

Actions to the Eastern Japan earthquake disaster by SSJ and to disaster and environmental issues in academic communities

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The Seismological Society of Japan (SSJ) has organized the Investigation Committee for disaster. The committee corrected preliminary research outputs and opened them as a link correction on the SSJ's web site at the 2011 eastern Japan great earthquake disaster.

One of the important tasks of the committee is the contact point for other related academic societies dealing with earthquake and tsunami. The SSJ participated in the Liaison Committee on the off the Pacific coast of Tohoku Earthquake established with the related societies, as well as in the Environmental Hazard Countermeasure Committee of the Japan Geoscience Union (JpGU). The Outreach Committee of SSJ performed enlightening actions for general public and mass media. The SSJ cooperated the action also by the Science Council of Japan.

What we learn from the 2011 eastern Japan great earthquake and tsunami disaster is global environmental issues and natural disaster are inseparable. Earth and planetary sciences should integrate such problems that we have considered completely different problems in the past. For this purpose, cooperative action among our community is a matter of course. In addition, cooperation with the community outside of us is indispensable to earth and planetary sciences, studies about basis of the prosperity of the human, contribute for building sustainable human society. The JpGU is expected to be a core for such cooperative actions. It is important to make careful preparations to be successful in the actions and cooperation between the societies during the emergence period. I propose a workshop such as " global environmental issues among natural disaster " for brainstorming.

Activities of the Geological Society of Japan in support of reconstruction after the 2011 Tohoku earthquake disaster

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I introduce the activities of the Geological Society of Japan (JGS) in support of the reconstruction after the 2011 Tohoku earthquake disaster on behalf of the Social Contribution Committee of the JGS. The JGS asked its members to submit proposals in support of the disaster recovery, and six of nine research programs in 2011 and one of two in 2012 were adopted and supported by funds of the Society. The seven projects can be categorized into three research categories: 1. recovery of specimens from museums destroyed by the tsunami, 2. development of methods of decontamination to help deal with the radioactive material spread by the Fukushima Daiichi nuclear power plant accident, and 3. surveys to recognize and quantify liquefaction caused by the Tohoku earthquake. The results of these studies were reported in poster presentations given at the JGS annual meetings and in newsletter articles published in 2012 and 2013. This report also introduces briefly the geopark activity that has been promoted by the JGS and its importance for local education in earth science including disaster prevention and mitigation in the eastern Tohoku coastal area (Sanriku area).

Keywords: Geological Society of Japan, 2011 Tohoku earthquake disaster, tsunami, liquefaction, decontamination of radioactive materials, recovery of museum specimens

Reframing the academic responsibility of JSAF on the basis of its activities after the 2011 Tohoku earthquake

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The Japanese Society for Active Fault Studies (JSAF) is devoted to the study of not only inland active faults but also offshore active faults including subduction zone mega-thrusts. The members of JSAF have been conducted emergently survey for every earthquake disasters related to active fault since the establishment of 2007. One of the important purposes of the survey is to identify and to describe any geological and geomorphological phenomena associated with earthquake and tsunami such as trace, geometry and displacement of surface rupture, coastal change and tsunami deposit. These modern analogues are key to reveal the past phenomena. And clarifying the past is key to estimate the future. This philosophy of paleoseismology and active fault study has been socially recognized in its importance for measuring low frequent great disaster after the 2011 great Tohoku earthquake (M9.0). However, as the lessons from the 2011 event and its triggered 2011 Fukushima Prefecture Hamadori earthquake (M7.0), we also recognized a limit of the current investigation technique of geological and geomorphological methods. The JSAF has an important role as a community for discussing new technique.

Keywords: Japanese Society for Active Fault Studies, 2011 great Tohoku Earthquake, 2011 Fukushima Prefecture Hamadori Earthquake, Active Fault Study, Paleoseismological Study

Activity of the AJG to the Great East Japan Earthquake Disaster: Role of academic societies at a big disaster

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The activity of the Association of Japanese Geographers (AJG) responding to the Great East Japan Earthquake Disaster was as follows:

1) "The Headquarters for Disaster Response," the general manager of which was the chairperson of the executive committee of AJG, was set up just after the disaster occurrence. It performed correspondence to a various inquiries, liaison and information exchange with other associations, communication to geographers in the fields, uploading quick reports and proposals to the web site, etc.

