Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-01 Room:A05 Time:May 24 09:00-09:15

Estimation of the airborne ash density for Sakurajima using PUFF model

TANAKA, Hiroshi[1*] ; IGUCHI, Masato[2] ; YOSHITANI, Junichi[3]

[1]CCS University of Tsukuba, [2]DPRI Kyoto University, [3]DPRI Kyoto University

Airborne volcanic ash is a danger object for the aviation safety. Once the jet aircraft encounters the ash cloud and engine failure occurs, the damage is estimated to reach to a billion of US dollar. Hence the real-time monitoring and estimation of the airborne ash density is an important research subject. According to ICAO report, the ash density above 2 mg/m3 is a threshold for the danger zone of the aircraft. A system to predict the airborne ash density is desired to develop in urgent based on the real-time observation of the emission rate and plume height.

In this study, we conducted numerical simulations of volcanic ash dispersal from Sakurajima volcano using the real-time volcanic ash dispersion transport model PUFF for one year period in 1985 when volcanic activity was considerably high. According to the numerical simulation by the Lagrangian formulae of PUFF model for one year given the observed emission rate and plume height, the total particle number of the ash fallout was 1,962,976. On the other hand, the total amount of the observed ash fallout for one year period was 28,870,000 ton. The comparison shows an important measure of the particle mass, which is estimated as 14.7 ton/particle in the PUFF model. Based on this mass measure, we are now able to estimate the airborne ash density as a function of 3D space and time. The developed new system at Sakurajima volcano will now be applied to other volcanoes in Indonesia under the SATREPS project by JST and JICA.

Keywords: Volcanic ash prediction, Emission rate of volcanic ash, Aviation safety, Sakurajima Volcano, PUFF model, SATREPS

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-02 Room:A05 Time:May 24 09:15-09:30

Three-Dimensional Radar Data Analysis Tools of Volcanic Ash Clouds

MAKI, Masayuki[1*] ; HIRANO, Kohin[2] ; SUZUKI, Ikuko[3]

[1]Research and Education Center for Natural Hazards, Kagoshima University, [2]National Research Institute for Science and Disaster Prevention, [3]Unaffiliated

Weather radar data analysis tools have been developed to investigate the internal structures of volcanic ash clouds. The analysis tools calculate statistical parameters, three-dimensional distributions of polarimetric radar parameters that can be used to retrieve the inner structures of ash columns and ash clouds, echo top heights, ash amounts, and the ascent or descent speeds of pyroclastic material. The analysis tools were applied to 31 explosive eruptions of the Sakurajima volcano that occurred in 2013, which eruptions were selected with the condition that their ash column heights were greater than 3000m from the crater. The radar data were collected by operational X-band polarimetric radar, which was located approximately 10 km south-southeast of the volcano. Analysis of the temporal change of the histogram of the radar parameters in the ash clouds shows interesting results; while both reflectivity and differential reflectivity had no peak just after the eruption, they began to exhibit a normal distribution with time. While the reflectivity peak value decreases, depending on time, the differential reflectivity peak value increases. This is probably due to the size sorting mechanism and the uniformity of the shape of the falling ash particles. The specific differential phase was less than 1 deg/km. Doppler velocity measured above the crater can be used to estimate the speed of the pyroclastic materials, which determines the scale of eruption and ash column height.

Keywords: Weather radar, volcanic ash column, volcanic ash clouds, volcanic ash smokes, statistic, size sorting

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-03 Room:A05 Time:May 24 09:30-09:45

Particle segregation from bent-over plume detected by reconstruction of eruption plume

MANNEN, Kazutaka[1*] ; HASENAKA, Toshiaki[2] ; MIYABUCHI, Yasuo[3] ; KIYOSUGI, Koji[4] ; HIGUCHI, Atsushi[5]

[1]Hot Springs Research Institute of Kanagawa Prefecture, [2]Faculty of Science, Kumamoto University, [3]Faculty of Education, Kumamoto University, [4]Earthquake Research Institute, The University of Tokyo, [5]Center for Environmental Remote Sensing, Chiba University

Recently, calculation of tephra fall distribution is utilized in forecasting and hazard analysis. On the other hand, such calculation often fails to reconstruct observation.

