Disclaimer

This report was compiled by an ADRC visiting researcher (VR) from ADRC member countries.

The views expressed in the report do not necessarily reflect the views of the ADRC. The boundaries and names shown and the designations used on the maps in the report also do not imply official endorsement or acceptance by the ADRC.

ASIAN DISASTER REDUCTION CENTER

VISITING RESEARCHER PROGRAM (FY2017B)

ADRC visiting researcher
PHAM HONG THANH
Disaster Management Policy And Technology Center (DMPTC)
Viet Nam Disaster Management Authority.

Kobe, Japan – March 2018

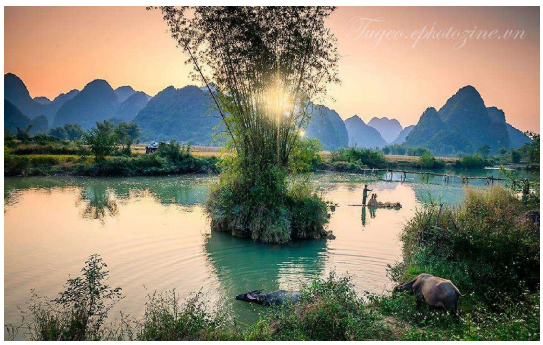
MONITORING LANDSLIDES AND EARLY WARNING SYSTEM

- ✓ NATURAL AND SOCIAL CONDITIONS MAKING JAPAN AND VIETNAM SUSCEPTIBLE TO SEDIMENT DISASTERS
- ✓ MONITORING LANDSLIDES IN JAPAN AND VIET NAM
- ✓ EARLY WARNING SYSTEM FOR LANDSLIDES



I. Natural and Social Conditions making Japan and Viet Nam Susceptible to Sediment Disasters

- ✓ Steep mountains, geological weakness and severe weather conditions
- ✓ Smaller proportion of habitable area as against land area
- ✓ Larger proportion of rapid rivers in Japan and Viet Nam
- ✓ Number of heavy rain and sediment disasters are increasing

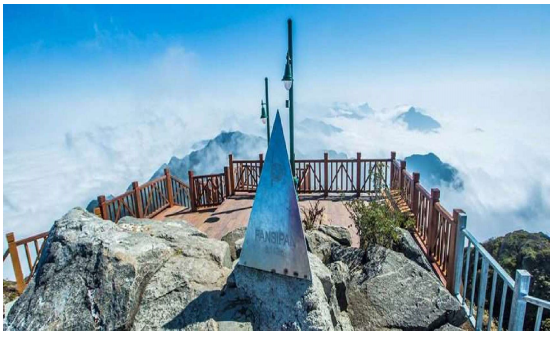


1. Steep mountains, geological weakness and severe weather conditions

Japan	Viet Nam
○ The mountainous and hilly areas make up **70%** of the total land area. Rapids and its geological weakness, the Japanese islands are vulnerable to sediment disasters caused by weather conditions like typhoons and localized torrential rain.	○ The mountainous and hilly areas make up **75%** of the total land area (mostly low hills). With a hot, rainy season (May to September) and warm, dry season (October to March). Humidity averages 84% throughout the year. Annual rainfall ranges from 1,200 to 3,000 millimeters, and annual temperatures vary between 5 degrees C and 37 degrees C. ○ Impact of high temperatures, heavy rainfall make strong erosion in hilly areas and Creates weathering crust (easy to destroy and erosion).