2) Based on a geographical property to make much of air-photo interpretation and mapping, AJG organized a working group for clarifying the entire surface of the tsunami inundation and published the first report on March 28 (revised eight times until December).

3) AJG gave the geography teaching materials to damaged schools by the members' contribution.

4) Until March, 2014, ten symposia relating to the Great East Japan Earthquake Disaster were held. The theme were of physical geography (tsunami, liquefaction, slope disaster, disaster of land developed for housing, radioactive contamination, etc.) and of human geography (life of damaged inhabitants, the revival way, etc).

On the occasion of a big disaster, societies of geosciences should do not only the academic activity but also take a social role as follows:

1) dispatching the research results in a easily understandable way quickly and broadly

2) Supporting people and governments based on specialized intellect.

3) Supporting to school education.

It is important for JpGU to have an open window for the society for disaster outbreak as well as to support the researchers who act in the field.

Cartographic society's contributions to crisis resolution of environmental issues and disasters

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¹Japan Cartographers Association

Maps are important for crisis management in environmental issues and disasters, however it is not clear if the current situations of providing and using maps for crisis management are appropriate or not. We try to clarify contributions and problems on map provisions and uses for crisis management from the viewpoint of cartographic society in our talk. Particularly, we focus on the following points.

- (1) prompt action and quality
- (2) appropriateness of map provisions to suffered communities depending on their situation
- (3) designing action plans of map provisions for levels of situations
- (4) paper maps and digital maps
- (5) appropriateness of current hazard maps
- (6) weak map literacy in decision making, communication, and media
- (7) international contributions
- (8) volunteered geographic information, location-based SNS, and ubiquitous mappings
- (9) use of spatio-temporal big data

Keywords: maps, disaster maps, aerial photographs, geospatial information, hazard maps, Volunteered Geographic Information

Disaster Response Support Activity based on Geospatial Information

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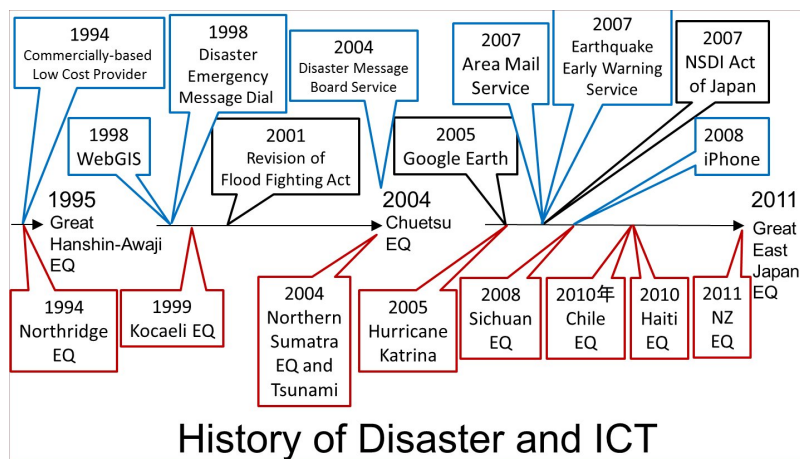
In this presentation, the history of major disasters and progress of information communication technology related to geospatial information after 1994.

In 1995 Great Hanshin-Awaji Earthquake, GIS and Remote Sensing got a lot of attention to manage disaster information.

In 2004 Chuetsu Earthquake, GSI and voluntary base research group tried to share damage and recovery process information through Web GIS.

After launch of Google Earth, ordinary person can share his/her geospatial information though internet. And in 2011 Great East Japan Earthquake, most layers of geospatial information were shared.

Keywords: Geospatial Information, GIS, Disaster Response Support Activity



Environmental pollution by the Fukushima Daiichi nuclear power plant accident and role of the atmospheric science

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There are several past and future issues to be discussed regarding the role of the atmospheric science in the accident of the Fukushima Daiichi nuclear power plant. SPEEDI model results were not effectively used in the evacuation plan by the government. It was found, on the other hand, that the performance of atmospheric chemistry transport models are comparable to or better than that of SPEEDI, for simulation of distribution of radioactive material over the wide area contaminated by the accident. In that situation, a bottom-up process were useful to gather results of simulation and in situ measurements by volunteer scientists to be utilized in the decision process of the government. The Science Council of Japan is now under discussion of establishing an emergency action manual for gathering data and knowledge by scientists to be shared by professionals to make useful outputs to government and public. As also indicated by the IPCC assessment process for climate change, it is important to present uncertainties included in the scientific knowledge to be released. In this regard, it is important for the atmospheric science to contribute to reducing the uncertainties through a further progress of the atmospheric dynamics, physics, and chemistry modeling system and through establishing more robust monitoring system of weather and other quantities. I like to discuss these issues for improving our ability to reduce damage caused by future disasters that may happen.

