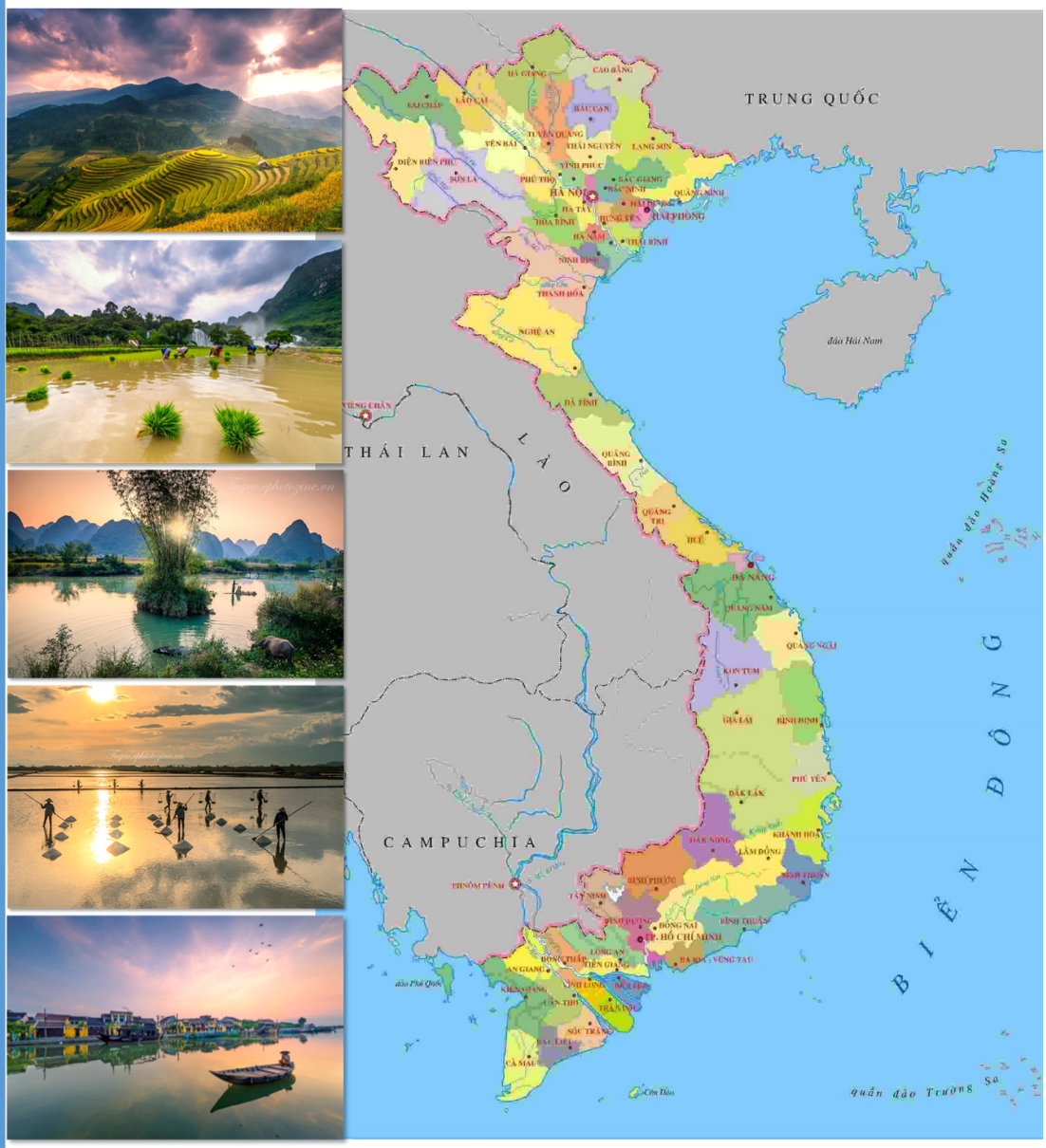
JAPAN, 2018

ASIAN DISASTER REDUCTION CENTER

Visiting Researcher Program

(FY2017B)

Viet Nam Final Report 2017



ADRC Visiting Researcher

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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.

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CHAPTER I. BACKGROUND, SPECIFIC AIMS AND PROPOSED RESEARCH ACTIVITIES

1. BACKGROUND

Vietnam is one of the countries worst affected by natural disasters and climate changes (there were 20/21 types of disasters in 2016, with exception of tsunami).

Natural disasters, in particular storms, floods, droughts, flash floods and landslides are increasing in intensity and frequency, causing severe human and economic losses: Over the past 20 years, disasters caused 10,800 dead and missing persons, and an economic loss to the GDP of: VND 28 trillion (1÷1.5% of Gross Domestic Product - GDP). Inside, Landslide and Flashfloods trending up.

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. Thereafter, 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. Viet Nam needs up-to-date world expertise in any scientific area which is likely to contribute to its sustainable development, focusing on landslides. My participation in the VR program at ADRC is therefore of great importance to my activities.

2. SPECIFIC AIMS

- Disaster Management in Japan and Viet Nam

- Analyze and Compare

- Monitoring Landslides ensure the safety population in mountain and foothill areas (Landslides in Viet Nam and Japan): About the Landslide Society, Major Landslides in Recent years and their impact, New methods of monitoring landslides and maintaining them in a stable state.

3. RESEARCH ACTIVITIES

- Collecting and analyzing the data on disaster history, disaster management in Viet Nam and Japan (Japan DM lesson, Field trip in Japan, attending workshops and seminars related to disaster).

- Data, book, articles, journals that are organizational structure, disaster response, relief operations, emergency response, the mega disasters that are happened especially.

- Lectures on Measurement System for Disaster Prevention, The Landslide Remote Monitoring System.

- The primary data collection was done in some of the Prefectures, Cities and Municipalities of Japan which have experienced mega disasters in the past history. Information sessions were provided by the Cabinet Office, JMA Regional Office, disaster management units of MLIT, Prefectural Governments, Japan Police, Cities and Municipalities, Fire Departments and Towns. Quite a lot of the data is from the Hyogo Prefecture and Kobe City. This research has used both primary and secondary data to understand the early warning setup and the disaster response mechanism at different levels in Japan.

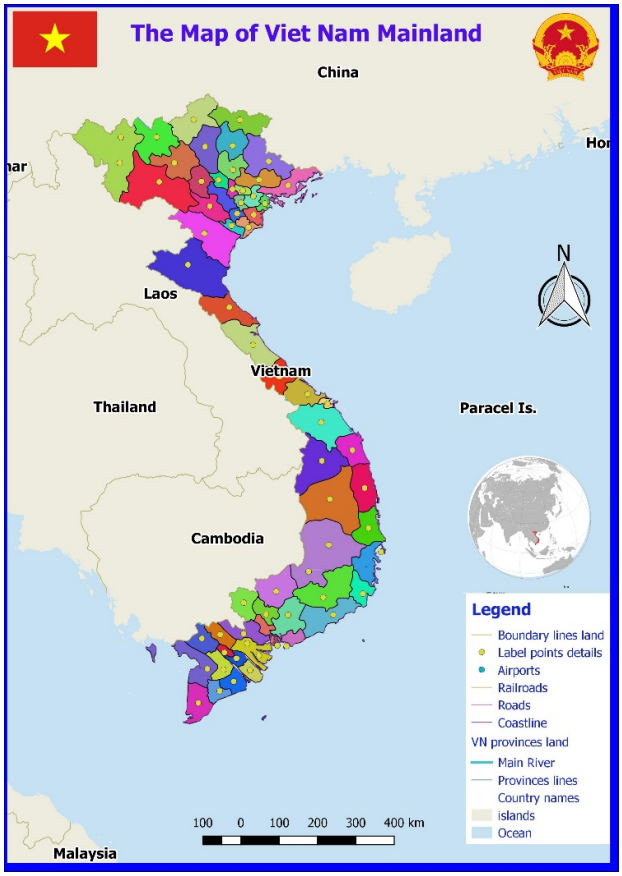
CHAPTER II. GENERAL INFORMATION

1. SOCIALIST REPUBLIC OF VIET NAM

1.1. Geography

Conventional long form	:	Socialist Republic of Vietnam
Conventional short form	:	Vietnam
Government type	:	Communist state
Capital	:	Hanoi
Administrative divisions	:	58 provinces and 5 municipalities existing at the same level as provinces (capital, singular and plural)

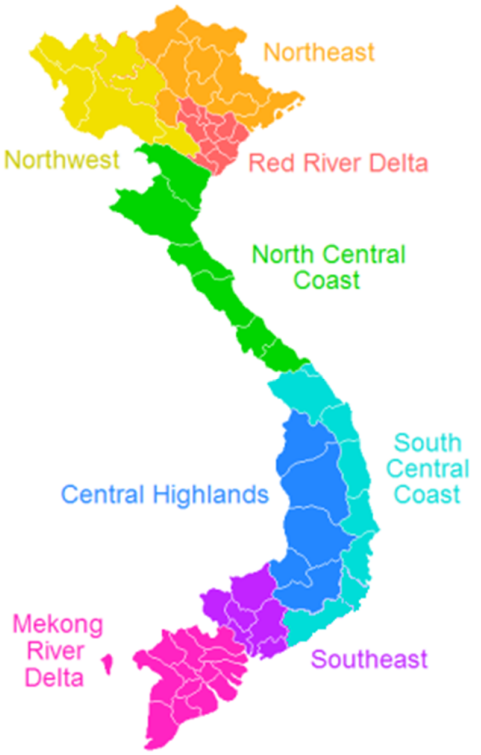
Vietnam is located in eastern Indochina, and borders with China, Lao, PDR and Cambodia. Narrow strip of land is 329,241 square kilometers in area. Southern part has the Mekong Delta and plains, whilst the central area is composed of mountains and slopes. North is mountainous and hilly, except the Red River Delta in the south. Tropical climate in the south and temperate in the north, with rainy season from April to October. In the mountains annual precipitation sometimes rise up to 4000mm. From October to March is dry season. Out of 95,6 million people, 86 percent are the Kinh. The population includes 53 other ethnic minority residents.

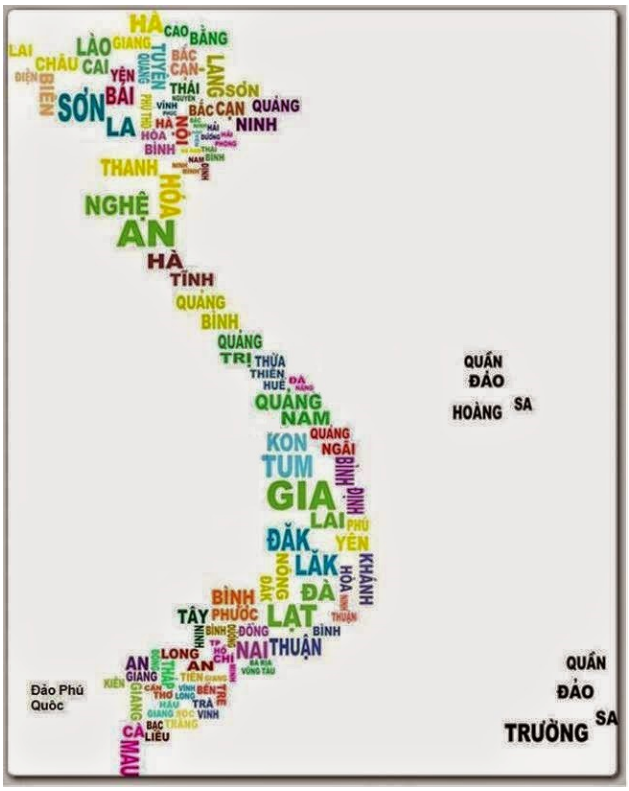


1.2. Administrative Divisions

Vietnam is divided into 58 provinces and 5 municipalities existing at the same level as provinces. The provinces are divided into districts, provincial cities, and county-level towns, which are subdivided into commune-level towns or communes. The municipalities are divided into rural districts and urban districts, which are subdivided into wards.

Vietnamese provinces are controlled by a People's Council, elected by the inhabitants. The People's Council appoints a People's Committee, which acts as the executive arm of the provincial government. This arrangement is a somewhat simplified version of the situation in Vietnam's national government. Provincial governments are expected to be subordinate to the central government.





1.3. Demographic

(*) Report No.1809/BC-BTNMT, dated 15/5/2014 of the Ministry of Natural Resources and Environment.

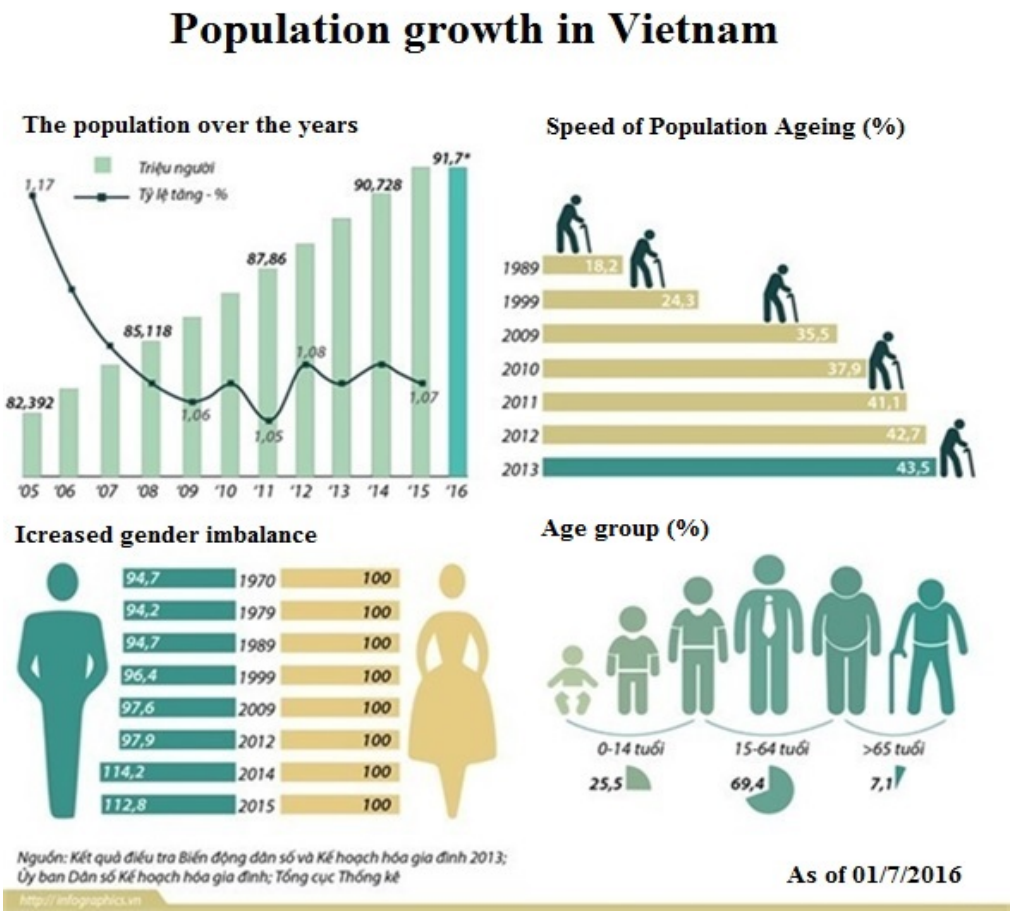
No	*Province, City*	*Area (Km2)*	*Average population (thousand people)*	*Population density (people/km2)*
Total		**330972,4**	**89708,9**	**271,0**
Red river delta		**21059,3**	**20439,4**	**971,0**
1	Ha Noi	3324,3	6936,9	2087,0
2	Vinh Phuc	1238,6	1029,4	831,0
3	Bac Ninh	822,7	1114,0	1354,0
4	Quang Ninh	6102,4	1185,2	194,0
5	Hai Duong	1656,0	1747,5	1055,0
6	Hai Phong	1527,4	1925,2	1260,0
7	Hung Yen	926,0	1151,6	1244,0
8	Thai Binh	1570,5	1788,4	1139,0
9	Ha Nam	860,5	794,3	923,0
10	Nam Dinh	1652,8	1839,9	1113,0
11	Ninh Binh	1378,1	927,0	673,0
Midlands and Northen Mountainous		**95274,7**	**11508,1**	**121,0**
12	Ha Giang	7914,9	771,2	97,0
13	Cao Bang	6707,9	517,9	77,0
14	Bac Kan	4859,4	303,1	62,0
15	Tuyen Quang	5867,3	746,7	127,0

No	*Province, City*	*Area (Km2)*	*Average population (thousand people)*	*Population density (people/km2)*
16	Lao Cai	6383,9	656,9	103,0
17	Yen Bai	6886,3	771,6	112,0
18	Thai Nguyen	3536,4	1156,0	327,0
19	Lang Son	8320,8	751,2	90,0
20	Bac Giang	3849,7	1593,2	414,0
21	Phu Tho	3533,3	1351,0	382,0
22	Dien Bien	9562,9	527,3	55,0
23	Lai Chau	9068,8	404,5	45,0
24	Son La	14174,4	1149,3	81,0
25	Hoa Binh	4608,7	808,2	175,0
North Central Coast and Central Coastal Region		**95834,5**	**19362,5**	**202,0**
26	Thanh Hoa	11130,5	3476,6	312,0
27	Nghe An	16492,7	2978,7	181,0
28	Ha Tinh	5997,3	1242,7	207,0
29	Quang Binh	8065,3	863,4	107,0
30	Quang Tri	4739,8	612,5	129,0
31	Thua Thien Hue	5033,2	1123,8	223,0
32	Da Nang	1285,4	992,8	772,0
33	Quang Nam	10438,4	1461,0	140,0
34	Quang Ngai	5152,0	1236,3	240,0
35	Binh Dinh	6050,6	1510,4	250,0
36	Phu Yen	5060,5	883,2	175,0
37	Khanh Hoa	5217,7	1192,5	229,0
38	Ninh Thuan	3358,3	587,4	175,0
39	Binh Thuan	7812,8	1201,2	154,0
Central Highlands		**54641,1**	**5460,4**	**100,0**
40	*Kon Tum*	9689,6	473,3	49,0
41	Gia Lai	15536,9	1359,9	88,0
42	Dak Lak	13125,4	1827,8	139,0
43	Dak Nong	6515,6	553,2	85,0
44	Lam Dong	9773,6	1246,2	128,0
45	Đông Nam Bộ	23590,8	15459,6	655,0
46	Binh Phuoc	6871,5	921,8	134,0
47	Tay Ninh	4032,6	1095,6	272,0
48	Binh Duong	2694,4	1802,5	669,0
49	Dong Nai	5907,2	2768,7	469,0
50	Ba Ria – Vung Tau	1989,5	1052,8	529,0
51	Tp. Ho Chi Minh	2095,6	7818,2	3731,0
Mekong River delta		**40572,0**	**17478,9**	**431,0**
52	Long An	4491,9	1469,9	327,0
53	Tien Giang	2508,6	1703,4	679,0

No	*Province, City*	*Area (Km2)*	*Average population (thousand people)*	*Population density (people/km2)*
53	Ben Tre	2359,5	1262,0	535,0
54	Tra Vinh	2341,2	1027,5	439,0
55	Vinh Long	1520,2	1040,5	684,0
56	Dong Thap	3378,8	1680,3	497,0
57	An Giang	3536,7	2155,3	609,0
58	Kien Giang	6348,5	1738,8	274,0
59	Can Tho	1409,0	1222,4	868,0
60	Hau Giang	1602,4	773,8	483,0
61	Soc Trang	3311,6	1308,3	395,0
62	Bac Lieu	2468,7	876,8	355,0
63	Ca Mau	5294,9	1219,9	230,0

As of 01/2017

- Population: 94,970,597 (1,27% in the World, Ranked 14th most Populous Country)
- Sex ratio: M 49,3% F 50,7%
- Average: 30,8 yr
- Area: 330,972 km2
- Population density: 308 persons/km2
- Urban population: 34,7% (33,121,357 people).
- Age group (2016): 25,5% (0-14 years old), 69,4% (15-64 years old), 7,1% (65 and more)



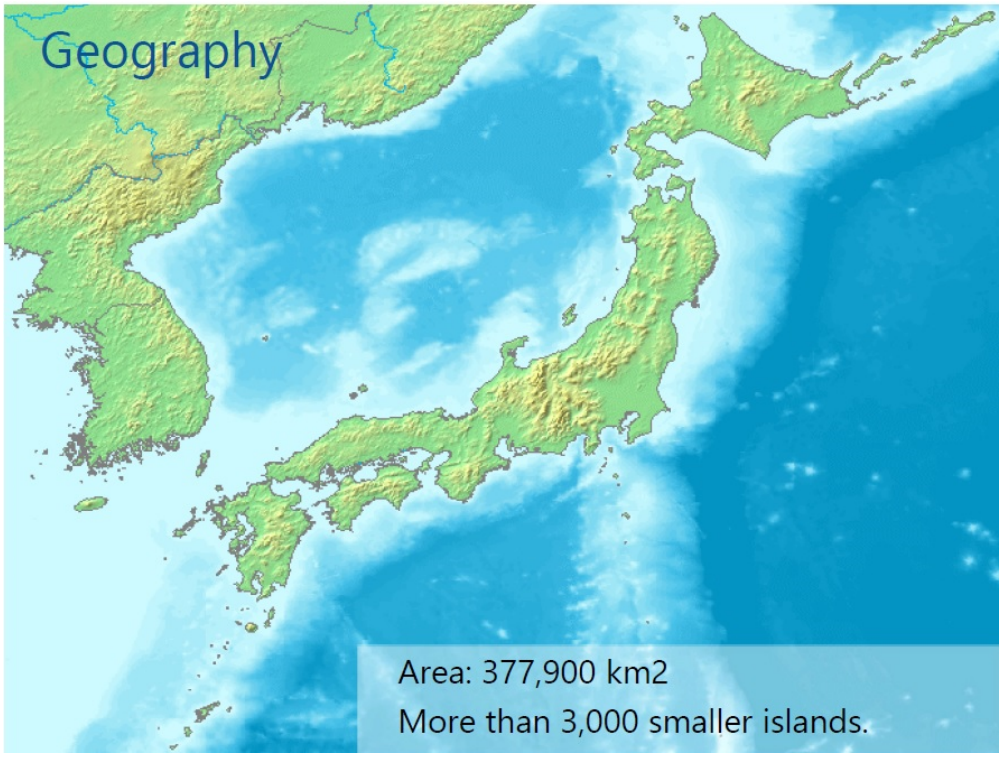
2. JAPAN

2.1. Geography

Japan has a total of 6,852 islands extending along the Pacific coast of East Asia. The country, including all of the islands it controls, lies between latitudes 24^0 and 46^0N, and longitudes 122^0 and 146^0E. The main islands, from north to south, are Hokkaido, Honshu, Shikoku and Kyushu. The Ryukyu islands, including Okinawa, are a chain to the south of Kyushu. Together they are often known as the Japanese Archipelago.

About 73 percent of Japan is forested, mountainous and unsuitable fo agricultural, industrial, orresidential use. As a result, the habitable zones, mainly located in coastal areas, have extremely high population densities. Japan is one of the most densely populated countries in the world.

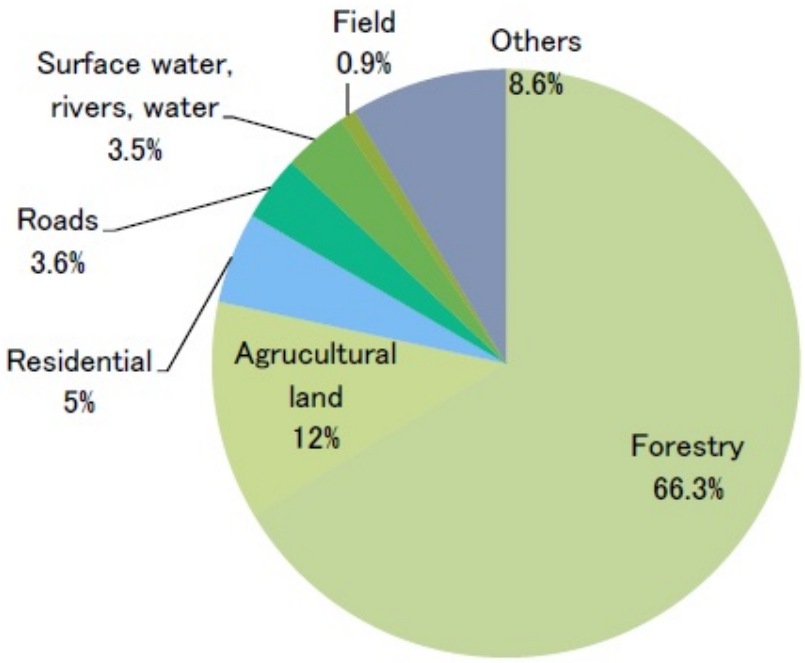
The islands of Japan are located in a volcanic zone on the Pacific Ring of Fire. They are primarily the result of large oceanic movements occurring over hundreds of millions of years from the mid-Silurian to the Pleistocene as a result of the subduction of the Philippine sea plate beneath the continental Amurian Plate and Okinawa Plate to the south, and subduction of the Pacific Plateunder the Okhotsk Plate to the north. Japan was originally attached to the eastern coast of the Eurasian continent. The subducting plates pulled Japan eastward, opening the Sea of Japan around 15 million years ago.



- Located in the Circum-Pacific "ring of fire", plate boundary
- Japan is predominantly mountainous
- The Japan Alps, studded with 3,000-meter peaks, bisect the central portion of Honshu, the main island.

