

Real time monitoring of underground temperature in Jigokudani, Midagahara volcano using LPWA devices

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Jigokudani is an active geothermal area in Midagahara volcano, Toyama prefecture, central Japan. It was formed as a result of repeated phreatic eruptions over 40,000 years. Increased volcanic activity in this area has been observed since 2011. In order to detect a precursory signal of a phreatic eruption, observations should be conducted on seismicity, ground deformation, geothermal activity, volcanic gas, etc. A real time monitoring system of underground temperature using LPWA (Low Power, Wide Area) devices was tested in Jigokudani first in 2018. The LPWA devices send temperature data every 30 minutes to a gateway to the internet situated in Hotel Tateyama. Underground temperatures were monitored on internet devices. However, the monitoring system was unstable due to the vulnerability of LPWA devices to volcanic gas and rain. Some devices ceased measuring during the test. In 2019, a real time monitoring system was constructed with another LPWA devices. An LPWA device (netvox, R718CX2) has two thermocouples and a transmitter (LoRaWAN). 8 devices were deployed in Jigokudani. Thermocouples were placed at the depths of 10 and 50 cm. Short-period (~10 hours) variations in temperature are remarkable at 10 cm, while quite weak at 50 cm. Short-period variations come from the temporal change in the surface temperature. The heat flux can be estimated from temperatures at different depths.

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