Highest point

Fujiyama 3,776 m

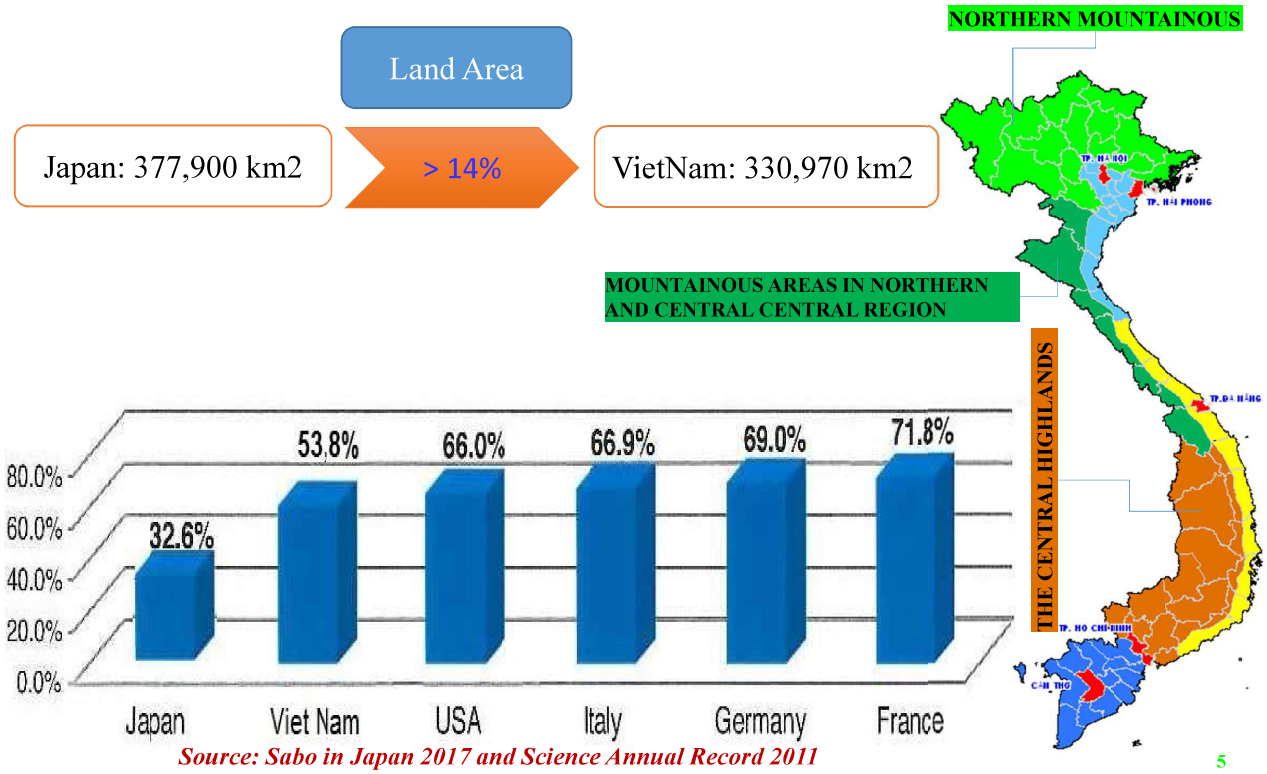


Fan Si Pan 3,144 m

2. Smaller proportion of habitable area as against land area

Land Area

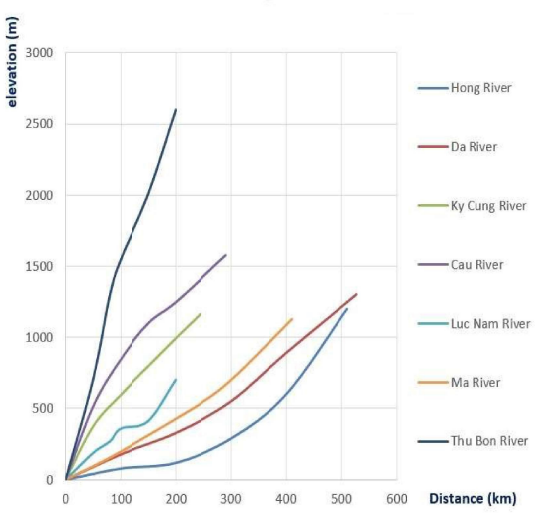
Japan: 377,900 km2 > 14% VietNam: 330,970 km2

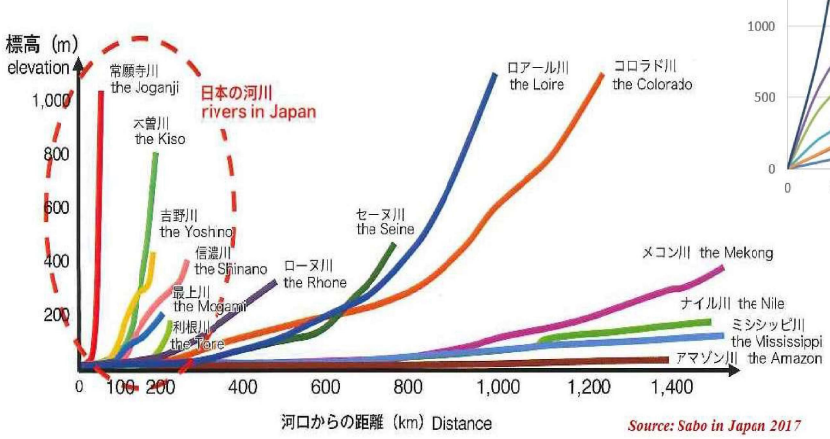


Source: Sabo in Japan 2017 and Science Annual Record 2011

3. Larger proportion of rapid rivers in Japan and Viet Nam

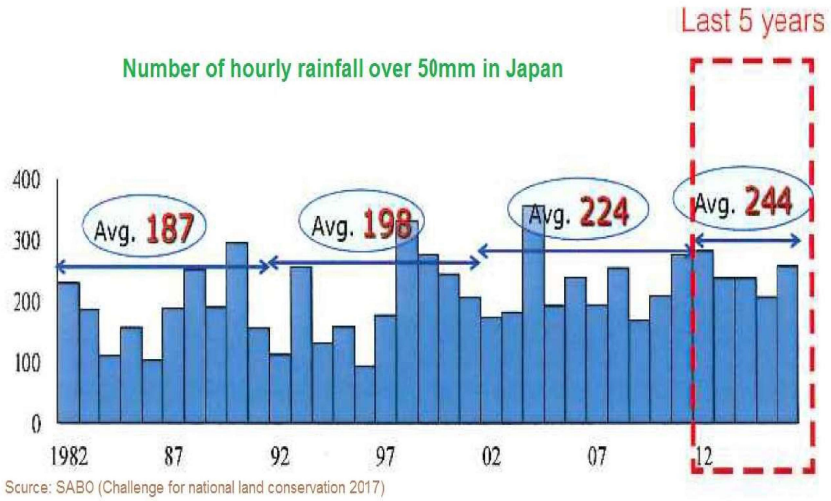
- Larger proportion of rapid river in Japan and Viet Nam than in other countries in the world
- Vietnam has a dense river network. Rivers with a length of over 10 km total about 2,372, comprising 13 large river systems with a total area of 10,000 km2.The 13 river basins, 10 of which are trans-boundary systems, cover 80% of the country's territory.





Source: Sabo in Japan 2017

4. Number of heavy rain are increasing

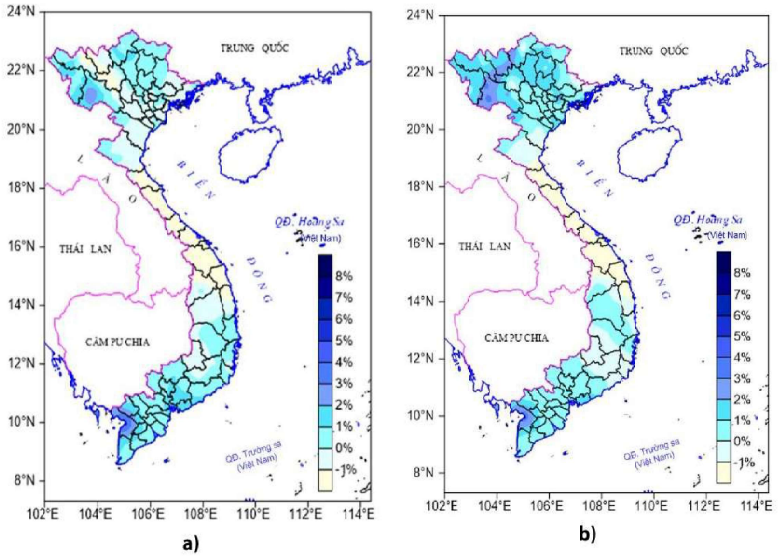


Scurce: SABO (Challenge for national land conservation 2017)