2.2. Land Use

- Mountains and agricultural lands consist 78 percent
- Residential area is 5 percent



As of 2012: http://www.stat.go.jp/data/nihon/g0101.htm

2.3. Demography

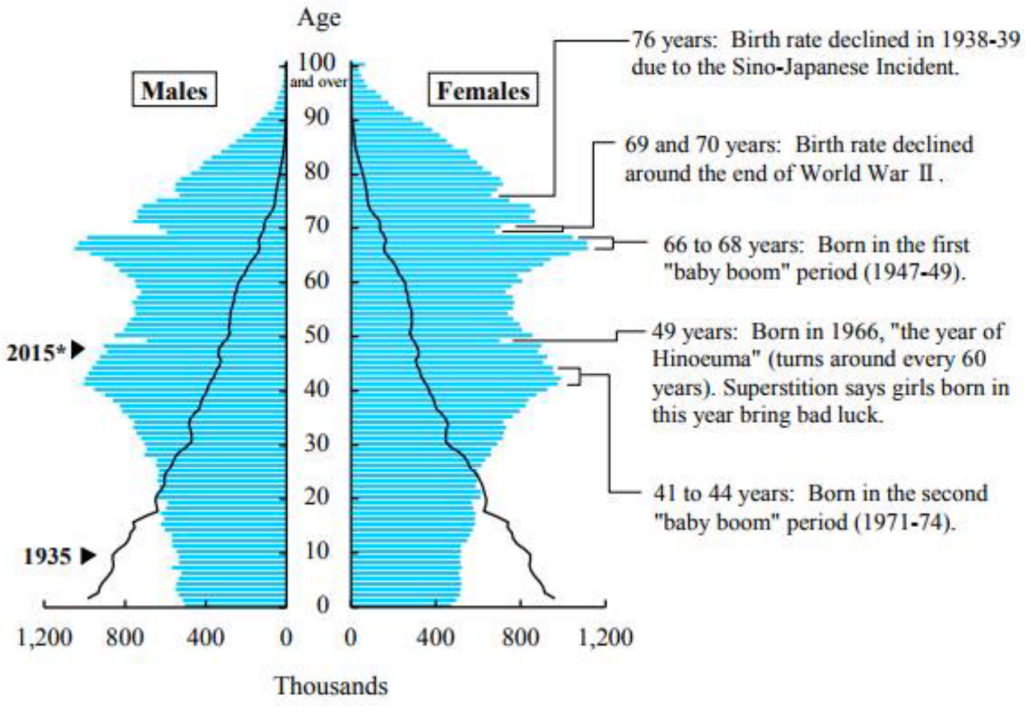
- Population (2015): 127,094,745
- Average: 45 yr
- Population density: 343 persons/km
- Labor force (2016): 66 million
- Unemployment rate (2016): 3.1%
- Birth rate: 1.43 (2013)
- Life Expectancy (2010)
- Aged 65 and more: 26.7% (2015)
- Life Expectancy (2010): M 79.64 F 86.39

⇒Aging, Urbanization and Marginalization

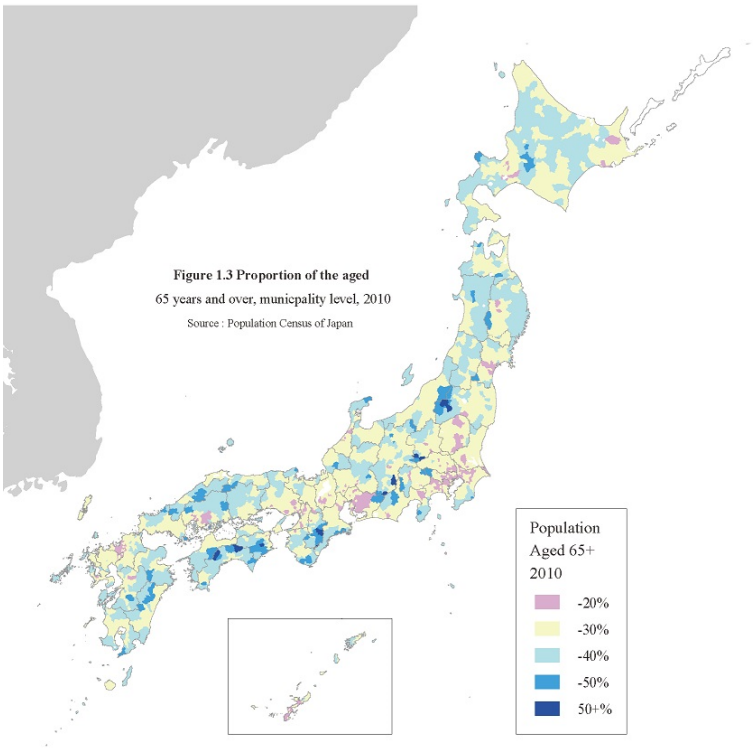
Ministry of Internal Affairs and Communications, Statics Bureau

http://www.stat.go.jp/index.htm

Population Pyramid (2015)

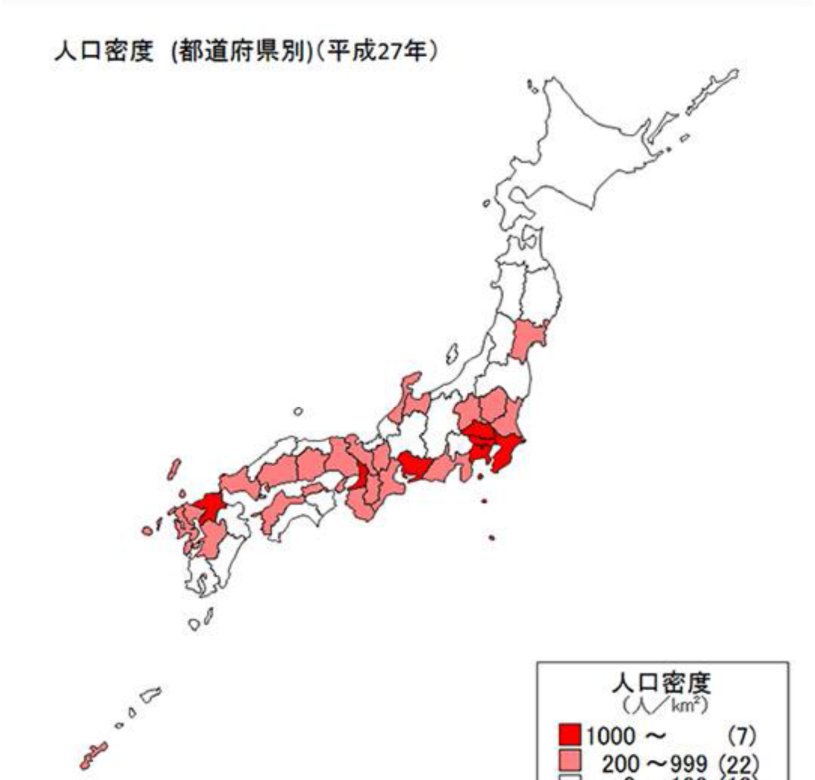


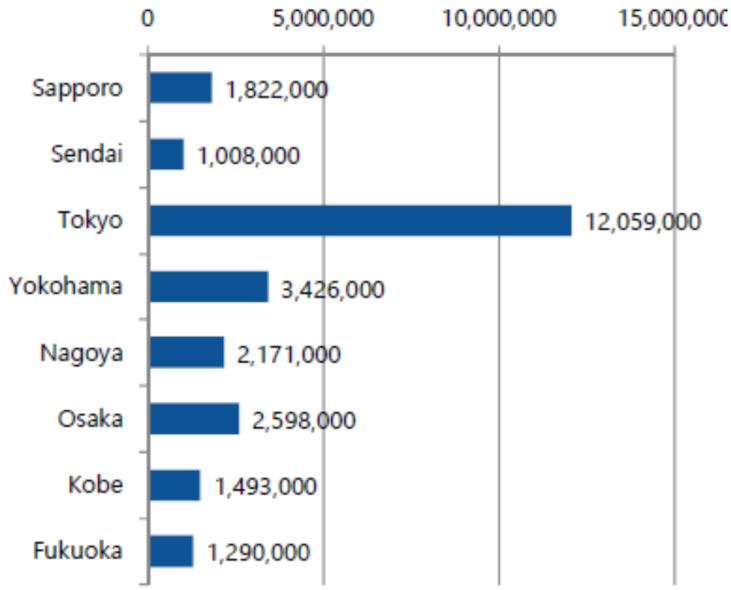
Statistical Handbook of Japan 2016
http://www.stat.go.jp/english/data/handbook/index.htm



http://www.ipss.go.jp/s-info/e/ssj2014/001.html

- The population of the Tokyo
- Metropolitan Area: 12 million





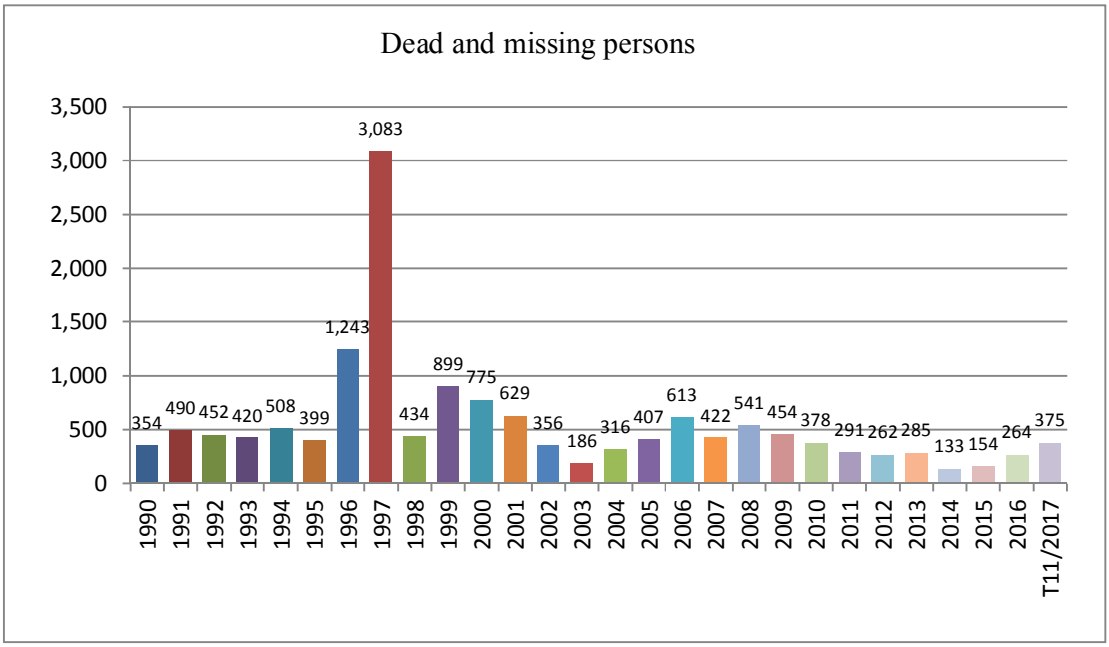
CHAPTER III. DISASTER MANAGEMENT

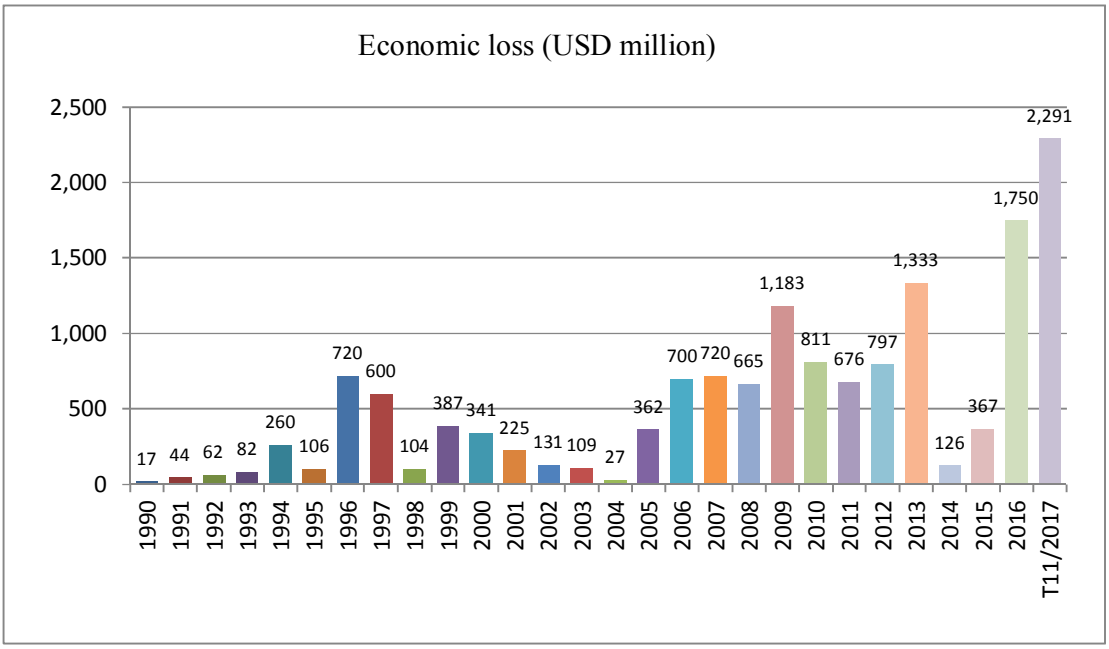
1. DISASTERS IN VIETNAM

1.1. Background

Vietnam is one of the countries worst affected by natural disasters and climate changes (there were 20/21 types of disasters in 2016, with exception of tsunami).

Natural disasters, in particular storms, floods, droughts, flash floods and landslides are increasing in intensity and frequency, causing severe human and economic losses: Over the past 20 years, disasters caused 10,800 dead and missing persons, and an economic loss to the GDP of: VND 28 trillion (1÷1.5% of Gross Domestic Product - GDP).





1.1.1. Typical Regional Disasters

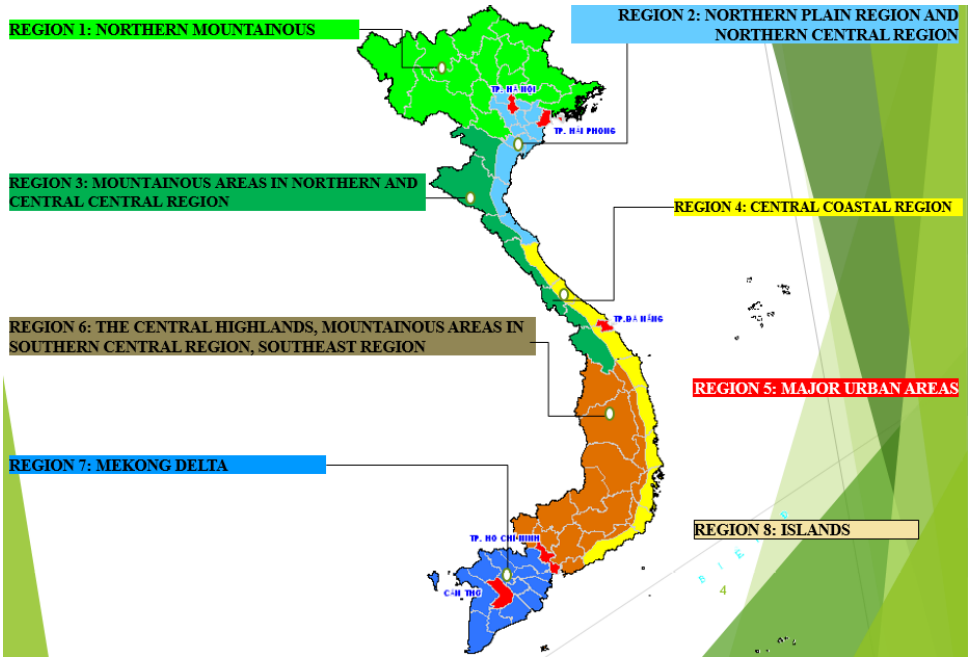
- Region 1: Northern Mountainous (Flashfloods, landslides, damaging cold, snow, frosts and heavy rains)**:** Flashfloods and landslides in Aug. 2017 in Son La, Yen Bai, Dien Bien, Lai Chau caused 44 dead and missing persons and an economic loss of VND 1,190 billion (~52 million USD).

- Region 2: Northern plain Region and Northern Central Region (Flood, typhoons, inundation, drought, saline intrusion, damaging cold and heavy rains)**:** Flood in 1945 broke 79 pieces of dyke, innudating 160,000 ha of productive land. Flood in 1971 broke 16 dyke points, innudating 200,000 ha of productive land.

- Region 3: Mountainous Areas in Northern and Central Central Region (Heating, flashfloods, landslides and damaging cold): Flashfloods in Sept. 2002 in Ha Tinh caused 53 dead and missing cases, 111 injuries.

- Region 4: Central Coastal Region (Heavy flooding, inundation, superstorms, water surging, saline intrusion, coastal and river erosion, heavy rains): Flood in 2016 caused 134 deads, inundated 1,200 houses.

- Region 5: Major Urban Areas (Inundation due to heavy rains and floods, tidal waves, heavy storms and whirlwinds and tornadoes)**:** Inundation in 2008 caused 22 deads and an economic loss of VND 3,000 billion.



- Region 6: The Central Highlands, Mountainous Areas in Southern Central Region, Southeast Region (Heating, drought, floods, flashfloods, landslides and inundation): Drought in 2015 – 2016 caused water shortage in 115,000 households, and damages to 15,000 ha non-productive land, 28,000 ha of paddy fields, and 140,000 perenial trees.

- Region 7: MeKong Delta (Typhoon, flood, inundation, tidal flooding, storm surging, drought, saline intrusion, coastal and river erosion, whirlwind, tornadoes and thunderbolts)**:**

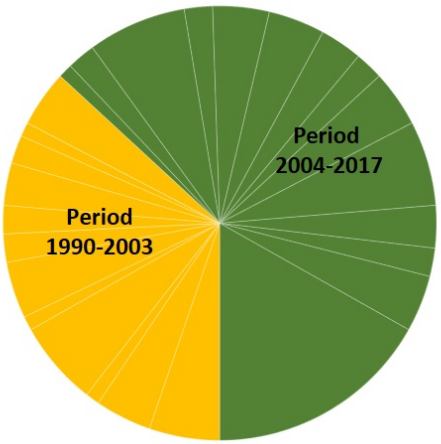
Saline intrusion in 2015 caused water shortages in 342,000 households, and damages to 216,000 ha of paddy rice.

- Region 8: Islands (Storms and superstorms)**:** Storm Chanchu in 2006 sunk 13 ships, 5 ships were lost, causing 266 dead and missing persons.

1.1.2. Extreme Events

1.1.2.1. Storms: at level 12 or above in the East Sea of Vietnam are trending up: In period 2004-2017 (60 events), increasing by 1.71 times from that in period 1990-2003 (35 events). Special, there were 16 storms in 2017

Total number of storms of level 12 and above



1.1.2.2. Out of season rains and flooding and extraordinary rains (are increasing in frequency)

- 8/2015 Flooding in Hoanh Bo, Quang Ninh 1,557mm.

- 11/2008 Flooding in the downtown of Hanoi 597 mm/day.

- 10/2016 Flooding in Dong Hoi, Quang Binh, Ha Tinh 949mm.

- 11/2016 Water release from Ba Ha HydroPower Dam, Phu Yen Qreliease: 11.500m3/s and rain 1,022mm.

1.1.2.3. Droughts

Year 2009-2010	Southern Central region
2010-2011	The Central Highlands
2014-2016	Southern region

1.1.2.4. Heating

- Year 2015: In areas of Northwestern and Central regions, the temperature reached 42 degrees in as long as 40 days.

- Year 2017: In areas of Northern region, the temperature rose to 42.5 degrees, in 4 days (history:38.7 degrees in year 1994)

1.1.2.5. Flashfloods: Trending up: 1990: 4 events; 2000, 2010: 14 events; 2016: 29 events.

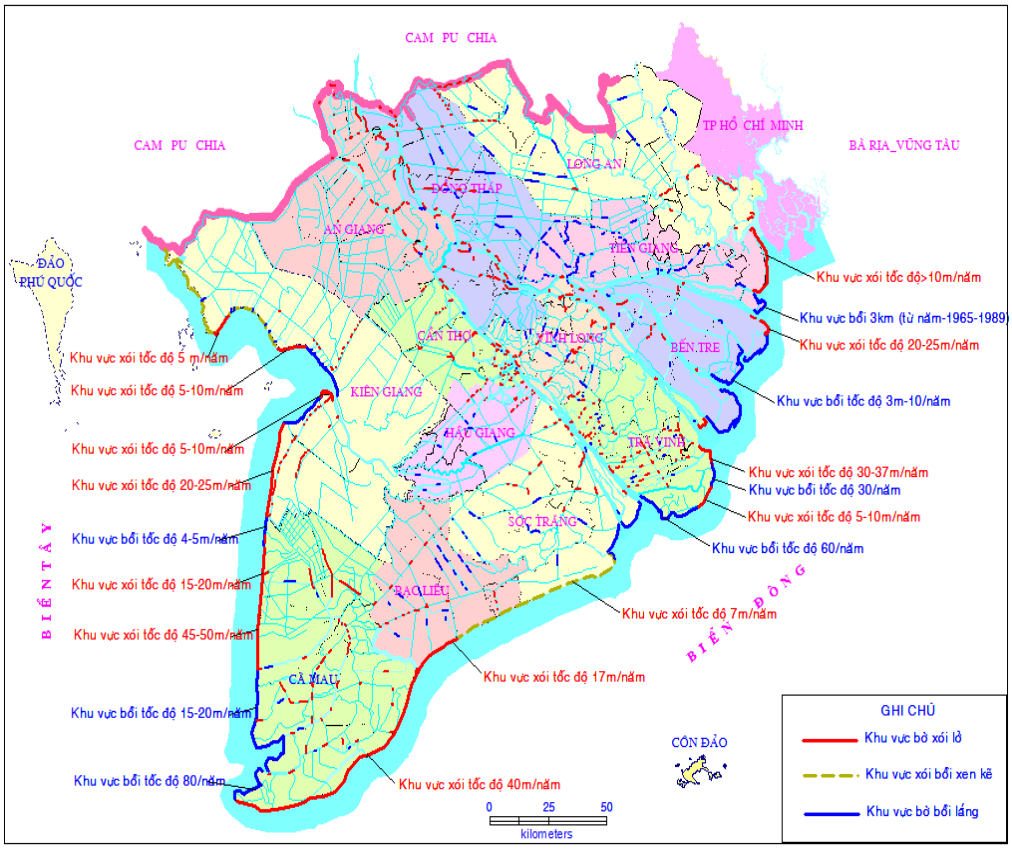
1.1.2.6. River and coastal erosions: Since 2010, erosion has been speeding up and become more severe, with significant socio-economic implications, At the time being, there are:

In total: 2,057 points/2,969 km (River bank: 1,857 points /2,227 km and Coastal bank: 200 points/469 km) Of which:

- Northern region: 562 points /470 km (River bank : 528 points/444 km and Coastal bank : 34 points/26 km).

- Central region: 817 points/1,279 km (River bank : 720 points/1,127 km and Coastal bank : 97 points/152 km).

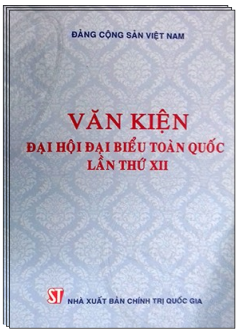
- Southern region: 678 points /947 km (River bank : 609 points/657km and Coastal bank : 67 points/291km).

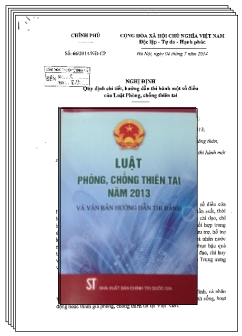


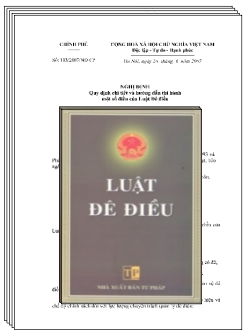
1.1.3. Opportunities

Disaster prevention and control are receiving due attention and guidance from the Party and the State. Party Resolutions and Guidance introduce a number of major political guidance on disaster prevention and control.

The legal and regulatory framework is consistently established for disaster prevention and control nationwide: The Law on Disaster Prevention and Control, and regulatory guidelines, the National Strategy on Disaster Prevention and Control…





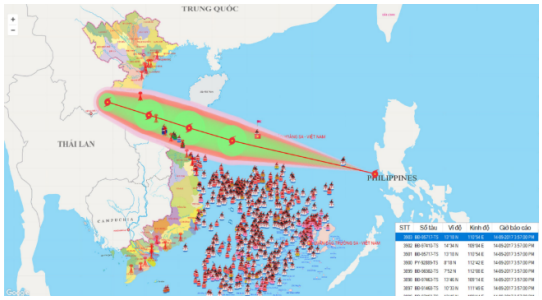


Scientific and technological breakthroughs and applicability in disaster prevention and control.

Remote sensing

Remote observations

New construction materials and technologies



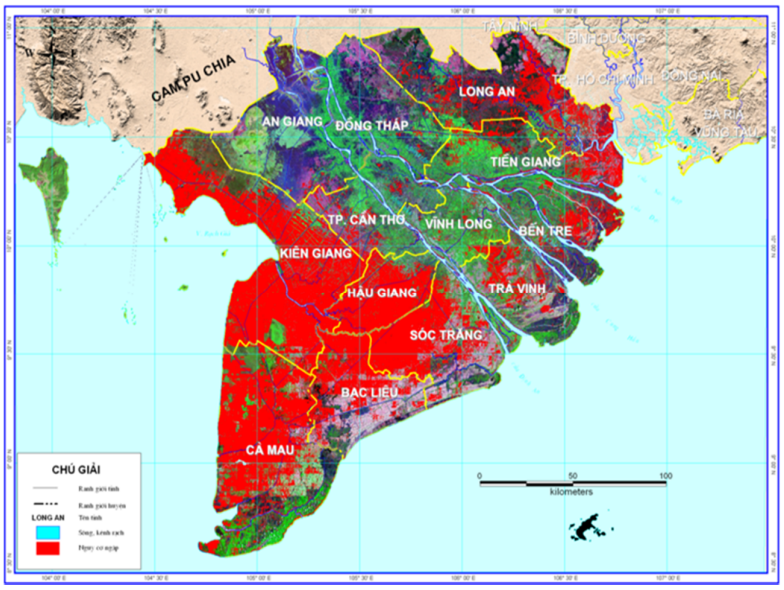
Boat and ship surveillance

Vietnam is integrating intensively and extensively into many international and regional fora as well as practical and effective activities in disaster prevention and control.

1.1.4. Challenges

The climate change continues to be a challenge, with increasing extreme and extraordinary disasters, in terms of intensity, space, time and irregularity.

