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

U07-01 Room:103 Time:May 28 09:00-09:15

Current situation of the tsunami deposit research and efforts of the Sedimentological Society of Japan

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Tsunami deposit is useful geological evidence of paleotsunami to understand its recurrence interval and size. In fact, the 869 Jogan earthquake tsunami, which has been well studied since late 1980s, is considered as possible predecessor of the 2011 Tohoku-oki tsunami event. In order to better understand identification criteria of the tsunami deposit and how to evaluate size of paleotsunami from the deposits, it is important to conduct field survey soon after the tsunami events because characteristics of initial wave, topography and source of sediments are well known. The tsunami deposit research is now regarded as an important work for future tsunami risk assessment. Sedimentological Society of Japan has taken initiative and acted to organize workshops and field trips to better understand characteristics of tsunami deposits and such efforts will be continued.

Keywords: tsunami, tsunami deposit, survey, Sedimentological Society of Japan

Japan Geoscience Union Meeting 2015
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U07-02 Room:103 Time:May 28 09:15-09:30

Researches on largest-possible mega tsunamis along the Nankai trough based on examination of paleotsunami deposits

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Since the 2011 Tohoku-oki earthquake and associated mega-tsunami, the Japanese Government has encouraged its people to prepare for largest-possible mega earthquakes and tsunamis generated in the Suruga and Nankai troughs, southwest Japan. The government also presented selection of earthquakes and tsunamis for hazard assumption based on scientific knowledge such as analysis of ancient documents and surveys of tsunami deposits and coastal topography. Many researchers of Paleosciences Society have examined paleotsunami deposits from cored deposits and trenches on the coastal area of Shizuoka Prefecture, Japan. No geological evidences of the largest-possible mega tsunamis have been found on the study areas.

Keywords: Nankai trough, largest-possible mega tsunamis, paleotsunami deposits

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

U07-03 Room:103 Time:May 28 09:30-09:45

Significance of natural history in geoscience related to the ”rescue” activities of tsunami-damaged museum specimens

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On 11 March 2011, the Great East Japan Earthquake hit the Tohoku district of Japan, and the associated tsunami devastated the Pacific coastal areas of the district. The disaster caused widespread damage to many museums, libraries and archives. The Agency for Cultural Affairs started the recovery of cultural assets on 1 April 2011. Museum rescue projects are promoted by the Committee for the Multi-Organizational Co-Operative Project for Preserving and Restoring Cultural Assets Damaged by Tsunami on March 11th, 2011, mainly at the Iwate Prefectural Museum, by the initiative of the Japanese Museum Association. Initially, the purpose of the rescue projects was to save cultural and other properties damaged during the disaster, and accordingly the natural history specimens were mostly not subject to saving and/or restoring. Therefore, the science community such as the Union of Japanese Societies for Natural History, including museums of natural history, offered voluntary activities to save the specimens from the damaged and destroyed museums. Natural history collections provide information invaluable for many fields of earth and planetary sciences, playing an essential role to understand the formation of the solar system, the history of the Earth, the evolution of life, environmental change, energy and resources, natural disasters, and so on. Japan Geoscience Union should make an effort for revival of natural history research and education in the current education system.

Keywords: natural history, Great East Japan Earthquake, rescue activity, tsunami-damaged, museum specimen

Japan Geoscience Union Meeting 2015
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U07-04 Room:103 Time:May 28 09:45-10:00

Tohoku Geographical Association's effort during the Great East Japan Earthquake

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This paper reports what actions did Tohoku Geographical Association have taken after the Great East Japan Earthquake. The association's headquarter is situated in the affected area, and have many associate who have experienced the disaster. It argues what an academic society and academics at the disaster area can and cannot do.

Keywords: Tohoku Geographical Society, The Great East Japan Earthquake, The 2011 East Japan Earthquake Bulletin

Japan Geoscience Union Meeting 2015
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U07-05 Room:103 Time:May 28 10:00-10:15

Contribution of Quaternary Study in the Environmental and Disaster Issues

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The Japan Association for Quaternary Research (JAQUR) is a group devoted to the study of the Quaternary period (the last 2.6 million years). This group comprises geologists, geographers, paleontologists, zoologists, botanists, soil scientists, anthropologists, archeologists, geophysicists, geochemists, engineers, and others interested in Quaternary studies.