How JAHS will manage the Great East Japan Earthquake?

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JAHS (Japanese Association of Hydrological Sciences) is an academic society that treat hydrological cycle on the Earth. Water is one of the most important component that makes feature of earth's surface. Water also is indispensable resources for human's life and activity, so hydrological sciences involves the relationship between hydrological cycle and human activities. JAHS have deep concern to human dimensions of environmental changes. To realize "Hydrological Sciences in the society" becomes important subject to be accomplished after the great earth quick in March 11, 2011.

After the great disaster, we carried out the studies both on Tsunami and on nuclear disaster. At a lecture, we will focus on the nuclear disaster in Fukushima District, because we think our knowledge and experiences on hydrology will be useful to understand the actual situation and future perspectives of radioactive contamination, and also useful to propose measures to restore the region contaminated by radioactive fallout.

The research works on the behavior of radioactive nuclides in the environment are divided into mechanism study and distribution study. In the latter, the distribution map should be discussed with the scales, because often what looks important at one scale is less important at another.

The small scale dose rate maps published by the government was useful to determine the evacuation area at the initial stage of the nuclear disaster, however, large scale map is necessary at the restoration stage. In the mountain village, the life and livelihood are strongly dependent to water and material cycles in SATOYAMA watershed. We have to know the distribution of radioactive materials, water and material cycles in the watershed. The knowledge and experiences in hydrology have great effect to make measures to cope with radioactive materials based on the SATOYAMA watershed scale. We are now conducting hydrological research in the small watershed in one of evacuation area. The outcomes are shared with local people and make them the materials to discuss the future of the region.

At the Fukushima Dai-ichi nuclear power plant, control of polluted water flowing from nuclear reactor buildings becomes an urgent issue to be solved. The buildings are located on the independent plateau. At this situation, local groundwater flow system, recharged on the surface and discharge to surrounding lowland, is the main system of hydrologic cycle. Groundwater from Abukuma Mountains belongs regional groundwater system, and its flux should be very low and residence time should be extremely long. This is hydrological knowledge, however, why accumulated knowledge does not apply to the field in problem?

Science is in the society, and supported by the society. We, scientists, have to consider how to use scientific knowledge in the framework that have common purpose.

Keywords: Japanese Association of Hydrological Sciences, nuclear disaster, FUKUSHIMA, the roll of hydrological sciences, distribution map and its scale, groundwater flow system

Transfer of radionuclides to river by Fukushima Daiichi NPP

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A number of studies have been conducted to monitor and model the time series change of radiocesium transfer through aquatic systems after significant fallout, especially from the Chernobyl disaster. Our research team has been monitoring the environmental consequences of radioactive contamination just after the Fukushima Daiichi NPP accident in Yamakiya-district, Kawamata town, Fukushima prefecture. Research items are listed below.

1. Radiocesium wash-off from the runoff-erosion plot under different land use.
2. Measurement of radiocesium transfer in forest environment, in association with hydrological pathways such as throughfall and overlandflow on hillslope.
3. Monitoring on radiocesium concentration in soil water, ground water, and spring water.
4. Monitoring of dissolved and particulate radiocesium concentration in river water, and stream water from the forested catchment.
5. Measurement of radiocesium content in drain water and suspended sediment from paddy field.

Our monitoring result demonstrated that the Cs-137 concentration in eroded sediment from the runoff-erosion plot has been almost constant for the past 3 years, however the Cs-137 concentration of suspended sediment from the forested catchment showed slight decrease through time. On the other hand, the suspended sediment from paddy field and those in river water from large catchments exhibited rapid decrease in Cs-137 concentration with time. The decreasing trend of Cs-137 concentration were fitted by the two-component exponential model, differences in decreasing rate of the model were compared and discussed among various land uses and catchment scales. Such analysis can provide important insights into the future prediction of the radiocesium wash-off from catchments with different land uses.

