Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SVC49-P01 Room:Convention Hall Time:May 19 18:15-19:30

The Development of a Web-based Volcano Hazard Map by Integrating into the Disaster Medicine Information-Sharing System

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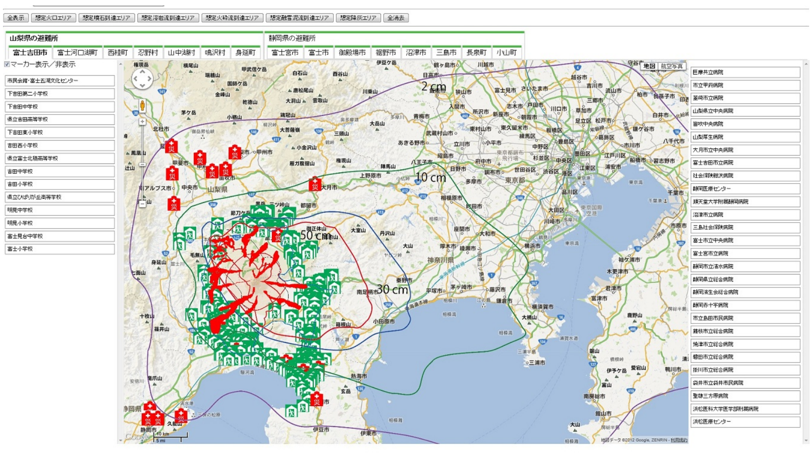
On the basis of the lessons learned from the Tohoku Earthquake and Tsunami Disaster occurred on 11th March, 2011, National Institute of Public Health are now developing a cloud-based information-sharing system to facilitate medical support teams to effectively and efficiently distribute a limited number of staff and resources during large-scale disasters. The mapping of relevant facilities, such as evacuation shelters and hospitals, is the key function of the information-sharing system because the understanding of geographical relationships is the first step to visit and work in an unfamiliar area during disasters. The system is also able to display the hazardous areas such as inundated lands due to tsunami and the debris-covered areas due to landslides. That means we can apply the information-sharing system to volcanic eruptions to display the potentially hazardous areas, although most previous hazard maps for volcanic eruptions have been printed on paper. In my presentation, I will show an example of the application by using the hazard map of Mt. Fuji, which has been published by Mt. Fuji Volcanic Disaster Prevention Conference in 2002 (See Figure 1).

Keywords: Hazard Map, GIS, Volcanic Eruption, Mt. Fuji, Disaster Medicine, Public Health



Japan Geoscience Union Meeting 2013
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SVC49-P02 Room:Convention Hall Time:May 19 18:15-19:30

Proposal of practical use of unmanned observation robots in the next Izu-Oshima eruption

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In the case of a volcanic eruption, in order to carry out evacuation guidance, it is important to observe the changing situation from just after the eruption to the completion of evacuation. In the 1986 eruption of Izu-Oshima, the explosive eruptions occurred at the unexpected points such as caldera floor and outside of a caldera. Therefore, volcanologists could not approach the vents and the opportunity of observation to gain the precious data for scientific understanding of the eruption phenomenon or disaster mitigation was lost. Moreover, during the evacuation from the island, the situation of the eruption had not been announced correctly to residents, and the mistaken information that the lava flow cut off the traffic between Okada-Motomachi was spread. Today, 20 years or more pass since a previous eruption in Izu-Oshima, and it has become the time to prepare the next eruption. In order to improve the situation at the time of the next eruption, development of the new observation robot which can respond immediately to an eruption and the establishment of an operation framework are required. From such a viewpoint, the author started Izu-Oshima Unmanned Observation Robot Symposium in 2009. This symposium is intended to bring together experts developing unmanned observation robots from different study fields such as volcanology, space engineering, and disaster relief to Izu-Oshima and to provide them the opportunity of field tests and exchange of knowledge to make them accelerate the development of the robots and the establishment of the operation framework. For these four years, many participants gathered to perform field test and to have an active information exchange. 8 UGV and 2 UAV from 9 research groups (2009), 5 UGV and 2 UAV from 5 groups (2010), 13 UGV and 3 UAV from 9 groups (2011), and 13 UGV and 6 UAV from 10 groups (2012) participated in the symposium. It can be said that the symposium grew up to be the biggest one as a field-test meeting for the volcano observation robot. At the presentation, the results so far and a future view will be shown. For further detail of the symposium in the current fiscal year please refer to the following URL (http://oshimarobot.web.fc2.com/index.html).