The feature of this association is that multi-dimensional and interdisciplinary researches of members'own and their joint researches are implemented because it aims at not a specific field of academic study but the Quaternary period and it publishes these accomplishments as the official organ Quaternary Research (Daiyonki-kenkyu).

While researches of the environmental and disaster issues are based on efforts of members'own, we hereby introduce the efforts to address the environmental and disaster issues in this association with a focus on the papers published through the official organ.

If the papers published in the official organ with regard to the environmental and disaster issues are compiled, basic phenomena to review the environmental and disaster issues are argued in many papers. It is assumed that it is also the role of this association related to Quaternary study to publish the basic knowledge extensively through the official organ, etc. in order to consider clarifications of causes, mitigation and evaluation of issues, etc. for efforts of various researchers and scientific societies to address the environmental and disaster issues from now on.

Keywords: environmental and disaster issues, Quaternary study, JAQUR

Japan Geoscience Union Meeting 2015
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U07-06 Room:103 Time:May 28 10:15-10:30

How the Association for the Geological Collaboration in Japan contended with the issues of environment and disaster

NAKAYAMA, Toshio[1*] ; SHIONO, Toshiaki[1] ; MATSUMOTO, Toshiyuki[1] ; HOUCHIGAI, Shigeji[1] ; SUENAGA, Kazuyuki[1]

[1]Association for the Geological Collaboration in Japan

How the Association for the Geological Collaboration in Japan (AGC Japan) contended with the issues of environment and disaster

Keywords: Earthquake, Ground, Debris flow disasters, Groundwater contamination, Research by collaboration study

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

U07-07 Room:103 Time:May 28 11:00-11:30

The direction of science and technology supporting DPR responses at the Japan Meteorological Agency

NAGATA, Masashi[1*]

[1]Meteorological Research Institute, [2]The direction of science and technology supporting DRR responses at the Japan Meteorological Agency

The JMA performs work, on the basis of science and technology, to monitor and forecast typhoons, localized heavy rainstorms, earthquakes, tsunamis, volcanic activity, climate change and so forth. To monitor and forecast these natural phenomena, we constantly strive to incorporate the products of the most up-to-date science and technology and to improve our disaster risk reduction (DRR) and weather information.

In recent years we have seen the worst series of disasters , such as the Great East Japan Earthquake of 2011, the torrential rain dropped on the Kii Peninsula by severe tropical storm Talas in 2011, and the eruption of Ontakesan in 2014. These terrible natural disasters have shown what we need to improve in order to protect human life from disasters: the accuracy of our monitoring and forecasts, suitable mechanisms for communication to utilize information relating to evacuation, and also attitudes, awareness and information literacy so that individual citizens can take appropriate actions for DRR. Accordingly, we are working to improve our technology development and the resulting information, and to collaborate with various institutions on efforts for public awareness and education about the uses of DRR information.

For effective DRR responses to protect life, it is important to concentrate on and promote improvements in information that contributes to the DRR responses being put into practice by the staff of disaster response bodies and by citizens. In regard to the science and technology that supports this, as well as natural science?refining our monitoring and forecasting technology?we must consider social science aspects such as, with forecasts featured by uncertainty, how the information is actually put to use by society.

This presentation will introduce the JMA's latest efforts towards effective mechanisms for DRR taking account of society's wishes, and will explain the significance of the technology development and fundamental research required to support these efforts on the technological side. The discussion will explore several urgent issues for the JMA, in particular the current and future directions of the following topics for improving our technology development:

1) Developing technology to monitor and forecast the localized heavy rain and tornadoes associated with cumulonimbus clouds that suddenly appear and grow

2) Accurately predicting line-shaped precipitation and nighttime localized rainstorms caused by backbuilding; upgrading and improving the precision of quantitative forecasting technology

3) Improving forecasts of tropical cyclonetrack and intensity up to five days ahead

4) Developing technology for the accurate warnings of tsunamis from major ocean trench type earthquakes, such as the Nankai Trough megathrust earthquake that is expected to occur in the future

5) Improving the prompt issue of level 2 and 3 volcanic warnings after the early detection of phreatic eruption and the accurate issue of level 4 and 5 volcanic warnings when transitions to magma eruptions are identified

The major medium-term issue for this technology development is research supporting the work of the JMA, which is being conducted mainly at weather research institutions in collaboration with universities and related bodies. In this session, discussion will be encouraged about the direction of research in relation to a renewed shared understanding of the significance of JMA's role in society and to further strengthen collaboration with researchers and experts in different scientific associations to resolve technical issues.

