decrease from 2000 to 2001. On the other hand, the gravity change of the stations that are in the comparatively lower place shows the change of a reverse phase. Since any remarkable changes in the altitude of the stations were not seen, we formed a hypothesis that the gravity change is caused by the change of the shallow groundwater level.

It is difficult to think a factor of the groundwater level change near the summit of a mountain except precipitation. Then, when we checked the monthly precipitation at the Mt. Unzen meteorological stations from 1999 to 2002, it is shown that the gravity change pattern is the same change of the precipitation in July, which is considered to affect the gravity value in August that is the annual gravity measurement time. This is not contradictory as explanation to the hypothesis.

Then, in order to detect a groundwater aquifer of the shallower part, the resistivity exploration was carried out at Azami-dani on the southern slope of Mt. Fugen in September 2003. A measurement line of 400 m length was set along the former Azami-dani mountain trail to the east from the junction with the present mountain trail which reaches Momiji-jaya with the electrode interval of 10 m and the detectable depth of 100 m, and performed inversion analysis by the conjugate gradient method after the measurement. As the result of the analysis, it is indicated that the aquifer which is detected as a low resistivity layer under this measurement line exists in the very shallow part, the thickness of the aquifer is less than 10 m which is the minimum analysis block size determined by the electrode interval, and the resistivity beneath the aquifer to about the depth of 100 m exceeds 10000 ohm-m.

The relation between groundwater level change and gravity change at other field and the calculation by using the infinite plate model showed that the gravity change of several 10 micro gals is explained by the groundwater level change of several meters. That is, it is possible that a thin aquifer detected by the electrical exploration causes the gravity changes observed in Mt. Fugen area, and it was concluded that the minute gravity change of this area is caused by the change of shallow groundwater level.