JST to start supporting International Urgent Collaborative Projects

regarding The 2016 Kumamoto Earthquake within the J-RAPID Program

The Japan Science and Technology Agency (JST) shall initiate support to 8 projects related to the earthquake that struck Kumamoto in April 2016 within the framework of the J-RAPID Program which supports urgent international collaborative research.

JST began preparations for the launch of the J-RAPID Program soon after the earthquake hit Kumamoto. The call for proposals was opened on 28th April and closed on 10th June 2016. 23 proposals were submitted. In order to enable rapid initiation of support to the awarded projects, applications were evaluated as and when they were received to shorten the selection period. Project duration is about 9-10 months and the level of funding is 2M-3M yen/project provided by JST to the Japanese team members.

JST implements the J-RAPID Program in cases of natural or anthropogenic disasters worldwide which have great social and economic impact, and which require emergency action. J-RAPID aims to play an initial response role by supporting research/survey activities more rapidly than ordinary programs can be implemented. The framework of the J-RAPID Program is designed for support of international collaborative projects with funding agencies and research institutes outside of Japan, and candidate projects for J-RAPID funding should demonstrate urgency of research/investigation in one or both of the following ways:

-Urgency in the need to collect data that will soon disappear and is unobtainable at any other time (e.g. survey of tsunami damage, measurement of initial distribution of pollutants following a leak, etc.)

-Urgency in the need to solve immediate problems (e.g. assessment of earthquake-damaged structures, investigation of urgent seismic retrofitting technologies, etc.)

JST has so far launched J-RAPID 4 times: following the Great East Japan Earthquake in 2011, the Thai flooding in 2011, Typhoon Yolanda in the Philippines in 2013, and the earthquake in Nepal in 2015 supporting 33, 2, 11 and 13 projects respectively. As a part of the J-RAPID implementation in relation to the Nepal Earthquake, JST co-hosted a workshop in Kathmandu with the Nepalese Ministry of Population and Environment in order to disseminate the outcomes of the projects to Nepal governmental institutions, research institutions and mass media. In this fashion J-RAPID-awarded projects have contributed to disaster risk management and rehabilitation of disaster-affected countries.

JST will continue to implement the J-RAPID Program in response to emergencies and to support research/investigations that contribute to the collection of scientifically important but short-lived data, speedy restoration after disasters and improvement of disaster preparedness in the future.