Keywords: Japan Meteorological Agency, Disaster risk reduction, Science and technology

Japan Geoscience Union Meeting 2015
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U07-08 Room:103 Time:May 28 11:30-11:45

Earthquake early warning: current status and future prospect

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Real-time prediction of strong ground motion is a strong tool for prevention/mitigation of earthquake disaster, and it has been applied for earthquake early warning (EEW). In early 1990s, Mexico started their EEW system for Mexico City, and railway companies in Japan also began their systems. The Japan Meteorological Agency (JMA) has been operated nationwide in Japan for general public since 2007, and possible use of such systems has been investigated in many countries. In this presentation, we will explain EEW methods, performance of its actual operation of JMA EEW since 2007, especially for the 2011 Tohoku Earthquake (M9.0) and its aftershocks, and future prospects based on lessons learned from the Tohoku Earthquake.

EEW methods are classified into three categories: (1) prediction of propagation, (2) prediction of S wave from P wave, (3) prediction of earthquake rupture. Regarding (3), many researchers have described their controversial opinions. At current JMA system, methods of (1) and (2) are adopted, but that of (3) is not used.

From Oct., 2007 to Feb., 2011 just before the Tohoku Earthquake, JMA had issued warning messages for 17 events, including one false alarm due to software bug. For the first 41 months, JMA and other organizations had made efforts to let people get aware ”what is EEW?”

During the Tohoku Earthquake, more than 15 s before the strong ground motion hit the cities, JMA issued EEW to the general public of the Tohoku district. The M 9.0 earthquake, however, revealed two important technical issues with the method: it under-predicted ground motion at large distances because of the large extent of the fault rupture, and it sometimes over-predicted because the system was confused by multiple aftershocks that occurred simultaneously. After the earthquakes, despite of the two issues, EEW has been recognized among people as an important tool for mitigation of earthquake disaster.

Since then, addressing the above two issues: large extent of rupture and multiple simultaneous events, has been an important research project for improving EEW system. While many researchers investigated methods for quickly determination of extent of fault rupture and for discrimination of multiple events, a new technique was proposed in which the process of determination of hypocenter and magnitude is skipped. In the method, current wavefield is estimated as precise as possible, and then future wavefield is predicted based on physics of wave propagation, which is the similar idea of ”numerical weather prediction” in meteorology. The new approach is expected to enable us to predict ground shaking even for large extent of fault rupture and multiple simultaneous events.

In JMA system which will be replaced in fisical year of 2015, the preliminary version of the new approach, which is called PLUM method, will be tested for examining its performance.

Keywords: Earthquake Early Warning, Real-time prediction of earthquake ground motion, The 2011 Tohoku earthquake, Future prospect

Japan Geoscience Union Meeting 2015
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U07-09 Room:103 Time:May 28 11:45-12:00

Remaining problem in the national and local governmental action against the volcanic hazards

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Introduction Ontake volcano, Japan erupted on 27 September, 2014, hitting many climbers who were taking lunch at its summit. Pyroclastic flow and following ballistic ejecta from craters, that were newly created at this eruption, caused 63 victims, including missing. Though the eruption took place at the worst timing, the lack of enough information raised the disaster. Volcano warning level was not raised although an activation of earthquake activity beneath the summit was noticed three weeks before the eruption. Following the tragedy, national and local government reviewed the existing countermeasures for volcanic eruptions and made reports for the renovation of countermeasures. The author is involved in these activities and had a chance to see the on-going discussion in various institutions. In this talk I introduce the activities of the national and local governments triggered by the eruption of Ontake, and point out the problems that appeared among the discussions.

