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Outline of and Technical Support for the Large-scale Sediment Disaster Triggered in the Kii Mountains by Typhoon 12

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Research Center for Disaster Risk Management

This article reports on the response by the National Institute for Land and Infrastructure Management (NILIM) to sediment disasters caused by Typhoon 12: its emergency inspection of the damage and its technical support.

Typhoon 12 of September 2011 caused a total of 100 sediment disasters in the three prefectures of Nara, Wakayama, and Mie, resulting in severe losses including 56 people dead or missing (Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Erosion and Sediment Control Department (Sabo Department), as of October 26). In the same region, the Totsukawa River disaster of 1889 and the Aridagawa River Disaster of 1953 caused many deep-catastrophic landslides, and the region appears to be particularly prone to such disasters according to the "Deep-catastrophic Landslide Estimation Frequency Map," released by the MLIT, Sabo Department and the Public Works Research Institute (PWRI). The recent typhoon caused many deep-catastrophic landslides, blocking river courses (forming natural dams) at 17 locations (Photo 1). The following is a report on the results of emergency inspections performed immediately after the typhoon.



Photo 1. Blockage of River Courses by Typhoon 12 (Iya, Tanabe City, Wakayama Prefecture)

The MLIT dispatched TEC-FORCE (Technical Emergency Control Force) consisting of erosion and sediment control experts (staff of the Erosion and Sediment Control Division) to the three prefectures from September 4 to 6 to inspect the state of the disaster (by helicopter and ground inspection) and provide technical support for recovery. (1) In Mie Prefecture, no river courses were blocked, but many debris flows occurred in Kihochō Town, Kumano City, and Owase City. (2) In Nara Prefecture, a large collapse several hundred meters in length and width occurred, starting near a ridge line in the Totsukawa River Basin, blocking river courses, and in other cases, a river was temporarily blocked until overflow erosion allowed the river to flow again. (3) In Wakayama Prefecture, a large-scale river blockage occurred in Iya, Tanabe City (Photo 1), and large-scale collapses were found at several other locations. In the Nachigawa River Basin, debris flowed down many tributaries on the left and right banks of the main river course.

In all three prefectures, sediment produced and discharged by collapses and debris flows, etc. remained on the mountainsides and torrent beds, so the TEC-FORCE gave advice on precautions when

conducting inspections to prepare for restoration, monitoring and observation, and evacuation systems.

In cases where conditions stipulated under the revised Sediment-related Disasters Prevention Law enacted on May 1 of this year, the form of river course blockage, confirmation of ash fall accompanying a volcanic eruption, and so on, were satisfied, the regional development bureau conducted emergency inspections and issued emergency reports on the sediment disasters. Following typhoon 12, emergency inspections based on the same law were conducted for the first time to deal with the blockage of river courses.

An emergency inspection was started by the Kinki Regional Development Bureau on September 6 based on the results of the inspection by TEC-FORCE, with technical support from the NILIM and PWRI. The emergency inspection included measuring the assumed start points of overflows, the relative heights of the natural dams, the lengths of submerged ground, etc. using a portable laser range finder from a helicopter and GPS, clarifying the form of each natural dam. Based on the results, regions at risk of disasters caused by debris flows, etc. triggered by the overflow and collapse of a natural dam, and the estimated time of such disaster, were analyzed, and this emergency sediment disaster information was shared with local government bodies on September 8, two days after the start of the inspection (Fig. 1). Based on this information, each local government body issued evacuation orders on the same day so that residents could be properly evacuated.