**Adopted projects related to the 2016 Kumamoto Earthquake**

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| **Title of the Project** | **Research leader** | **研究・調査課題概要** |
| An integrated Information Sharing for the Kumamoto earthquake DisasterOverview | Hiroyuki Fujiwara, Director general, Research Center for reinforcement of resilient function, National Research Institute for Earth Science and Disaster Resilience | NIED established “Crisis Response Site” right after the April 14 foreshock, and kept updating this web portal for disaster responses organizations as well as that for general public. This portal covers a wide range of topics regarding the Kumamoto earthquake disaster: from hazard side such as seismology, volcanology, geo-tech, to response and recovery side such as evacuation and sheltering, water supply, and early recovery efforts. In the United States, a similar function has been performed by EERI under a legendary “Learning from Earthquakes (LFE) Program”, EER established a virtual clearinghouse for the current event to promote an integrated research. In this project, both NIED and EERI will bring together their information to examine the effective ways to integrate various kinds of relevant information to provide common operational pictures for different stakeholders to establish long-term collaborative framework for integrated disaster information sharing between US and Japan. |
| Jay Berger, Executive Director, Earthquake Engineering Research Institute |
| Next generation damage evaluation and seismic design based on collapse mechanism and residual capacity of buildings damaged due to repeated strong ground motions | Masaki Maeda, Professor, Department of Architecture and Building Science, Graduate School of Engineering, Tohoku University | The objectives of this research project are to develop evaluation methods of residual seismic capacity and to perform investigations of collapse mechanism for buildings damaged by repeated strong ground motions. Moreover, estimation methodologies of safety against future earthquakes for damaged building and next generation seismic design concept for new buildings are developed in order to improve the resilience of buildings and cities against earthquake disasters. Collaborative research works between Japanese group and NZ QuakeCoRE group include 1) detailed field survey of damage and structural characteristics of buildings (mainly reinforced concrete school and public buildings are focused on) in the affected area, 2) analyses of seismic capacity before and after the earthquake of damaged buildings and investigation of collapse mechanism, 3) verification and improvement of residual seismic evaluation method, and 4) proposal of next generation seismic design concept based on effects of repeated strong ground motions. |
| Kenneth Elwood, Professor and QuakeCoRE Director, Department of Civil and Environmental Engineering, University of Auckland |
| Mechanism of Fluidized Landslides due to 2016 Kumamoto Earthquake and Risk Evaluation of Unstable Soils- A Factual Investigation by Japan-USA Joint Research | Hemanta Hazarika, Professor, Department of Civil Engineering, Kyushu University | Chain events of 6.5 magnitude foreshock and 7.0 Magnitude main shock that occurred within 28 hours, called The 2016 Kumamoto Earthquake, resulted in huge loss of lives and properties. The earthquake also resulted in heavy damage to infrastructures including landslides, slopes and embankment failures, road damage, earthquake and liquefaction induced building damage. In order to carry out the damage analysis and construct landslide hazard map of the area through factual surveys, a joint investigation of the damaged sites and joint research will be conducted by a team of researchers from Japan and the USA. Based on the field survey, collection of data, laboratory testing of collected soils samples, damage analysis of collected data and numerical analysis, hazard map will be constructed and evaluated through brainstorming discussion amongst the researcher of both the countries and finally disaster mitigation measures in the vulnerable areas will be proposed. |
| Robert E. Kayen, Professor, Adjunct Faculty, Civil and Environmental Engineering Department, University of California, Los Angeles |
| Sophistication of seismic hazard evaluation based on investigation of strong ground motion and damages on immediate vicinity of the active faults | Ken Xiansheng Hao,Senior Researcher, National Research Institute for Earth Science and Disaster Resilience  | The Fudagawa and Hinagu active faults generated Mw6.2 and Mw7.0 earthquakes in April 2016, and have triggered many aftershocks. The Greendale and surrounding faults, in New Zealand, generated the Canterbury M7.1 earthquake in September 2010 and triggered the M6.3 Christchurch earthquake and other large aftershocks. These events have caused great damage in both countries. Near-fault strong motion data and the study of related co-seismic rupture and damage distributions are very limited. Better understanding is critical to society and will aid such things as hazard assessment, including those for nuclear power plants. Research to understand how to model and assess strong motions generated by proximal active faults is critical in both countries. Building on our seismic hazard assessment collaboration since 2013, we will investigate the following: The Japanese team will investigate near-fault strong motion, surface traces of co-seismic rupture, and damage, liquefaction, and landslide distributions. Using this treasures data to reconsider their simulation results for the Fudagawa and Hinagu active faults since 2004, they will improve existed method for evaluating strong ground motion. The NZ team will model aftershock sequence behavior using cumulative and radiated energy (Fry and Gerstenberger, 2012) instead of the standard catalogue based methods. The Kumamoto sequence is ideal for this due to the existing high-quality data and the data currently being collected. Energy-based aftershock models have the potential to significantly improve aftershock forecast models such as used for revision of the building design standard in Canterbury, NZ. A model will be developed for testing in the global collaboratory for the study of earthquake predictibility (Japan, NZ, California, Europe). The two teams will work cooperatively together with the ground motion simulations providing input and validation for the energy calculations. |
| Matt Gerstenberger, Risk & Engineering Team Leader, Risk & Society, Hazards Division, GNS Science |