Response after the eruption of Ontake With a triggering by the eruption of Ontake, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Meteorological Ageny (JMA), Central Disaster Management Council (CDMC) started to discuss for the renovation of disaster mitigation countermeasures for volcanic activity. A revised budget including emergent countermeasure for volcanic disaster reduction was approved for FY2014. In parallel to the governmental discussion, local government such as Gifu and Nagano prefecture started to review the existing countermeasures. A volcano countermeasure board of Ontake was established by the two prefectures by combining the existing separate boards in each prefecture.

Problem remaining Although intensive discussion is made in each organization, each has its limitation that is bounded by the definition of its charge. MEXT discuss on the academic research for disaster mitigation, JMA discuss on the monitoring and warning issuing at the volcanic crisis. CDMC is in charge of creating national plan, but limited by the feasibility of the measures in relatively short time range. Lack of national strategy for volcano disaster mitigation appeared through the discussions and actions of national and local governments. There is no institution to make strategic plan including basic survey and research, infrastructure construction, monitoring and warning for each of many active volcanoes in Japan. Volcano countermeasure board at each volcano may in charge of plan a strategy, but has insufficient potential and budget.

Actions required for JpGU JpGU, as an assembly of academic researchers, is probably one of few organizations that can make a strategy both in local to global level and in shot to long time range, being free from the limitation of governmental administration. We are in charge of making academic research, which is also the limitation in the disaster countermeasure activity. Break the limitation and plan a strategy of disaster countermeasure that is globally optimized.

Keywords: volcanic eruption, Ontake Volcano, Disaster mitigation measure, administration, government, local government

Japan Geoscience Union Meeting 2015
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U07-10 Room:103 Time:May 28 12:00-12:15

Summary of the snow and ice disaster and effort of The Japanese Society of Snow and Ice

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Recently, 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 160 people were killed each year. The Kanto Kousin heavy disaster caused by the heavy snow fall in 2014. The Japanese Society of Snow and Ice organized the research group with Japan Society Snow and Engineering and started field study. 2014-15 winter have heavy snow fall, it is becoming important for our society to study for heavy snow fall disaster in a few snow area not only heavy snow area.

Keywords: snow and ice disaster

Japan Geoscience Union Meeting 2015
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U07-11 Room:103 Time:May 28 12:15-12:30

Satellite Data Utilization for National Land Environment and Disaster Prevention

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[1]The Remote Sensing Society of Japan

Tohoku and Kanto district suffer from the serious natural disaster that is called 2011 off the Pacific coast of Tohoku Earthquake (11 Mar. 2011). With such a large-scale disaster, consequences of disasters extend to wide area, and it requires a long time to recover and resurrection. For this reason, we focus on the monitoring method by using satellite image. Finally, we aim to propose the usage of satellite data at the time of a disaster.

Keywords: satellite image, natural disaster, guideline

Japan Geoscience Union Meeting 2015
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U07-12 Room:103 Time:May 28 14:15-14:30

Issues on numerical weather prediction detected by formation mechanisms of Hiroshima heavy rainfall on 20 August 2014

KATO, Teruyuki[1*]

[1]Meteorological Research Institute

On 20 August 2014, heavy rainfall exceeding 200 mm/3hour occurred in Hiroshima, located about 300 km south of a stationary front extending northeastward over the Sea of Japan, and brought some huge landslides that killed 74 peoples. The rainfall was caused by a band-shaped precipitation system with a hierarchical structure consisting of convective cells and band-shaped multi-cell clusters that stagnated for 4 hours. The band-shaped precipitation system had a back-building type formation, as well as the multi-cell clusters, in which new multi-cell clusters successively formed upstream of the pre-existing ones, and consequently extent northeastward with a width of 20˜30 km and a length of about 100 km. Convective cells successively formed under instable atmospheric conditions that were enhanced by the inflows of mid-level colder air and low-level humid air. The colder air was produced through adiabatic cooling due to large-scale updrafts that existed south of the stationary front. The updrafts also brought a humid condition at the middle level that is favorable for the development of convective cells. The humid air was accumulated below a height of 1 km by the effect of Bungo Strait, located just south of Hiroshima. Both the sides of Bungo Strait have terrains exceeding a height of 1 km, which accelerated southerly winds from the Pacific Ocean that took along humid air. The effect of Bungo Strait also produced the upward pressure gradient force to transport humid air upward.