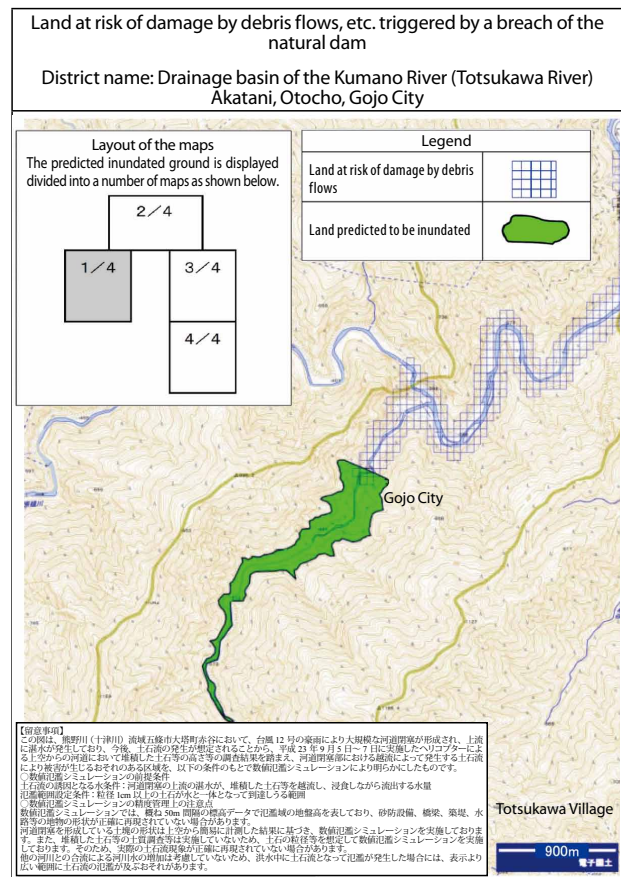


Figure 1. Example of an Emergency Sediment Disaster Inspection in a District at Risk of Disaster by a Debris Flow Triggered by Inundation, Overflow and Collapse of a Natural Dam

Study Tour and Observation to Modernize the Facilities of the RDCRB, Indonesia

International Research and Promotion Division,
Planning and Research Administration Department

From September 26 to 30, 2011, the NILIM held a study tour for the Research and Development Center of Roads and Bridges (RDCRB) of the Ministry of Public Works of Indonesia.

This study tour, which was planned and held in preparation for modernizing the facilities used to test bridges and structures at the RDCRB, included visits to related research institutes—the Public Works Research Institute, the Building Research Institute, and the Port and Airport Research Institute—and also a tour of the Three-Dimensional Full-Scale Earthquake Testing Facility (E-Defense) at the National Research Institute for Earth Science and Disaster Prevention. With the cooperation of the Honshu-Shikoku Bridge Expressway Co., Ltd. and the Hanshin Expressway Co., Ltd., the participants also observed road management and bridge structures (Akashi Kaikyo Bridge and Minato Bridge) and visited a memorial library to learn about the materials and structures damaged by the Hanshin-Awaji Earthquake in 1995, including temporary countermeasures during the emergency. This tour in the Kansai Region was impressive and educational for all members in their speciality. We are confident that the study tour has helped strengthen the research bonds between our research institutes.

(Future schedule)

Japan and Indonesia are both prone to earthquakes and other natural disasters, and intend to deepen their mutual cooperation in this field in order to protect their own economies and people. At a meeting of representatives of the two research institutes on the day the Indonesian delegates arrived, Director-General Kazuhiro Nishikawa and Director-General Jawali Marbun confirmed that

the Fifth Joint Workshop (including a seminar) would be held in Indonesia next month at the end of October. The workshop will include research according to the roadmap of joint research themes confirmed by the Third and Fourth Workshops (<http://www.nilim.go.jp/english/coop/indonesia-4thws-20110603.pdf>).



Photo: View of the Study Tour
(Top left: Courtesy call to Vice Minister Sato; upper right, courtesy visit to Director General Nishikawa; middle and bottom: Views of facility tours)

NILIM website (International Activities)
(<http://www.nilim.go.jp/english/coop/conference.htm>)

Development of a Method for Evaluating Energy Saving Renovations of Detached Houses and Apartments (2010-2012)

Residential Environment Planning Division, Housing Department

To promote energy-saving renovations in existing houses, we have clarified various available energy conservation renovation methods, and developed an evaluation method to predict the resulting energy conservation rate.

There is an urgent need for society to reduce energy consumption in houses. So measures to evaluate energy conservation by newly

built houses, Top Runner Standards for Housing ^{Note 1)}, etc. have been introduced. However, there are far more existing houses than new houses being built, and thus for the entire nation to conserve energy in houses, it is essential to encourage renovations to improve the energy efficiency of the stock of existing houses.

Therefore, in 2010, the NILIM began a research project on improving energy conservation in existing houses ^{Note 2)}, and the study is now in its second year.

