by Eikichi Tsukuda and *G-EVER Promotion Team

Report of the 2nd G-EVER International Symposium and the 1st IUGS and SCJ International Workshop on Natural Hazards and the “Sendai Agreement”

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The Asia-Pacific Region is an area with a high risk of catastrophic natural disasters such as earthquakes, tsunamis and volcanic eruptions. In today's highly globalized economy, when a major disaster occurs, it can create unpredictable turmoil not just in the affected area but also the rest of the world. Countermeasures against these natural disasters are crucial for the sustainable development. We believe that continuous efforts to develop an effective international framework to reduce the risk of natural disasters are very important. It is expected that geological institutions will collaborate and create a system to gather and process information to formulate disaster mitigation measures in the Asia-Pacific Region. This system must be easy to use and freely accessible to the public to meet societal needs. The Sumatra earthquake of December 26, 2004 and Tohoku earthquake of March 11, 2011 clearly show the urgency of developing an information and knowledge system for infrequent natural hazards. We also have to recognize that smaller events could have adverse effect to society. For example, the magnitude of the February 2011 Christchurch earthquake was just 6.3 (M_L), but caused major damage to the second largest city of New Zealand and 185 casualties. Volcanic ash ejected from the Eyjafjallajökull eruptions in Iceland on April 2000 caused more than 20,000 airline flight cancellations a day in Europe, resulting to the largest air-traffic shut-down since World War II. The IATA estimated that airline companies lost US\$200 million a day during the shut-down. After the 2011 Tohoku earthquake, more efforts for the prevention and reduction of the risks of natural disasters have been made all over the world. The G-EVER Consortium promotes natural disaster risk reduction activities through the collaboration different research institutes worldwide. The consortium's major activities are the following:

1. Establish a framework for cooperation of research institutes and organizations working on volcanic disaster prevention in the Asia-Pacific region.
2. Enhance the exchange and sharing of information on seismic and volcanic disaster prevention.
3. Formulate international standards for the database, data exchange and disaster risk assessment.

The 2nd G-EVER International Symposium and the 1st IUGS & SCJ International Workshop on Natural Hazards aimed to encourage extensive discussions on the present situation of natural disaster mitigation of earthquake, tsunami, volcanic eruption and landslide in the Asia and Pacific regions. The discussions included (1) prioritization of important researches to make society strong and resilient, (2) development of suitable hazard maps which are essential to society and Asia-Pacific scale hazard assessment activities, and (3) the importance of contributions to solid earth science. There were also discussions on the mitigation processes needed in the next-decade to reduce the risks of natural hazards.

The 2nd G-EVER International Symposium and the 1st IUGS & SCJ International Workshop on Natural Hazards was held in Sendai, Tohoku, Japan on Oct. 19-20, 2013 (Fig. 1). The symposium was organized by the G-EVER Consortium, Geological Survey of Japan, AIST, the International Union of Geological Sciences (IUGS) and Science Council of Japan (SCJ). It was co-organized by the Geological Society of Japan and the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP). Tohoku University, Disaster Prevention Research Institutes (DPRI) of Kyoto University, National Research Institute for Earth Science and Disaster Prevention (NIED), GNS Science, Philippine Institute of Volcanology & Seismology (PHIVOLCS), the Seismological Society of Japan, the Volcanological Society of Japan, Japan Association for Quaternary Research, Japanese Society for Active Fault Studies, Japan Society of Engineering Geology, and Tokyo Geographical Society supported the symposium (Fig. 2).

Figure 1. Participants of the 2nd G-EVER International Symposium and the 1st IUGS & SCJ International Workshop on Natural Hazards which was held in Sendai, Tohoku, Japan, on October 19-20, 2013.

Figure 2. Organizers, Co-organizers, institutes and societies supporting the 2nd G-EVER International Symposium and the 1st IUGS & SCJ International Workshop on Natural Hazards.

There were 94 participants representing 12 nations and regions and 13 institutes attended the symposium. Invited speakers were Ian Lambert and Roland Oberhaensli (both from IUGS), Akira Ishiwatari (Tohoku Univ.), Kuniyoshi Takeuchi (ICHARM), John Eichelberger (Alaska Univ.), Chris Newhall (EOS), Shinji Takarada (GSJ), Setsuya Nakada (ERI), Peter Bobrowsky (Simon Fraser Univ.), Kiichiro Kawamura (Yamaguchi Univ.), Masahiro Chigira (Kyoto Univ.), Cheng-Hong Lin (Academia Sinica), Dong Shuwen (CAGS), Ruizhi Wen (CEA), Yuzo Ishikawa (GSJ), Nguyen Hong Phuong (VAST), Pilar Villamor (GNS Science), Ken Xiansheng Hao (NIED), Toru Matsuzawa (Tohoku Univ.), Yuichiro Tanioka (Hokkaido Univ.), Mark Cloos (Univ. Texas), Takuya Nishimura (Kyoto Univ.), Yasutaka Ikeda (Univ. Tokyo), Kazuhisa Goto (Tohoku Univ.), Daisuke Sugawara (Tohoku Univ.), James Goff (Univ. NSW), Masataka Ando (Shizuoka Univ.), Phil Cummins (ANU), Ronald Harris (Brigham Young Univ.) and Yildirim Dilek (Miami Univ.).