Keywords: Izu-Oshima, unmanned observation robot, robot, volcano

SVC49-P03 Room:Convention Hall Time:May 19 18:15-19:30

geopark & volcanic activity

Kazuyuki Nakagawa[1*]

[1] JijIPress

The geopark started in 2008 in Japan.
5 societies take part in the planning. The Volcanological Society of Japan, The Geological Society of Japan, The The Japan Association for Quaternary Research, the Association of Japanese Geographers, Seismological Society of Japan.
Earth science knowledge has told that it is indispensable to a geopark.
In 2012,25 geoparks is located in Japan.
There is an active volcano in the geopark of 11.
There are also seven geoparks which can enjoy the scene related to volcanic activity.
The sightseeing and the volcano disaster prevention which have sometimes so far been opposed to each other work together at Geoparks.
In the eruption of the Kirishima volcano in 2011, receive coverage from the sightseeing persons concerned. ”Mt. Shimmoe is a valid volcano.
It was chosen as the geopark and it was said that erupting because the volcano is made sale was natural.”
The measure for volcano disaster prevention in each geopark is surveyed.

Keywords: geopark, volcano, disaster, geotour

SVC49-P04 Room:Convention Hall Time:May 19 18:15-19:30

The Eruption Scenario of Bandai Volcano by the topographic Analysis

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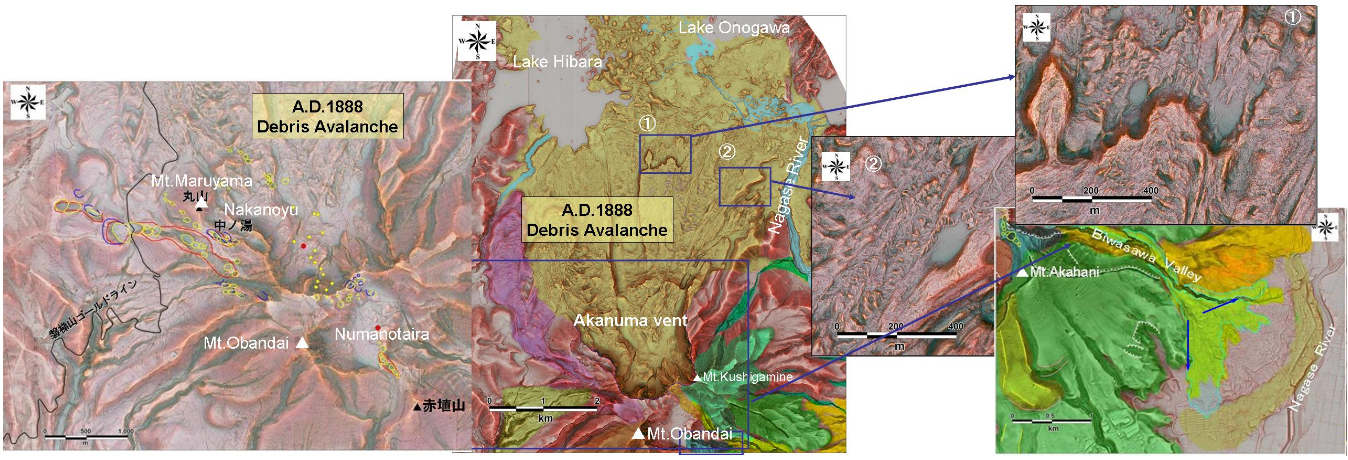
[1]Asia Air Survey Co., Ltd.