Such discrepancy could be caused by lack of modeling during transportation (i.e. particle aggregation); however over simplification of the particle source is also attributed to the defect. In fact, recent reconstruction of particle source based on Tephra2 analysis showed that there is a large heterogeneity of particle segregation as a function of column height (particle segregation along the column; PSC: Mannen, 2014; JVGR 284, 61-78). In addition to that, vertical source that is assumed in many tephra fall calculation including Tephra2 could be the source of the large error.

We conducted sampling and sieving for tephra fall deposit of the 2011 eruption of Shinmoe-dake and prepared a dataset of mass loading per unit area for several particle size classes of 1 phi interval. Using this dataset and a mesoscale analysis of Japan Meteorological Agency, we reconstructed PSC based on method of Mannen (2014).

The reconstructed source shows that most of the particles are segregated from the source less than 5 km high. This result is consistent to the column height that is analyzed from satellite images and trajectory models.

However, tephra deposit observed more than 20 km from the source vent was not reconstructed by Tephra2 calculation based on the optimum PSC and wind data. Distribution axis of such deposit is parallel to the wind direction of approximately 4 km high. Thus bent-over plume that drifted approximately 4 km high is implied as a significant source of the tephra deposit. We consider introduction of bent-over plume to the source model is key to improve tephra fall calculation.

Keywords: tephra, Tephra2, Kirishima volcano, Shinmoedake, ash fall forecast

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-04 Room:A05 Time:May 24 09:45-10:00

Vulnerabilities in thermal power systems: dust-loading tests for air filters with volcanic ash

YAMAMOTO, Takahiro[1*] ; OKUYAMA, Kazuhiro[2] ; FURUKAWA, Ryuta[1]

[1]Geological Survey of Japan, AIST, [2]Shinwa Corporation

We experimented with air filters to evaluate ash-fall impact on thermal power systems. Because, the electricity in Japan highly depends on thermal power plants after the Fukushima nuclear accident. The most of the thermal power plants use gas turbines, which can easily be damaged by inhalation of ash as in the case of jet engines of aircrafts. Although there is an air filter system in the thermal power plants, it may be clogged up by ash and partially or totally blocking the air flows into the gas turbines. We carried out the dust-loading test for pre-filter, middle-effective filter and combined filters with various spatial density of 3-phi-diametr volcanic ash in 70, 700, 7000 mg/m^3 under inhalation flux in 56 m^3/min. The middle-effective and combined filters were clogged up from 1 hour 30 minutes to 1 minute 40 seconds and from 3 hours to 3 minutes 30 seconds, respectively. Although the pre-filter took much longer times for clogging, half of the ash passed the pre-filter.

Keywords: volcanic ash, air filters, dust loading test, thermal power system

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-05 Room:A05 Time:May 24 10:00-10:15

A review of volcanic phenomena caused by phreatic eruption in Japan

SASAKI, Hisashi[1*] ; NARUKE, Shino[1] ; KISHIMOTO, Hiroshi[1] ; ARAI, Kenichi[1]

[1]Asia Air Survey Co., Ltd.

We reviewed volcanic phenomena caused by phreatic eruption. Pyroclastic flow by phreatic eruption occurred in Tarumaesan 1978 eruption, Asozan 1979 eruption, Miyakejima 2000 eruption and Ontakesan 2014 eruption. Mud flow by phreatic eruption occurred in Yakedake 1915 eruption, Niigatayakeyama 1974 eruption, Meakandake 2006 eruption and Ontakesan 2014 eruption. Only 40% of maps of the phreatic eruption are made with the volcano hazard map in Japan. Ballistic projectiles, ash falls and debris flows are often displayed to a hazard map. It is a problem that a hazard map has few mentions of pyroclastic flow and the mud flow. We think that the revision such as volcano hazard map and disaster prevention plans is necessary.