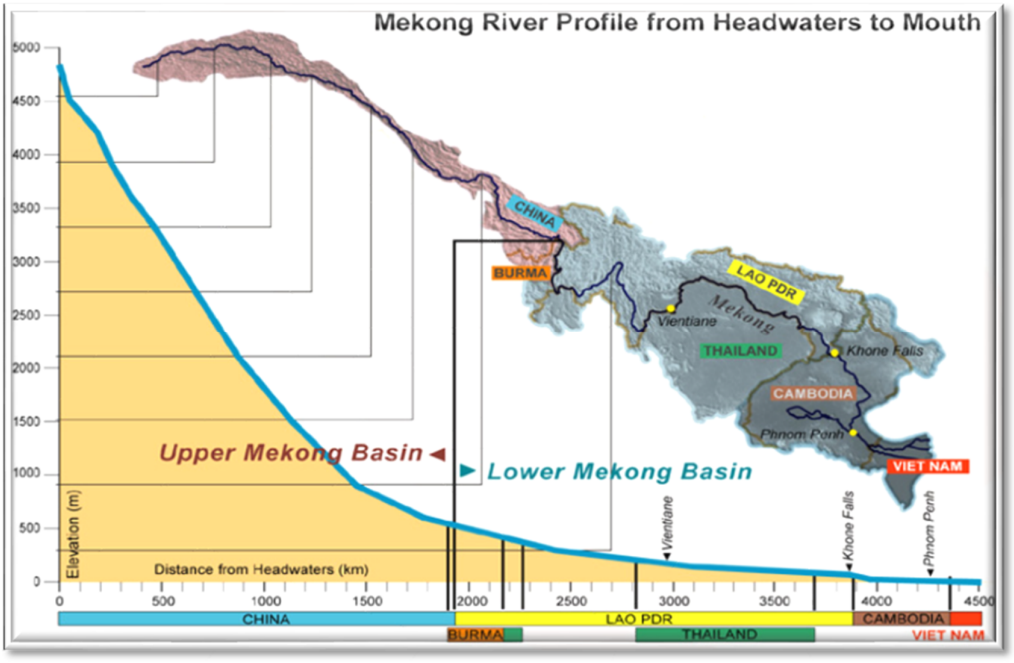
The impacts of socio-economic development: Rapidly growing population and economy, with increasing needs to be secured from disasters. Disaster prevention and control are not well integrated in to socio-economic activities; which increases exposures and even new disaster risks.



The coverage of innudation when the sea level rises 100 cm (5th IPCC report, 2013)

Upstream water use

CHINA	PDR LAOS	THAILAND	CAMBODIA
- Hydropower - Water transfer - Industry	- Hydropower - Irrigation/ agriculture	- Irrigation/ agriculture - Water transfer - Hydropower - Industry	- Irrigation/ agriculture - Girdle shaped dyke - Hydropower - Flood sewage - Tonle Sap lake interventions - Fishery - Industry - Population



1.2. The Legal Basis for Natural Disaster Prevention and Control

1.2.1. Law and other documents guiding the implementation of the Law include

- The Law on Dykes, passed by the National Assembly of Socialist Republic of Viet Nam with Decision No. 79/2006QH11 on 29/11/2006

- The Law on Natural Disaster Prevention and Control, passed by the National Assembly of Socialist Republic of Viet Nam with Decision No. 33/2013/QH13, on 19/06/2016, entered into force on 01/05/2014.

Other documents guiding the implementation of the Law include:

- Decree No. 66/2014/ND-CP, dated 07/04/2014 of the Government on detailing and guiding a number of articles of the Law on Natural Disaster Prevention and Control.

- Decree No. 94/2014/ND-CP, dated 10/17/2014 of the Government on the setting up and management of natural disaster prevention and control funds.

- Decision No. 172/2007/QD-TTg, dated 16/11/2007 of the Prime Minister on Approving the National Strategy for natural disaster prevention and mitigation to 2020.

- Decision No. 76/2009/QD-TTg, dated 11/05/2009 of the Prime Minister on Strengthening the National Committee for Search and Rescue and the system for search and rescue organization of ministries and central agencies and localities.

- Decision No. 1002/QD-TTg, dated 13/07/2009 of the Prime Minister on Approving the program "Raising public awareness and community-based disaster risk management."

- Decision No. 44/2014/QD-TTg, dated 15/08/2014 of the Prime Minister on detailed regulations on the levels of natural disaster risk.

- Decision No. 46/2014/QD-TTg, dated 15/08/2014 of the Prime Minister on Providing for natural disaster forecasting, warning and communications.

- Decision No. 367/QD-TTg, dated 03/17/2015 of the Prime Minister on the establishment of the Central Steering Committee on natural disaster prevention and control.

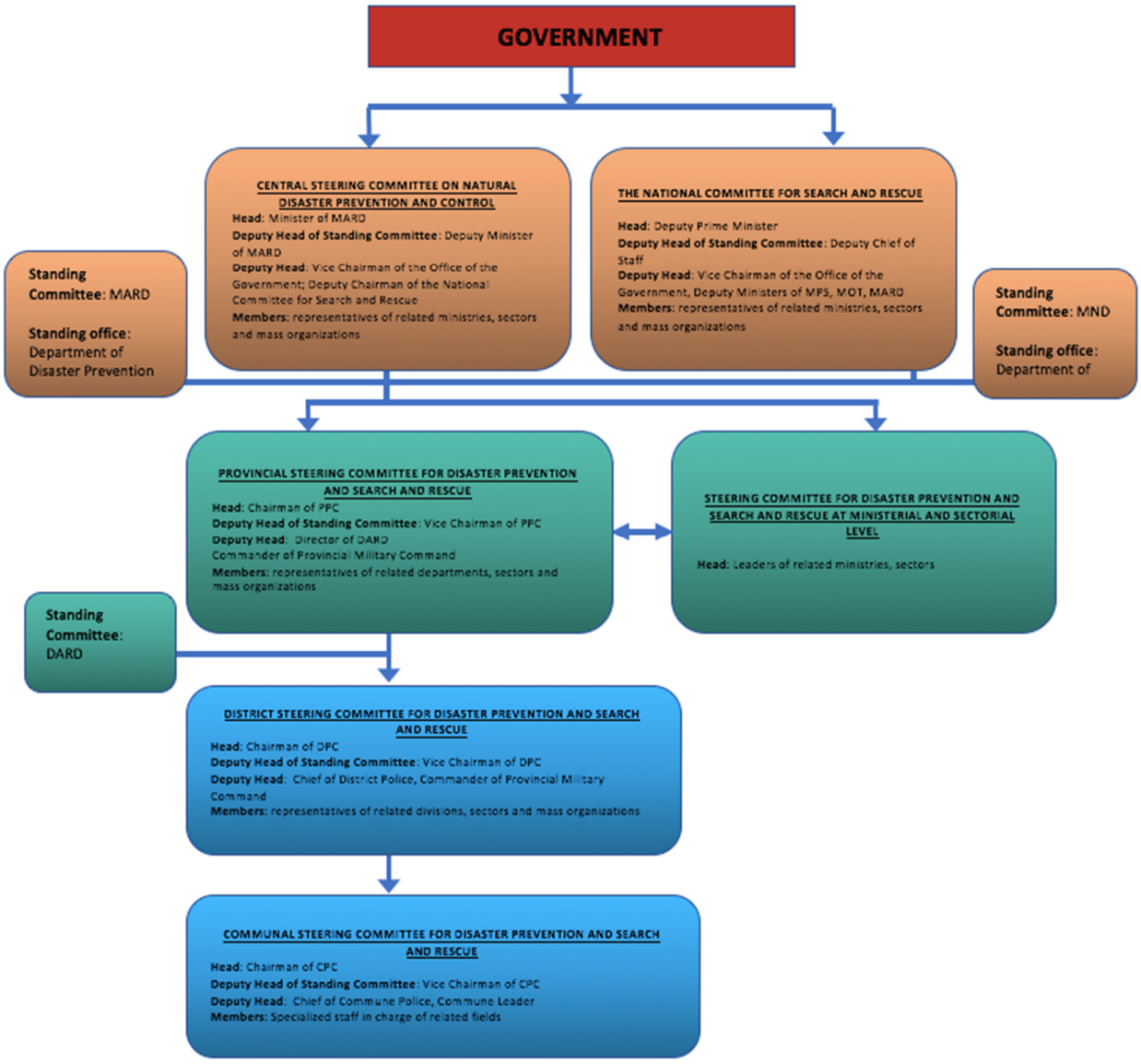
- Joint Circular No. 43/2015/TTLT BNNPTNT-BKH, dated 23/11/2015 of the Ministry of Agriculture and Rural Development and the Ministry of Planning and Investment on Guiding the collection of statistics and assessment of damage caused by natural disasters.

- Circular No. 05/2016/TT-BKH of the Ministry of Planning and Investment on Guiding the integration of natural disaster prevention and control work into sectoral development and socio-economic development master plans and plans.

1.2.2. Organizational Structure of the Natural Disaster Prevention and Control System in Viet Nam

The system of natural disaster prevention and the system of search and rescue in Viet Nam is shown in the diagram below.

System of natural disaster prevention and the system of search and rescue in Viet Nam

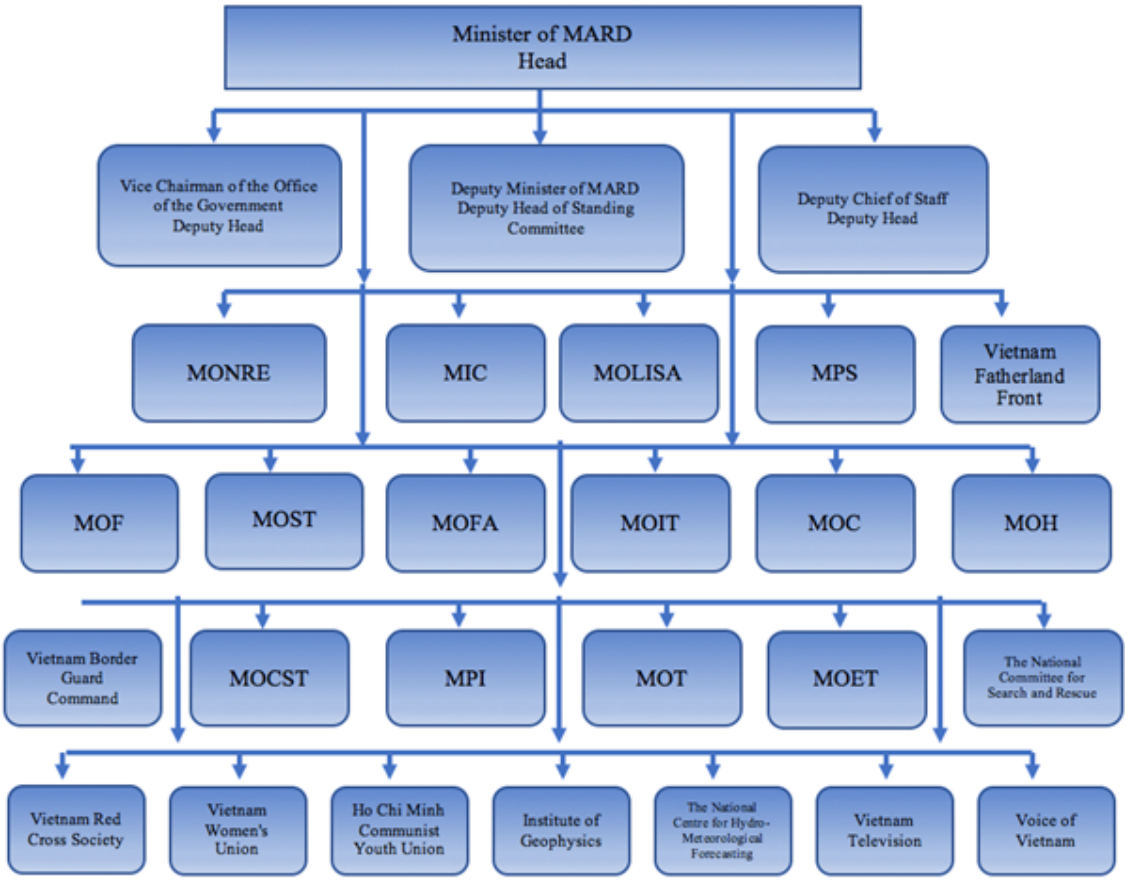


1.2.3. The Central Steering Committee for Natural Disaster Prevention and Control

The Central Steering Committee on NDPC was established under Decision No. 367/QD-TTg, dated 03/17/2015. The Committee is responsible for inter-agency coordination to assist the Government and the Prime Minister in organizing, directing, operating disaster prevention, response, and recovery on a national scale.

The Minister of the Ministry of Agriculture and Rural Development (MARD) is the Head of the Central Steering Committee for NDPC. A Vice Minister of MARD plays a role as a Permanent Vice Chairman; a Vice Chairman of the Government Office and a Vice Chairman of the Steering Committee of the National Search and Rescue play the role as Vice Chairmen.

Central Steering Committee for NDPC



Members of the Central Steering Committee are representatives that are leaders of ministries, ministerial-level agencies, and Government agencies: MARD, MONRE, Ministry of Defence, Ministry of Public Security, Ministry of Information and Communication, Ministry of Industry and Trade, Ministry of Transport, Ministry of Construction, Ministry of Education and Training, Ministry of Health, Ministry of Culture, Sports and Tourism, Ministry of Foreign Affairs, Ministry of Labour, War Invalids and Social Affairs, Ministry of Planning and Investment, Ministry of Finance, Viet Nam Television, Voice of Viet Nam; representatives of some units of MARD, MONRE, Ministry of Defence, National Committee for Search and Rescue, and the Viet Nam Academy of Science and Technology.

Based on work requirements, the Head of the Central Steering Committee for NDPC invites representatives from the following organizations: the Central Committee of the Viet Nam Fatherland Front, Viet Nam Women's Union, Ho Chi Minh Communist Youth Union, Viet Nam Red Cross, and other relevant organizations to participate in the Central Steering Committee on NDPC.

MARD is the permanent body of the Central Steering Committee on NDPC, performing the tasks of state management on NDPC. The ministry uses the the apparatus and staff of the NDPC Department to serve as the Permanent Office of the Steering Committee.

The organizational structure and tasks of the Central Steering Committee on NDPC are defined in Article 18, Chapter II, Decree No. 66/2014/NĐ-CP dated 04/07/2014 (see Figure 2).

Functions of the Central Steering Committee on NDPC:

Guiding the development and urging the implementation of national strategies, plans, policies, and legislation on NDPC.

Guiding the development of disaster response plans.

Directing and coordinating disaster response and recovery on a national scale: directing the response of disaster levels 3 or 4; coordinating and supporting localities in responding to disaster levels 1 or 2.

Making decisions on emergency measures, mobilizing the resources of the ministries, ministerial-level agencies, government agencies, organizations and individuals to cope with and overcome the consequences of natural disasters in accordance with the Law on NDPC.

Directing the collection of statistics on disater damageand the relief needs of localities, ministries, ministerial-level agencies, and Government agencies; and proposing to the Government and the Prime Minister on the decision of measures and resources to overcome disaster consequences across the country.

Inspecting and urging ministries, sectors, and localities to implement NDPC activities.

1.2.4. The National Committee for Search and Rescue

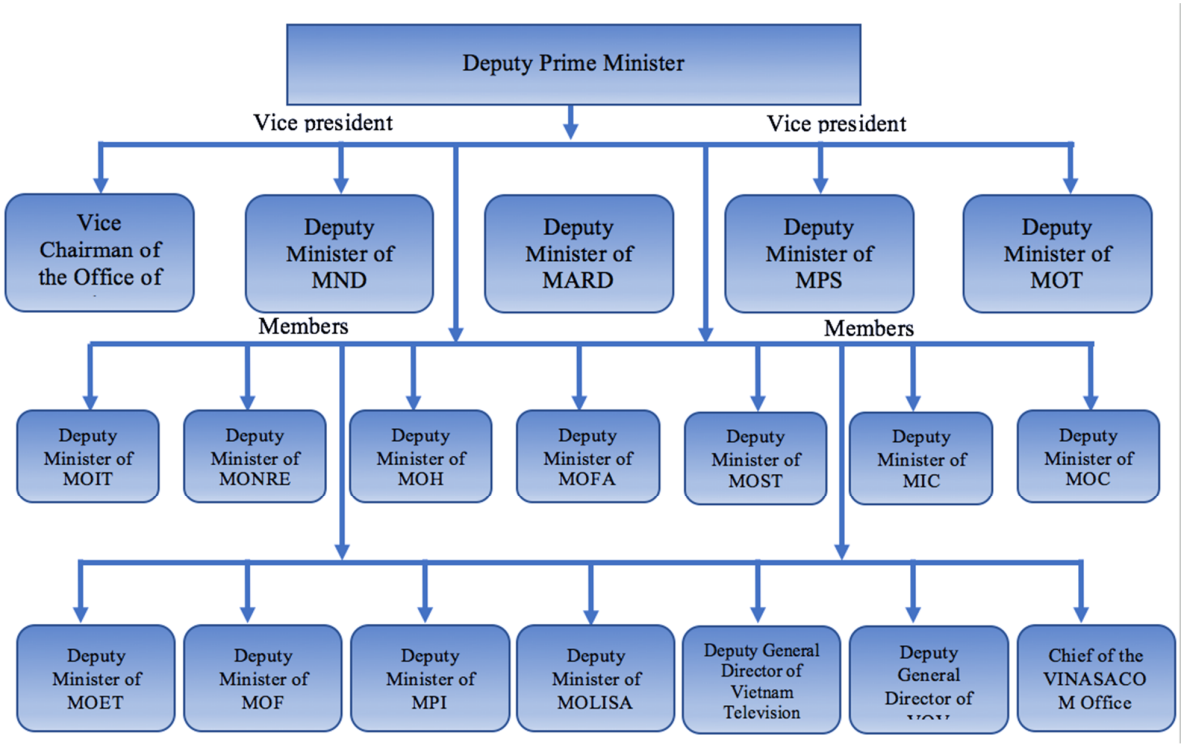
The National Committee for Search and Rescue (VINASARCOM), established in 1996, is the leading agency of the Government on search and rescue. Its tasks were last updated in 2009 under Decision No. 76/2009/QD-TTg, dated 11/05/2009 by the Prime Minister, which aimed to strengthen the National Committee and the organizational structure of the search and rescue system of ministries, central agencies, and localities.

VINASARCOM is under the Government Office and chaired by a permanent Deputy Prime Minister with Deputy Minister of the Ministry of Defence as the permanent Vice-Chair. Other Vice-Chairs are the Deputy Chairman of the Government Office and the Ministers of the Ministry of Public Security, Ministry of Transport, and MARD.

The Head of the Steering Office of VINASARCOM is a permanent member. Other members include leaders of ministries, Viet Nam Television, and Voice of Viet Nam.

The operating regulations of VINASARCOM are stipulated in Decision No. 445/QD-UB, dated 22/04/2009 of the Chairman of National Committee for Search and Rescue.

National Committee for Search and Rescue



1.2.5. Coordination mechanisms between the Central Steering Committee on Natural Disaster Prevention and Control and the National Committee for Search and Rescue (Article 23, Decree 66/2014/ND-CP)

The Central Steering Committee for Natural Disaster Prevention and Control shall assume the prime responsibility for and coordinate with National Committee for Search and Rescue in issuing written directions for response to specific disaster circumstances.

The Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue shall proactively notify each other of accidents or incidents occuring during disasters, coordinate in handling those accidents or incidents immediately after being notified and reach agreement on measures and mobilize manpower, means, supplies and equipment to respond to natural disasters.

The Central Steering Committee for Natural Disaster Prevention and Control shall take the prime responsibility for mobilizing resources to respond to, and overcome consequences of natural disasters, and coordinate with the National Committee for Search and Rescue in mobilizing and coordinating search and rescue forces to conduct search and rescue in natural disasters.

The Central Steering Committee for Natural Disaster Prevention and Control shall reach agreement with the National Committee for Search and Rescue on the contents on search and rescue support to be sought from foreign countries in serious natural disasters before reporting them to the Prime Minister for making decision.

1.2.6. Commanding Committees for Natural Disaster Prevention and Control and Search and Rescue of Ministries, Ministerial-Level Agencies and Government-Attached Agencies (Article 19, Decree 66/2014/NĐ-CP)

The Ministries of National Defense; Public Security; Transport; Construction; Industry and Trade; Finance; Natural Resources and Environment; Information and Communications; Health, Education and Training; and Labor, Invalids and Social Affairs shall establish ministerial-level commanding committees for natural disaster prevention and control and search and rescue with ministerial leaders as chairpersons.

Based on requirements and tasks, ministerial-level commanding committees for natural disaster prevention and control and search and rescue may establish a standing body to advise ministries in performing the management of natural disasters and search and rescue within the scopes of their ministries.

Ministerial-level commanding committees for natural disaster prevention and control and search and rescue may use the ministries' seals; their standing bodies have their own seals, funds, and accounts for operation and are based at the ministries' offices.

Based on requirements and tasks of natural disaster prevention and control and search and rescue, ministers shall decide on the establishment of commanding committees for natural disaster prevention and control and search and rescue of their units.

Tasks of a ministerial-level commanding committee for natural disaster prevention and control and search and rescue:

To advise and assist the minister in conducting natural disaster prevention and control and search and rescue under their management;

To coordinate with other ministries, ministerial-level agencies and localities in discharging natural disaster prevention and control and search and rescue tasks nationwide under the direction of the Prime Minister, the Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue;

To decide on urgent measures and mobilize according to its competence the ministry's resources for response to and recovery from consequences of natural disasters and search and rescue under their management and for support of localities.

1.2.7. Commanding Committees for Natural Disaster Prevention and Control and Search and Rescue in Localities

The organization and tasks of commanding committees for natural disaster prevention and control and search and rescue of localities are defined in Article 20, 21 and 22, Chapter II, Decree 66/2014/NĐ-CP dated 04/07/2014, as follows:

1.2.7.1. Provincial level

Chairpersons of provincial-level People's Committees shall establish provincial-level commanding committees for natural disaster prevention and control and search and rescue to advise and assist provincial-level People's Committees in managing, commanding and administering natural disaster prevention and control and search and rescue activities in their

localities. Provincial-level commanding committees for natural disaster prevention and control and search and rescue have their own seals, funds and accounts for operation.

A provincial-level commanding committee for natural disaster prevention and control and search and rescue comprises the following members:

The provincial-level People's Committee chairperson as the committee chairperson.

A provincial-level People's Committee vice chairperson as the permanent vice chairperson.

The provincial-level Agriculture and Rural Development Department director as a vice chairperson in charge of natural disaster prevention and control.

The commander of the provincial-level military command as a vice chairperson in charge of natural disaster relief and rescue.

The commander of the provincial-level Border Guard, leaders of provincial-level departments and local agencies involved in natural disaster prevention and control and search and rescue as members; the chairperson of the provincial-level commanding committee for natural disaster prevention and control and search and rescue may invite leaders of the provincial-level Fatherland Front, Women's Union, Youth Union and Red Cross Society to join the provincial-level commanding committee for natural disaster prevention and control and search and rescue.

Tasks of a provincial-level commanding committee for natural disaster prevention and control and search and rescue:

To advise and assist the provincial-level People's Committee in discharging the natural disaster prevention and control tasks prescribed in Clause 1, Article 43 of the Law on Natural Disaster Prevention and Control.

To formulate and approve plans and projects on response to natural disasters.

To command the response to, and search and rescuse in, natural disasters in the locality.

To inspect and urge provincial-level departments and local agencies in discharging natural disaster prevention and control tasks.

1.2.7.2. District level

The district-level People's Committee chairperson shall establish the district-level commanding committee for natural disaster prevention and control and search and rescue to advise and assist the district-level People's Committee in examining, urging, commanding and administering natural disaster prevention and control and search and rescue work in the locality. The district-level commanding committee for natural disaster prevention and control and search and rescue has its own seals, accounts and funds for operation.

Members of a district-level commanding committee for natural disaster prevention and control and search and rescue include:

The Chairperson of the district-level People's Committee as the committee chairperson/

A vice chairperson of the district-level People's Committee as the permanent vice chairperson.

The district-level police chief and the commander of the district-level military command as vice chairpersons.

Leaders of district-level sections and local agencies involved in natural disaster prevention and control and search and rescue as members; based on specific requirements of the district, the district-level People's Committee chairperson may invite leaders of the district-level Fatherland Front, Women's Union, Youth Union and Red Cross Society to join the district-level commanding committee for natural disaster prevention and control and search and rescue.

Tasks of a district-level commanding committee for natural disaster prevention and control and search and rescue:

To advise and assist the district-level People's Committee in discharging the natural disaster prevention and control tasks prescribed in Clause 1, Article 43 of the Law on Natural Disaster Prevention and Control.

To formulate and approve local plans and projects on response to natural disasters.

To command and organize the response to, and search and rescue in, natural disasters within the district.

To inspect and urge local agencies and units in discharging natural disaster prevention and control tasks.

1.2.7.3. Commune level

The commune-level People's Committee chairperson shall establish the commune-level commanding committee for natural disaster prevention and control and search and rescue to advise and assist the commune-level People's Committee in inspecting, urging, commanding and administering the natural disaster prevention and control work within the locality.

Members of a commune-level commanding committee for natural disaster prevention and control and search and rescue include:

The chairperson of the commune-level People's Committee as the committee chairperson.

A vice chairperson of the commune-level People's Committee as the permanent vice chairperson.

The commune-level police chief and the commander of the commune-level military command as vice chairpersons.

Irrigation and agriculture officers and heads of commune-level political and mass organizations as members.

The commune-level commanding committee for natural disaster prevention and control and search and rescue is based at the commune-level People's Committee office. It may use the seal of the commune-level People's Committee and professional staff of the commune-level People's Committee to act as the standing body, and is allocated funds for operation.

Tasks of a commune-level commanding committee for natural disaster prevention and control and search and rescue:

To advise and assist the commune-level People's Committee in performing the natural disaster prevention and control tasks prescribed in Clause 2, Article 43 of the Law on Natural Disaster Prevention and Control.

To transmit superior authorities' directions and commands on response to natural disaster to the community.

To command the response to, and search and rescue in, natural disasters within the commune.

To formulate and approve local plans and projects on response to natural disasters.

To inspect and urge local organizations and individuals in discharging natural disaster prevention and control tasks.