The Japan Meteorological Agency operates Local Model (LM) with a horizontal resolution of 2 km every hour for nine hour forecasts. The forecasts with initial conditions at 18 JST (= UTC + 9hours) 19 August 2014 successfully reproduced the band-shaped precipitation system; those with initial conditions after then, however, produced different features in rainfall amounts and the location of the precipitation system. Even when low-level inflow has the same equivalent potential temperature, rainfall amounts depend on water vapor flux amounts that are changed by wind speed and the 1˜2 degree change of wind direction alters the location of the precipitation system by a few tens kilometers. These indicate that the accuracy of wind speed and direction is necessary for the improvement of heavy rainfall predictions, as pointed out by Kato and Aranami (2005), in addition to the accuracy information of low-level water vapor upstream of the occurrence location of heavy rainfall. In Hiroshima heavy rainfall case, water vapor was accumulated in the lower atmosphere over Bungo Strait, which suggests that boundary layer processes in numerical models should be validated to be improved. Since observations over the sea are necessary to be obtained, the cooperation with different fields of research institutes is important as well as that of meteorology.

Reference

Kato, T., and K. Aranami, 2005: Formation factors of 2004 Niigata-Fukushima and Fukui heavy rainfalls and problems in the predictions using a cloud-resolving model, *SOLA*, **1**, 1-4.

Keywords: heavy rainfall, band-shaped precipitation system, numerical weather prediction model

Japan Geoscience Union Meeting 2015
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U07-13 Room:103 Time:May 28 14:30-14:45

Landslide disaster induced by the 2014 Hiroshima rainstorm

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[1]Disaster Prevention Research Institute, Kyoto University

A rainstorm in 20 August 2014 induced many debris slide-flows, resulting in heavy damage including 74 fatalities. I made investigations on the landslides by observation from the air, field surveys, and by high-resolution DEM analysis as a member of the Mountain Hazards Laboratory of DPRI, Kyoto University and the investigation team of the Japan Society of Engineering Geology. Landslides occurred more than 140 in an area with a 3 km of width and a 12 km of length, of which area coincided with an area with over 150 mm rainfall in 3 hours. The highest density was 30 landslides in 1 km2. The affected area is underlain by Jurassic sedimentary rocks and Cretaceous Takada rhyolite and granite; the sedimentary rocks are metamorphosed by the intrusion of the granite.

We identified three types of landslides. The first is a planar type, in which a planar soil layer with a depth of 1 m or so slid. The second is a gush-out type, in which water gushed out from slopes to make holes; the base of a hole is occupied by rock fragments with many openings and less amounts of fine fractions. The third is a long, gully like slide with a wedge-shaped profile sided by an along-valley joint or a fault. In the torrent of the Ken-ei-jyutaku in Yagi 3-chome, debris avalanches went down along the river entraining large rock blocks separated from the bedrock by sheeting joints and high-angle joints. Similar phenomenon occurred in the upstream torrent of Midorii 8-chome. Other than these two torrents, large blocks in debris flows were mainly fine-grained granite, which is resistant to weathering. In hornfels areas on the other hand, gush-out type landslides were predominant.

Landslides and debris flows in granitoid areas have characteristics dependent on weathering extent. In the affected area of the Hiroshima disaster, granite in higher elevations is weathered to form micro-sheeted rock, which is incised deeply to expose fresh rock beneath it. The fresh rock body was separated into large rock blocks by sheeting joints and high-angle joints along the river. Consequently, the debris of landslides in higher elevations came down along a river, entraining the large blocks, getting destructive energies, and hitting the residential houses on fluvial cones. Another cause of the destructive debris flows were large blocks of fine-grained granite, which is more resistant to weathering than medium-grained granite. Gush-out type landslides in hornfels areas are assumed to have occurred when the rainfall intensity became too strong for the openings in the zone of rock fragments to drain the groundwater flow, which finally blew out.