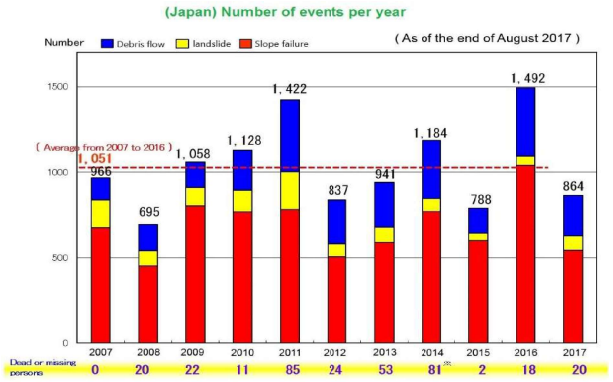
4. Number of heavy rain are increasing

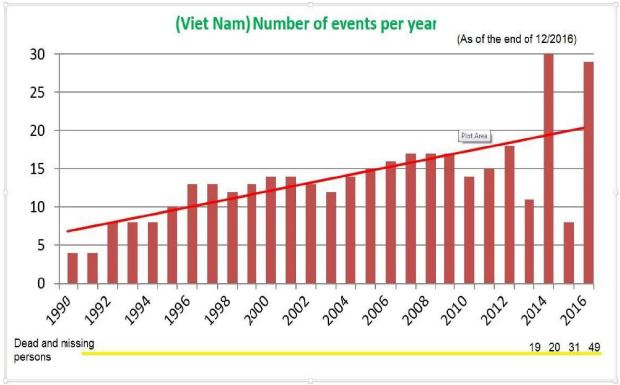
The frequency of projected heavy rainfall will increase in the 21st century in many parts of Viet Nam. Heavy rainfall will increase landslide risks in mountainous areas. According to observed data, the occurrence of heavy rainfall is increasing. (*Viet Nam Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adapation*).

Projected change in the number of rainy days over 50 mm (a) in the middle of the 21st century and (b) at the end of the 21st century



5. Number of sediment disasters are increasing





LIST OF POTENTIAL LANDSLIDE PLACES IN 10 EXAMPLE PROVINCES (VIET NAM)

Source: Report on results of survey and assessment of landslide and flash flood in mountain provinces, Vietnam (2014)

Provinces	Total places	Classification of scale of landslide				
		Small	Fair	Big	Very big	Absolute scale
Bắc Kạn	700	285	281	123	9	2
Hà Giang	967	522	288	145	4	8
Yên Bái	2326	1165	580	385	187	9
Lào Cai	534	316	162	53	3	0
Sơn La	1694	795	622	266	11	0
Lai Châu	970	337	325	280	18	10
Điện Biên	673	335	181	139	12	6
Tuyên Quang	248	144	91	11	1	0
Thanh Hóa	864	620	178	65	0	0
Nghệ An	1290	671	420	187	6	6
Total for 10 Prov.	**10266**	**5190**	**3128**	**1654**	**251**	**41**

I. Natural and Social Conditions making Japan and Viet Nam Susceptible to Sediment Disasters

5. Number of sediment disasters are increasing

LIST OF SEDIMENT-RELATED DISASTERS IN JAPAN

No.	Prefecture	Number of mountain streams at risk of debris flow	Places at risk of landslide	Places at risk of steep slope failure
1	Hokkaido	1,607	437	3,158
2	Aomori	645	63	1,318
3	Iwate	2,204	191	1,792
4	Miyagi	1,359	105	1,841
5	Akita	1,692	262	1,318
6	Yamagata	1,268	230	585
7	Fukushima	1,678	143	1,435
8	Ibaraki	537	105	1,105
9	Tochigi	1,043	96	887
10	Gunma	1,863	213	1,667
11	Saitama	585	110	825
12	Chiba	212	52	1,613
13	Tokyo	391	26	2,046
14	Kanagawa	705	37	2,511
15	Niigata	2,544	860	1,975
16	Yamanashi	1,653	104	1,412
17	Nagano	4,043	1,241	3,205
18	Toyama	556	194	1,004
19	Ishikawa	1,030	420	1,177
20	Gifu	2,934	88	2,957
21	Shizuoka	2,311	183	3,749
22	Aichi	1,555	75	2,910
23	Mie	2,693	85	4,090
24	Fukui	2,080	146	1,588
25	Shiga	1,421	62	1,317
26	Kyoto	2,328	58	1,637
27	Osaka	1,009	145	896
28	Hyogo	4,310	286	5,557
29	Nara	1,136	106	1,289
30	Wakayama	2,526	495	3,144
31	Tottori	1,626	94	1,530
32	Shimane	3,041	264	2,874
33	Okayama	3,019	198	2,475
34	Hiroshima	5,607	80	6,410
35	Yamaguchi	2,655	285	3,865
36	Tokushima	1,129	591	2,097
37	Kagawa	1,592	117	929
38	Ehime	3,540	506	2,750
39	Kochi	1,939	176	4,175
40	Fukuoka	2,508	215	3,566
41	Saga	1,760	200	1,759
42	Nagasaki	2,785	1,169	5,121
43	Kumamoto	2,120	107	3,552
44	Oita	2,543	222	4,927
45	Miyazaki	1,413	273	2,823
46	Kagoshima	2,160	85	4,231
47	Okinawa	163	88	465
	Total	**89,518**	**11,288**	**113,557**

Source: International SABO Network

Total population in the threatened area preserved	Population in the mountain streams at risk of debris flow	Population in the places at risk of landslide	Population in the places at risk of steep slope failure
~ 12.1 million people	~ 4.3 million people	~ 1.6 million people	~ 6.2 million people

Latest figures of designation of high risk areas of debris flow, landslide, slope failure and total (link reference):
http://www.mlit.go.jp/river/sabo/link20.htm

5. Number of sediment disasters are increasing

02-03 August, 2017, Damages caused by landslide and flash floods in the four provinces of Son La, Yen Bai, Dien Bien and Lai Chau.

42 people
dead and missing

398 households
evacuated

239 houses
Collapsed and swept away

1,400 billion VNĐ
(62 million USD)