Keywords: phreatic eruption, ballistic projectiles, pyroclastic flow, mud flow, hazard map

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-06 Room:A05 Time:May 24 10:15-10:30

Evaluation of volcanic disaster risk: the cooperation between lava flow simulator and building database

FUJITA, Eisuke[1*] ; KANASUGI, Hiroshi[2] ; SHIBASKI, Ryosuke[2]

[1]NIED, [2]CSIS, University of Tokyo

Volcanic disaster is caused by the various volcanic phenomena, affecting some damages around neighbors. For the evaluation of volcanic disaster, the eruption event tree

(Newhall and Hoblitt, 2002) is widely applied and we judge the forthcoming phenomena from several possibilities at the event tree nodes. Each node of the event tree is defined as: node 1: unrest, 2: origin, 3: outcome, 4: magnitude, 5: phenomena, 6: sectors, 7: distance, 8: exposure and 9: vulnerability. For nodes 1 ? 7, the evaluation is based on volcanology, but for nodes 8 and 9, social factors are incorporated For the area in risk of the volcanic disasters, we made a time- and space dependent model of population, real estates, transportation infrastructures, and production bases, and evaluate its temporal evolution. Our volcanic disaster risk management system applied the RDBMS (Relational DataBase Management System). LavaSIM, lava flow simulator is used for volcanic hazard evaluation. In addition, for the evaluation of exposures and vulnerabilities, we used the data developed by CSIS, the University of Tokyo. The new system enables quick evaluation of volcanic disaster by comparing lava flow and building data by use of the comparison in RDBMS, and expresses the results in GIS. In near future, people flow data is also incorporated into system as the data of exposures and vulnerabilities.

Keywords: volcanic disaster, risk evaluation, lava flow simulation, building database, exposure, vulnerability

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-07 Room:A05 Time:May 24 10:30-10:45

Unmanned observation robot demonstration test in preparation for the Izu Oshima eruption

SAIKI, Kazuto[1*] ; ICHIHARA, Mie[2]

[1]Graduate School of Science, Osaka University, [2]Earthquake Research Institute, University of Tokyo

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. In the 2013 fiscal year, Izu-Oshima was hit by the 27th typhoon of the year just before the symposium. While an open lecture meeting was canceled, 5 UGV and 1 UAV from 6 groups performed field tests. In the 2014 fiscal year, 6 UGV and 1 UAV from 5 groups performed field tests. Because some robots have already been reached practical range, we will present the ability of the robots and the results of our activity so far and excavate a new observation requests.

For further detail of the symposium in the current fiscal year please refer to the following URL (http://www.volcano-robot.org/index.html).
Since 2013, our activity has been supported by an accommodation of the research funds from the specific joint research B of Earthquake Research Institute of the University of Tokyo.

Keywords: Izu Oshima, unmanned observation robot, UAV, UGV

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-08 Room:A05 Time:May 24 11:00-11:15

The characteristics of rockfall and accident on Mount Fuji

KOMORI, Jiro[1*]

[1]Teikyo Heisei University

Among the mass wasting on mountains, rockfall is general phenomena. These events in active volcanic area, including small slope failures are common, even if that is at quiet interval period. Nevertheless, in the case of Japan which disaster prevention measures around roads and settlements have been applied, rockfall phenomenon is recognized as affairs of other people. On the other hand, in the well developed country in terms of tourism and mountaineering business, actual risk of rockfall to the peoples will be high, if they enter to mountain areas without knowledge of landslide hazard.

In the Japanese mountain sightseeing route and trail, most accident-prone area by rockfall is Shirouma-daisekkei (Nagano Prefecture), then Mt. Fuji (Shizuoka and Yamanashi Prefecture). Besides, the most deadly accident occurred at Yoshida-osawa valley in Mt. Fuji in 1980. In spite of descending route was closed after the 1980 tragedy, fatal and injury rockfall accident almost every year. Furthermore, in the last seven years, more than 300,000 visitors passed through the 8th station (EL. 3500 m) of Mt. Fuji in every year. Hence, detail study for prior incidents of rockfall and possible danger area along the trail are required.