Keywords: landslide, debris flow, rainstorm, disaster

Japan Geoscience Union Meeting 2015
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U07-14 Room:103 Time:May 28 14:45-15:00

The role of the Geological Society of Japan (JGS) at the time of natural disaster

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[1]Geological disaster committee, Geological Society of Japan

The Geological Society of Japan (JGS) has published geological information of a disaster-stricken area on the website immediately after a disaster. The information includes findings of a study conducted not only by the JGS but also by external agencies. To improve the quality of the information in preparing for a natural disaster, especially due to geological disturbances such as earthquake and volcanic eruption, it is essential to conduct an ongoing fieldwork and to undertake information gathering. Despite the importance of these facts, fieldwork in disaster area is conducted only at the time or immediately after disaster, and much geological information is scattered in the local government, private organization, and individual member of the JGS. The role of the JGS is to deliver effective geological information via the Internet as well as to gather it. The presentation also takes heavy rain disaster in Hiroshima city in August, 2014 as an example of geological fieldwork at the time of disaster.

Keywords: geological disaster, geology, landslide

Japan Geoscience Union Meeting 2015
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U07-15 Room:103 Time:May 28 15:00-15:15

Innovation of Spatial Representation Technology to Support Disaster Responses

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[1]GSI of Japan

Thanks to recent development of geospatial information technology, geospatial information has become essential for disaster response activities. Advancement of Web mapping technology allows us to understand the situation by overlaying various location-specific data on a base maps on the web, and specify the areas which the activities should be focused on. Distribution of reasonable image processing software applying SfM and MVS theory has brought the innovation of auquisition methods of disaster information. 3D modelling technology enables realistic understandings of the relationship between disaster and topography.

Geospatial information technology also can support the proper judgement of preparation and emergency response against disaster by the individuals and local communities through such as hazard mapping and information seivices using mobile devices. For instance, mobile phone applications to assist the evacuation of residents and network analysis system of evacuation routes as the risk communication tool among local community have been rapidly popularizing. Thus, spatial presentation technology, the result of geography and cartography, is now more and more taking vital role for all the stages of disaster response and risk management.

Keywords: geospatial information technology, disaster response, web mapping, 3D modelling, mobile devices, risk communication

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U07-16 Room:103 Time:May 28 15:15-15:30

A Roll of GIS in Multidisciplinary Management of Disaster Information

HATAYAMA, Michinori[1*]

[1]Michinori Hatayama

Almost all types of disaster information increase their values by attachment of their spatial information. And the temporal information is also important because the situation changes every moment. It is pointed out after Great Hanshin-Awaji Earthquake that GIS is the most useful tool to integrate disaster information provided by multidisciplinary divisions. In this presentation, I show some concrete examples of disaster information sharing with GIS, and denote some action assignments to integrate disaster information effectively.

Keywords: GIS, Disaster Information, Information Sharing

Japan Geoscience Union Meeting 2015
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U07-17 Room:103 Time:May 28 16:15-16:30

The Geochemical Society of Japan's response to and after the Fukushima Nuclear Power Station accident

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On March 11 in 2011, a great earthquake hit the eastern part of mainland Japan. It triggered several gigantic tsunami waves that destroyed the coastal areas in Tohoku and north Kanto districts, which face the Pacific Ocean. The earthquake that was coupled with a tsunami fatally damaged the Fukushima Daiichi Nuclear Power Station (FDNPS), which was operated by the Tokyo Electric Company, taking over the nuclear reactors. When the backup electricity supply was lost, nuclear fuels were partly melted, causing a couple of hydrogen explosions that eventually released a large amount of radioactive materials into the environment. Radioactive nuclides, mostly produced by the nuclear fission of 235U, were detected in a wide area, not only in the immediate vicinity surrounding the FDNPP but also in remote areas such as the Kanto district and metropolitan Tokyo. Subsequently, some radioactive nuclides were detected in the United States and in some European countries. Apparently, radioactive materials released into the atmosphere and oceans are carried by global atmospheric and oceanic circulations all over the world.