Making a Red Relief Image Map based on terrain analysis using LiDAR data of Mt.Bandai Volcano. I checked local records, etc. Based on the report and recent topographic analysis after the eruption of Mt.Bandai A.D.1888 eruption, I have confirmed traces of volcanic topography and sediment movement caused by the eruption which had not been previously known.

In addition to soil movement due to the collapse of the mountain forming a natural dam in the foothills north, at Mount Bandai after the A.D.1888 eruption, the sediment transport and repeating pyroclastic surge toward the swamp biwa southeastern foot, mudflow type eruption crater occurred important information such as the review is considered to have been, a scenario that forms the basis of measure eruption volcanic eruption was obtained.

Keywords: LiDAR, Erution Scenario, Volcanic Disaster, Terrain analysis, Red Relief Image Map, Lahar



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SVC49-P05 Room:Convention Hall Time:May 19 18:15-19:30

Eruption Scenarios and Volcanic Risk Mitigation Strategies of Hokkaido Komagatake Volcano, Northern Japan

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During the 350 years, four major eruptions of Hokkaido-Komagatake volcano occurred in 1640 1694, 1856 and 1929. The 1929 eruption was one of the largest magmatic eruptions in Japan in the last 100 years. The disaster management for volcanic disaster of the volcano has carried out since 1980, although volcanic activities have been inactive since 1942. Because no major precursor activity was recognized prior to 1929 plinian eruption, so for the suspected future eruption, it is necessary to cooperate with wide area for quickly and smoothly evacuation. Komagatake Volcanic Disaster Prevention Council organized by five local governments in 1980 has prepared disaster management plans on the assumption that a future eruption is similar scale of the 1929 eruption, and produced hazards map for the volcanic disaster which is the first map for a volcanic disaster in Japan. The Plan was revised entirely in 2004 based on the experiences incurred at the time of the 2000 Usu eruption and the 1998-2000 Komagatake eruptions.

In this presentation, I show the volcanic risk mitigation strategies of Hokkaido-Komagatake volcano, and examine the eruption scenarios based on the revised eruption history of the volcano.

Keywords: Hokkaido-Komagatake Volcano, Eruption Scenarios, Volcanic Risk Mitigation

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Integration of stochastic models for long-term eruption forecasting into a Bayesian event tree scheme

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Eruption forecasting refers, in general, to the assessment of the occurrence probability of a given eruptive event, whereas volcanic hazards are normally associated with the analysis of superficial and evident phenomena that usually accompany eruptions (e.g., lava, pyroclastic flows, tephra fall, lahars, etc.). Nevertheless, several hazards of volcanic origin may occur in noneruptive phases during unrest episodes. Among others, remarkable examples are gas emissions, phreatic explosions, ground deformation, and seismic swarms. Many of such events may lead to significant damages, and for this reason, the risk associated to unrest episodes could not be negligible with respect to eruption-related phenomena. Our main objective in this paper is to provide a quantitative framework to calculate probabilities of volcanic unrest. The mathematical framework proposed is based on the integration of stochastic models based on the analysis of eruption occurrence catalogs into a Bayesian event tree scheme for eruption forecasting and volcanic hazard assessment. Indeed, such models are based on long-term eruption catalogs and in many cases allow a more consistent analysis of long-term temporal modulations of volcanic activity. The main result of this approach is twofold: first, it allows to make inferences about the probability of volcanic unrest; second, it allows to project the results of stochastic modeling of the eruptive history of a volcano toward the probabilistic assessment of volcanic hazards. To illustrate the performance of the proposed approach, we apply it to determine probabilities of unrest at Miyakejima volcano, Japan.