1.2.8. Functions, Tasks, Powers of Central Agencies on Natural Disaster Prevention and Control

1.2.8.1. State Agencies on Natural Disaster Prevention and Control

Under the provisions of the Law on Natural Disaster Prevention and Control, MARD is the governmental agency responsible for performing state management in natural disaster prevention and control. Functions, tasks, and powers of MARD are defined in Decree No.199/2013/ND-CP, dated 26/11/2013 of the Government, as follows: MARD is a governmental agency performing the state management in the following sectors and fields: agriculture, forestry, salt production, fisheries, irrigation, and rural development throughout the country; and the state management of public services in the sectors and fields under its management.

1.2.8.2. Viet Nam Disaster Management Authority

Decision No.26/20117/QD-TTg of the Prime Minister established a Disaster Management Authority (VNDMA) in Viet Nam in line with the DPC Law. The responsibilities of the VNDMA are to:

Take charge of inter-sectoral coordination to support the Government and Prime Minister in organising, instructing and managing activities of disaster prevention, response and recovery throughout the country;

To give instructions in developing national strategies and plans, policies and legal documents in disaster management, and supervising the implementation of the national strategies and plans, policies, legal documents in disaster management;

To give instructions in developing disaster response plans;

To give instruction and coordinate disaster response and recovery throughout the country;

To make urgent decisions, mobilize resources from Ministries, Government agencies, organisations and individuals for disaster response and recovery in accordance with regulations;

To carry-out inspection and supervision of disaster management activities implemented by Ministries, sectors and provinces.

The work of the VNDMA focuses around 21 areas related to disaster management. These areas include the promulgation and implementation of legal documents, policies, strategies, plans and standards related to disaster prevention and control activities. The VNDMA also aims to develop and disseminate technical instructions for natural disaster management and disseminate the Law on Disaster Prevention and Control.

The VNDMA has the mandate to prevent and control disaster risks, and to effectively respond and promote recovery from national disasters. This includes undertaking community and awareness raising activities, promoting community-based disaster risk management (CBDRM), and overseeing the management of Viet Nam's dyke system, which is key to flood defense.

Some other key areas related to the VNDMA's roles and responsibilities include:

Supporting the Minister of MARD as secretariat for the Standing Committee for Natural Disaster Prevention and Control, and collecting and managing data in the field of natural disaster management.

Managing research projects and conduct scientific research on natural disaster prevention and control and dyke technology transfer, including with regard to the new rural areas.

Implementing technical inspections in accordance with the DPC Law and to manage budgets, resources and construction investments as well as implement other duties as assigned by the MARD Minister.

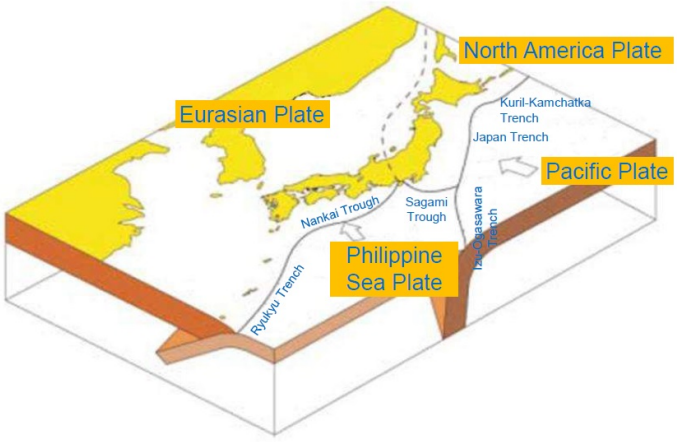
In addition to its internal management and capacity development functions, it also oversees international cooperation in natural disaster management and instructs and supervises associations and non-governmental organizations working in disaster management.

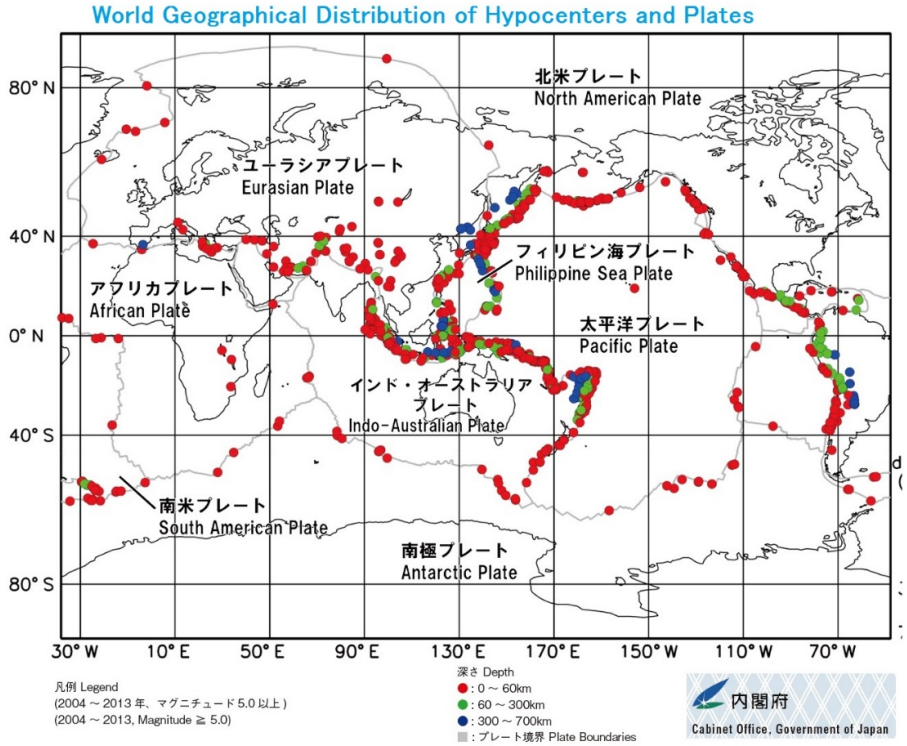
2. DISASTERS IN JAPAN

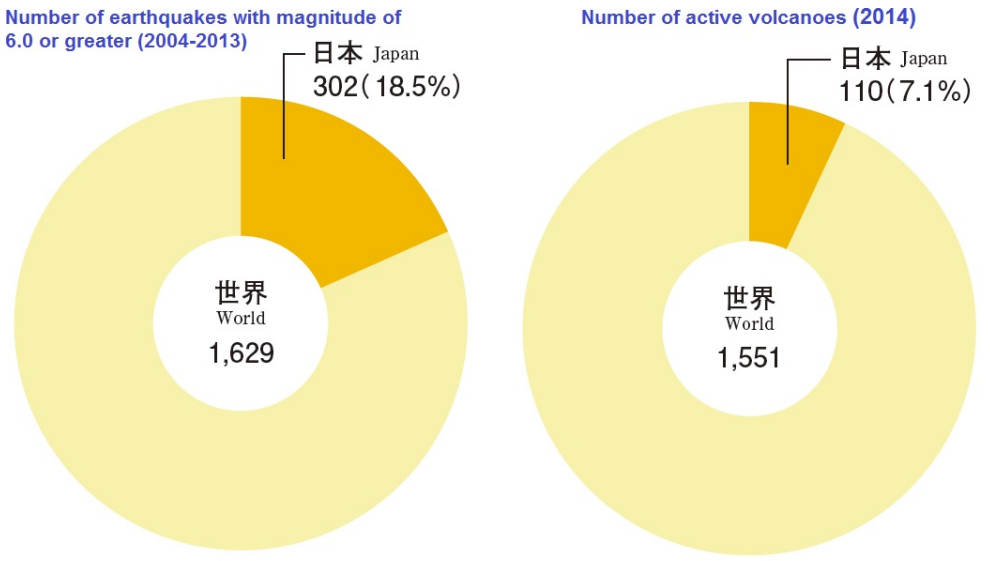
2.1. Natural Hazards in Japan

Japan is located in the Circum-Pacific Mobile Belt where seismic and volcanic activities occur constantly. Although the country covers only 0.25% of the land area on the planet, the number of earthquakes and active volcanoes is quite high (Japan is earthquake prone area due to the geological formation with plate boundaries of the Pacific plate, the Philippine Sea plate, the Eurasian plate, and the North American plate).

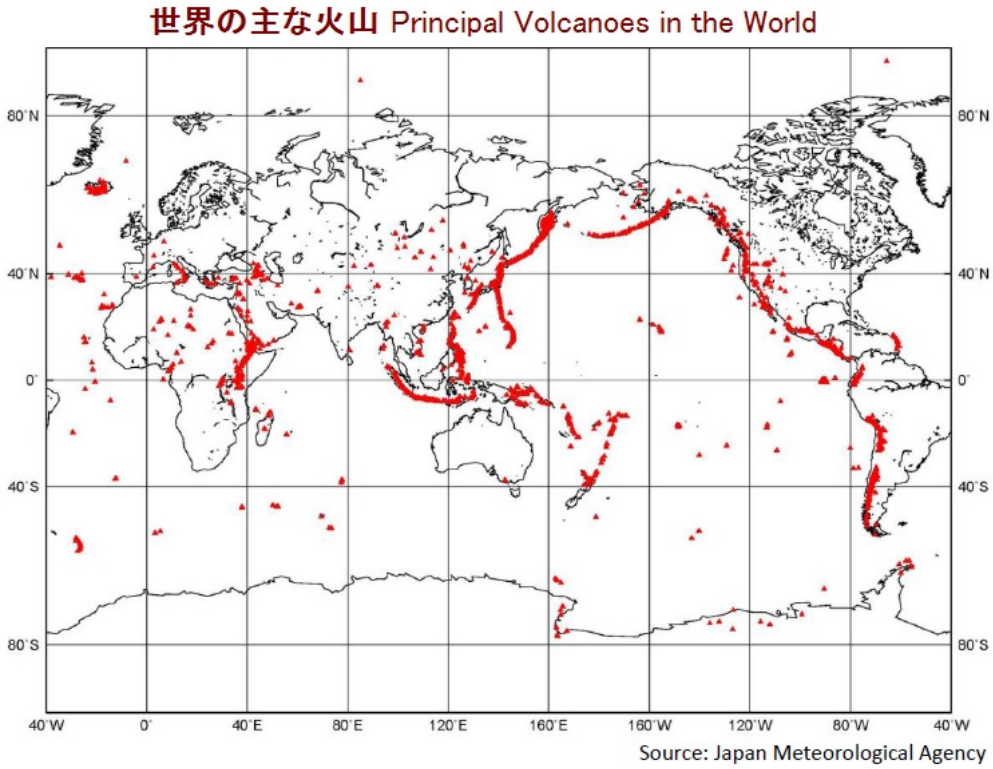
In addition, because of geographical, topographical and meteorological conditions, the country is subject to frequent natural disasters such as typhoons, torrential rains and heavy snowfalls, as well as earthquakes and tsunami.

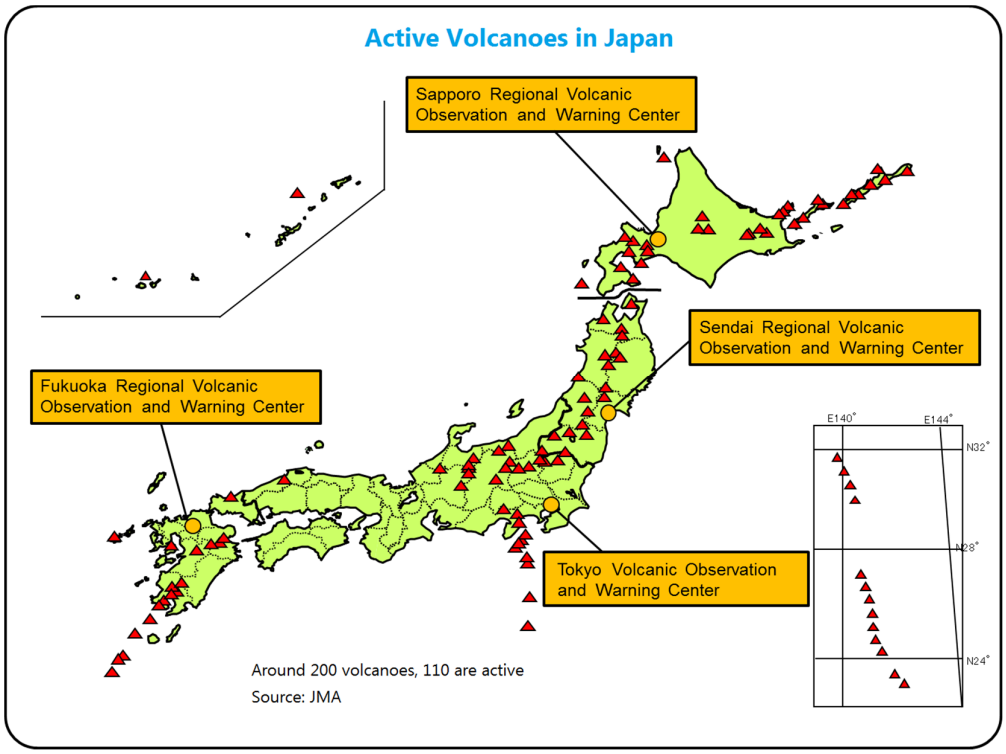






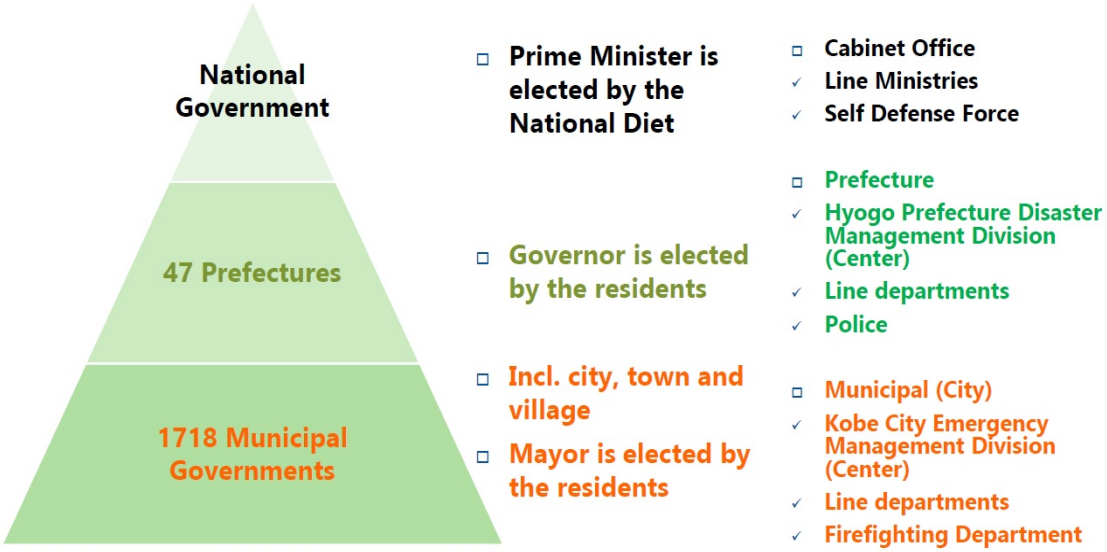
出典：防災白書　Source: White Paper on Disaster Management



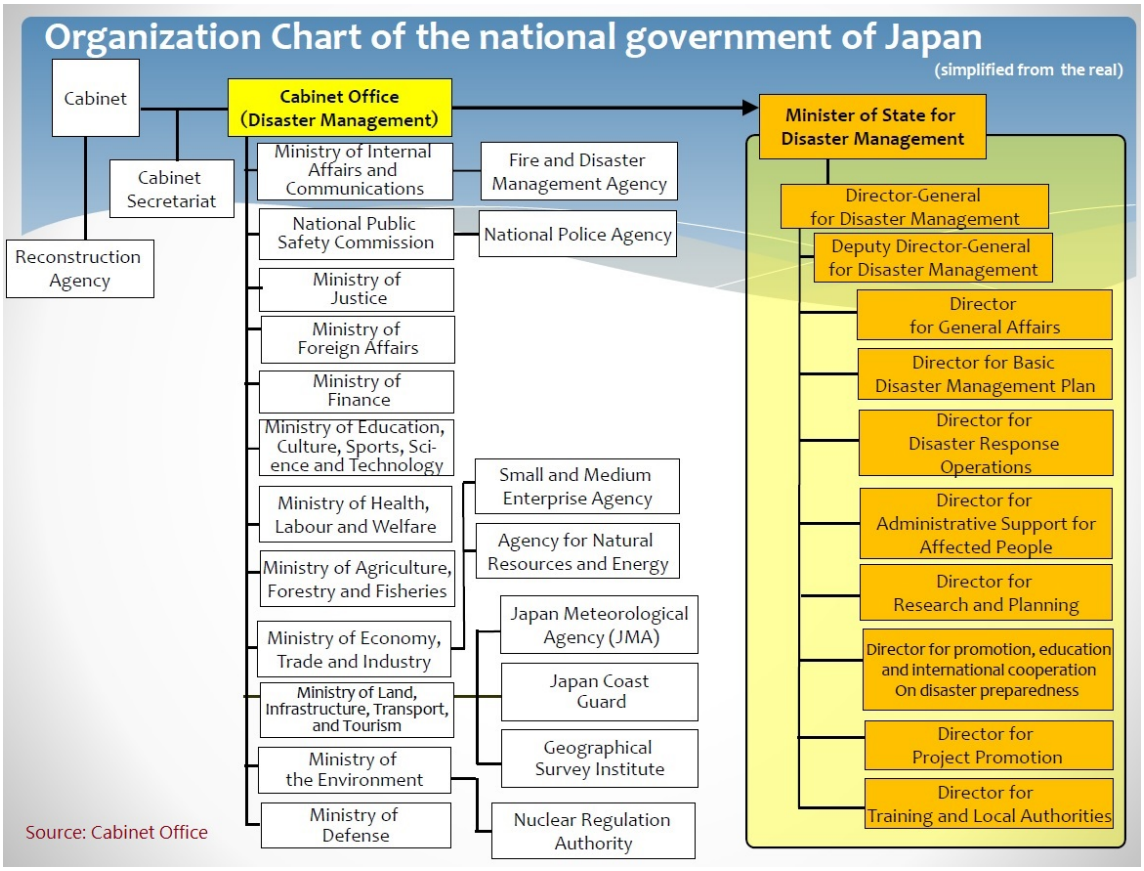


2.2. Disaster Management System of Japan

2.2.1. Administrative System



Japan has three (3) administrative levels of governance; national, prefectural and municipal. Each level of governments has its own disaster management organizations, policy frameworks and budgets. When disasters occur, municipalities respond first. In case disasters are large in scale beyond their capacity, national and prefectural governments provide every possible support.



2.2.2. Structure of Disaster Management

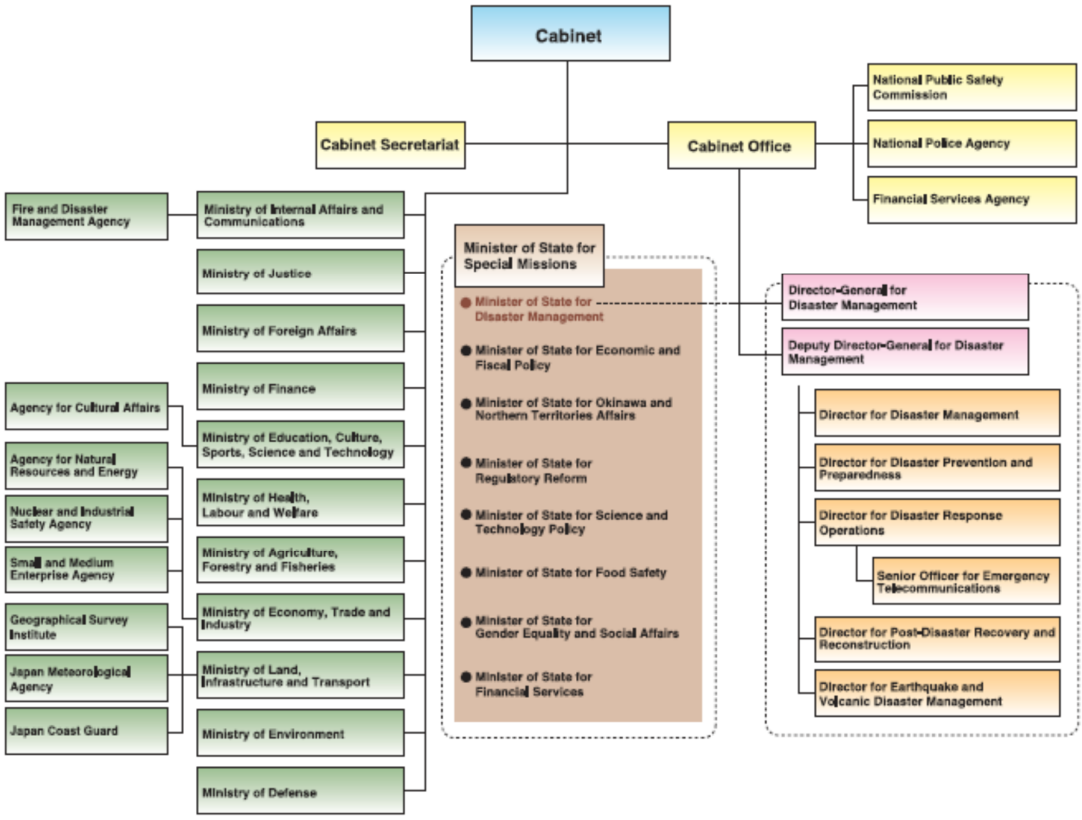
2.2.2.1. National Platform for Disaster Risk Reduction.

Under the Disaster Countermeasures Basic Act, the Central Disaster Management Council was formed, its brief being to ensure the comprehensiveness of disaster risk management and to discuss matters of importance with regard to disaster management.

2.2.2.2. National Organizations for Disaster Risk Reduction

All the line ministries and agencies have responsibility to take actions related to disaster reduction within their own mandate. The Cabinet Office is responsible for formulating basic policies, strategies and guidelines for disaster reduction and for securing coordination of government disaster reduction activities. Within the Cabinet Office, which is the secretariat for the Central Council, the Minister of State for Disaster Management has been assigned as the Minister State for Special Missions to take lead in the responsibilities for disaster reduction in the Natural Government. The Minister is assisted by the department of the Cabinet Office Director-General for Disaster Management. The Director-General has mandate to handle planning and central coordination with regard to matters relating to basic policy on disaster risk reduction, and matters concerning disaster countermeasures in the event of a large-scale disaster.

Central Disaster Management Council



2.2.2.3. Local Organizations for Disaster Risk Reduction

In prefectures and local municipalities, the prefectural and municipal Disaster Management Councils are established with the members of representatives of local government organizations including police and fire management department, and designated local public corporations. Implementation of disaster risk management measures is based on the Local Disaster Management Plans drafted by the Councils.

- Legal System and Framework.

+ In order to applying to all of the disaster phases of prevention, mitigation and preparedness, emergency response as well as recovery and rehabilitation, relevant laws and regulations were enacted.

+ The cornerstone of legislation on disaster risk reduction is the Disaster Countermeasures Basic Act enacted in 1961.

- The main features of the Act are:

+ Responsibilities of national and local governments as well as the private sector and people;

+ Organization of multi-sectorial coordination bodies for disaster risk management at the national and local levels;

+ Disaster risk management planning system;

+ Basic actions to be taken in each phase of the disaster management cycle: prevention preparedness, emergency response, and recovery rehabilitation;

+ Annual Government Official Report on Disaster Countermeasures.

Relevant laws are as follows.