Last year, cases of renovation for energy conservation were surveyed to compile suitable methods such as sun shading, insulating, and replacing equipment and appliances, etc. Renovation



Examples of energy conservation renovation methods (from left, blocking air flow in walls, adding insulation below the floor, sash window attachment method)

only for energy conservation is rarely done, but is usually combined with other work not related to conserving energy (refurbishing the interior finishing, repairing the plumbing, placing waterproof materials in bathrooms, etc.). Before such renovations are carried out, it is necessary to decide how the energy conservation renovation methods surveyed will be combined and executed.

This year, a method of calculating the energy-saving effects of these energy-saving renovation technologies was developed. If this method can be applied, it will be possible to generally predict by how much energy-saving renovations will reduce energy consumption.

For the achievements and progress of this research, please visit: <http://www.nilim.go.jp/lab/icg/shouenekaishuu/>

Note 1: Notification No. 2 of the Ministry of Economy, Trade and Industry and the Ministry of Land, Infrastructure, Transport and Tourism of 2009, Top Runner Standard for Housing

Note 2: Development of Energy Consumption Performance Evaluation Methods for Various Types of Houses (2010 to 2012)

Application of HF-radar System to Improve Tsunami Alert Systems and Reduce Tsunami Hazards

Coastal Zone Systems Division, Coastal and Marine Department

Two important roles of the HF-radar system for tsunami measures are described based on tsunami measurements in the Kii Channel.

The tsunami caused by the March 11, 2011 Magnitude 9.0 Tohoku-Oki earthquake reached the continental shelf south of the Kii Channel about 1.5 hours after the earthquake. At 5:00 p.m. on the day of the earthquake, we switched the observation mode of HF radars at two sites located on the eastern coast of the Kii Channel (Figure) from normal hourly observation to tsunami observation every two minutes. Signals from the tsunami waves induced by the earthquake and subsequent resonances were detected as radial velocity variability by the HF radar installed at the northern site.

The figure shows the time series of radial velocity along the sixth beam. From the first to the third wave with larger velocity amplitudes, the phases in the distant ranges lead those in the closer ranges. The phase relationship gradually changed after the third wave and became out of phase from 20:00 to 23:00 followed by the establishment of an in-phase relationship throughout the range from 1.5 to 30 km along the beam due to resonance. We are now analyzing the radial velocities from the other radar beams to clarify the processes of tsunami propagation and excitation of the subsequent resonances in the channel.

Research groups in the United States and Germany also detected the surface current variability induced by the tsunami wave by using HF radars in coastal regions in Japan, the United States and Chile.

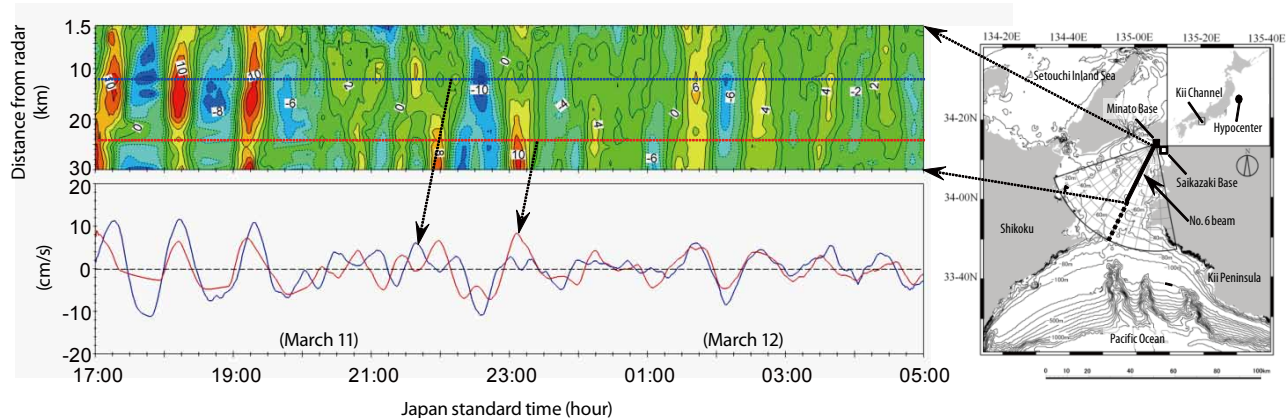
These observations suggest that in regions facing a sufficiently broad continental shelf, it is possible to detect tsunami early on using HF radar. However, the continental shelf on the south coast of Japan is generally only 20 km wide or less. The current velocity induced by the tsunami off the continental shelf is of the order of the velocity resolution of the radar or even smaller. To achieve early tsunami detection using HF radar, further technological development is necessary.