| Field Survey and Development of GIS Database for Agricultural InfrastructureInformation on Rural Areas Affected by the Kumamoto Earthquake | Hiromu Okazawa, Professor, Department of Bioproduction and Environment Engineering, Tokyo University of Agriculture | This research aims to create a GIS database of agricultural infrastructure information to enable rapid agricultural reconstruction and improve agricultural productivity in the area affected by the Kumamoto Earthquake in April, 2016. The research areas are Aso Region and Mashiki Town, Kumamoto Prefecture where have been hit by a magnitude 6.2 foreshock, 7.0 mainshock and ongoing aftershocks. Because these areas’ main industry is agriculture, damage on agricultural land and facilities such as rice paddy fields, cropland, grassland, irrigation and drainage channels as well as its economic loss are significant. Therefore, an immediate research action is necessary for the area’s rapid reconstruction and “build back better”. The research methods include data collection by field survey and remote sensing and GIS database building as well as analysis. First of all, data collection aims to collect data and information of damage on agricultural lands and facilities through field survey and analyzing remote sensing data such as satellite and aerial photographs to cover the project site. In addition, UAV (unmanned aerial vehicles) is also applied to collect more detailed data because there is restriction in satellite and aerial images such as photography period and image resolution. Then, the collected data is reflected on GIS for building the database. And then, agricultural infrastructure information and agricultural land-use classification map is created taking account of disaster risks and agricultural productivity on GIS. After this research it is expected that the research results can be used for suggesting a land-use method to reduce disaster risks in the future and improve agricultural productivity for rapid reconstruction. |
| Bim Prasad Shrestha, Professor, School of Engineering Kathmandu University |
| Field and laboratory investigations on damage due to large deformation of volcanicsoil caused by the Kumamoto Earthquake | Takashi Kiyota, Associate Professor, Institute of Industrial Science , University of Tokyo | On the 16th of April 2016, the Kumamoto earthquake (Mw 7.0) hit the Central Kyushu Region, Japan, following a Mw 6.2 shock on the 14th of April. The earthquake sequences caused severe damage in Kumamoto Prefecture. A number of moderate to large scale landslides occurred in Aso Caldera area. Huge amount of debris from a landslide at the west end of the caldera travelled a longdistance and fell into Kurokawa River together with the Aso Ohashi Bridge. In addition, many landslides occurred at relatively gentle slope during this earthquake. Meanwhile, damage to the recently developed residential land was also observed in Aso Caldera area. A trough-like depression found in the basin of Aso Caldera caused damage to residential houses and agriculture. The soil condition in the affected area was a mixture of volcanic ash, andsol, a highly porous dark-colored material comprising of volcanic ash mixed with organic matter, and pumice, which might have caused significant strength reduction during the earthquake. In order to investigate mechanisms of the geotechnical damage due to the ground deformation caused by the earthquake, this research plans to conduct a field survey including surface wave test and dynamic cone penetration test, and a series of laboratory experiments by using in-situ soil. |
| Gabriele Chiaro, Lecturer in Geotechnical Engineering, Department of Civil and Natural Resources Engineering, University of Canterbury |
| Urgent environmental survey on groundwater pollution caused by the 2016 Kumamoto Earthquake | Haruhiko Nakata Associate Professor, Graduate School of Science and Technology, Kumamoto University | In April 2016, mega-earthquake (moment magnitude: >7.0) occurred in Kumamoto, southwestern Japan, and 50 individuals died or missed by the destruction of houses and buildings. Serious damages were also inflicted in social and industrial infrastructure, especially the water supply and water treatment systems in the downtown area of Kumamoto. This implies that large amount of wastewater is discharged into the public water supplies, resulting in serious pollution of anthropogenic chemicals in groundwater. In Kumamoto, groundwater is an important resource for drinking water. Thus, the local government and citizens have great oncerns for sustainable use and conservation of groundwater quality. Based on these backgrounds, the objectives of this study are to investigate the status of groundwater pollution by exfiltration of wastewater in the Kumamoto region following earthquake. This information will be useful to restore sewer pipes and reconstruction of wastewater treatment system in Kumamoto city. |
| Kurunthachalam Kannan, Professor, Environmental Health Sciences, State University of New York, USA |
| Damage assessment and vulnerability modeling of structures in the 2016 Kumamotoearthquake based on the data acquired from field investigation and remote sensing | Fumio Yamazaki, Professor, Department of Urban Environment Systems, Chiba University | This joint research proposal on the April 2016 Kumamoto, Japan earthquake sequence aims at the development and progress of remote sensing and damage assessment technologies. After the Kumamoto earthquake various sensors onboard satellites, aerial and ground vehicles captured remote sensing images of the affected area. In this research, the project team will try to extract damages to buildings and infrastructures from Japanese ALOS-2 PALSAR-2 and other satellite imagery data. The extracted results will be compared with airborne optical images and field investigation data, and the usefulness of synthetic aperture radar (SAR) data in early damage assessment in a wide area will be highlighted. Based on inventory and damage data of buildings and infrastructures (road, water, gas etc.), the team will also try to enhance the methods used in damage assessments for scenario earthquakes in Japan. Since the current methods were statistically developed based on mostly from the data from the 1995 Kobe earthquake, the ample data acquired from the Kumamoto earthquake will be efficiently used to improve the current methods. All these studies will be carried out through tight collaboration among the researchers from Japan and Thailand. Hence the result will also contribute disaster management in Thailand, where active faults exist in its northern and western territory, as well as that in Japan. |
| Pennung Warnitchai, Professor, School of Engineering and Technology, Asian Institute of Technology |