Basic Acts

1. Disaster Countermeasures Basic Act (1961)

2. Act on Prevention of Marine Pollution and Maritime Disaster (1970)

3. Act on Disaster Prevention in Petroleum Industrial Complexes and other Petroleum Facilities (1975)

4. Act on Special Measures for Large-scale Earthquakes (1978)

5. Act on Special Measures for Nuclear Disasters (1999)

6. Act on Special Measures for Promotion of Tonankai and Nankai Earthquake Disaster Management (2002)

7. Act on Special Measures for Promotion of Disaster Management for Trench-type Earthquakes in the Vicinity of the Japan and Chishima Trenches (2004)

Disaster Prevention and Preparedness

1. Erosion Control Act (1897)

2. Building Standard Law (1950)

3. Forest Act (1951)

4. Act on Temporary Measures for Disaster Prevention and Development of Special Land Areas (1952)

5. Meteorological Services Act (1952)

6. Seashore Act (1956)

7. Landslide Prevention Act (1958)

8. Act on Special Measures for Disaster Prevention in Typhoon-prone Areas (1958)

9. Act on Special Measures for Heavy Snowfall Areas (1962)

10. River Act (1964)

11. Act on Prevention of Steep Slope Collapse Disaster (1969)

12. Act on Special Measures for Active Volcanoes (1973)

13. Act on Special Financial Measures for Urgent Earthquake Countermeasure Improvement Projects in Areas for Intensified Measures (1980)

14. Act on Special Measures for Earthquake Disaster Countermeasures (1995)

15. Act on Promotion of the Earthquake-proof Retrofit of Buildings (1995)

16. Act on Promotion of Disaster Resilience Improvement in Densely Inhabited Areas (1997)

17. Act on Promotion of Sediment Disaster Countermeasures for Sediment Disaster Prone Areas (2000)

18. Specified Urban River Inundation Countermeasures Act (2003)

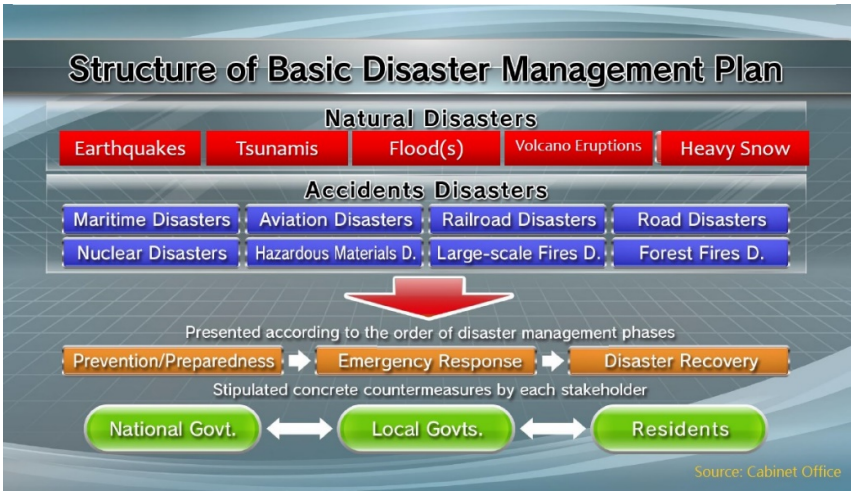
2.2.2.4. Disaster Management Strategy and Policy in Japan

Basic Disaster Prevention Plan is the master plan and a basis for disaster reduction activities in Japan. Basic Disaster Prevention Plan is prepared by the Central Disaster

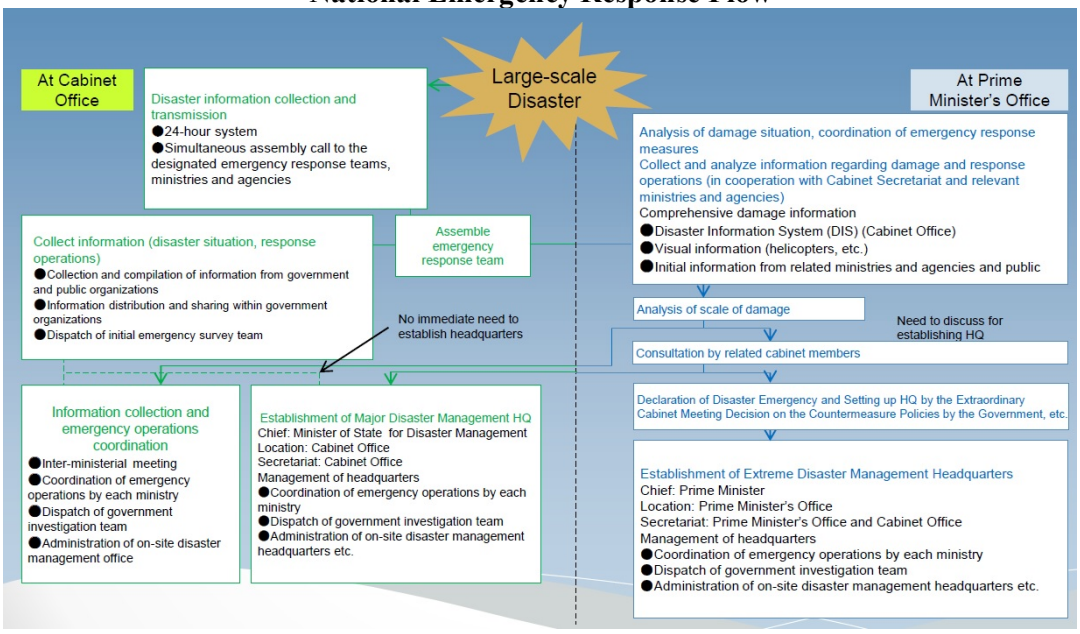
Management Council in accordance with Article 34 of the Disaster Countermeasures Basic Act. The plan clarifies the duties assigned to the Government, public corporations and the local government in implementing measures. For easy reference to countermeasures, the plan also describes the sequence of disaster countermeasures such as preparation, emergency response, recovery and reconstruction according to the type of disaster.

Basic Disaster Prevention Plan has been reviewed annually and amended as needed. In a recent review in February 2008, the Basic Plan was revised based on the lessons learned in the recent disasters and the deliberation in the Central Council including the view points of necessity to take follow-up measures of priority issues and to facilitate nationwide movement for disaster reduction.

Besides of the Basic Disaster Prevention Plan, Disaster Management Operation Plan is made as a plan for each designated government organization and designated public corporation, and Local Disaster Management Plan is drafted as a plan for each prefectural and municipal disaster management council, based on the Basic Disaster Management Plan.



National Emergency Response Flow

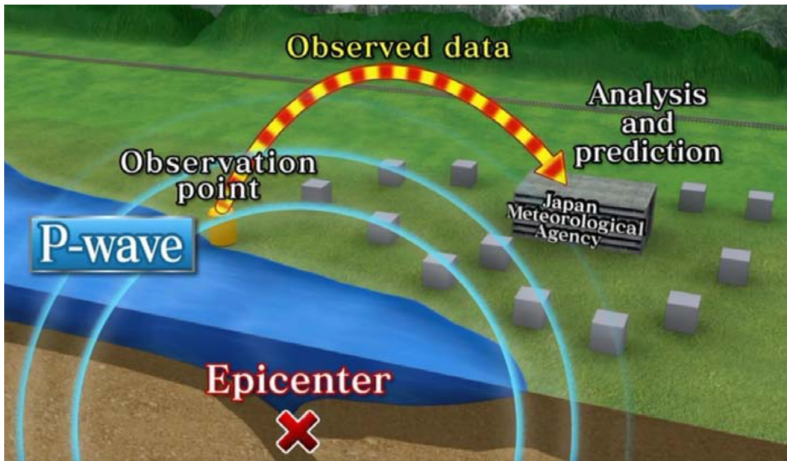


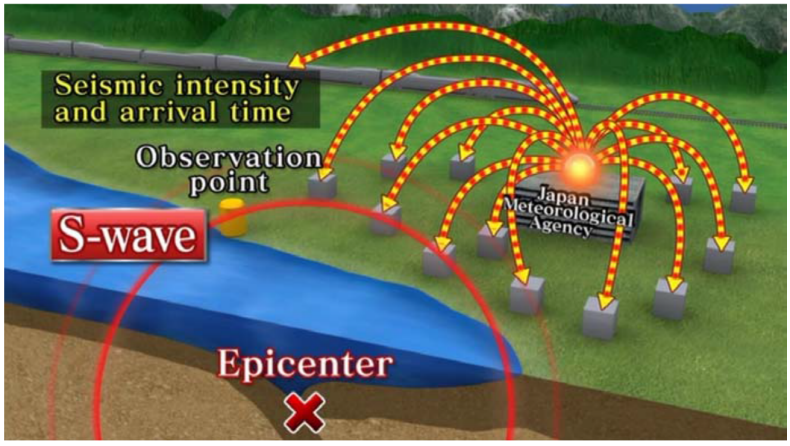
Further, disaster reduction perspectives are incorporated into relevant development plans such as Comprehensive National Development Plan, Social Infrastructure Development Priority Plan, Land Use Plan and urban and rural planning.

2.2.3. Japan's Current Disaster Prevention Measures

2.2.3.1. Research and development

JMA monitors seismic activities in and around Japan around the clock, and issues tsunami warning/information and earthquake information promptly when an earthquake occurs. In addition, JMA constructed a dense monitoring network around the Tokai area in cooperation with relevant organizations in order to detect the precursor of the great earthquake, which is estimated to occur in the near future. If anomalous data is observed in the region, JMA will issue information on the Tokai Earthquake. When an earthquake occurs, JMA issues seismic intensity information in 2 minutes, which announces the occurrence of the earthquake and regions where the seismic intensity is equal to or greater than three in JMA Scale. Subsequently information on the hypocenter and magnitude of the earthquake and cities/towns/villages where a strong shake has been felt is issued. Since seismic intensity information is directly connected to the expected damages, therefore, this information is used as a trigger for disaster management authorities to take emergency measures. In case earthquakes occur repeatedly, such as aftershocks of a large earthquake or earthquake swarm events, the number of the earthquakes is also announced (**Alerts transmitted via TV, radio and cell phones).**





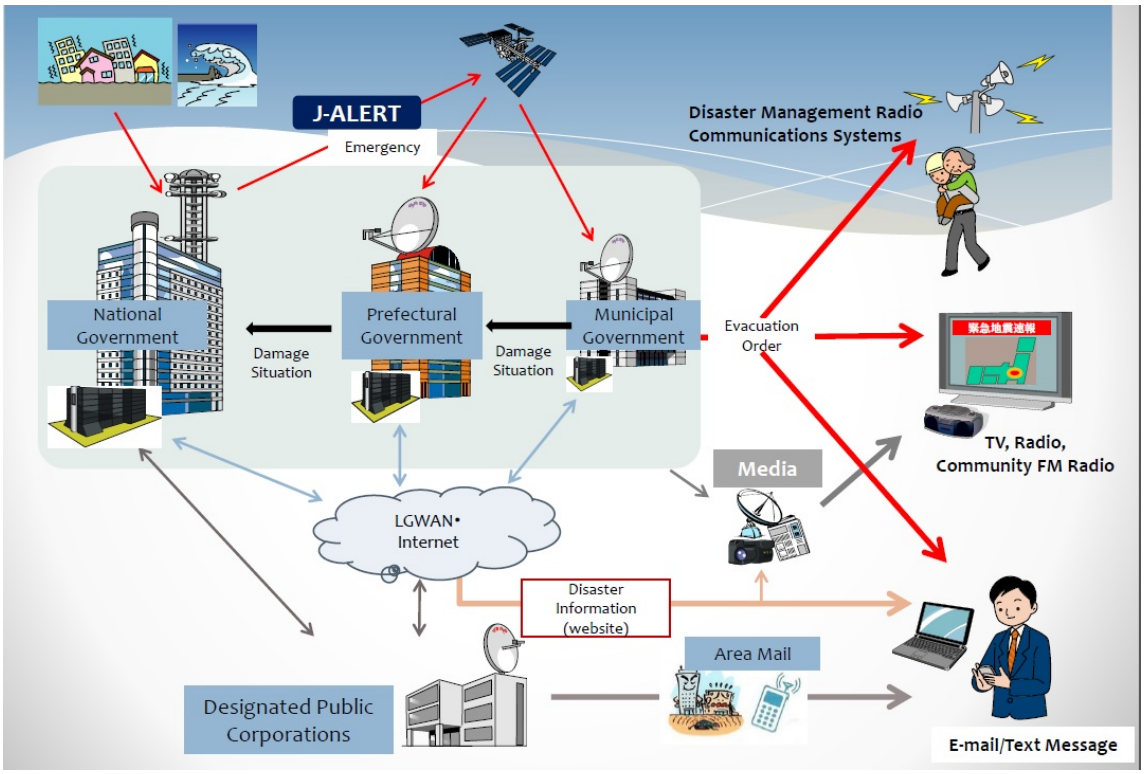
Earthquake Monitoring Network

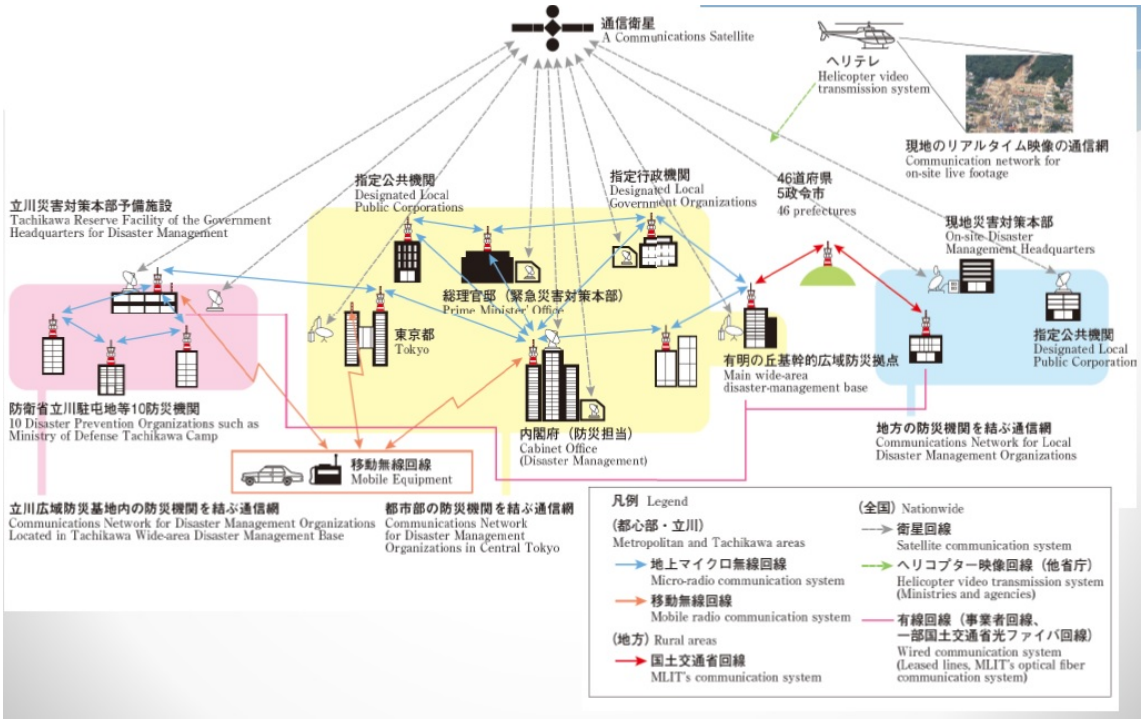
JMA operates seismic network, which consists of about 180 seismometers and collects seismic waveform data in real-time around the clock. When a large earthquake occurs, JMA quickly determines hypocenter and magnitude of the earthquake using the collected seismic data and issues tsunami warning and earthquake information. JMA also collects and analyzes seismic data from universities and disaster management research institutes such as the National Research Institute for Earth Science and Disaster Prevention (NIED) in order to conduct a comprehensive assessment on seismic activities for promotion of research activities in cooperation with the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The products of this analysis are shared with relevant organizations.

Seismic Intensity Network

JMA installed about 600 seismic intensity meters throughout the country. In addition, JMA collects seismic intensity data from other 3,300 stations operated by local governments and the National Research Institute for Earth Science and Disaster Prevention (NIED). When an earthquake occurs, JMA promptly issues seismic intensity information based on the data obtained at those stations. The seismic intensity information is used by disaster management authorities as reference for their initial actions in emergency.

2.2.3.2. Early Warning systems and Prevention against natural disaster




通信衛星
A Communications Satellite
ヘリテレ
Helicopter video transmission system
現地のリアルタイム映像の通信網
Communication network for on-site live footage
立川災害対策本部予備施設
Tachikawa Reserve Facility of the Government Headquarters for Disaster Management
指定公共機関
Designated Local Public Corporations
指定行政機関
Designated Local Government Organizations
46道府県
5政令市
46 prefectures
現地災害対策本部
On-site Disaster Management Headquarters
総理官邸（緊急災害対策本部）
Prime Minister's Office
東京都
Tokyo
有明の丘基幹的広域防災拠点
Main wide-area disaster-management base
指定公共機関
Designated Local Public Corporation
防衛省立川駐屯地等10防災機関
10 Disaster Prevention Organizations such as Ministry of Defense Tachikawa Camp
内閣府（防災担当）
Cabinet Office (Disaster Management)
地方の防災機関を結ぶ通信網
Communications Network for Local Disaster Management Organizations
移動無線回線
Mobile Equipment
立川広域防災基地内の防災機関を結ぶ通信網
Communications Network for Disaster Management Organizations Located in Tachikawa Wide-area Disaster Management Base
都市部の防災機関を結ぶ通信網
Communications Network for Disaster Management Organizations in Central Tokyo
凡例 Legend
（都心部・立川）
Metropolitan and Tachikawa areas
地上マイクロ無線回線
Micro-radio communication system
移動無線回線
Mobile radio communication system
（地方）Rural areas
国土交通省回線
MLIT's communication system
（全国）Nationwide
衛星回線
Satellite communication system
ヘリコプター映像回線（他省庁）
Helicopter video transmission system (Ministries and agencies)
有線回線（事業者回線、一部国土交通省光ファイバ回線）
Wired communication system (Leased lines, MLIT's optical fiber communication system)

CHAPTER IV. MONITORING LANDSLIDES IN MOUNTAIN

1. NATURAL AND SOCIAL CONDITIONS MAKING JAPAN AND VIETNAM SUSCEPTIBLE TO SEDIMENT DISASTERS

1.1. 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).

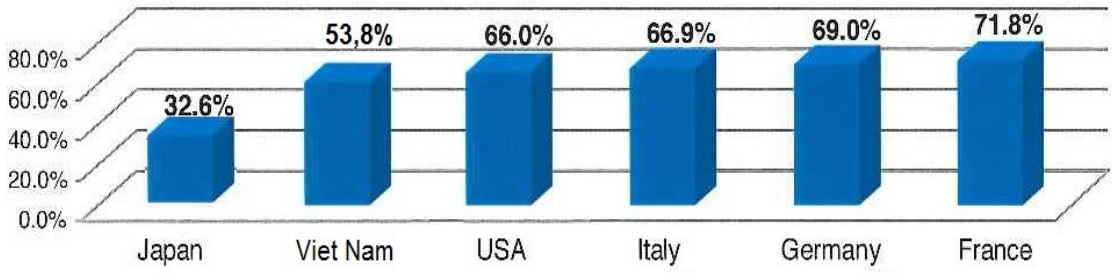
Highest point:

Fujiyama 3,776 m

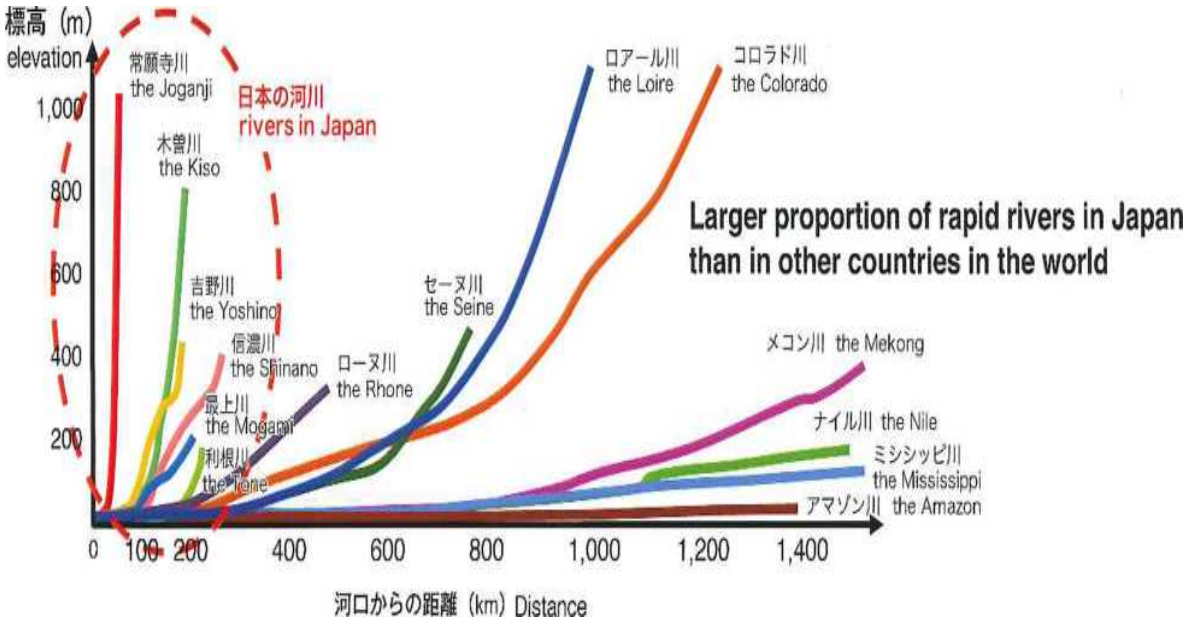
Fan Si Pan 3,144 m

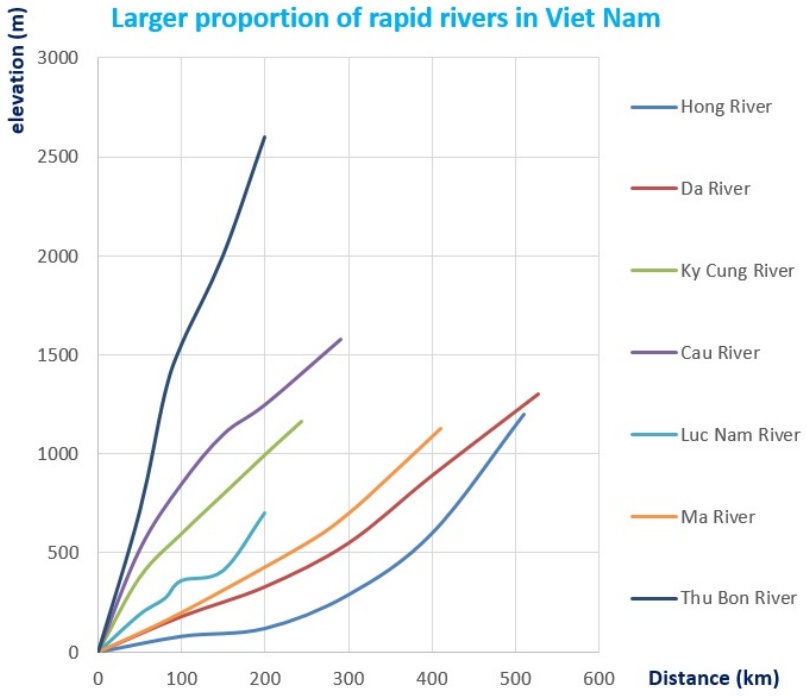
1.2. Smaller proportion of habitable area as against land area of Japan: Total Land Area in Japan (377,900 km2) 14% more than Viet Nam (330,972 km2).

The land areas of countries were calculated in the following formula: Habitable land area=Total land area - (Forest area + Lake area) The 'lake area' include natural lakes and other major lakes having an area over 5,000km2 (Based on "Science Annual Record" 2011).



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





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. Basins of the 9 largest river systems, which include Red, Thai Binh, Bang Giang - Ky Cung, Ma, Ca La, Thu Bon, Ba, Dong Nai and Cuu Long, account for 90% of the total river basins nationwide.

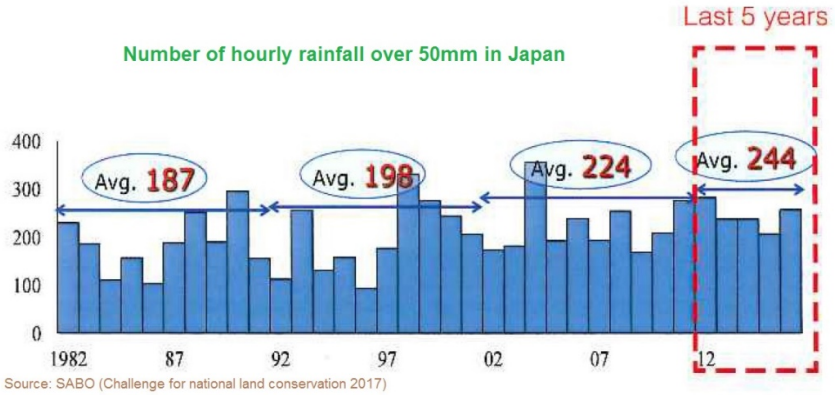
Some basic characteristics of 9 major river systems in Vietnam

No	River systems	Area of basin (km^2)			Total volume of water flow annual (bill m^3)			Capacity water flow	
		External part	Internal part	Total	Overseas	In home	Total	Thousand m^3/km^2	m^3/ person
1	Bang Giang – Ky Cung	1,980	11,280	13,260	1.7	7.3	9.0	798	9,070
2	Thai Binh		15,180	15,180		9.7	9.7	1,550	5,160
3	Hong	82,300	72,700	155,000	45.2	81.3	126.5		
4	Ma	10,800	17,600	28,400	5.6	14.0	19.6	1,110	5,500
5	Ca - La	9,470	17,730	27,200	4.4	17.8	22.2	1,250	8,290
6	Thu Bon		10,350	10,350		20.1	20.1	1,940	16,500
7	Ba		13,900	13,900		9.5	9.5	683	9,140
8	Dong Nai	6,700	37,400	44,100	3.5	32.8	36.3	877	2,980
9	Mekong	726,180	68,820	795,000	447.0	53.0	500.0	7,265	28,380
10	Other rivers		66,030	66,030		94.5	94.5	1,430	8,900
Total		**837,430**	**330,990**	**1,167,000**	**507.4**	**340**	**847.4**	**2,560**	**11,100**

Source: National profile on water resources, the Department of Water Resources Management

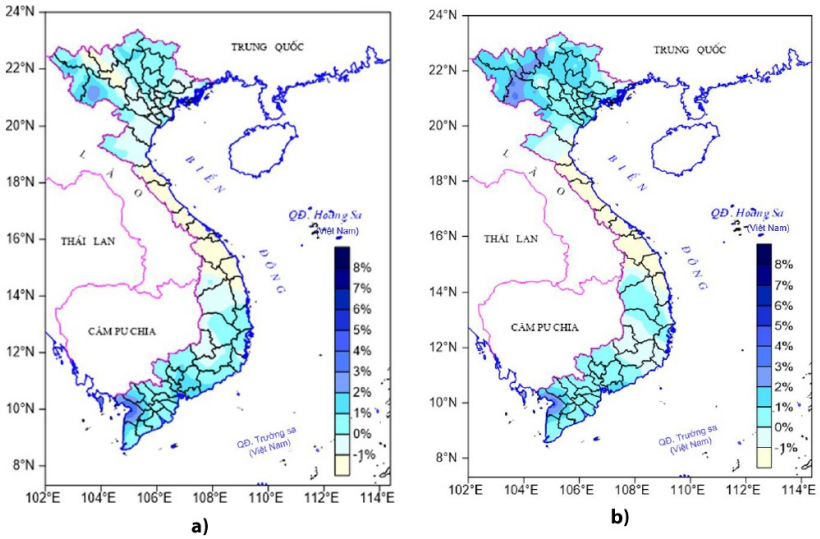
1.4. Number of heavy rain and sediment disasters are increasing

1.4.1. Heavy rain



Source: SABO (Challenge for national land conservation 2017)

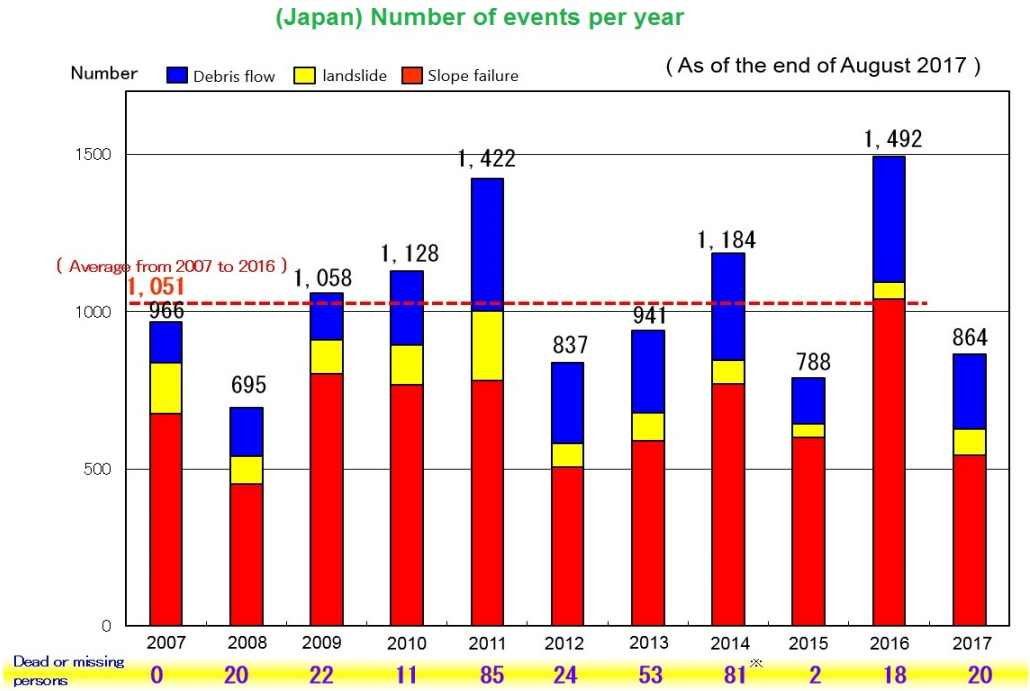
Projected change in the number of rainy days over 50 mm (a) in the middle of the 21st century and (b) at the end of the 21st century

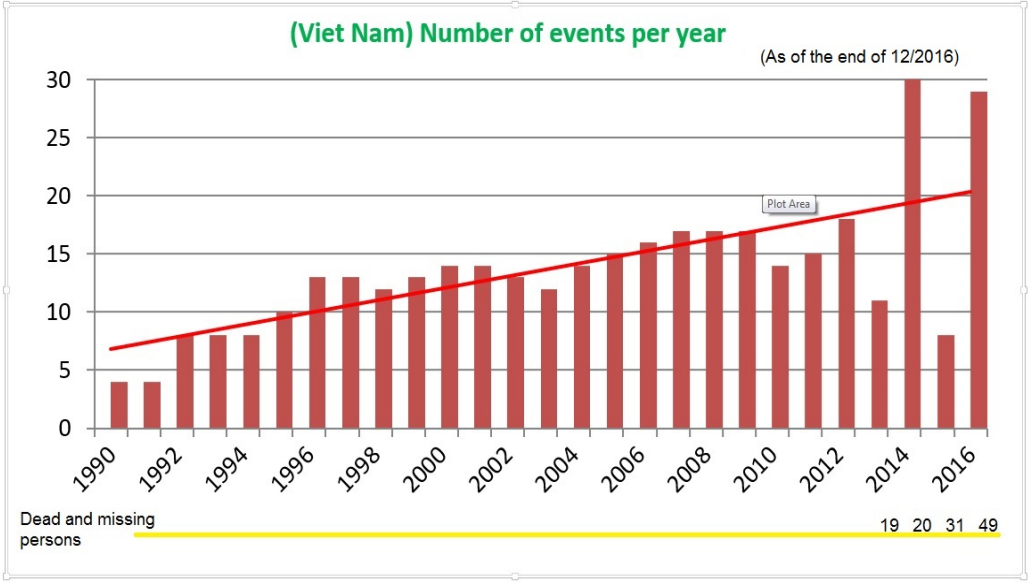


a) b)

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).