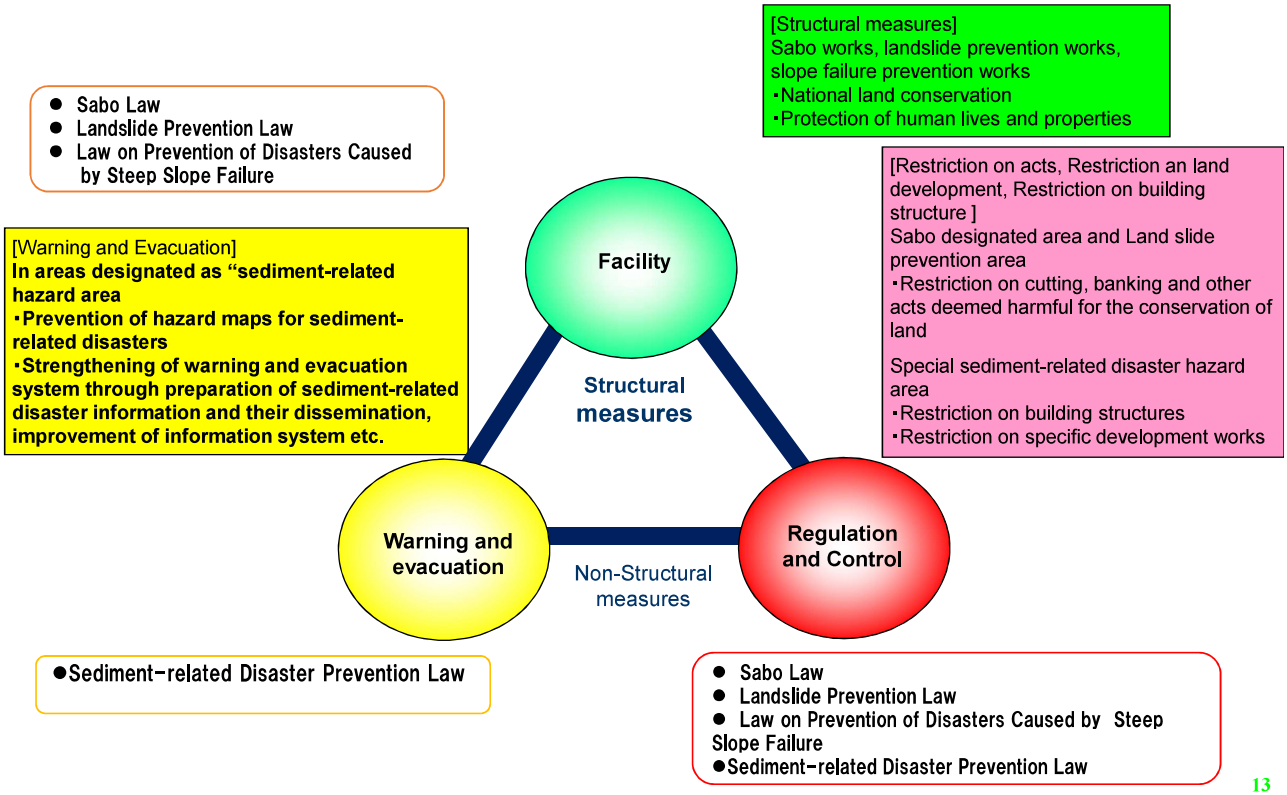
Flash floods and landslide in Muong La district, Son Lan province

Mu Cang Chai district, Yen Bai province

II.1. MONITORING LANDSLIDES IN JAPAN

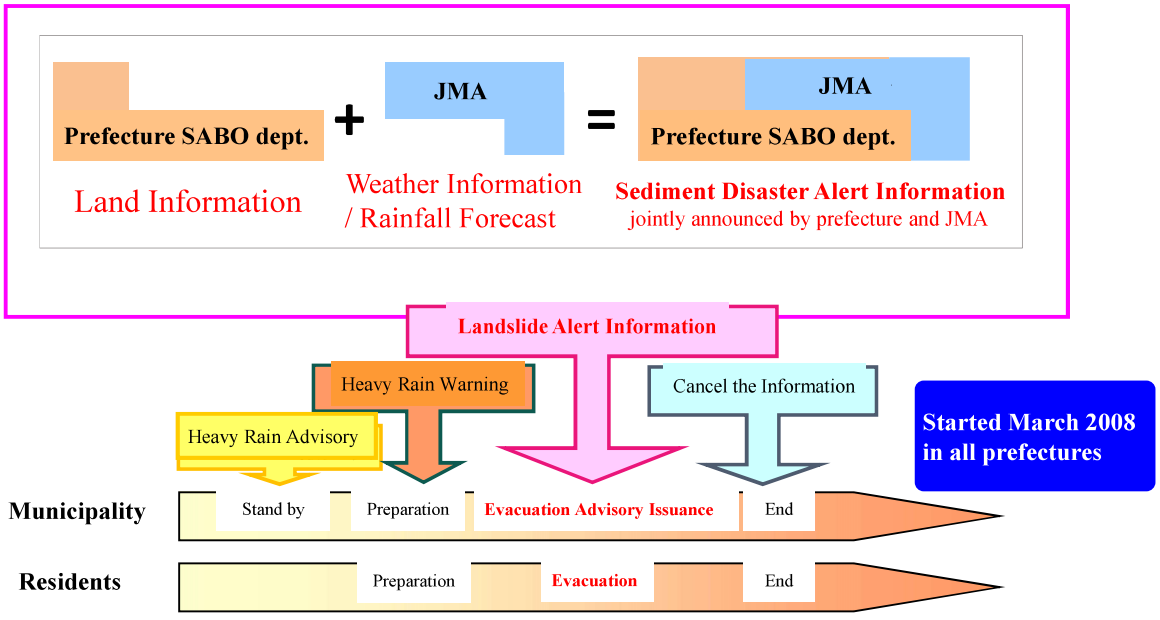
- ✓ Law for prevention of sediment-related disasters
- ✓ Landslide Alert Information
- ✓ Phased information dissemination of Landslide Alert

1. Law for prevention of sediment-related disasters



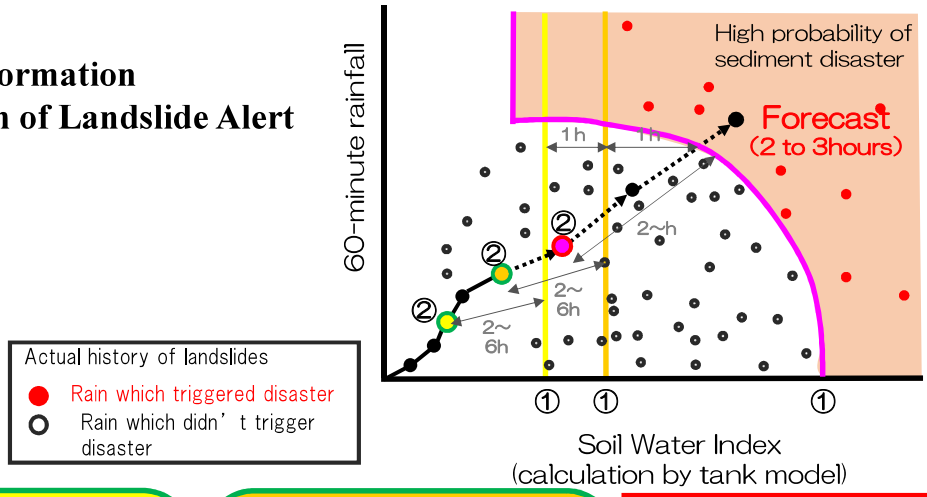
2. Landslide Alert Information

When risk of sediment disaster triggered by heavy rain is imminent, "Landslide Alert Information" is jointly announced by prefectural government and JMA (Japan Metrological Agency)
This is to help judgment of mayor's evacuation advisory issuance and resident's voluntary evacuation.