Keywords: Cs-137, Fukushima Daiichi NPP, soil erosion, suspended sediment, river, flux

U08-10

Room:Main Hall

Time:May 2 11:30-11:45

Stock and Flow of Environmental radionuclides in Lake ecosystem

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Stock and Flow of Environmental radionuclides in Lake ecosystem

Keywords: Fukushima daiichi nuclear plant accident, environmental radioactivity, Lake ecosystem

Activities of JAGH relating to the earthquake disaster and disaster relief

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Followings are the activities of Japanese Association of Groundwater Hydrology (JAGH) relating to the 2011 off the Pacific coast of Tohoku Earthquake.

Program Committee (Chair: Makoto Nakashima) organized the symposium “ The way of groundwater use as the emergency water source at the time of the earthquake ” on May 26, 2012, at the Kashiwa Campus of the University of Tokyo. In the symposium, following presentations were given; “ Ensuring safety and security of the water supply system ” by Kenichi Yamamoto (Ministry of Land, Infrastructure, Transport and Tourism), “ The securing water in areas affected by the Great East Japan Earthquake Tsunami ” by Yoshiharu Ueno (Iwate prefecture), “ About the use of groundwater as a domestic water at the time of the disaster in Nagoya ” by Kazuhiro Takemoto (Nagoya City), “ Investigation of the effect of tsunami induced by the Great East Japan Earthquake on groundwater ” by Kei Nakagawa (Nagasaki University). Then, the panel discussion was coordinated by Makoto Taniguchi (Research Institute for Humanity and Nature). In this symposium, difference of water usage between emergency and non-emergency times, management method and registration system were discussed based on the presentations.

Editorial Committee (Chair: Tomochika Tokunaga) organized and published two special issues. In the special issue of “ The 2011 off the Pacific Coast of Tohoku Earthquake and groundwater ” (Vol.54, No.1, Feb, 2012), Technical Report of “ Change in groundwater environment caused by the 2011 off the Pacific Coast of Tohoku Earthquake in the southern part of Sendai Plain ” by Kazushi Mori et al. and Research-in-Progress of “ Impact of Tsunami caused by the 2011 off the Pacific coast of Tohoku Earthquake on groundwater usage and quality in Asahi-city, Chiba Prefecture Japan ” by Fumi Sugita are published. In the special issue of “ Earthquake Hazard and Groundwater ” (Vol.55, No.1, Feb, 2013), Review of “ Importance of groundwater as security ” by Makoto Taniguchi, Research-in-progress of “ Field study on the damages of a well due to the Great East Japan Earthquake ” by Kunio Ohtoshi et al., Data of “ Effect of Tsunami induced by the 2011 off the Pacific coast of Tohoku Earthquake on groundwater ” by Kei Nakagawa et al., Data of “ Treatment and effective utilization of debris and tsunami deposits generated by the Great East Japan Earthquake ” by Takeshi Katsumi et al., and Data of “ Symposium, The way of groundwater use as the emergency water source at the time of the earthquake ” by Makoto Taniguchi and Makoto Nakashima were published. All these papers have been published in the J-stage (<https://www.jstage.jst.go.jp/browse/jagh/-char/ja/>).

Prof. Ichiro Kaihotsu organized the joint investigation team of JAGH and JSHWR (Japan Society of Hydrology and Water Resources). They visited public water works offices and collected water samples at the wells of the city in Kamaishi city, Rikuzen Takata city, and Minami Sanriku town during June 16-19 and August 1-3, 2011. They also sampled water at the well for disaster in Wakaba-ku, Sendai City at that time. As a follow up of these investigations, the team of University of Tokyo and Nagasaki University sampled groundwater, river water and soil in Minami Sanriku town. In these investigations, we mainly focused on recovery from the salinization of groundwater due to tsunami induced by the earthquake.

Keywords: JAGH, The 2011 off the Pacific coast of Tohoku Earthquake, Symposium, Special issue, Joint investigation team, Salinization of groundwater

Oceanic dispersion model intercomparison for the Fukushima accident

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There are several attempts to simulate oceanic dispersion of radionuclides discharged into the ocean after the accident of Fukushima Daiichi Nuclear Power Plant on March 11, 2011. In order to understand a present status of model capability to simulate the dispersion of radionuclide and uncertainty in the model simulations, detailed comparisons of model results with observations and also among the model results are necessary. A model intercomparison project, launched by a working group established under the Oceanographic Society of Japan, and then under Japan Science Council, compared results from several downscaling dispersion models focusing on Cesium 137 dispersion for the Fukushima case. Eleven model results from ten groups are participating in the project. Although there are general similarities in basic flow fields and dispersion patterns, significant differences among the simulated results also exist, due to differences in model settings and uncertainty in the forcing fields. This presentation introduces the model intercomparison activity and discuss some preliminary results of the comparisons.

