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


SVC49-01 Room:201A Time:May 19 09:00-09:15

# Overview of interpretation microtopography of volcano

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For disaster prevention and mitigation of disasters caused by the volcanic eruption is an effective measure to clarify the characteristics of the volcanic activity in the past, to know in advance the range of high-risk and hazard maps. To do this, grasp of past performance is a challenge for each volcano. Sediments that make up the surface of the volcano What kind of thing is, somewhere, how far has reached the position of the crater, the volume it is important to know how much. However, the eruption interval is covered with trees for longer, even in aerial photographs and field survey, it was difficult to grasp has been often.

Detailed data of the terrain recent advances in airbone LiDAR, and to eliminate the influence of the trees have been able to obtain. In addition, the use of three-dimensional map of red as a method to represent data microtopography of LiDAR-DEM, the use of field survey and interpretation microtopography progresses, the discovery of volcanic activity and vent, previously unknown.

With interpretation and field survey shows an example of a red relief image map using laser 1mDEM . We want to show a manual of interpretation microtopography with red relief image map.

Keywords: microtopography, LiDAR, RRIM, lava flow, pyroclastic flow, hazard

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# Recapitulation on the development of an unmanned ground vehicle ”Mobile Observatory of Volcanic Explosion (MOVE)”

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To observe volcanic explosions safely from near we developed an unmanned ground vehicle ”Mobile Observatory of Volcanic Explosion (MOVE)”, as one of a main project in Grants-in-Aid for Scientific Research ”Dynamics of Volcanic Explosion” conducted from 2002 for 5 years. Since then we repeated its trial and improvement to make ready for coming eruptions, but without an opportunity for it, ten-year durable period passes. The installed equipment is out of date now and some of their repair parts are out of stock. We consider it is unrealistic to maintain MOVE anymore. Here we recapitulate the MOVE project to terminate it.

We planned to remodel an existing remote-controlled vehicle, and selected power shovel MPX10 by Hitachi Construction Machinery Co., Ltd. designed to work at dangerous disaster site under operator’s eyes within 100m distant. We initially installed four cameras and enhanced wireless controlling system to operate MOVE from 2 km distant. The operator runs MOVE based on transmitted camera images. The position of MOVE is displayed on the map at the operation base using transmitted GPS data. To enhance the controllability two cameras for monitoring tiltmeter and viewing back, respectively, are added later.

To catch wide amplitude and frequency range pressure waves, four pressure sensors with different properties were installed; piezo-electric pressure transducer, gauge-type pressure sensor, low frequency condenser microphone and a differential pressure sensor. A quick-response thermocouple was also installed to measure the temperature of volcanic blast and surge. Acquired signals are stocked into the installed multimedia acquisition system and simultaneously displayed at the operation base graphically. The stocked digital data can be sent to the observation base on demand.

A heat insulation box was mounted to contain remote-controlling and observation equipment and their power supplying batteries. A grapple was substituted into bucket on end of the arm to remove obstacles, install an observation system on the ground and collect rock samples.

We also developed operation base car equipped with operation system and telescopic antenna pole. It shortened the setting up and closing time greatly, made operation possible even under bad weather and extended flexibility to select operation base location.

During the past ten years we maneuvered only four times on volcanoes, two times each at Aso volcano and at Izu Oshima. In addition to the cost problem, there seemed no other appropriate test field to apply MOVE. Through the maneuvers we recognized that it is much difficult to run MOVE on volcanoes than expected. Especially disconnection of image transmission radio by topographic interruption is serious. Even on Aso volcano we could not complete to run MOVE to crater rim. On Izu Oshima, to the contrary, we avoided radio disconnection by moving the operation base car to new position where there was no topographic interruption against MOVE and succeeded in running it to crater rim. We confirmed over 2.3km remote controlling is possible if there is no topographic interruption to hinder radio transmission.

It is hard to say we achieved our aims satisfactory without bringing MOVE into observation. But we clarified hurdles such as restriction by radio law and necessity of operating organization, in addition to technological difficulties. We are also sure we have blazed a trail for future unmanned exploration. In fact some unmanned vehicles, such as SKY-1 and Homura, have been developed later for volcanic observation, and ”Observation Robot Symposium and Field Experiment in Izu-Oshima Volcano” is annually held since 2009. We hope unmanned observation will be practical and the pioneering MOVE project will receive recognition in the future.

Acknowledgements: We are grateful to engineers of Hitachi Construction Machinery Co., Ltd. and IHI Aerospace Co., Ltd., who constructed MOVE, and all participants who supported our activities.