II.1. MONITORING LANDSLIDES IN JAPAN

3. Phased information dissemination of Landslide Alert



● Heavy Rain Advisory

①**Heavy Rain Advisory Index Baseline** is based on the index that corresponds to the one observed about 1 hour before Heavy Rain Warning announcement.

②The announcement is issued 2 to 6 hours before forecasted rainfall index is expected to exceed Heavy Rain Advisory Index Baseline

• Stand by (Disaster management agencies)
• Watch for minor sediment disaster

● Heavy Rain Warning

① **Heavy Rain Warning Index Baseline** is based on the index that corresponds to the one observed about 1 hour before landslide alert information announcement.

② The announcement is issued 2 to 6 hours before forecasted rainfall index is expected to exceed Heavy Rain Warning Index Baseline

• Evacuation preparation / start of evacuation of elderly etc.

● Landslide Alert Information

①**Landslide alert baseline (Critical Line)** is determined by the history of landslides.

②Landslide alert information is announced more than 2 hours* before forecasted rainfall index is expected to exceed the CL

(*) Each prefecture has different criteria.

• Evacuation advisory etc.
• Voluntary evacuation

II.2. MONITORING LANDSLIDES IN VIET NAM

Basic law: The Law on Natural Disaster Prevention and Control with Decision No. 33/2013/QH13, on 19/06/2013, entered into force on 01/05/2014 and Other documents guiding the implementation of the Law include

Decision No. 44/2014/QD-TTg dated August 15, 2014, on detailed regulations on natural disaster risk levels:

There are 2 levels of natural disaster risk caused by landslide and ground subsidence that are caused by rain or flow (Article 12):

1. Level 1 natural disaster risk includes:

a) Rain is heavy with the rainfall of 200 mm to 300 mm in 24 hours and it has been raining for more than 2 days on the mountains side with the slope of over 25 degrees, with soft ground, loose soil; or remnant slope soil;

b) Rain is heavy with the rainfall of over 300 mm in 24 hours and it has been raining for 1 to 2 days, on the mountains side with the slope of over 25 degrees, with soft ground, loose soil;

c) Rain is heavy with the rainfall of over 300 mm in 24 hours and it has been raining for more than 2 days, on the mountains side with the slope of over 25 degrees, with soft schist ground.

2. Level 2 natural disaster risk is announced when it is likely to rain heavily with rainfall of over 300 mm every 24 hours and has been raining for more than 2 days, on the mountains side with the slope of over 25 degrees, with soft ground, loose soil; or remnant slope soil.

II.2. MONITORING LANDSLIDES IN VIET NAM

No.	Type of disaster	Levels of natural disaster risk				
		1	2	3	4	5
1	Tropical depression and storm			X	X	X
2	Tornado, thunderbolt and hail	X	X			
3	Heavy rain	X	X	X		
4	Extreme heat	X	X	X		
5	Drought	X	X	X	X	
6	Damaging cold, frost	X	X	X		
7	Fog	X	X	X		
8	Flood and overflow	X	X	X	X	X
9	**Flash flood**	**X**	**X**	**X**		
10	**Landslide and ground subsidence that are caused by rain or flow**	**X**	**X**			
11	Saltwater intrusion	X	X			
12	Strong wind at sea	X	X	X		
13	Earthquake	X	X	X	X	X
14	Tsunami			X		X

Risks of natural disaster are classified into 5 levels; each level goes with a specific color that indicates the increasing risk of the natural disaster (Decision No. 44/2014/QD-TTg):

a) Level 1 - blue indicates low risks
b) Level 2 - yellow indicates average risks
c) Level 3 - orange indicates high risks
d) Level 4 - red indicates extremely high risks;
e) Level 5 - purple indicates disasters

II.2. MONITORING LANDSLIDES IN VIET NAM

Decree No. 66/2014/ND-CP dated July 4, 2014, detailing and guiding a number of articles of the law on natural disaster prevention and control

Assignment and decentralization of responsibilities and coordination in response to level natural disasters:

Article 7. Level-1 natural disasters

- Chairpersons of commune-level People's Committees and heads of commune-level commanding committees for natural disaster prevention and control and search and rescue.

- District-level People's Committee chairpersons, heads of district-level commanding committees for natural disaster prevention and control and search and rescue shall directly command and mobilize resources under their competence to respond to level-1 natural disasters which hit two or more communes or when they receive requests for support.

Article 8. Level-2 natural disasters

- Chairpersons of provincial-level People's Committees and heads of provincial-level commanding committees for natural disaster prevention and control and search and rescue.

- In cases falling beyond the responding capacity of provinces, chairpersons of provincial-level People's Committees and heads of provincial-level commanding committees for natural disaster prevention and control and search and rescue may report to and request support from the Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue.

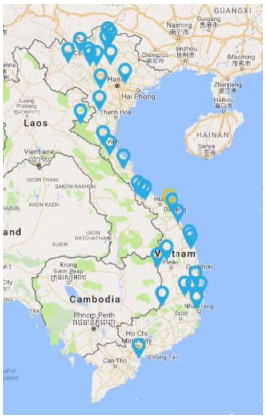
II.2. MONITORING LANDSLIDES IN VIET NAM

Weather Information /Rainfall Forecast

Viet Nam Meteorological and Hydrological Administration (Ministry of Natural Resources and Environment)

Land Information
(Map on current state of landslide for 15 northern mountainous provinces)

Landslide Alert Information



National hydrometeorological station network: **growth rate very low**

- Rain gauge density (around the country): **260km2/point**
- Rain gauge density (plain region): **120km2/point**
- Rain gauge density (mountainous): **300km2/point**

LAW HYDROMETEOROLOGY
No. 90/2015/QH13 dated
November 23, 2015
→ Effect from the day 01/7/2016

National hydrometeorological station network
(**695** Automatic Rain gauge/ many years)

