Japan Geoscience Union Meeting 2014
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SVC52-P01 Room:Poster Time:April 28 18:15-19:30

Reproduction of the Eruptive sequence of the 2011 Shinmoedake eruption using the kitchen volcano experiments

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For elementary and junior high school students, we conducted a program for the reproduction of the eruptive sequence of the 2011 Shinmoedake eruption using the kitchen volcano experiments. Learning about the Shinmoedake eruption in 2011 will lead to disaster prevention. This program plays an important part of education and disaster prevention activities in the Kirishima Geopark.

Keywords: The 2011 Shinmoedake eruption, kitchen volcano experiment

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SVC52-P02 Room:Poster Time:April 28 18:15-19:30

HOMURA: Development of mobile sensor for volcanic exploration

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Monitoring of phenomena near craters of active volcanoes is important to learn symptoms of volcanic eruptions and to understand eruption dynamics. At present, some devices such as crater camera, volcanic gas sensors, and seismographs that have been installed in a calm period of volcanic activity are monitoring volcanic phenomena near the craters. On the other hand, we cannot approach the crater and cannot install new devices after beginning of a volcanic eruption, even if we want to observe unexpected volcanic phenomena. Therefore, unmanned robots that observe them on an ad hoc basis are needed. Previously some projects have tried to develop robots for volcanic exploration. However, those projects which required large budgets ended before a practical application.

We hope to destroy the status quo and are trying to develop a practical unmanned-ground-vehicle-type robot for volcanic exploration that carries out monitoring near active craters. We named this system "Homura". Homura is controlled by wireless remote control, move in volcanic field, approach an active crater, monitor volcanic phenomena with sensors equipped in the vehicle, and send their data to the base stationin real time. In this presentation, we introduce a prototype of Homura and report a test campaign in Mihara-yama volcano, Izu-Ohshima.

Guidelines of development of Homura are two: (1) the vehicle does not readily become undrivable in volcanic fields, and (2) assemblage and use of Homura require low conts. We produced the prototype of Homura these guidelines. Homura is a six-wheeled vehicle with a vertically symmetric shape. Its size is 750 length x 430 width x height 310 height mm, its weight is about 12 kg. The power source is two-cell lithium polymer battery (7.4 V, about 250 Wh capacity). Some sensors such as camera, GPS, CO2 gas sensors are installed in the vehicle. Homura communicates with the base station by digital radio communication, and receives and send commands from base stations and data in real time. An installed small computer control all telecommunication, movement, and sensors. Production cost of vehicle is about 200,000 JPY, which is much lower than the robots developed in the previous projects.

Means of stable radio communication are needed for practical missions in volcanic field. Homura can use wireless transceiver modules that directly communicate with another module and Docomo FOMA modem using mobile phone network. The former wireless transceiver modules can be used in any volcanic field but distance between Homura and the base must be less than 1 km. The latter FOMA communication needs cell phone network. If the network is available, we can control Homura in any place.

We carried out a test campaign of Homura around Mihara-yama volcano, Izu-Ohshima in November, 2013 to examine remote control with FOMA communication. The base station was placed at Ohshima Spa Hotel which is about 2 km distant from the summit crater. Homura started Ohshima Spa Hotel. We controlled Homura only with information from sensors such as camera, GPS, and gyro. Homura moved on the mountain trail and reached the summit. Then, it climbed down on scoria slope without trail. This campaign result indicate that we can control Homura with remote control in volcanic fields. On the other hand, the radio communication with FOMA was not stable enough in Izu-Ohshima. At four areas where lava walls were barriers between Homura and a relay antenna of FOMA, the communication became unstable or disconnected. This indicates that we cannot move Homura to the summit only by remote control in Mihara-yama. When a UGV robot carries out missions in the volcanic field, we must obtain means of stable telecommunication before the missions. There are some cases where temporal stations of relay antenna are needed to use cell phone network.

Keywords: robot, Remote control, Telecommunication by cell phone, Izu-ohsima

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SVC52-P03 Room:Poster Time:April 28 18:15-19:30

Particle fallout from an eruption column (2) - evaluation of reproducibility

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One of the major sources of error in tephra fall simulation is considered to be the source term, which depicts amount of particle release as a function of height in eruption column. The source term has been assumed to be linear or modeled using relationship between particle size and plume velocity (Suzuki function); however, no direct observation of the source term has been reported. The author has tried to obtain source term of the 1986 Izu-Oshima B eruption based on inversion technique using a tephra simulation code named Tephra2. Here the reproducibility of the inversion is evaluated.

In this study, two methods are applied to evaluate reproducibility. One is validation using a dummy source term. In this method, a dummy source term is given and tephra loads on each observation point is calculated using Tephra2. Based on the calculated loads, the source term is inversely calculated and compared with the originally given source term.

The other method is jackknifing. In this method, source terms are calculated using dataset in which a single observation is deleted one by one. The calculated source term is called as pseudo-value and the estimated source term is defined as an average of the pseudo-values. The error of the source term is also defined as a standard deviation of the pseudo-values.

In the 1986 Izu-Oshima B eruption, range of reproducible height changes as a function of grain size; 0-7 km for -3 phi particles and 0-4 km for 0 phi particles. The errors of obtained source parameter was limited; less than 10 % in the most cases.

Keywords: Pyroclastic fall, Tephra2, simulation

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Detection of thermal anomaly associated with volcanic activity from MODIS data

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There are a lot of volcanoes in the world.And then, it is difficult to monitor all volcanoes because of costs.But we can monitor efficiently a lot of volcanoes using satellite remote sensing, because a volcanic activity will cause the increase in surface temperature and satellite (whose sensor can observe the surface temperature) remote sensing can cover a large area on surface.Therefore, various approaches have been suggested to monitor volcanic activities using remote-sensing satellite data.

Removing cloud pixel is essential to monitor volcanic activities using remote-sensing satellite data. Therefore, the purpose of this study is to remove cloud accurately and to develop an adequate algorithm continuously to detect thermal anomalies related to volcanic activities (especially lava activity which causes serious damages involve human lives) using MODIS (Moderate Resolution Imaging Spectroradiometer) infrared sensor onboard Aqua satellite.

We investigate spatial-time changes in thermal infrared in the statistical way. In order to detect only hotospots related to lava activities without faints, the developed algorithm investigates the difference temperature behavior between a target point and reference points, and we get spatial difference of brightness temperature (S). The presence of cloud causes large value of S that doesn't related to volcanic activities (Noguchi 2011). Therefore, removing cloud is essential in the proposed algorithm. To remove cloud, we use some BTD(Brightness Temperature Difference) which is sensitive to cloud. And we verified the technique of cloud removal as compared with Lidar data.

Keywords: MODIS, Lidar, Volcanic activity, Shinmoe-dake, lava activity