There were intensive discussions on how to reduce the risks of natural disasters such as earthquakes, tsunamis, landslides and volcanic eruptions. The program and abstract volume are available at the G-EVER Hubsite <http://g-ever.org/en/symposium/symposium2.html>.

Schedule:

Oct. 19 (Sat) 9:30-18:10

Session 1: Scientific challenges for risk reduction of natural disasters: Overview

Session 2: Volcanic eruption, landslides and seismic hazards

Oct. 20 (Sun) 9:00-18:30

Session 3: Hazard assessment, 2011 Tohoku-oki earthquake and subduction tectonics

Session 4: 2011 Tohoku-oki earthquake and tsunamis

General Discussion

Oct. 21 (Mon)

Field trip to the area on the Pacific coast of Tohoku that was

affected by the March 11, 2011 Tsunami. One conspicuous outcrop was observed at the inundation area, approximately 1 km inland from the seashore in Iwanuma City, Miyagi Prefecture, Sendai Bay (Fig. 3). Here some layers of past tsunami deposits were identified by the Board of Education of Iwanuma City.

During the symposium, the participants drafted the “Sendai Agreement” and unanimously endorsed it. A broad consensus for future natural hazard mitigation strategies was developed.

THE SENDAI AGREEMENT

- Study the processes leading to natural disasters through the support of international, broad-based, and inter-disciplinary scientific studies relevant to the entire System Earth.
- Improve the methods and content of hazard maps, for society and hazard assessment activities in Asia-Pacific region.
- Create or help build comprehensive international databases, including on past disasters and hazards, and also on geological and geophysical features of subduction zones of the world.
- Promote scientific research on topics such as geodetic measurements, submarine landslides and predicting the maximum aftershocks from major earthquakes, including the 2011 Tohoku-oki earthquake.
- Enhance systematic mapping/dating of paleo-tsunami deposits in all regions especially those with significant populations and infrastructure.
- Promote innovative practical applications of monitoring data.
- Strive for better hazard assessments by seeking convergence of a variety of methods and disciplines, and also try to understand any discrepancies.
- Improve the quantity and quality of data on past events (paleo), recent events (modern analogues), including that from monitoring, and other precursors of future events, including better

Figure 3. Vertical trench surface of Iwanuma City, 1 km inland from the present shoreline. Three tsunami deposits were identified, from the top, at the time of 2011 Tohou-oki earthquake and tsunami, probable 1611 Keicho earthquake and tsunami, and probable 869 Jogan earthquake and tsunami, respectively. Between the latter two, 915 Towada volcanic ash (To-a) is intercalated. Some paddy field soils and swamp deposits are also dated to confirm the ages of the tsunami deposits. Red and white band scale 5 cm each. Refer to the home page of the Board of Education of Iwanuma City, <http://www.city.iwanuma.miyagi.jp/kakuka/050300/050302/kikakuten.html>.

understanding and modeling of what controls occurrence and magnitude of events.

- Promote better translations from hazard to risk – including damage curves, values at risk, etc.
- Improve outreach mechanisms, including visualizations, to enhance communication with end users from early stages of research to outreach stages. Develop multidisciplinary teams and communicate uncertainty to end-users.
- Improve methods for communicating authoritative information to underpin decision-making. Offer training to public officials and local people to reduce geo-risks.
- Promote the optimum use of geoscientific information by public officials and other decision makers. Lessons-learned and best practices are the most useful types of warning information. Gather feedback from public officials and engage in dialogue about what decisions they need to make and what information they need to make those decisions.
- Develop creative new options for mitigating impacts, based on

scientific, technical and socio-economic expertise, and develop effective means to have advice used in policies/decisions. Engineers, social scientists and economists should be involved.

- Play international leadership, coordination, and best practices through ICSU.
- Participate in related global risk reduction efforts, such as Integrated Research on Disaster Risk (IRDR) Program, Future Earth, Global Earthquake Model (GEM), and Global Volcanic Model (GVM).

We hope that our activities will help to build a better future for Earth. The 3rd United Nations (UN) World Conference on Disaster Risk Reduction will be held in Sendai Japan on March 14-18, 2015. I hope our efforts will be an important model for the future disaster risk reduction activities in the world.

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