Special-purpose hydrometeorological station network

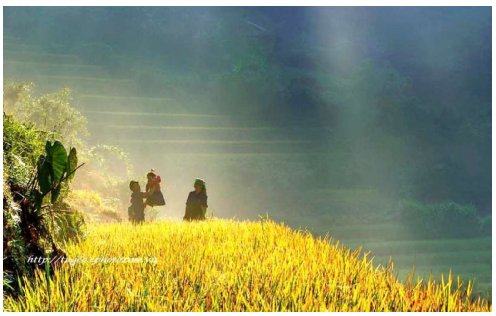
320 Automatic rain gauge/ **02 years** (23 provinces, city and Water tower)

19

III. EARLY WARNING SYSTEM FOR LANDSLIDES

(Learning from many companies & Lectures)

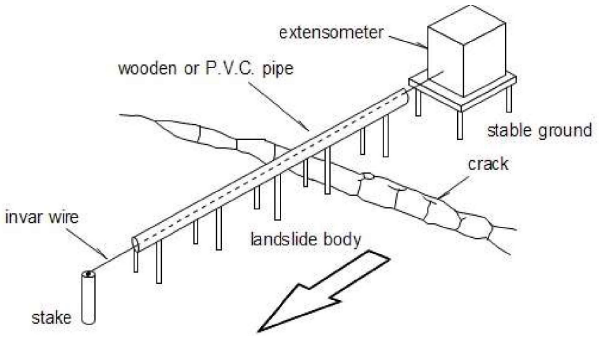
- ✓ **Extensometers**
- ✓ **Rain gauges**
- ✓ **Pipe strain gauges**
- ✓ **Clinometers and load cells**
- ✓ **Water level gauges**
- ✓ **Water Level Data Logger**
- ✓ **Other support devices**
- ✓ **Manual for Community Based Early Warning System**

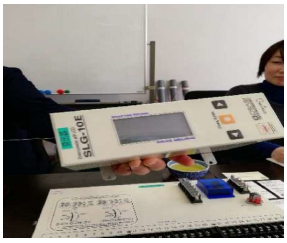


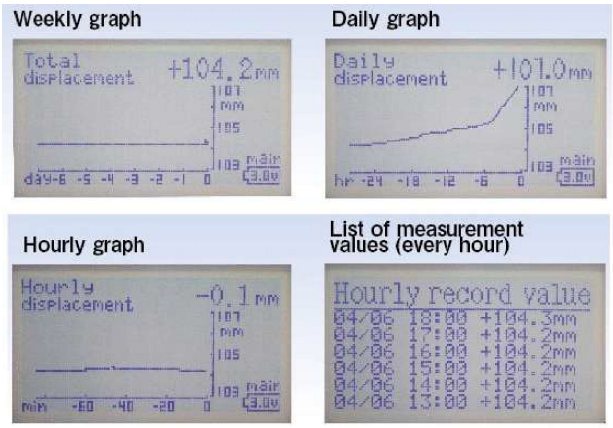
21

1. Extensometers

- Compatible with SD cards. The CSV format is used (Excel)
- Various alarm output patterns: There are 4 types of alarm output (Figure).
- Wide measurement range (1,000mm). The frequency of replacement of the invar wire on site with large movement is greatly reduced.
- Easily visible to read liquid crystal display: The contents of the screen can be easily checked.
- Easy operability: Settings can be performed simply with 3 buttons on the top surface.







2. Rain gauges

- Two types of tipping-bucket rain gauges: 0.5 mm and 1 mm per tip. Heaters are also available for use in cold districts.
- A data recorder receives the contact signals from the tipping bucket and stores them as data.
- The data recorder can also be used as a pulse logger if it is connected to a sensor that outputs contact signals.
- The data recorder also features an alarm contact.

3. Pipe strain gauges

- A pipe strain gauge is a pipe on which strain gauges are appended at even intervals;
- it is installed in an exploration borehole at a landslide site.
- It is used to estimate the depth of a slip plane, together with the results of analyzing other subjects such as boring cores.
- Osasi Technos offers a pipe strain data recorder that supports multiple channels of signals from a strain gauge (up to 90 channels with an expansion unit).
- A single-channel water level gauge is also available for measurement of underground water levels in a borehole.

4. Clinometers and load cells

- A range of 4-gauge strain data recorders for strain-gauge transducers with an I/O resistance of 350 ohms used primarily in civil engineering, such as clinometers, anchor load cells, pore pressure gauges, and earth pressure gauges.
- With connection units, the recorders support up to 60 channels of signals from other devices. Thermocouples can also be used. There is also a model that features a built-in 1-channel water level gauge.

5. Water level gauges

- The hydraulic water level sensors feature an atmospheric relief pipe, which prevents the system from being influenced by changes in the atmospheric pressure due to weather conditions, thus allowing accurate measurement of water levels.
- The sensors come in a wide variety—voltage output types, current output types, titanium-made types, and small-diameter types for narrow areas.
- Two types of data recorders are available: network type and waterproof type.

III. EARLY WARNING SYSTEM FOR LANDSLIDES

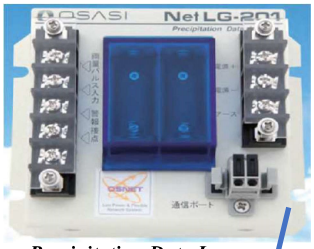
6. Water Level Data Logger

- Versatile alarm function: This instrument can be set up to four water level alarm limits, each of which is either upper or lower limit with hysteresis.
- A wide variety of monitoring functions: display three types of water level, namely, actual water level, groundwater level and water level elevation. And it also has functions to monitor power supply voltage, to diagnose breakage and short-circuit of sensor cables and to measure input resistance of sensor.
- Low-power-consumption design:
  + One year with a single main lithium battery.
  + 02 years with the use of the auxiliary battery.
- OSNET compatibility: upgrade the system easily from a data logger and a sensor to an alarm with an additional alarm function and then, to an automatic remote monitoring system.

Landslide and debris flow control

This instrument is installed inside and outside of landslide for hydrological studies. Data measured is used for the analysis of the mechanism of landslide and for designing and evaluation of the countermeasures. This instrument with a wire sensor is installed in the upper reaches of mountain streams along which debris flow could occur and used for the issuance of alarms. In addition, the flow rate measured is used to detect the occurrence of debris flow, i.e. the process from a slope collapse to a natural dam.