Keywords: Volcanic unrest, Eruption forecasting, Bayesian event tree, Stochastic models, Miyakejima volcano

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Terrain analysis of an active volcano using oblique photogrammetry

Hisashi Sasaki[1*], Kenichi Arai[1], Shigenori Fujimaki[1], Yumiko Yamaguchi[1], Manabu Maya[1]

[1]Asia Air Survey Co., Ltd.

Volcanic eruptions often cause topographic changes, such as the destruction of an edifice due to an explosive eruption. For volcanic hazard mitigation, it is important to quickly measure these topographic changes. When a volcano erupts explosively, an airplane cannot fly directly over a crater to carry out aerial photography and LiDAR measurements. In order to obtain information regarding topographic changes, we can take many oblique aerial photos from an airplane and a helicopter, but it is difficult to obtain spatial information such as the spread area of pyroclastic flow deposits from oblique aerial photos. Therefore, we have developed a new system for real-time monitoring of volcanic activity. Our system can generate a three-dimensional model from many oblique photos. The three-dimensional models are generated by an image correlation method. From this data, we can estimate the volume of ejecta and analyze topographic changes. We analyzed a lava dome from the 2011 eruption of Shinmoedake volcano, Kirishima volcanic group, Japan. We measured the elevation of the summit of the lava dome and the distance of the lava spread area, and estimated lava thickness from cross sections generated from the three-dimensional data. Our measurements were consistent with results of airborne synthetic aperture radar (SAR) and photographic surveying using oblique aerial photographs. The accuracy of this system is sufficient for effective volcano monitoring. This system can be used to conduct a time series analysis of the formation and movement of craters or growth of lava dome.

Keywords: oblique photogrammetry, active volcano, terrain analysis, modelization, disaster prevention, disaster investigation

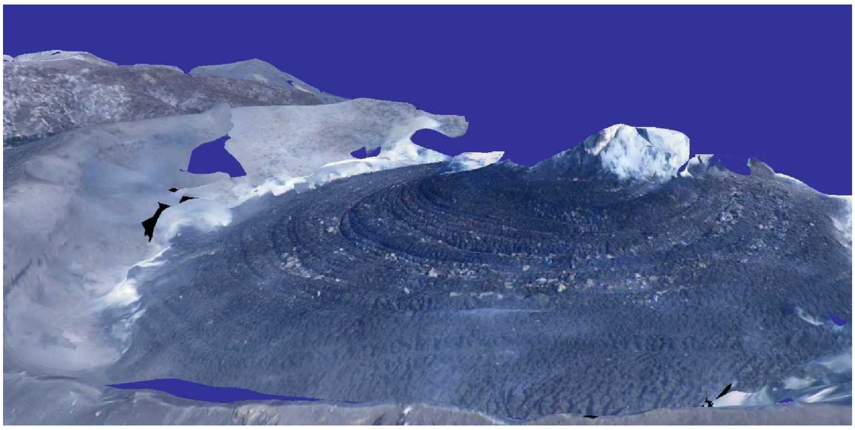

Fig.1 Three-dimensional model generated from oblique aerial photo

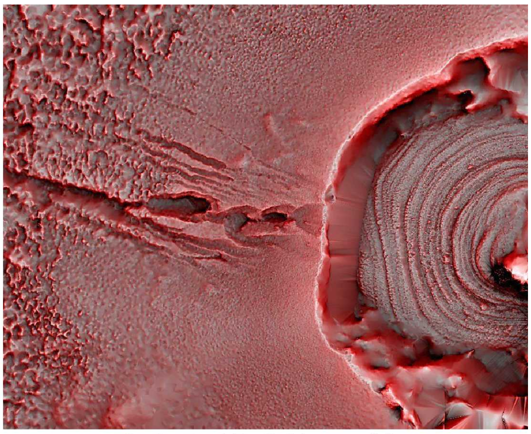

Fig.2 Red Relief Image Map

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Quantitative estimation of topographical change caused by 1986 eruption at Izu-Oshima