1.4.2. Sediment disasters





02-03 August, 2017, Damages caused by landslide and flash floods in the four provinces of Son La, Yen Bais, Dien Bien and Lai Chau: 42 people dead and missing, 239 houses collapsed and swept away, 398 households evacuated. Total economic loss more than 1400 billion VNĐ (about 62 million USD).

2. MONITORING LANDSLIDES IN VIET NAM

2.1. The Real State Of Flash Floods And Landslide

Year	People dead and missing		
	Caused by flash floods and landslide in the mountainous northern areas	**Nationwide**	**Percentage %**
2014	19	133	15
2015	20	154	13
2016	31	264	12
2017	49	139	35
Mean annual	**47**	**375**	**12**

Year	Flash floods	People dead and missing
2005	The flash flood in Van Chan district, Yen Bai province after Typhoon No. 7	64
2009	The landslide in Pac Nam district, Bac Kan province	13
2013	The flash flood in Ban Khoang commune, Sa Pa district, Lao Cai province	11
2014	The landslide in Hoang Su Phi district, Ha Giang provicne	7
	The landslide in Dong Dang town, Cao Lap district, Lang Son province	6
	The flash flood in Tam Duong district, Lai Chau province	5
2015	The flash flood in Thuan Chau district, Son La province after Typhoon No.1	11
2016	The flash flood and landslide after Typhoon No.2 in Bat Xat district, Lao Cai province	13
2017	Landslide and flash floods in the four provinces of Son La, Yen Bais, Dien Bien and Lai Chau (02-03 August, 2017)	42

Flash flood in Yen Bai in 2005

Landslide in Bac Kan in 2009

Flash flood in Lao Cai 2013

Flash flood in Lai Chau in 2014

Flash flood in Son La in 2015

Flash flood in Lao Cai 2016

Flash floods and landslide in Lao Cai in 2016

Flash floods and landslide in Mu Cang Chai district, Yen Bai province 2017

Flash floods and landslide in Nam Pam (Son La) on August 3 - 8, 2017

Nam Pam (Son La) Bridge was broken in the flash flood on August 3 - 8, 2017

LIST OF POTENTIAL LANDSLIDE PLACES IN 10 EXAMPLE PROVINCES

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	**10266**	**5190**	**3128**	**1654**	**251**	**41**

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

2.2. Establishment Of Constitution And Policies

- Establishment and enactment of Natural Disater Prevention and Control Law in 2014.

- Directive No.32/2004/CT-TTg dated September 17, 2004 offered short-term and long-term solutions for flash flood and landslide prevention and control programmes.

- Decision No.172/2007/QD-TTg dated November 16, 2007 approving the National Strategy for natural disaster prevention and mitigation up to 2020.

- Decision No.1002/QD-TTg dated 13 July 2009 approving the project on "Promoting the Community's Awareness and Community-based Disaster Risk Management"

- Decision No. 193/QD-TTg dated August 24, 2006 and Decision No. 1776/QD-TTg dated November 21, 2012 promulgating the program on population location in natural disaster-hit areas, extremely poor areas, borders, islands, free-immigration areas and special-use forests.

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

Natural disaster risk is classified by types of natural disaster based on the intensity, the range of influence, the area under direct impact, and possible damage inflicted by the natural disaster.

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:

Level 1 - blue indicates low risks;

Level 2 - yellow indicates average risks;

Level 3 - orange indicates high risks;

Level 4 - red indicates extremely high risks;

Level 5 - purple indicates disasters.

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

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

- Level 1 natural disaster risk includes:

+ 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;

+ 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;

+ 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.

- 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.

2.2.2. 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

Article 7. Assignment and decentralization of responsibilities and coordination in response to 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 shall directly command, and mobilize on-the-spot resources for, prompt response to natural disasters upon their occurrence; report to, and implement directions and commands of, superior natural disaster prevention and control agencies.

- Commune-level People's Committee chairpersons may mobilize the following resources for natural disaster response:

+ Militia and self-defense forces, youths, local organizations and individuals and voluntary organizations and individuals;

+ Reserve supplies prepared by the people, and supplies, equipment and means of communes and local organizations and individuals.

- Forces participating in natural disaster response in commune-level localities shall closely coordinate with one another under the commune-level People's Committee chairpersons or authorized persons.

- In cases falling beyond the response capacity of the commune level, commune-level People's Committee chairpersons may request support from district-level People's Committees and 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 from commune-level People's Committee chairpersons, and implement commands and directions of superior commanding agencies in charge of natural disaster prevention and control.

- District-level People's Committee chairpersons may mobilize the following resources for natural disaster response:

+ Militia and self-defense forces, youths, local organizations and individuals and voluntary organizations and individuals;

+ Supplies, equipment and means of districts and local organizations and individuals.

Article 8. Assignment and decentralization of responsibilities and coordination in response to 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 shall command localities and local agencies and units to respond to natural disasters, mobilize

resources under their competence to promptly and properly respond to natural disaster developments in their localities, and report to, and implement commands and directions of, the Prime Minister, the Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue.

- Chairpersons of provincial-level People's Committees may mobilize the following resources for natural disaster response:

+ Militia and self-defense forces, youths, local organizations, individuals and search and rescue, fisheries control and armed forces, and voluntary organizations and individuals;

+ Supplies, equipment and means of provinces, and reserve supplies for natural disaster prevention and control and those of local organizations and individuals.

- Chairpersons of People's Committees and heads of commanding committees for natural disaster prevention and control and search and rescue at district and commune levels shall perform the tasks specified in Article 7, observe commands of superior agencies, guide and evacuate residents to safe places; chairpersons of district-level People's Committees shall organize coercive evacuation when organizations or individuals fail to voluntarily obey evacuation directions, commands and guidance for natural disaster prevention and control for the sake of safety for people.

- 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.

- The Central Steering Committee for Natural Disaster Prevention and Control shall coordinate with the National Committee for Search and Rescue in mobilizing resources to support natural disasters response when receiving requests from chairpersons of provincial-level People's Committees and heads of provincial-level commanding committees for natural disaster prevention and control and search and rescue. Local forces participating in natural disaster prevention and control shall observe commands of provincial-level People's Committee chairpersons or authorized persons.

Article 9. Assignment and decentralization of responsibilities and coordination in response to level-3 natural disasters

- The Central Steering Committee for Natural Disaster Prevention and Control shall direct localities, ministries, ministerial-level agencies and government-attached agencies in taking natural disaster response measures; decide on urgent measures and mobilize resources under their competence to assist localities in responding to natural disasters when necessary.

- Based on each practical circumstance, the National Committee for Search and Rescue shall arrange forces and means for, and coordinate, natural disaster response activities.

- The commanding committees for natural disaster prevention and control and search and rescue of ministries, ministerial-level agencies and government-attached agencies shall take natural disaster response measures under their management, and, concurrently participate in natural disaster response under the direction and mobilization of the Central Steering

Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue.

- Chairpersons of provincial-level People's Committees and heads of provincial-level commanding committees for natural disaster prevention and control and search and rescue shall command and mobilize resources under their competence and take measures to respond to natural disasters in their provinces.

- Chairpersons of People's Committees and heads of commanding committees for natural disaster prevention and control and search and rescue at district and commune levels shall perform the tasks specified in Clause 3, Article 8 of this Decree suitable to specific situations in their localities; and observe directions and commands of superior agencies.

- In case natural disasters occur beyond level 3 or are likely to cause serious damages, the Central Steering Committee for Natural Disaster Prevention and Control shall report them to the Prime Minister for direction.

Article 10. Assignment and decentralization of responsibilities and coordination in response to level-4 natural disasters

- The Prime Minister shall direct ministries, ministerial-level agencies, government-attached agencies and related localities in taking natural disaster response measures.

- The Central Steering Committee for Natural Disaster Prevention and Control shall advise the Government and the Prime Minister on natural disaster response measures.

- The National Committee for Search and Rescue shall arrange forces for natural disaster response and coordinate natural disaster response activities under the direction of the Prime Minister.

- Ministers, heads of ministerial-level agencies and heads of government-attached agencies shall take natural disaster response measures under their management, and concurrently participate in natural disaster response under the direction and mobilization of the Prime Minister, the Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue.

- Chairpersons of provincial-level People's Committees and provincial-level commanding committees for natural disaster prevention and control and search and rescue shall direct and mobilize resources under their competence, take natural disaster response measures in their localities and observe directions of the Prime Minister, the Central Steering Committee for Natural Disaster Prevention and Control and the National Committee for Search and Rescue.

- Chairpersons of district- and commune-level People's Committees and heads of district- and commune-level commanding committees for natural disaster prevention and control and search and rescue shall perform the tasks specified in Clause 3, Article 8 of this Decree suitable to local practical situations and observe directions and commands of superior agencies.

Article 11. Assignment and decentralization of responsibilities and coordination in response to state of emergency due to natural disasters

- In case a natural disaster's severity exceeds level 4, the Prime Minister shall propose the President to promulgate a state of emergency due to natural disasters.

- The assignment and decentralization of responsibilities and coordination in response to a state of emergency due to natural disasters must comply with the law on state of emergency.

2.3. Achievements And Some Limitations

2.3.1. The situation of implementation of the project "Investigating, surveying and zoning warning landslide risk in mountainous areas in Vietnam"

2.3.1.1. Investigating current state of landslide and mapping

- The project has developed and formulated map on current state of landslide for 15 northern mountainous provinces: Thanh Hoa, Nghe An, Lao Cai, Yen Bai, Son La, Lai Chau, Dien Bien, Cao Bang and Bac Kan, Tuyen Quang, Ha Giang, Bac Giang, Quang Ninh and Hoa Binh, Lang Son (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with the units under the General Department of Geology and Minerals of Vietnam).

- Completing the mapping work of weathering for 11 provinces: Yen Bai, Lao Cai, Thanh Hoa, Nghe An, Lai Chau, Dien Bien, Son La, Hoa Binh and Ha Giang; Bac Kan and Cao Bang (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with the University of Mining and Geology).

- Completing the mapping work of hydrological geology – engineering geology for 13 provinces: Thanh Hoa, Nghe An, Lai Chau, Hoa Binh, Yen Bai, Lao Cai, Dien Bien, Son La and Ha Giang; Bac Kan, Cao Bang, Tuyen Quang and Bac Giang (implemented by Vietnam Institute of Geosciences and Mineral resources).

- Formulating maps of rainfall distribution causing landslide risk for 18 mountainous provinces, including Ha Giang, Lao Cai, Yen Bai, Lai Chau, Thanh Hoa, Nghe An, Dien Bien, Son La, Hoa Binh, Bac Giang, Cao Bang, Bac Can, Lang Son, Phu Tho, Quang Ninh, Thai Nguyen, Tuyen Quang and Vinh Phuc and evaluating the frequency of heavy rain for these 18 provinces (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with Institute of Hydrology and Meteorology Science and Climate Change).

- From 2012 to 2015, the project has implemented the application of remote sensing technology in 12 provinces: Lai Chau, Dien Bien, Son La, Lao Cai, Yen Bai, Thanh Hoa, Nghe An, Hoa Binh, Ha Giang, Cao Bang and Quang Ninh; Lang Son (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with National Remote Sensing Center).

- Formulating detailed topographic maps and digital stereoscopic model at 1/10,000 scale stereotypes in the areas of 22 provinces: Lai Chau, Dien Bien, Son La, Lao Cai, Yen Bai, Ha Giang, Lang Son, Cao Bang, Tuyen Quang, Bac Kan, Bac Giang, Quang Ninh, Hoa Binh, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue, Phu Tho, Vinh Phuc and Thai Nguyen and neighboring areas (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with Vietnam Natural Resources and Environment Corporation).

- Performing the work of computerization of diagrams, maps, database development with 240 pieces/sheets of diagrams, maps; developing and maintaining of a spatial database and WebGIS system for landslides with more than 2,000 information pages. Currently, the WebGIS system for landslide of this project has been published at the website www.canhbaotruotlo.vn (implemented by Vietnam Institute of Geosciences and Mineral resources in cooperation with the Center for Geological Information).

2.3.1.2. Mapping on zoning warning of landslide risk

In 2014-2015, the project completed mapping on zoning warning for 4 provinces: Nghe An, Thanh Hoa, Lao Cai and Yen Bai.

In 2016, continueing the work of mapping a zoning map for Lai Chau, Dien Bien and Son La provinces and the mapping on current status and component maps has been completed.

2.3.1.3. Investigating the current status of landslide at scale of 1:25,000 and 1:10,000

The investigation of current status of landslide at scale of 1:25,000 and 1:10,000 in Ban Khoang commune, Sa Pa district, Lao Cai province was conducted in 2016 by the Geophysical and Geotechnical Technology Center under Vietnam Institute of Geosciences and Mineral resources.

2.3.2. Results of KC.08.28/11-15 Programme: "Additional Research, Creation And Publication Of A Set Of Natural Disaster Maps In VietNam (mainland), Based On Results Of The Research Which Have Been Done Since 2000"

For: Storm, Drought, Flood, Landslide, Flash floods – mud and rock flooding, Erosion, Karst, River and Erosion, Salinization, Coastal eroson, Earthquake, Soil cracks, Other types of natural disasters, General warning of disaster risks in Viet Nam.

- 10 maps of disaster risks of Vietnam (mainland) with the scale of 1: 1,000,000 have been published, with 500 copies for each type of map.

- 500 copies of the Atlas of Disasters in Vietnam with the scale of 1: 3,000,000 have been published, 160 pages thick each, reflecting 14 types of natural disasters in Vietnam.

- An electronic atlas of 14 major natural disasters in Vietnam with the scale of 1: 1 000 000 and 1: 3 000 000 has been developed and published on the websites of the Institute of Geology and Vietnam Academy of Sciences and Technologies.

- 500 monographs of "Some Critial Issues In Natural Disaster Research And Assessment In VietNam (mainland)" have been published.

Landslide in the Vietnamese Territory

Key T – L factors are selected, as follows:

1. Slope [o^o];
2. Average annual rainfall [mm];
3. Overlay type.
4. Soil group.
5. Geological classification [q:l/sm; Q:l/s]
6. Distance to active cracks [km];
7. Cracking density [km/km2];
8. Horizontal cutoff [km/km2];
9. Deep cleavage [km/km2];
10. Type of vegetation cover

4.2.3.3. Landslide prevention solutions used in Vietnam

- Slope reinforced by concrete slab;

- Slope reinforced by concrete mortar;

- Slope reinforced by planting vetiver.

Slope reinforced by concrete mortar

Slope reinforced by concrete slab

Slope reinforced by Planting vetiver on the slope

Slope reinforced by Geotextile

Reinforced by retaining wall

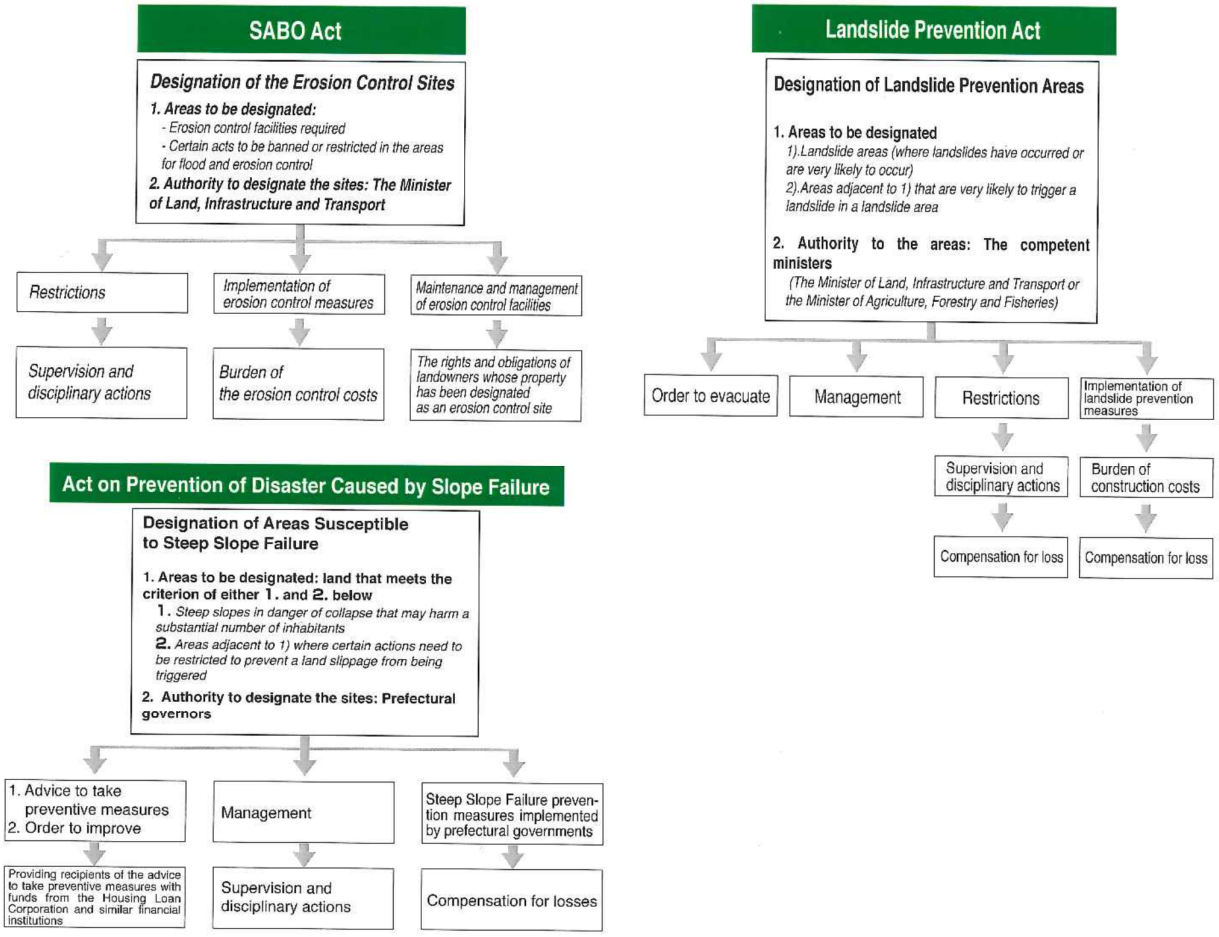
Reinforcement solutions against landslide by metal rock anchor combined with collecting groundwater

Reinforcement solutions against landslide by metal rock anchor combined with planting tree, grass on the slope

3 MONITORING LANDSLIDES IN JAPAN

3.1. Act on Preventing Sediment Disasters

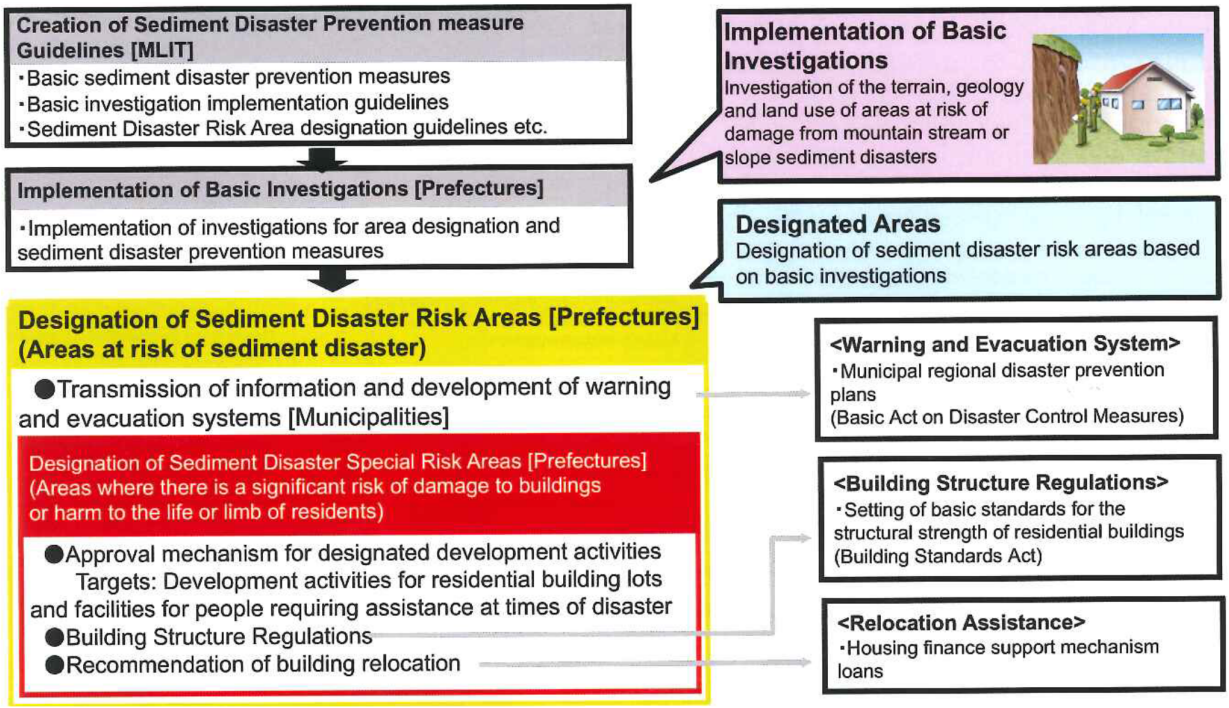
Sediment disasters occur in very extensive areas and in a variety of forms. In order to protect people and properties from sediment disasters, two types of preventive measures are taken: structural measures for disaster prevention by building facilities and structures; and non structural measures by way of establishing a system for warning and evacuation, and restricting and controlling new residential land development in areas vulnerable to a sediment disaster.