The past cases in rockfall accident were collected and studied based on newspaper, mountain journals and police reports. The following characteristics were revealed,

- major accidents have been occurring between the 8th station and the summit on all four mountain route (trail from Fujiyoshida/Subashiri, Fujinomiya and Gotenba)
- most of the accidents were recorded in the end of July to the middle of August
- temporal trend of occurrence time of the day is obscure
- human-induced rockfall is prone to occur from descending person or at descending route.
- the sources of regular rockfalls are cracky lava or weak agglutinated rock. A rock face with open crack near the summit of the Fujinomiya route seems to be ready to fall down. The location of present route should be shifted to elsewhere.

Keywords: mountaineering, mountain tourism, agglutinate, human-Induced rackfall, quiet interval, case study

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-09 Room:A05 Time:May 24 11:15-11:30

Development of G-EVER volcanic hazard assessment support system, and earthquake and volcanic hazard information system

TAKARADA, Shinji[1*] ; BANDIBAS, Joel[1] ; ISHIKAWA, Yuzo[1] ; NISHIOKA, Yoshiharu[1] ; NAGATSU, Juri[1] ; G-EVER, Promotion team[1]

[1]Geological Survey of Japan, AIST

The G-EVER volcanic assessment support system is developed based on eruption history, volcanic eruption database and numerical simulations (Takarada et al., 2014). The volcanic eruption database is developed based on past eruption results, which only represent a subset of possible future scenarios. Therefore, numerical simulations with controlled parameters are needed for more precise volcanic eruption predictions. The ”best-fit” parameters of the past worldwide major eruptions have to be estimated and the simulation results database should be made. Using the volcano hazard assessment system, the time and area that would be affected by volcanic eruptions at any locations near the volcano can be predicted using numerical simulations. The system could estimate volcanic hazard risks by overlaying the distributions of volcanic deposits on major roads, houses and evacuation areas using GIS enabled systems. The G-EVER hazard assessment support system is implemented with user-friendly interface, making the risk assessment system easy to use and accessible online. The volcanic hazard assessment support system using Energy Cone and Titan2D simulations is available online (http://volcano.g-ever1.org). The system can assess any volcano in the world using ASTER Global DEM (10m resolution DEM is used in Japan). Links to major volcanic databases, such as Smithsonian, VOGRIPA, ASTER Satellite images, and Volcanoes of Japan are available on each volcano information popup on the map. A new fast-processing version of energy cone simulation system using elevation tiles is available (g-ever1.org/quick). The updated Titan2D simulation system could be run using DEM data uploaded by the user and download more detailed simulation results. It also provides informative and user friendly interface.

The Asia-Pacific region earthquake and volcanic hazard mapping project aims to make an advanced online hazard information system (ccop-geoinfo.org/G-EVER) that provides past and recent earthquake and volcanic hazards information and links to global earthquake and volcanic eruption databases. It could also be used as earthquake and volcanic hazard risk assessment tool. The information system also shows tsunami inundation areas, active faults distributions and hazard maps. The online hazard information system provides useful information about earthquake and volcanic hazards in an interactive and user-friendly interface. This project will be implemented with the cooperation of major research institutes and organizations in the Asia-Pacific region such as the Center for Volcanology and Geological Hazard Mitigation (CVGHM) of Indonesia and Philippine Institute of Volcanology and Seismology (PHIVOLCS).

The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) and Geological Survey of Japan (GSJ) started the CCOP-GSJ Geoinformation Sharing Infrastructure for East and Southeast Asia (GSi) project. The project aims to compile various geoscientific information in CCOP countries and develop a Web-based database and Geographic Information System (Web-GIS) using Free and Open Source Software (FOSS) and Open Geospatial Consortium (OGC) based standards. The preliminary portal site of the project (ccop-geoinfo.org/GeoPortal) provides spatial data about geohazards, geology, geoenvironment, groundwater, mineral resources, remote sensing, geophysical and topography covering the countries in East and Southeast Asia. Development of spatial data model standard, data integration and sharing and capacity building are the major targets of this project.

Keywords: G-EVER, volcanic hazard mitigation, hazard assessment, simulation, Asia Pacific, International Standadization