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The 1986 eruption at Izu-Oshima produced three types of lava flow (LA, LB, and LC) from different craters. In order to test the algorism for a numerical simulation of lava flow in the near future, we made a digital elevation model (DEM) of Izu-oshima before eruption and measure the topographical change by subtracting a DEM before eruption from that after eruption. The post-eruption DEM has already been published as "Digital Map 10m Grid (Elevation of active Volcanos) " by The Geospatial Information Authority of Japan (GSI). On the other hand, there is no published pre-eruption DEM. We digitized a topographical map (paper map) published in 1981. We made a digitizing assist software with Processing language and digitize the shape of contour lines of the topographical map. Then the data was resampled into 1 m mesh DEM with kriging method by a mesh resampling software that we made with IDL language. Kriging is a group of geostatistical techniques to interpolate the value of a random field, based on a stochastic model of the spatial dependence quantified by the variogram. To estimate an amount of shift between the pre-eruption DEM and the post-eruption DEM, we searched for shift-parameters for the match by shifting the area of post-eruption DEM at eastern caldera, which is not topographically affected by eruption, ranging +-50 m horizontally with 1 m intervals and +-30 m vertically with 0.1 m intervals and checked the difference between the pre- and post- eruption DEMs at the area. When we shifted the post-eruption DEM 29 m to the South, 31 m to the West, and 0.8 m downward, the average of absolute difference of elevations took minimum value 2.09 m. Because the value does not match the amount of shift by plate sliding, it requires consideration. Using the matched DEMs and a boundary shape of Lava A interpreted by Google Map's satellite image we estimated the volume of Lava A by multiplying grid area (10 m x 10 m) and the difference of elevation between the DEMs and obtained the value 6.6 x 10^5 m^3. The estimated volume is a little larger than the value (5.5 x 10^5 m^3) estimated by Nagaoka (1988) and that (2.3 x 10^5 m^3) by Endo et al. (1988). We estimated also the amount of deposition by Lava B and a scoria cone and obtained the value 38 m maximum. We found a new landslide at Kengamine and confirmed it by Google Map's satellite image interpretation.

Keywords: lava flow, topographical change, DEM

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Particle fallout from a eruption column - an analysis using Tephra2

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Tephra fall simulations sometimes give significantly inconsistent results from observed data. One of the sources of the error is the source model, which depicts the amount of particle released from a certain height of an eruption column. In this study, we modeled particle source of the 1986 Izu-Oshima eruption based on tephra fall simulation and observed data.

We calculated mass contribution (c_{ij}) of a certain height interval in the eruption column (i) to a certain observation point (j) using a tephra fall simulation code Tephra2. When the amount of released particle is r_i, amount deposit at a site j (S_j) equals to Sigmacijri. In this study we set evaluation function, which is the representative degree of fitness between calculated (S_{cj}) and observed (S_{oj}) S_j as E = log(S_j/S_{oj}). Then we obtained a set of r_i that shows minimum E using grid search.

Our result shows that most significant particle discharge takes place at 2 to 3 km high and up to 90% of released particle from the vent is lost from the column at this height. The particle of -2 and -3 phi also released from 6 to 7 km high and approximately 20% of released particle from the vent is lost from the column at this height. For the particles smaller than -2 phi, particle release more than several km in height is not known because these went beyond the island's shore and fell to the sea. For particles larger than -3 phi, particle release from several km high is not significant.

From the previous studies, height of the 1986 Izu-Oshima eruption column is considered to be 13km in maximum and 10km in most of the time. Thus the particle release from 6 to 7 km high implied in this study could be interpreted as particle from the umbrella cloud. On the other hand, the particle release from 2 to 3 km high may take place plume bending due to the high wind at the altitude.

Keywords: eruption column, volcanic ash, Izu-Oshima, tephra fall, simulation, Tephra2