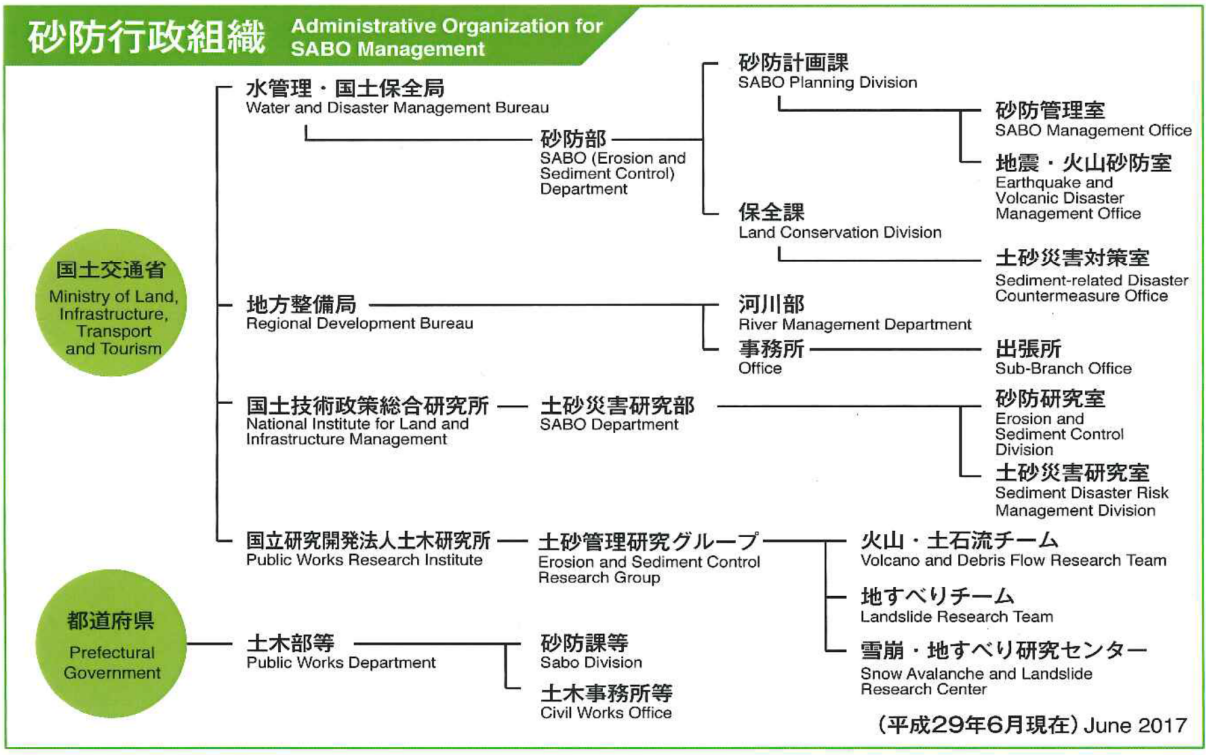


3.1.1. Overview of the Sediment Disaster Prevention Act

The Sediment Disaster Pervention Act* is intended to promote soft measures to inform of risks, develop warning and evacuation mechanisms, regulate the location of new housing, and promote the relocation of existing homes in order to protect the lives of residents from sediment disasters in areas at risk of sediment disaster.

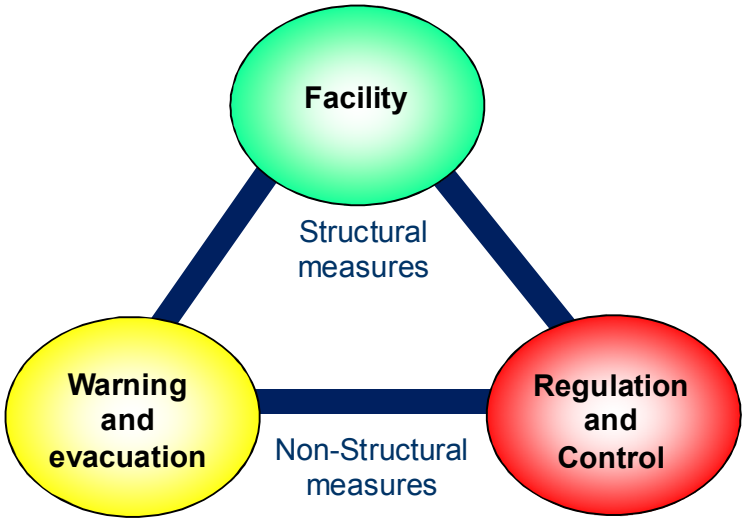
* Official Name "Act on Sediment Disaster Countermeasures for Sediment Disaster Prone Areas"





Photos and Figures are provided by the Ministry of Land, Infrastructure, Transport and Tourism

- Sabo Law
- Landslide Prevention Law
- Law on Prevention of Disasters Caused by Steep Slope Failure
- Sediment-related Disaster Prevention Law



3.1.2. Structural measures

- Sabo works, landslide prevention works, slope failure prevention works
- National land conservation
- Protection of human lives and properties

3.1.3. Warning and Evacuation

- In areas designated as “sediment-related hazard area
- Prevention of hazard maps for sediment-related disasters
- Strengthening of warning and evacuation system through preparation of sediment-related disaster information and their dissemination, improvement of information system etc.

3.1.4. Restriction on acts, Restriction an land development, Restriction on building structure.

- Sabo designated area and Land slide prevention area: Restriction on cutting, banking and other acts deemed harmful for the conservation of land
- Special sediment-related disaster hazard area

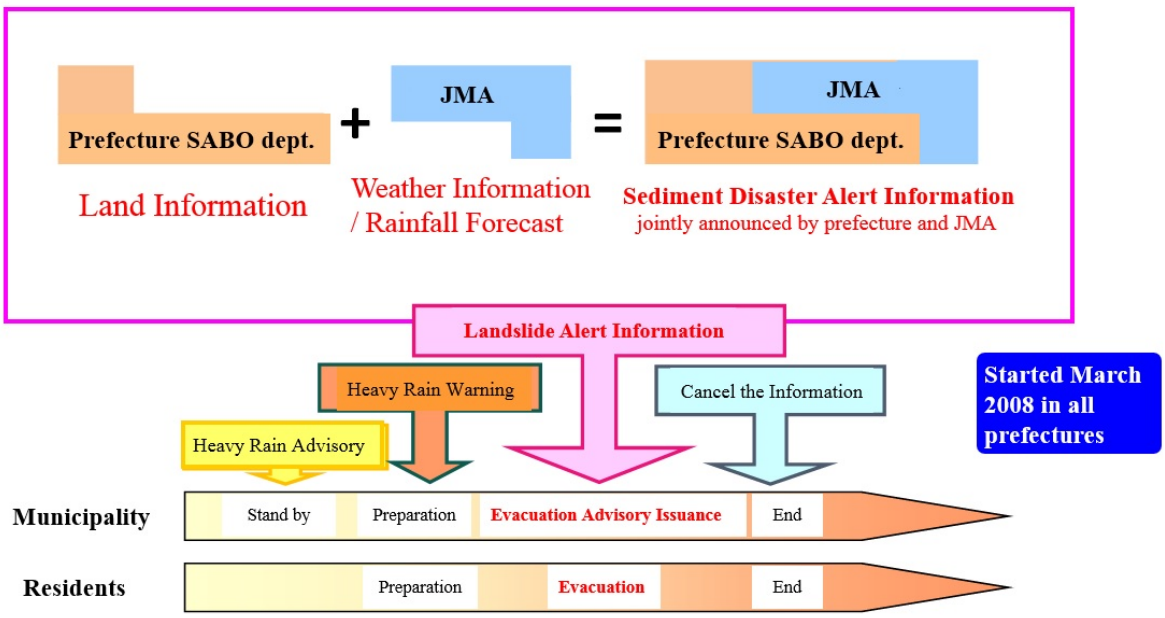
+ Restriction on building structures

+ Restriction on specific development works

3.2. Landslide Alert Information

3.2.1. Implementing Agencies

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.

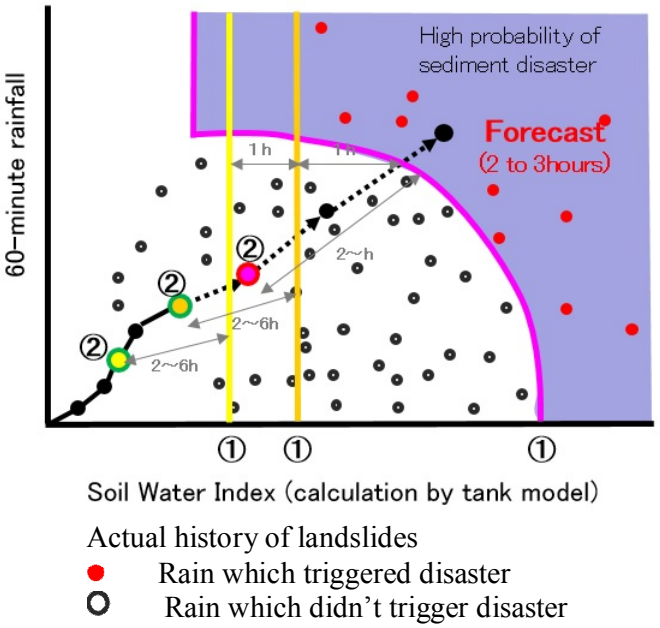


3.2.2. Phased information dissemination of Landslide Alert

3.2.1.1. 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.

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



3.2.1.2. 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

3.2.1.3. Landslide Alert Information

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

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

(*) Each prefecture has different criteria.

3.3. List of Sediment-related disasters in Japan

A total of 12.1 million people is threatened with sediment-related disasters in Japan (Source: http://www.sabo-int.org/data/sediment.html)

Prefecture	Number of mountain streams at risk of debris flow	Places at risk of landslide	Places at risk of steep slope failure
Hokkaido	1,607	437	3,158
Aomori	645	63	1,318
Iwate	2,204	191	1,792
Miyagi	1,359	105	1,841
Akita	1,692	262	1,318
Yamagata	1,268	230	585
Fukushima	1,678	143	1,435
Ibaraki	537	105	1,105
Tochigi	1,043	96	887
Gunma	1,863	213	1,667
Saitama	585	110	825
Chiba	212	52	1,613
Tokyo	391	26	2,046
Kanagawa	705	37	2,511
Niigata	2,544	860	1,975
Yamanashi	1,653	104	1,412
Nagano	4,043	1,241	3,205
Toyama	556	194	1,004
Ishikawa	1,030	420	1,177
Gifu	2,934	88	2,957
Shizuoka	2,311	183	3,749
Aichi	1,555	75	2,910
Mie	2,693	85	4,090
Fukui	2,080	146	1,588
Shiga	1,421	62	1,317
Kyoto	2,328	58	1,637
Osaka	1,009	145	896
Hyogo	4,310	286	5,557
Nara	1,136	106	1,289
Wakayama	2,526	495	3,144
Tottori	1,626	94	1,530
Shimane	3,041	264	2,874
Okayama	3,019	198	2,475
Hiroshima	5,607	80	6,410
Yamaguchi	2,655	285	3,865
Tokushima	1,129	591	2,097
Kagawa	1,592	117	929
Ehime	3,540	506	2,750

Prefecture	Number of mountain streams at risk of debris flow	Places at risk of landslide	Places at risk of steep slope failure
Kochi	1,939	176	4,175
Fukuoka	2,508	215	3,566
Saga	1,760	200	1,759
Nagasaki	2,785	1,169	5,121
Kumamoto	2,120	107	3,552
Oita	2,543	222	4,927
Miyazaki	1,413	273	2,823
Kagoshima	2,160	85	4,231
Okinawa	163	88	465
Total	**89,518**	**11,288**	**113,557**

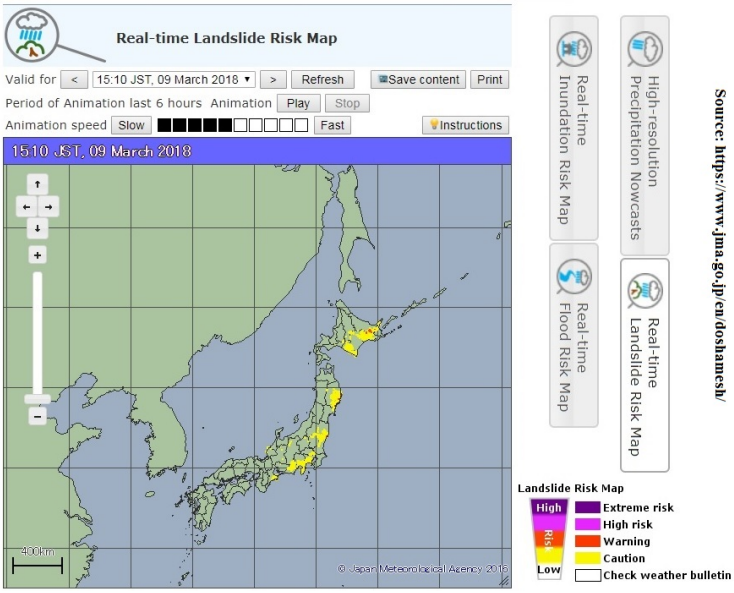
(The above figures for debris flow and slope failures, avalanche, and landslide are published in fiscal 2003, 1997, and 1998 respectively).

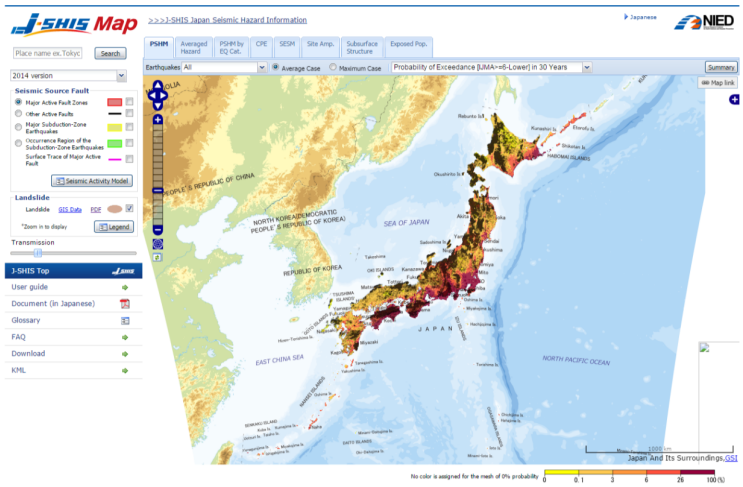
Total population in the threatened area preserved	Population in the mountain streams at risk of debris flow	Population in the places at risk of landslide	Population in the places at risk of steep slope failure
About 12.1 million people	About 4.3 million people	About 1.6 million people	About 6.2 million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

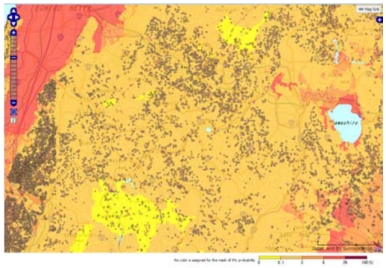
Latest figures of designation of high risk areas of debris flow, landslide, slope failure and total (link reference): http://www.mlit.go.jp/river/sabo/link20.htm

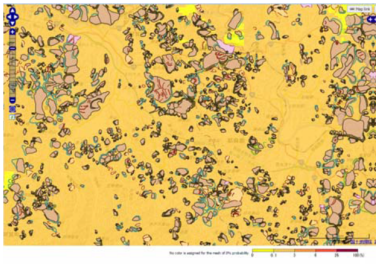
3.4. New methods of monitoring landslides and maintaining them in a stable

Two third of the Japanese Archipelago is dominated by mountains; 100 million people are forced to live and work in slopes or around slopes. Landslides often cause disasters and cause extensive damage. In this regard, research organizations and universities to carry out research work on the study and prevention of landslides. Also conduct monitoring of landslides and develop new designs to maintain a steady state of landslides.









Map of landslides

Boundary Structures
Main scarp and lateral scarp(flank)

	Main and/or lateral scarp of which crown is fresh or not dissected
	Partially dissected crown
	Mostly dissected crown
	Roundly subdued and vague crown
	The missing part of the scarp and crown by dissection.
	Exposed slide surface without sharp scarp.
	Lunar or crown cracks, multiple scarps and ridges.

Boundary Structures
Margin of moving mass

	Definite margin of the moving mass
	Indefinite margin of the moving mass
	An area unstable mass is remained
	A part of margin overlain by another moved mass or deposits
	Probable boundary of an area inferred as an unstable or quasi-moving mass
	A mountain or hill difficult to identify whether mass is moving or not

Interior Structures

	Secondary scarp: The crown is similarly shown in a main scarp
	Boundary between sub-units or an interior moving/moved mass
	Ridge (interior)
	Wide trench or open crack
	Narrow trench or open crack
	Echelon cracks
	Linear depression or valley floor line. Arrow shows the downstream

Movement Direction and Main Moving Direction of the Mass

	Slide
	Creep
	Flow
	Fall
	Slow movement with external rotation
	Dip of the move slope surface. Usually shown in case of reverse dip from original slope

Centroid

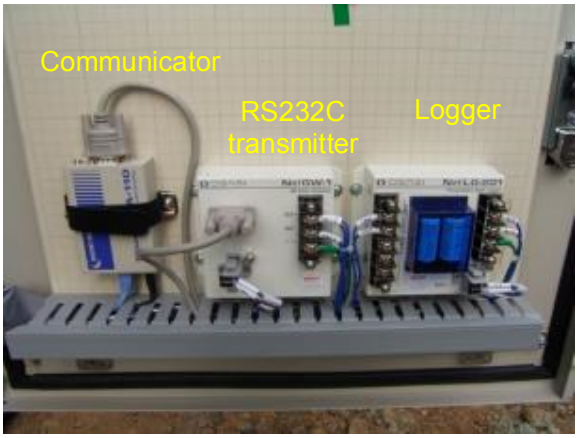
○	Centroid of moving mass

The legend for map of landslides

3.4.1. Automated Observing System

Install the rain gauge observation system in high risk area. And combine with automatic observation system to communicate with relevant organizations: Facility manager (Provincial office etc.), Local government office, Fire Station

Rain gauge



Logger was installed

Facility manager (Provincial office etc.)

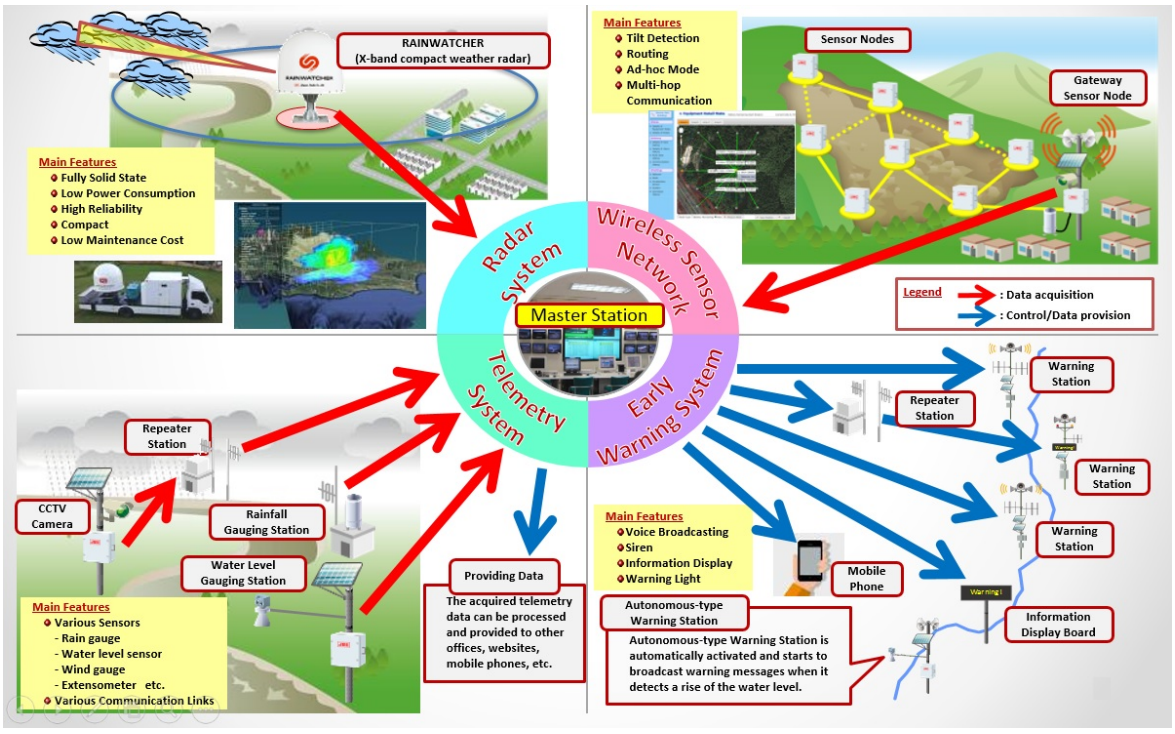
Local government office

Fire Station

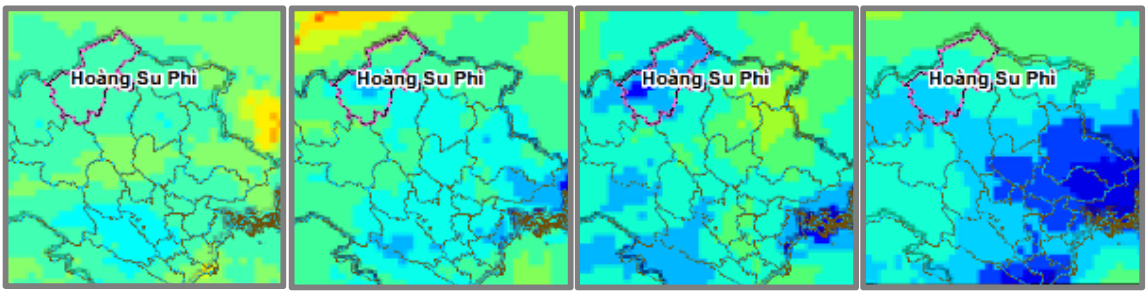
3.4.2. Remote monitoring system for floods

This observation system enables you to observe remote locations by visual and data. It helps to detect abnormal circumstance, sing of disaster and environmental variation.

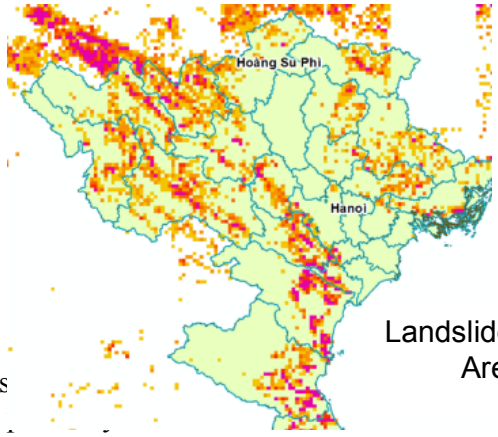
3.4.3. Weather radar ・Warning system



3.4.4. Risk Analysis in Mountain/Slope Area using Satellite and Topographic data



Occasional Risk

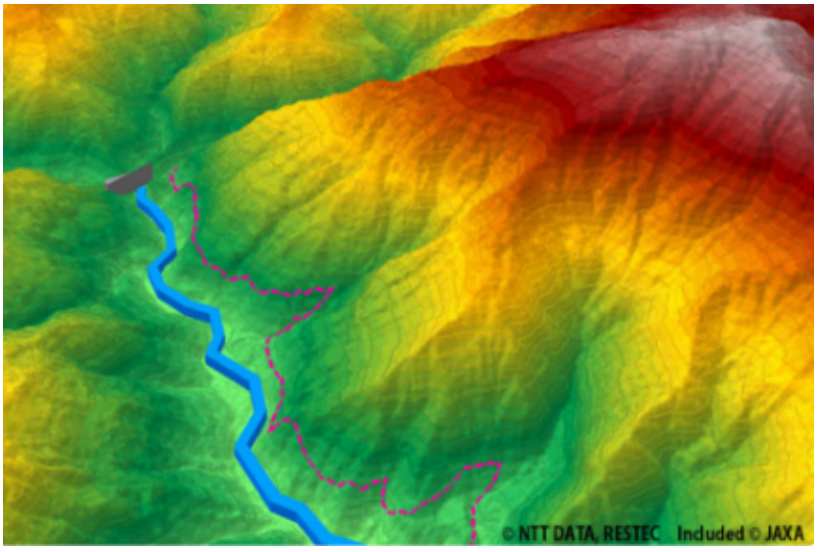


Landslide/Flash Flood High Risk Area (sample image)

Rainfall data from s

- ✓ Archive for
- ✓ Update every hours
- ✓ Spatial resolution 0.1degree

Primary Risk



Topographic data covers global land surface: 30m spatial resolution

3.4.5. Preparedness－Hazard Map and Disaster Observation

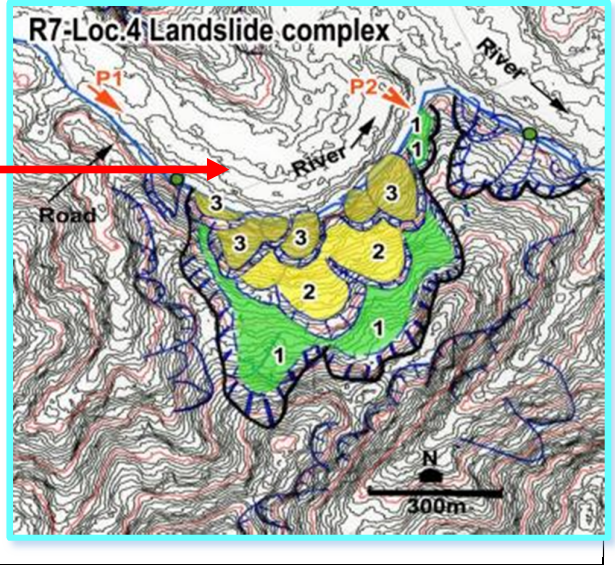
Mapping with satellite based geomorphological data and land use, with Road and other data

Natural disaster risk analysis using GIS, and validation of field surveying

Actual result-1; Detection of over one thousand landslide hazard belong National Road in the middle of Vietnam, using satellite based geomorphological data

Actual result-2 ; Quick understanding disaster situation after typhoon, earthquake and other event

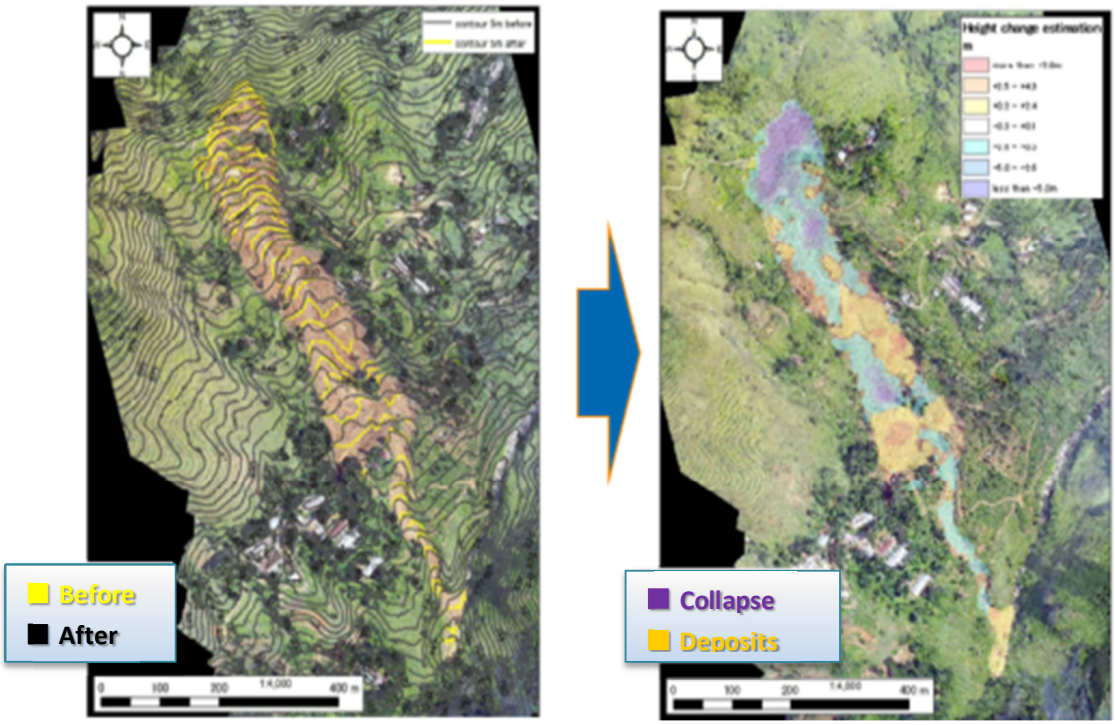
Actual result-1



Actual result-1; JST/JICA SATREPS

Providing Prof. Toyohiko MIYAGI, Division of Human Informatics, Graduate School, Tohoku Gakuin University

Actual result-2



3.4.6. Emergency Response: Observing disaster - Install wire sensor

- Debris flow sensor：Install in a mountain stream

- Debris flow sensor：Install on the countermeasure work

- Extensometer (Landslide sensor)

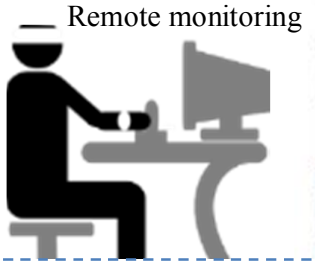
3.4.7. Install simple monitoring and observation for warning

Install simple monitoring and observation equipment: Monitoring station is able to deploy anywhere you wish to monitor at minimum cost, time and maintenance.