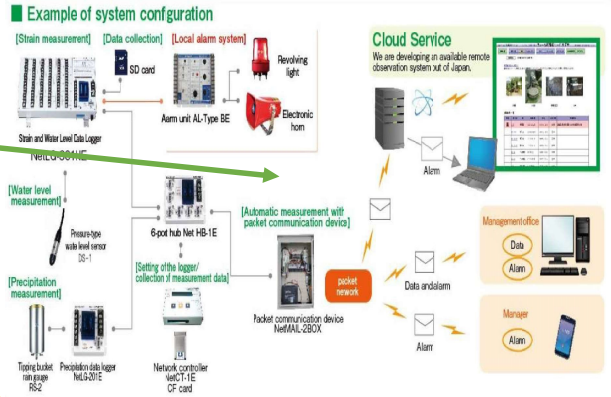
7. Other support devices



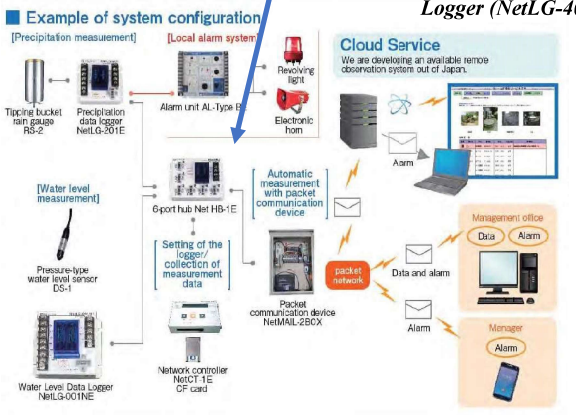
Precipitation Data Logger (NetLG-201E)

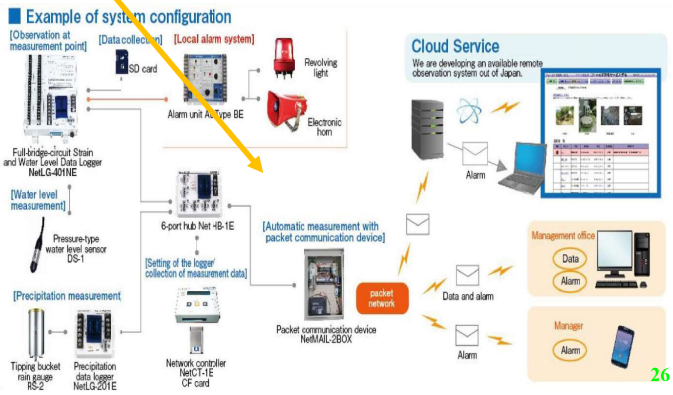
Strain and Water Level Data Logger (NetLG-301NE)

Strain and Water Level Data Logger (NetLG-401NE)



Design by OSASI TECHNOS INC

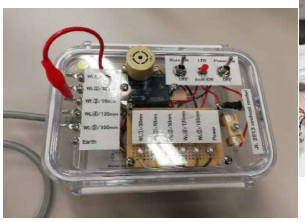


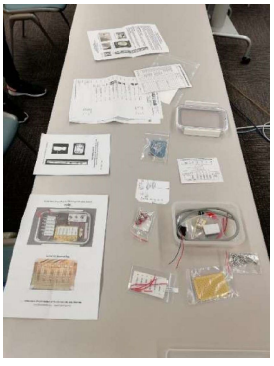


8. Community Based Early Warning System

(explore more)

ASSEMBLY





1. The equipment consists of:

- ✓ Monitoring apparatus for display and warning
- ✓ A sensor for measurement (Rainfall/River)
- ✓ An external LED level indicator (E.L.L.I)

2. Power supply: 12 volt 2amps AC – DC adaptor/ 12 volt Solar battery, solar panel and a charger controller may be considered where there is no power or power supply is not stable.

3. Circuit diagram of the monitor is given in Figure 1.

4. Circuit diagram of the external LED level indicator is given in Figure 2.

5. Details of tools for assembly and parts are given from Table 1, 2, 3 and 4 respectively.

6. One day will be enough to assemble a set of the monitoring apparatus.

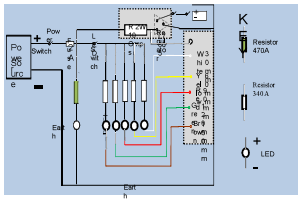


Fig. 1. Monitor Circuit Diagram

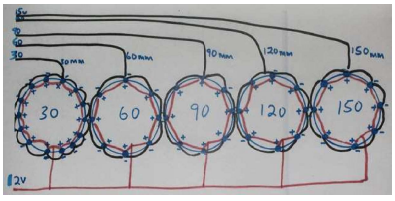


Fig. 2. External LED level Indicator Circuit Diagram (E.L.L.I)

8. Manual for Community Based Early Warning System

Advantages

1. Parts availability

- The parts for making / replacing the worn out ones are easily available in most of the electronics shops
- Parts are cheap and affordable

2. Simplicity

- Anyone can assemble this monitor, but one is advised to do so under a supervision of a technician or trained volunteer.

3. Easy to Operate and maintain

- Can be solved by the persons who assembled the equipment, which may take less time and save money

4. Effective and safe measurement

- The observer can measure heavy rainfall and sudden rise in water level without fail even if they occur in the mid-night (Due to the external LED rainfall/water level indicator).
- Without going out to the observation sites under storm, mid-night, at a safe distance and other difficult conditions.

Limitations

1. Rainfall/Water level monitors/equipment

- Not for "real time observation".
- Not for "automatic recording".
- Requires frequent monitoring to avoid electric corrosion of sensor terminal.
- Requires manual switching of power source in case of power failures i.e. from AC to DC

2. Rainfall equipment

- Requires adding a pinch of salt to improve electric conductivity of rain water.
- One needs to drain the accumulated rain in the container.
- For accumulated rainfall and not for "intensity "(rainfall during any optional unit time).

Despite "Limitations", the equipments will be suitable for CBEW due to "Advantages", especially "Simple in structure" and "Easy to Operate and maintain". There are many cases where hydrological equipments are not working which were imported and installed with external assistance.