Keywords: Oceanic Dispersion Model, Radionuclides, Model Intercomparison

Development of Composite Materials with Zeolite and Magnetite for Radioactive Cs Decontamination in Soil

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1. Introduction

The decontamination of radioactive Cs from the accident at the Fukushima No.1 nuclear power plant is an urgent problem. Zeolites are the most promising material for the Cs decontamination in water such as ponds and rice fields. The movement of the Cs⁺ ions in the soil to the zeolite should be possible when the powdered zeolite mixes with the soil during the wet process using a K⁺ or NH₄⁺ ion-containing solution for ion exchange with the Cs⁺ ions in the soil. However, the collection of the zeolite after the decontamination of the radio Cs⁺ ions is impossible when the powder material mixes with the soil. Magnetic collection is one of the methods using a composite material composed of the zeolite and a magnetic material after the Cs⁺ ion adsorption.

An Na-P1 type artificial zeolite (Na₆Al₆Si₁₀O₃₂·12H₂O) having a high cation exchange capacity (CEC) is able to be synthesized at a low cost using alkali from the waste coal fly ash of thermal power stations. On the other hand, the synthesis method using alkali for the nano-sized magnetite (Fe₃O₄) is very similar to that for the Na-P1 type artificial zeolite. We considered that a new composite material using alkali from a suspension of both starting materials would be a promising material for the Cs decontamination.

In this study, we synthesized the composite material (magnetic zeolite) of the Na-P1 type zeolite and nano-sized magnetite by alkali processing from a mixed solution of the fly-ash and iron chlorides for the magnetic collection of the zeolite after Cs⁺ ion adsorption.

2. Experimentals

Fly ash (JIS II type) from thermal power stations (Shikoku Electric Power Co.) was used for the preparation of the Na-P1 type zeolite. For the preparation of the Na-P1 type zeolite, the fly ash and 2M NaOH were mixed and refluxed at 100 °C for 24 h. The powder was collected and washed several times by centrifugal separation, and then dried at 80 °C. For the preparation of the nano-sized magnetite, FeCl₂·4H₂O and FeCl₃·6H₂O (mole ratio=1:2) were dissolved in pure water. The mixed solution was placed in a water bath at 100 °C, and then a 2M NaOH solution was added with stirring and held at the same temperature for 30 min. For the preparation of the composite material (magnetic zeolite) of the Na-P1 type zeolite and magnetite, the synthesized magnetite in water and then fly ash was added to the mixed solution. A 2M NaOH solution was added to the mixed solution and refluxed at 100 °C for 24 h.

3. Results and discussion

For the material without magnetite, the main peaks for the XRD were the Na-P1 type zeolite with mullite (Al₆Si₂O₁₃) as the second phase. The peak intensity of the magnetite increased with an increase in the magnetite content. The peaks of the magnetite were very broad due to its small crystalline size. The particle size for the magnetic zeolite was 5~30 μm for a SEM observation. These particles of the magnetic zeolite were easily attracted by the neodymium magnet. For the TEM observation, the Na-P1 zeolite, the magnetite, and amorphous phases were confirmed using the electronic diffraction of the center of the particle. The nano-sized and aggregated magnetite particles were observed in the bright-field image. Due to the slow formation of the zeolite crystals after formation of the nano-sized magnetite, the magnetite particles existed at the grain boundary between the polycrystalline zeolites.

We tested that the magnetic zeolite (200 g) and the soil (2 kg) obtained from the rice fields in Fukushima were mixed using a shaking apparatus with NH₄⁺ ion containing solution. The magnetic zeolite with radioactive Cs collected using neodymium magnet (8000 gauss). We succeeded to decontaminate ca. 80 % radio active Cs from the soil using the magnetic zeolite.

Keywords: Radioactive Cs Decontamination, Na-P1 type zeolite, Magnetite, Composite Material

The Mission of Human Geoscience in the Study of Disasters and Global Environmental Problems

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The Human Geoscience Section of JpGU has been emphasizing the importance of studying increasing disasters and global environmental problems together in an integrative way, and has worked together with the Human Geoscience Committee of the Science Council of Japan to organize various meetings and issued proposals related with global environmental problems and hazards/disasters. The lecture reviews these activities and their achievements, the harsh reality of the still continuing Great East Japan Disaster, and the worsening global environmental problems and the efforts to combat them, and discusses the missions of human geoscience now and towards future.