Keywords: volcanic explosion, unmanned observation, remote controlling

SVC49-03 Room:201A Time:May 19 09:30-09:45

# The G-EVER next-generation real-time volcanic hazard assessment system

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The Asia-Pacific Region Global Earthquake and Volcanic Eruption Risk Management (G-EVER) Consortium among the Asia-Pacific geohazard research institutes was established in 2012. There are currently 4 working groups that were proposed in the G-EVER Consortium. The next-generation volcano hazard assessment WG is planning to provide a useful system for volcanic eruption prediction, risk assessment, and evacuation schemes at various eruption stages. The assessment system is planned to be developed based on volcanic eruption scenario datasets, volcanic eruption database and numerical simulations. Defining volcanic eruption scenarios based on precursor phenomena leading up to major eruptions of active volcanoes is quite important for the prediction of future eruptions. A high quality volcanic eruption database, which contains compilations of eruption dates, volumes and styles is important for the next-generation volcano hazard assessment system. Formulating international standards on how to estimate the volume of volcanic products (eg. tephra and pyroclastic flow deposits) is needed in making high quality volcanic eruption database. Spatial distribution database of volcanic products (eg. tephra and debris avalanche distributions) that are encoded on Geographic Information System (GIS) is necessarily for more precise area and volume estimation and risk assessments. For example, tephra fall distribution database of major eruptions in the world with estimated total volume, column height and flux are important for the future tephra fall risk assessment during volcanic eruptions. The volcanic eruption database is developed based on past eruption results, which only represent a subset of future scenarios. Therefore, numerical simulations with controlled parameters are needed for more precise volcanic eruption predictions. The "best-fit" parameters of the past major large-scale eruptions in the world have to be estimated and the simulation results database should be made. Using these best-fit parameters is quite useful for emergency situation especially when similar-style eruptions happened before.

The use of the next-generation system should enable the visualization of past volcanic eruptions datasets such as distributions, eruption volumes and eruption rates, on maps and diagrams using timeline and GIS technology. Similar volcanic eruptions scenarios should be easily searchable from the eruption database. Using the volcano hazard assessment system, prediction of the time and area that would be affected by volcanic eruptions at any locations near the volcano would be possible, using numerical simulations. The system should estimate volcanic hazard risks by overlaying the distributions of volcanic deposits on major roads, houses and evacuation areas using a GIS enabled system. The next-generation real-time hazard assessment system would be implemented with user-friendly interface, making the risk assessment system easily usable and accessible online.

Keywords: next-generation, real-time, vocanic hazards, G-EVER, simulation, database

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# For the next generation volcanic Sabo planning

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More than 20 years passed after the master plan of Volcanic Sabo (disaster mitigation) was created. Constructions works, warning system installation and various disaster mitigation plan associated with the master plan were developed for more than 27 domestic volcanoes. These plans have been created with new technical development including the numerical simulations.

In this presentation, an overview of volcanic Sabo planning that has been developed, and suggested several problems to planning of it.

Keywords: volcanic Sabo plan, numerical simulation, New technology, GIS

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# Numerical study on time-series of ash concentration in the atmospheric boundary layer during the eruptions at Mt. Shinmo

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An estimation of ash concentration in the planetary boundary layer (PBL), is of practical interest in discussion on volcanic ash impacts on critical infrastructure. For estimating ash concentration in the atmosphere, numerical simulations with an ash transport- and deposition-model have become a powerful tool (e.g. Folch 2012). However, the ash concentration in the PBL, where the ash transport processes strongly depend on meteorological conditions, has not fully discussed, while that for the atmosphere and the ground deposition have been actively examined.

In the present study, we consider a test case corresponding to the eruption at Mt, Shinmoe-dake on January 2011; the eruption column height is approximately 8000m and the total mass flow rate is about 5e9 kg during 2 hr.

We have used two models to represent the interaction between dispersion- and meteorological- processes: one is the CRIEPI weather forecasting and analysis system, NuWFAS, which consist of a numerical weather model, WRF, and some pre- and post-processing tools; the other is an ash transport- and deposition-model, Fall3D. The numerical weather-model parameters, such as the horizontal- and vertical-grid spacing and PBL scheme, are set to correctly predict advection and turbulence diffusion processes in the PBL, which are chosen through the sensitively test.

After verifying the capability of this setup through the comparison with the observations of isomap of ash deposition, we discuss the predicted ash concentration in the atmospheric surface layer in detail; the time-series of ash concentration near the ground, especially near the vent, depict complex wave forms and there values fluctuates; this is due to the change in the advection and turbulence diffusion processes of volcanic ash.

More details will be presented in the presentation, and we believe that our study must be helpful to comprehend essential characteristics of ash transport process in the PBL.

Keywords: Volcanic ass dispersion, Ash transport- and deposition-model, Numerical weather prediction, Advection, Turbulence diffusion