The Geochemical Society of Japan (GSJ) initiated several actions soon after the earthquake and the FDNPP accident. For instance, in response to the society's appeal, many GSJ members joined the project to map the distribution of several radioactive nuclides in soil samples in the Fukushima Prefecture under the supervision of the Cabinet Office and Ministry of Education, Culture, Science, Sport and Technology (MEXT). The members' contributions led to the creation of several distribution maps of radioactive nuclides, such as 134, 137Cs, 131I, and 132Te, trapped in soils in Fukushima (MEXT, 2011). The GSJ members also performed several experiments from various aspects individually or in groups in collaboration with researchers from neighboring fields. Considering these situations, the GSJ proposed to organize special sessions on research activities related to the FDNPS accident on the occasions of the 2011 Goldschmidt Conference and 2011 Annual Meeting of the GSJ.

For the Fukushima Review session of the 2011 Goldschmidt Conference in Prague, nine papers (all invited) were orally presented on August 16, 2011. After the session, a statement was appealed by the presidents of three societies, Drs. Mitsuru Ebihara, Bernard Bourdon, and Samuel Mukasa, on behalf of the GSJ, the European Association of Geochemistry, and the Geochemical Society, respectively. In this statement, the disclosure of monitoring data on radioactive material, continued monitoring of the spread of radioactive materials, and international alliance of researchers for the global monitoring of radioactive materials was strongly appealed.

Keywords: Geochemical Society of Japan, Great East Japan Earthquake, Fukushima Nuclear Power Station accident, radioactive material

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U07-18 Room:103 Time:May 28 16:30-16:45

Groundwater pollution and the prospects of the Fukushima Daiichi NPS

MARUI, Atsunao[1*]

[1]Geological Survey of Japan, AIST

Contaminated groundwater problems at Fukushima Daiichi Nuclear Power Station and countermeasures for them have been reported in various ways since its accident on March 11, 2011. However, it seems that few reports accurately describe the local natural environment, and the purpose and conditions of countermeasures for contaminated groundwater (Marui, 2014). Consequently, many misunderstandings have occurred and many proposals and criticisms have been made in the media. In this report, based on the latest knowledge on the local geological and groundwater conditions, current problems and countermeasures taken are described considering the long-term plan of the national government and Tokyo Electric Power Company for reactor decommissioning, and future challenges are discussed based on them.

The current position and volume of contaminated water; The trench means a kind of tunnel from the building to the sea, through which pipes and wires run. It became widely known because contaminated water leaked out immediately after the accident and contaminated the surrounding soil and sea. Although the surrounding soil was improved using water glass (chemical feeding), 11,000 tons of contaminated water still remains in it as of October 2014. The contaminated water flew out directly from the turbine building, and high concentration contaminated water exist in the trench. Currently, the trench is isolated from the buildings with the frozen soil method, and countermeasures to remove the internal contaminated water are being taken with a method of filling in the trench.

There are melt-down fuels in the reactor, which are being cooled every day. Consequently, a large amount of contaminated water that leaked out from the reactor exists in the reactor buildings and the turbine buildings next to them. In addition, because measures to prevent the leakage of contaminated water from the buildings are taken by letting surrounding groundwater leak into the buildings, contaminated water is increasing by about 400m3 per day (groundwater in middle-grained sandstone beds flows into the buildings). To treat it and transfer it to the tanks, the process building and the HTI building are also temporarily used for storage of contaminated water. It is estimated that about 89,300m3 of contaminated water exists in these buildings currently, and prompt treatment is desired.

The place where the largest amount of contaminated water is stored is the land-based tanks. It is said that they hold about 200,000 tons of contaminated water treated using radioactive material removal equipment (described later) and about 360,000 tons of high concentration contaminated water that waits for treatment or that has been treated. Because 400 tons per day of surrounding groundwater flows into the buildings, contaminated water is anticipated to increase by about 130,000 tons per year. This would be an appropriate estimate because in addition to a large amount of contaminated water generated for cooling at the early stage of the accident, more than three and half years have passed since the accident.

For decommissioning, debris which melted down has to be retrieved finally. Countermeasures for contaminated groundwater are discussed below considering what should be done and the steps to be adopted for retrieval. The overall decommissioning plan is as follows:

1) Drying-up:
2) Circulative cooling:
3) Retrieval of debris:

Based on the current conditions, it is scheduled that dry-up is finished within 10 years after the accident, circulative cooling is performed for about 15 years after then, and debris is retrieved during the next 15 years or more. Because there are many technologies to be developed and many challenges found at present (contaminated groundwater problems, etc.), it is inevitable that completion of decommissioning will become in the latter half of this century.