Keywords: human geoscience, Great East Japan Disaster, global environmental problem, sustainability, disaster

A new research field after the 2011 Tohoku earthquake and tsunami

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The Tohoku region in Japan was hit by a gigantic earthquake of M=9.0 subsequently followed by a huge tsunami which occurred off the Pacific ocean. Both of them have caused huge damage on the eastern coast of Japan, having a huge inundation area more than 500km² with the attack of destructive wave forces. There are several issues why this tragedy occurred, and what unrecognized factors contributed to the high vulnerability of the area, and how the risk at each region in the future earthquake and tsunami.

The damage actual situation of the East Japan great earthquake disaster and the study base formation of practical disaster prevention studies based on the lesson are big problems and develop the situation of the damage, a future evaluation, prediction from elucidation of a giant earthquake and the outbreak mechanism of the tsunami and must record a then lesson to earthquake disaster archives. Furthermore, study such as the ways of the disaster prevention that stood on improvement of the trust of the risk evaluation, the construction of support studies, cooperation with the disaster medicine, the history culture will be necessary to prepare for domestic and foreign disasters.

In natural disaster scientific research, I arrest prior measures, the outbreak of the disaster, influence of the damage, urgent correspondence, restoration, revival, forehandedness with a series of disaster cycles and elucidate the phenomenon in each process, and it is necessary to make the lesson generalization, unification. Social incorporate result of the natural disaster scientific research that assumed knowledge and the world provided from the research in the East Japan great earthquake disaster, the action to reconstruction contracts a field and a human being, society is smart and copes for a disaster cycle to become complicated and systematizes study to build society system keeping a lesson alive through hardship as "practical disaster prevention studies", and a wound wants to form the scientific value.

Keywords: Disaster Science, 2011 Tohoku earthquake and tsunami

How volcanology will manage environment and hazard?

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In order to mitigate volcanic disaster, it is necessary to understand the timing and magnitude of eruption before eruption, and to evaluate the transit of eruption properly, indicating the development of volcanology is essential. Therefore, the roles of volcanology and volcanologist are important to mitigate the volcanic disaster.

Japanese volcanologists have contributed to mitigate the volcanic disaster in case of volcanic unrest or eruption. A few examples will be reviewed during the session.

However, these contributions have not been made by the volcanological society, but by volcanologists personally. It is not clear how the academic society such as volcanological society should contribute to mitigate the natural disaster. Academic society could be an organ to contribute in risk evaluation through the scientific discussion within the society, but may not be an organ to engage in risk management.

Keywords: Volcanology, volcanic hazard, volcanic disaster mitigation

Recent transformation of the snow and ice disaster and emerging issues

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Recently, the natural environment and social environment surrounding Japan, such as the increased global warming and the acceleration of demographic aging, have changed greatly. A few decades ago, there was a view that snowfall will decrease sharply with the progress of global warming and the resultant snow disaster will be drastically alleviated. However, since heavy snowfall appears frequently after the 21st century, it is being accepted widely that the impact of global warming on variations in snow cover is not a simple problem. The heavy snowfall events which appeared in three consecutive years from 2010/11 winter to 2012/13 winter are good examples, and consequently more than 100 people were killed each year. Moreover, it is noteworthy that the aspect of snow disaster has greatly differed from the time of Showa. In relation to earthquakes and heavy rainfalls which occurred frequently in the heavy-snow region of Japan, new issues of the compound disaster events, hardly taken note until now, began to gain prominent attention recently. In this study, I am going to discuss about the research perspective towards mitigation of the snow disaster.

Keywords: snow and ice disaster

Space disasters and space weather studies

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When the solar flare occurs, the high energy particles hit the satellite and cause serious troubles in the communication and broadcasting systems. The geomagnetic storm causes induced currents giving damages to the power transmission system. To avoid the damages due to the solar flare and geomagnetic storms, we are doing research to achieve the prediction model of the solar flare and magnetospheric and ionospheric storms. This talk will present examples of the satellite failures and power outage and also the simulation studies which will enable us to predict the space weather.

Keywords: Space weather, magnetic storm, geomagnetically induced current, radiation particles, satellite anomaly, power outage