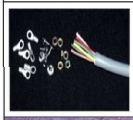
8. Manual for Community Based Early Warning System (TOOLS AND PARTS)

Table 1: Tools for assembly

	Soldering iron for electric work Solder for electric work Flux for soldering		Screw driver
	Radio pliers		Mini driver Hexagoral nut driver for M3
	Rasp		Tap for M3 screw
	Metal cutting saw		Electric driver drill
	Cutter (small) Cutter (large)		Awl
	Drills 2mm, 2.5mm, 3.1mm, 4.5mm 6.5mm, 9mm etc.		Press for aluminum terminal
	Measure and Ruler		Tester

8. Manual for Community Based Early Warning System (TOOLS AND PARTS)

Table 2: Parts for Monitoring Apparatus

Appearance	Item	Model	Standard		No.
	Glass pipe fuse	N30C	2A	pc	1
	Fuse holder			Pc	1
	DC jack	Standard female		Pc	1
	Wire (2) 12" long	6 lines cable	0.25or0.30 mm.sq.	Inches	2
	Wire (3) 8" long	Black/red wire	Flex wire	Inches	3
	Wire (1) 10" long	6 lines cable	0.5mm.sq.	Inches	1
	M3 bolt		3mm	Pcs	6
	M3 nut		3mm	Pcs	6
	M3 squash Terminal			Pcs	6
	Heat contract insulation tube or insulation tape	3mm & 4mm			
	AC converter	Input: 100-240V Output: 12V.2A		Pc	1

Appearance	Item	Model	Standard		No.
	Plastic case	Lunch box	0.5 litter	Pc	1
	Universal basis	Standard	2.54mm pitch 72x47mm	Pc	
	Spacer for Basis	M3 6mm bolts And nuts	4 bolts 12 nuts	Pcs pcs	4 12
	Regulator	(regulator number)	6 – 9volts	Pc	1
	Heat sink	Standard		Pc	1
	Resistor	10 amps 2 watts		Pc	1
	Mechanical Buzzer		9v(3-12volt)	Pc	1
	M3 Screw to fix buzzer	3mm	Bolt Nut	pcs pcs	4
	Carbon resistor	½ W 330Ω		Pcs	5
	Carbon resistor	½ W 430Ω		Pc	1
	12v High brightness LED	Red		Pcs	6
	Toggle switch			Pcs	3
	Bagworm clip			Pc	1
	M3 screw for selecting terminal	3mm		Mm	6
	M3 nut			Mm	6
	M3 squash Terminal	Round		Mm	5

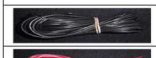
III. EARLY WARNING SYSTEM FOR LANDSLIDES

8. Manual for Community Based Early Warning System (TOOLS AND PARTS)

Table 3: Parts for Rainfall Equipment (Throw-in type)

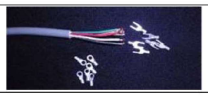
Appearance	Item	Model	Standard	Unit	No.
	3 litter large neck bottle			pc.	1
	Cable protector/ Trunk			Cm	20
	M3 stainless Bolt	25mm		pcs.	10
	M3 stainless Nut			pcs.	10
	Stainless wire	φ0.7mm		Cm	20
	6 lines cable	0.3mmsqr		m	1
	M3squash terminal	Round		pcs.	6
	terminal	Y shaped		pcs.	6
		2cmx20cm		pc	1
	M3 stainless bolt	8mm		pcs.	3
	M3 stainless nut			pcs.	3
	Heat contract insulation tube or insulation tape	3mm & 4mm		roll	0.1

Table 4: Parts for Water level Equipment (Height: 2m, Distance: 30m)

Appearance	Item	Model	Standard	Unit	No.
	for sensor	φ40mm x 2m		pc.	1
	for casing	φ75mm x 2m		pc.	1
	Stainless wood screw			pcs.	10
	M4 Stainless washer			pcs.	10
	terminal	Round		pcs.	10
	Wire	Black		m	3
	Wire	Red		cm	8
	End cap	75mm		pc.	1
	M3 Stainless bolt	6mm		pcs.	3
	M5 Stainless bolt	100mm		pcs.	2
	M5 Stainless nut			pcs.	4
	M3 Stainless bolt	6mm		pcs.	6
	terminal	Round		pcs.	6
	Wire (1)	6 lines cable	0.3mm.sq.	m	30
	M3 Squash terminal	Round		pcs.	6
	M3 squash terminal	Y shaped		pcs.	6
	Heat contract insulation tube or insulation tape	3mm & 4mm		roll	0.1
	Color adhesive seal	Outdoor use	10cmx4 5cm	pcs	3

8. Manual for Community Based Early Warning System (TOOLS AND PARTS)

Table 5: External LED light indicator (E.L.L.I)

Appearance	Item	Model	Standard	Unit	No.
	LED lights		12 volts	Pcs	80
	Chip board/ ply wood	9'' x 27''		pcs	2
	Slim timber frames ½'' square	27''		Pcs	2
	Slim timber frames ½'' square	8''		Pcs	2
	Tag nails ½"			Pcs	30
	6core cable M3 Squash terminal	As long as needed Round		pcs	6

CONCLUSIONS

In Japan, every year there is a great loss of people's lives and properties due to natural disasters. Until the second half of 1950s, largescale typhoons with earthquakes caused extensive damage and thousands of casualties. It's the valuable lesson from disaster history. The surface of the Earth will change continuously under the influence of natural processes. Landslides will take place on unstable hillsides. Man is powerless to prevent the natural processes themselves, but in its power to avoid casualties and damages.

With the progress of society's capabilities to respond to disasters and mitigate vulnerabilities to disasters by developing disaster management systems, promoting national land conservation, improving weather forecasting technologies, and upgrading disaster information communications systems, disaster damage has shown a declining tendency (DM in Japan, Cabinet Office).

ADRC's mission is to enhance disaster resilience of its member countries (30 countries), to build safe communities, and to create a society where sustainable development is possible. And currently, Viet Nam Disaster Management Authority collaborates and interested in further cooperation with ADRC mitigation of natural disasters, with the common goal of substantial reduction of the victims, the early warning of the dangers and to reduce the social, economic and environmental assets of communities.

In Japan, I learned about a new system of disaster management, early warning and disaster prevention. Special, that's Early Warning system for Landslides (It spent a wonderful time that I want to turn back the hands of time). And after returning to the country, I have a plan to recommend this "Early Warning System for landslide" the chairman.

Finally, I want to say "thank you" ADRC, for organizing all meetings, lectures, presentations, trips and for wholesome advice. And also thanks all the staff ADRC for hospitality and support for the first time I go to Japan. Special, thank Shiomi-san who's always ready to accompany with me on the trips.

Thank you very much! I'm really going to miss you.