I will discuss about the condition of groundwater, countermeasures and prospectives at the NPS.

Keywords: Fukushima Daiichi NPS, East Japan Great Earthquake, Groundwater, Pollution, Radioactive contamination, Countermeasures

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

U07-19 Room:103 Time:May 28 16:45-17:00

Establishment of Water Cycle Basic Law and future outlook

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The author mentioned the establishment of the Water Cycle Basic Law, which has been enforced on 1 July, 2014 and its corresponding the Draft of Water Cycle Basic Plan just opened on 5 February, 2015, and described the activities of Japanese Association of Hydrological Sciences against 3.11 nuclear and environment disasters in relation to the contents both of the Water Cycle Basic Law and the Draft of Water Cycle Basic Plan. Finally, the author expressed desire the future direction of the Association as aiming at the science for society.

Keywords: Japanese Association of Hydrological Sciences, Water Cycle Basic Law, Draft of Water Cycle Basic Plan, environment disaster, 3.11 nuclear disaster, science for society

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

U07-20 Room:103 Time:May 28 17:00-17:15

Efforts of JSHWR to the Great Earthquake and a new model for assessing internal dose based on hydrological methodology

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Japan Society of Hydrology and Water Resources (JSHWR) established the "Special subcommittee of countermeasures against disasters caused by the Great East Japan Earthquake" to cope with rapid and remarkable influences with regard to hydrology and water resources within a month after the earthquake occurred. This subcommittee was established aiming to contribute for restoration in the disaster areas, strengthening information exchanges and coopration with the other societies and focusing the problems to be solved from the position of hydrology and water resources. JSHWR urgently asked for research groups to support the initial movements for establishing research activities with regard to hydrology and water resources contributing restoration in the disaster areas. Three groups were funded as the urgent research groups about two months after the earthquake. The groups investigated the destruction of an earth-fill dam, the groundwater changes, and the hydrological dynamism of radioactive materials. Preliminary results of the urgent research were reported at the annual meeting of JSHWR held at the end of August 2011, and further results were reported at the annual meeting of JSHWR next year. The groundwater research group has cooperated with the Japanese Association of Groundwater Hydrology as well as the local governments where the groundwater investigations were made. The radioactive group has further established research projects studying hydrological processes in terms of radioactive materials, and studies of long-term monitoring.

In order to cooperate with other research fields including countermeasures against disasters, we propose a readily-understandable internal dose calculation based on the hydrological methodology. The system of electrical facilities to control Fukushima Daiichi nuclear power plant (NPP) was destroyed by the subsequent tsunamis of the Great East Japan Earthquake. Several radioisotopes leaked from the damaged reactor containment vessels and diffused. The effects of internal exposure caused by radioactivity on food supply have become an issue of great interest. The internal dose calculation which includes complex mathematical model of the human body (computational human phantom) has been developed by radiologists. The International Commission on Radiological Protection (ICRP) recommendation is accepted the model as an accurate method for dose limits. However, it is too challenging for general technologists who do not specialize in radiology. In order to overcome the above difficulty, a new model has been developed in which the human body is treated as a single vessel. The conservation of the number of radioisotopes and radioactivity in the human body is described by the continuity equation. The beta and the gamma ray from cesium-137 are treated as a concrete example because it is noticed due to the NPP accident. Radioactivity in the body decreases exponentially because of radioactive decay. That is why the continuity equation of the number of radioisotopes is described by the first order ordinary differential equation, which can be solved analytically. The equation which describes radioactivity is equivalent to that of the number of radioisotopes because radioactivity is proportional to the number of radioisotopes. Internal total exposure dose is obtained from time integration of radioactivity. The absorbed energy into the human body per one radioactive decay event is estimated based on the Fermi theory of beta decay. The effective dose is calculated from internal exposure dose, absorbed energy per radioactive decay and the body weight. The comparable accuracy of our method calculating the effective dose is demonstrated by comparison with previous research. Our method to calculate radioactivity can be applied to not only the human body but also the soils and agricultural products. In summary, our method provides an understanding of the influence of radioisotopes for general technologists.

Keywords: nuclear accident, urgent survey, internal dose, lumped model