However, our observations show that HF radar has another important role, which is to measure the detailed resonance mode in coastal regions, since it is important to clarify the mode in advance in order to take tsunami countermeasures. Basically, mode calculations for coastal regions with complex topography rely on a numerical model, but verification has been done based on data from sparsely distributed water level gauges in coastal regions. Therefore, we considered extracting the resonance mode from the HF radar observations and using it to verify the numerical model. This will allow us to improve the predictions of wave height after the second wave.

Although tsunamis are rare events, resonance in coastal regions can be caused not only by tsunami, but also by meteorological disturbances. When typhoons (Nos. 6 and 12) approached the Kii Channel this year, we measured the surface current velocities in the Kii Channel by the radars in the tsunami observation mode. We are trying to understand the mechanism of the resonance mode excited in the channel based on these HF radar observation data.

Reference

Hinata et al., *Estuarine, Coastal and Shelf Science*, doi: 10.1016/j.ecss.2011.08009, 2011.



Schedule of Principal Events (November 2011 to January 2012)

Scheduled Dates	Event Name
Nov. 19	Open house: Public Works Day (Asahi Office, PWRI) http://www.nilim.go.jp/lab/bbg/event/index.html
Nov. 23	Special Conference on Port and Airport Technologies in Tohoku 2011 http://www.yok.nilim.go.jp/oshirase/linkpage_1.html
Dec. 1	2011 Conference of the National Institute for Land and Infrastructure Management http://www.nilim.go.jp/lab/bcg/kisya/journal/20111028.pdf
Dec. 20	National Conference on the Restoration of the Sea: Tokyo Bay Symposium
Jan. 31 to Feb. 2	Fourth Road/Traffic Workshop with the Institute of Transport Science and Technology, Ministry of Transport (ITST) of Vietnam

PROJECT RESEARCH REPORT of National Institute for Land and Infrastructure Management (August-October,2011)

No.	Title of Paper	Project Leader
33	Risk management methods of the business continuity for the international air/sea transport	Research Coordinator for Advanced Port Technology
34	Evaluation Method of Countermeasures with Various Utilities against Infrequent Mega-Risk Type Coastal Hazards	Director of the Coastal Disaster Prevention Division

RESEARCH REPORT of National Institute for Land and Infrastructure Management (August-October,2011)

No.	Title of Paper	Names of Divisions
46	Overtopping and Overflow Modeling in Storm Surge with High Waves and Estimation of Storm Surge Inundation Damage Sensitivity to Global Warming in Japan's Three Major Bays	Port and Harbor Department

TECHNICAL NOTE of National Institute for Land and Infrastructure Management (August-October,2011)

No.	Title of Paper	Names of Divisions
637	Trends in Sabo Project Related Studies and Research (VIII)	Erosion and Sediment Control Division
639	Report of Panel Exhibition for Coastal Ecosystem Restoration (3rd, 4th, 5th and 6th)	Marine Environment Division
640	Report of Tokyo Bay Symposium (7th - 11th: Implementing Stakeholder's Cooperation)	Marine Environment Division
641	Analysis of Current Sightseeing Boats of Active Conduct, Navigation Situation, User Consideration and Possibility of Regional Resources	Coastal Zone Systems Division
642	Analysis on World Container Ship Movement and Containerized Cargo Flow (2011)	port Planning Division
643	Study on International Air-Passenger Traffic in East and Southeast Asia	Airport Planning Division
644	Report of the research activities of International Research and Promotion Division in FY 2010.	International Research and Promotion Division

- Documents issued by the NILIM can be viewed at our web site. (<http://www.nilim.go.jp/lab/bcg/siryu/index.htm>)
- NILIM research activities and achievements are now available on the web site (<http://www.nilim.go.jp/english/annual/annual2011/ar2011e.html>), as Annual Report 2011.



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