- Rain gauge with warning alarm was constructed

Monitoring station

Install water gauge with flood waring alarm: Set warning alarm by phase, monitor and observe the water level



Monitoring web service

3.4.8. Install temporary countermeasure work

- Install temporary counter measure work to prevent expansion of the disaster area. Materials of installing temporary countermeasure work is storing for emergency response.

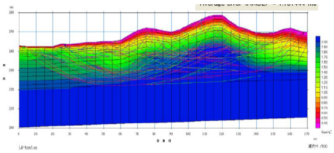
- Storing for temporary countermeasure: Japanese are storing the materials for emergency response to recover the disaster area when disaster occurs.

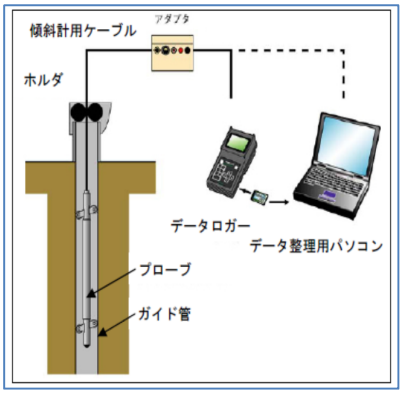
Storing sandbag by local government (Sand back station)

3.4.9. Reconstruction (Long-term plan)

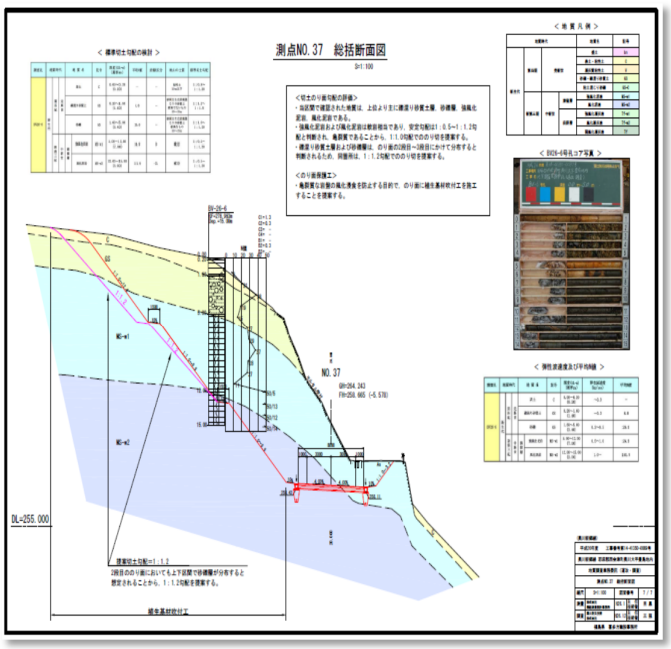
3.4.9.1. Permanent countermeasure consulting: Site investigation→Mechanism Analysis→Plan→Design→Temporary Plan→Construction

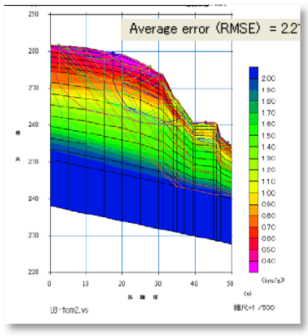
Step 1: Site Investigation

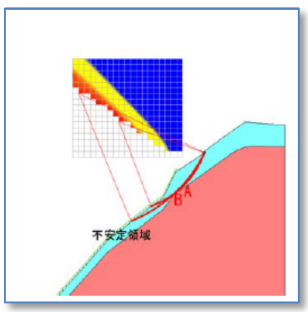




Step 2: Mechanism Analysis, Plan and Design







Step 3: Temporary Plan and Construction

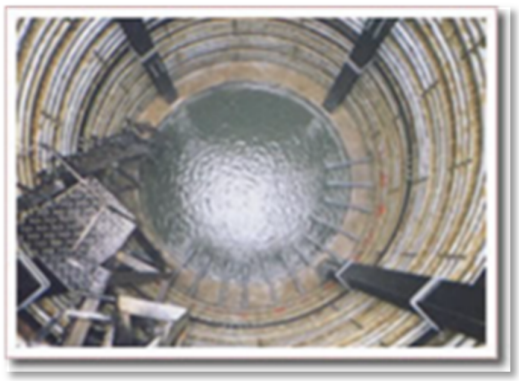
3.4.9.2. Japanese permanent countermeasures: Various counter measure corresponding to different types of disaster are commercialized

Slope management

Anchor

Concrete frame

Landslide management
Catchment wells

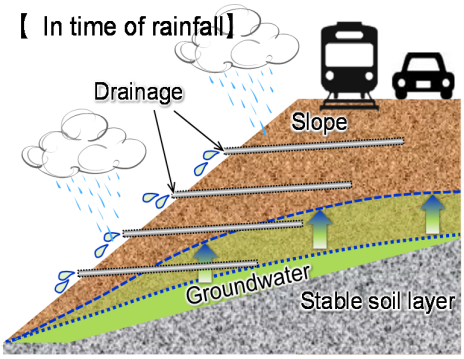


Debris Flow management
Steel slit dam

3.4.9.3. Construct simple permanent countermeasure: Drainage pipe and prevention erosion mat are easy to construct and useful to reduction of the risk of sediment disaster.

+ Groundwater is one of the main causes in many cases of slope failure

+ "Telescopic Drainage Pipe (TDP)" can prevent slope failure by draining groundwater



Prevention erosion mat

3.4.10. YEC's Experience of Sediment Disaster Management

YEC conducted sediment disaster management projects in Japan, Indonesia, etc.

Structure Measures	Non-structure Measures
➢ Construction of Sabo Dam ➢ Rehabilitation of Existing Dam ➢ Rehabilitation of River Facilities ➢ Rehabilitation of Irrigation Facilities ➢ Construction of Groundsill	➢ Monitoring, Forecasting & Warning System ➢ Evacuation Facilities (Road, Shelter, Signboard) ➢ Heavy Equipment & Workshop for Disaster Management ➢ Establishment of Community Base Sand Mining Management Org. ➢ Evacuation Drills in 4 sub villages x 3 times ➢ Establishment of Disaster Education Program for Child ➢ Sand Mining Management Plan, Manuals ➢ Disaster Management Event

3.4.10.1. Open type steel sabo dam for debris flow management: These are typical types used as open type dam for capturing debris flow. Since these can secure high opening ratio, they can easily close up their slits by the boulders at the frontline of debris flow and effectively capture the entire debris flow.

Steel slit dam

Example of Sediment Control Dam (YEC's Experience of Sediment Disaster Management)

Source: Japan Bosai Platform (JBP)

CHAPTER V. EARLY WARNING SYSTEM FOR LANDSLIDES

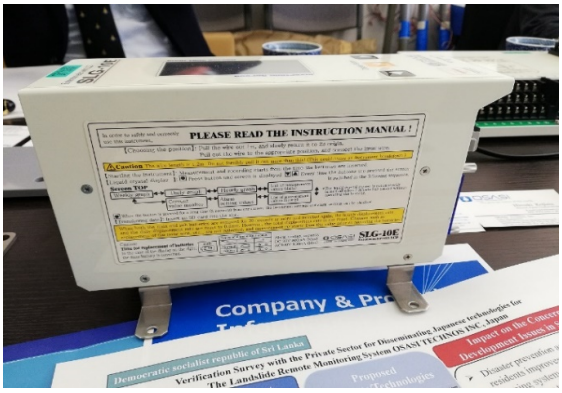
(Learning from many companies & Lectures)

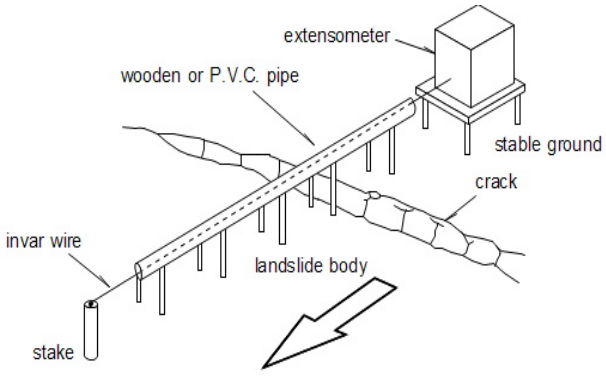
A landslide is a movement of a slope. So, Extensometers, rain gauges, and alarms are installed to support alert and evacuation in case of a landslide due to a heavy rain. In addition, hydrographs, pipe strain meters, and clinometers are installed for observation to clarify the mechanism of a landslide, analyze stability, design countermeasures, and evaluate stability after the countermeasures have been implemented.

Landslide: Extensometer, rain gauge, Pipe strain gauge, underground water level gauge, clinometer. Water analysis: thermometer, turbidimeter, ph meter, EC meter. Weather observation: rain gauge, thermohygrometer.

1. EXTENSOMETERS

To determine the movement of a ground surface on a landslide location, two piles are installed across a crack: one at a fixed point and the other at a moving point. An invar wire is stretched between the piles to measure the change in distance. This extensometers continuously monitor the expansion and contraction, and trip an alarm contact when the displacement has exceeded a threshold. You can install a vertical wire inside the borehole to observe the bend of the hole (vertical extensometer). This extensometers have a resolution of 0.1 mm, so they can be used to monitor not only landslides but also bedrock collapses and displacements in temporary constructions.





- Compatible with SD cards: It is possible to collect the recorded data onto an SD card. The CSV format is used, so the data can be easily handled using ordinary spreadsheet programs such as Excel, etc.

- Various alarm output patterns: There are 4 types of alarm output: hourly displacement, daily displacement, total displacement, and specified-duration displacement rate (10 minutes to 10 days). In systemization it is possible to configure a site alarm or a remote alarm system that is suitable for the level of alarm.

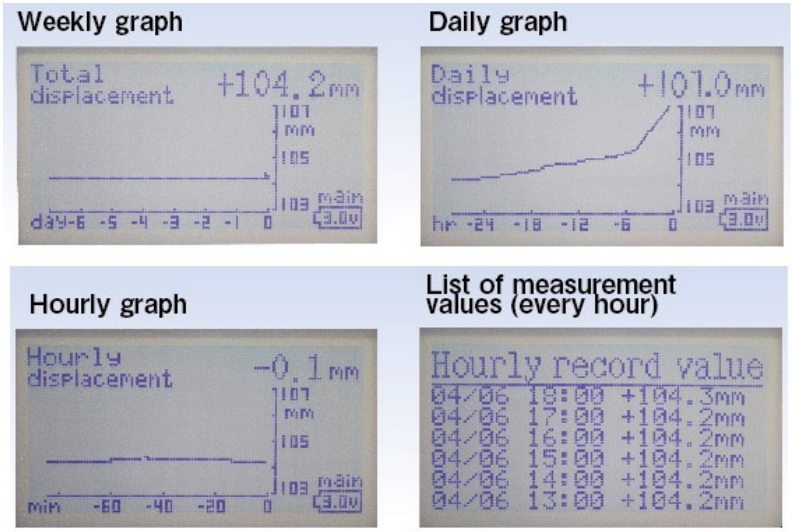
* For specified-duration displacement rate and system configuration settings the dedicated controller NetCT-1E Is necessary.

- Wide measurement range (1,000mm): The measurement range has been greatly extended compared with conventional extensometers. The frequency of replacement of the inver wire on site with large movement is greatly reduced.

- Easily visible to read liquid crystal display: Liquid crystal display is placed on the top surface. The contents of the screen can be easily checked at any installation site by the screen inversion function, Also reliable monitoring can be achieved on site by the large character. The backlight function improves the visibility more.

- Easy operability: The various settings can be set using the instrument itself. Settings can be performed simply with 3 buttons on the top surface.

Liquid crystal display



2. RAIN GAUGES

Contrary to what most people would expect, most rainfalls are uniform only in a very narrow area. You cannot always get the right data for your exploration area from an adjacent observatory. In exploration, it is important that rainfall be observed on-site.

Osasi Technos offers 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

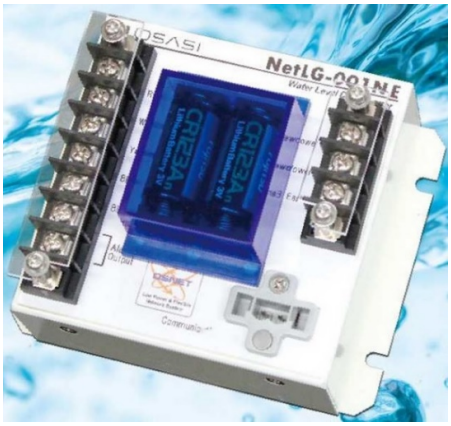
A range of 4-gauge strain data recorders for strain-gauge transducers with an I/O resistance of 350 ohms used primarily in civil engineering, such as clinometers, anchor load cells, pore pressure gauges, and earth pressure gauges. With connection units, this recorders support up to 60 channels of signals 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

Construction of roads, rivers, and dams changes the topography and affects underground water. To investigate the influence, underground water levels near the construction site are continuously monitored; it starts before the commencement of construction and ends after completion. Our 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. Network-type data recorders are combined with multiple devices via a network and allow centralized management. Waterproof-type data recorders are for standalone use.

6. WATER LEVEL DATA LOGGER



6.1. 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. Thus, it is possible to develop a four-step alarm system. It is also equipped with one alarm output contact.

6.2. A wide variety of monitoring functions

This instrument has a function to 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. Thus user can detect malfunction of the instrument and the sensor early and has responses quickly.

6.3. Low-power-consumption design

Our original low-power-consumption design enables operation of the instrument for one year with a single main lithium battery in the case of the one-hour recording interval. Moreover, with the use of the auxiliary battery, the instrument can be operated for 2 years without replacing batteries.

6.4. OSNET compatibility

A user can upgrade the system easily from a simple measurement system with only a data logger and a sensor to an alarm with an additional alarm function and. then, to an automatic remote monitoring system at sites in different conditions and with different amounts of budget.

➔ **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.

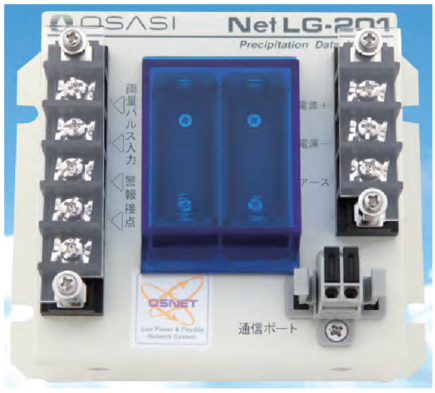
7. OTHER SUPPORT DEVICES

7.1. Precipitation Data Logger (NetLG-201E)

- Lightweight and Compact: Light weight and portable for easy installation. Mounting plate included.

- Low Power Consumption: Using our specially developed low power consumption circuitry, the logger can operate for long periods on its in-built lithium battery or an external power supply.

- Extended Data Collection: Collected data is stored in high-capacity internal memory. Around four years of rainfall data can be stored if annual precipitation is 1,900 mm.

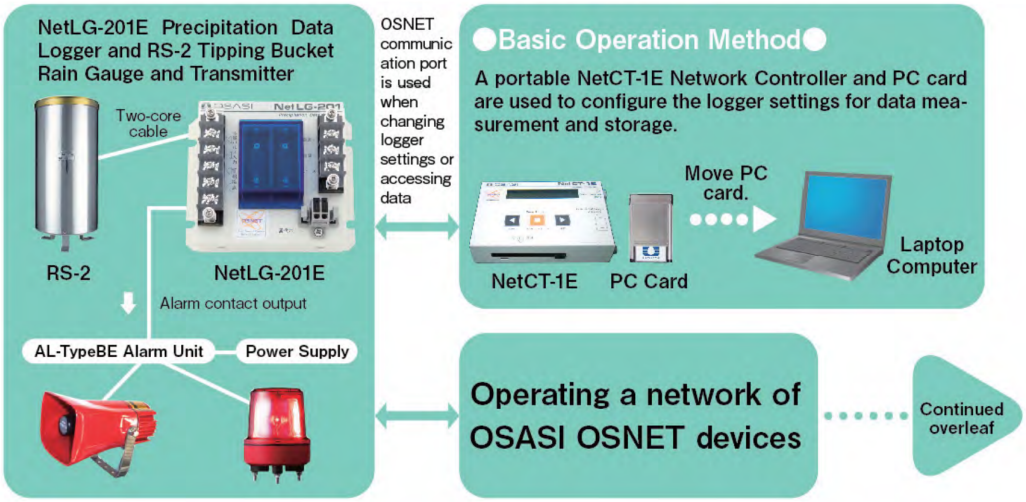


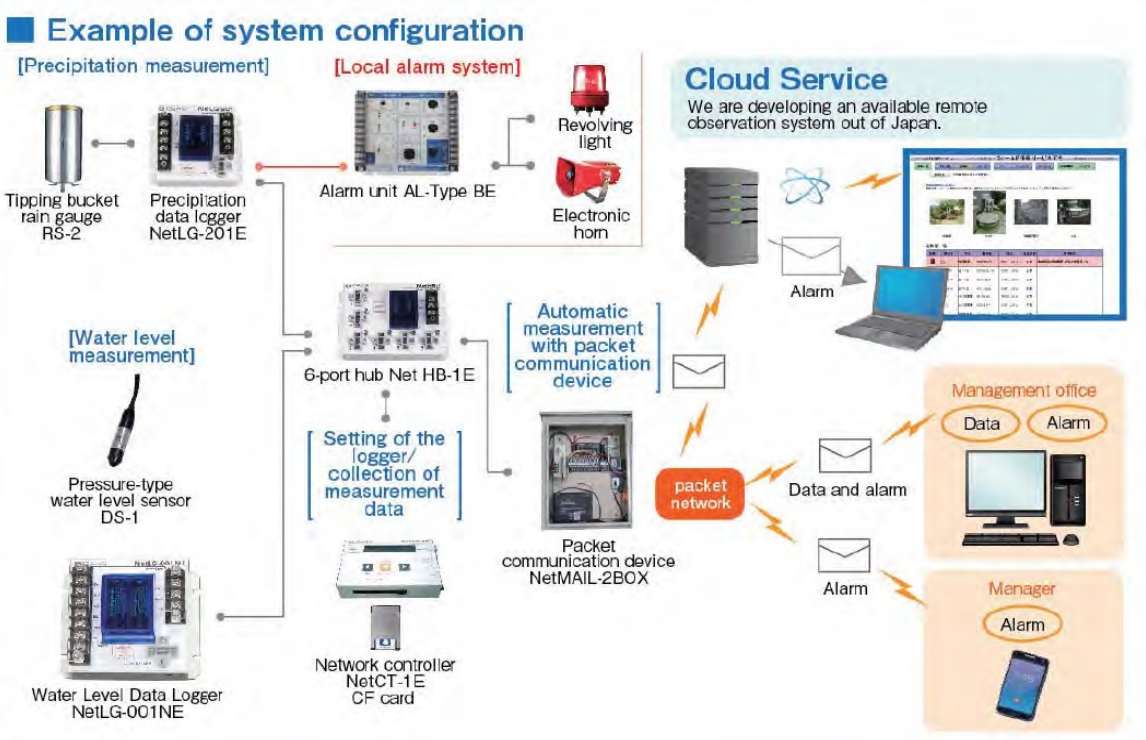
- Alarm Output Function: A signal can be sent to sound an alarm when hourly, daily, accumulated, or effective accumulated rainfall reaches user-defined settings.

- Environmental Durability: rge protector is present on all circuit inputs to combat static electricity and foreign noise. Operational stability can be maintained over a wide temperature range.

- OSNET Compatible: Compatibility with OSNET network specifications enables easy conversion from semi-automatic data collection to fully-automatic data collection.

Example Configuration:





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

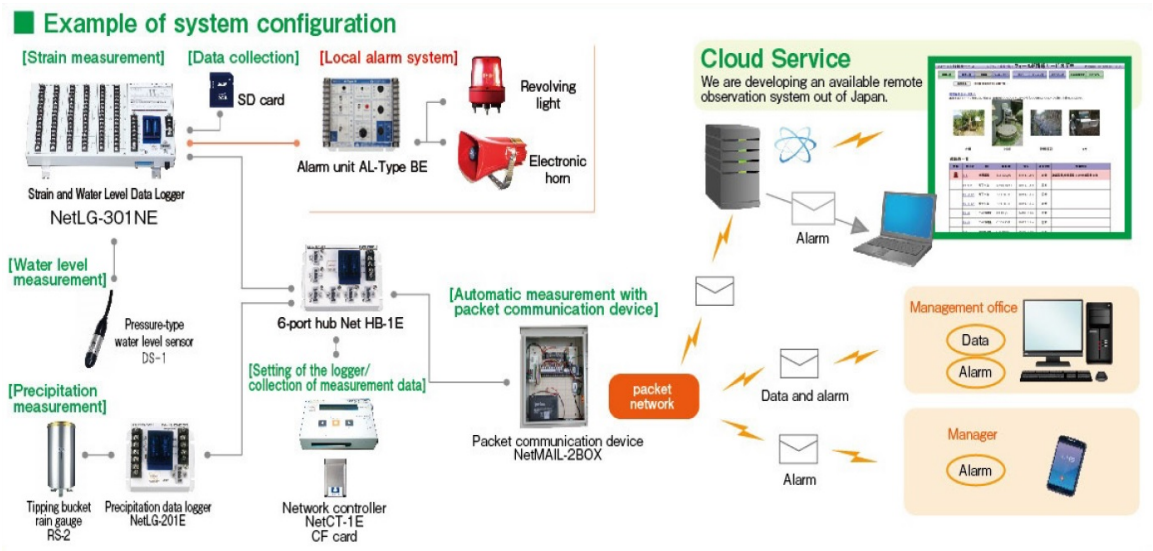
- Correspondence with expansion unit: The number of measurement channels can be increased easily up to 90. Each expansion unit (301N+) has ten channels. The expansion unit allows flexible system configuration for various site conditions.

- Versatile alarm function: This Instrument allows alarm settings for upper and lower limits (water level), and accumulative change and specified-duration change amount (strain measurement)

- Compatible with SD cards: It is possible to collect the recorded data onto an SD card.

- Reverse polarity of strain measurement data: The use of different methods of sensor Installation and sensors of different manufacturers may result In Inconsistency in the polarity of strain measurement data. This instrument allows easy solution of such inconsistency.

- OSNET compatibility: 2-gauge/3-wire-type 120 D strain gauge sensor: 30 channels Water level gauge: 1 channel.



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

- Correspondence with expansion unit: The 10-channel expansion unit (401N+) allows easy addition of measurement channels.

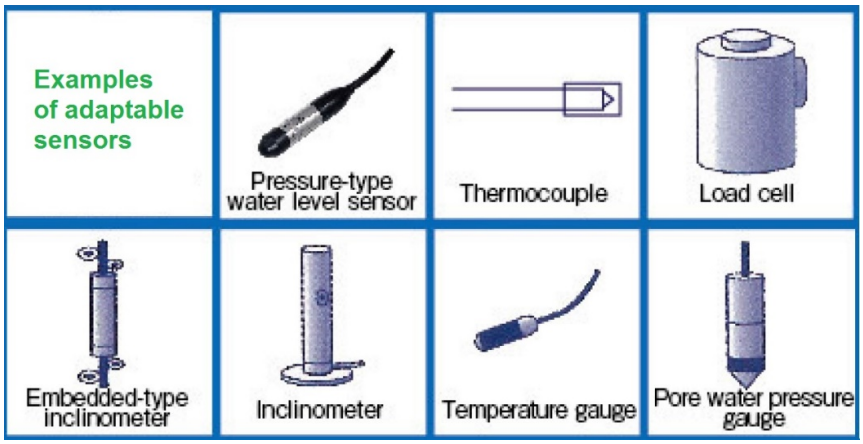
- Applicable to thermocouple measurement: This Instrument allows easy multipoint temperature measurement as all the measurement channels are compatible with type-K,N,J and T thermocouples.

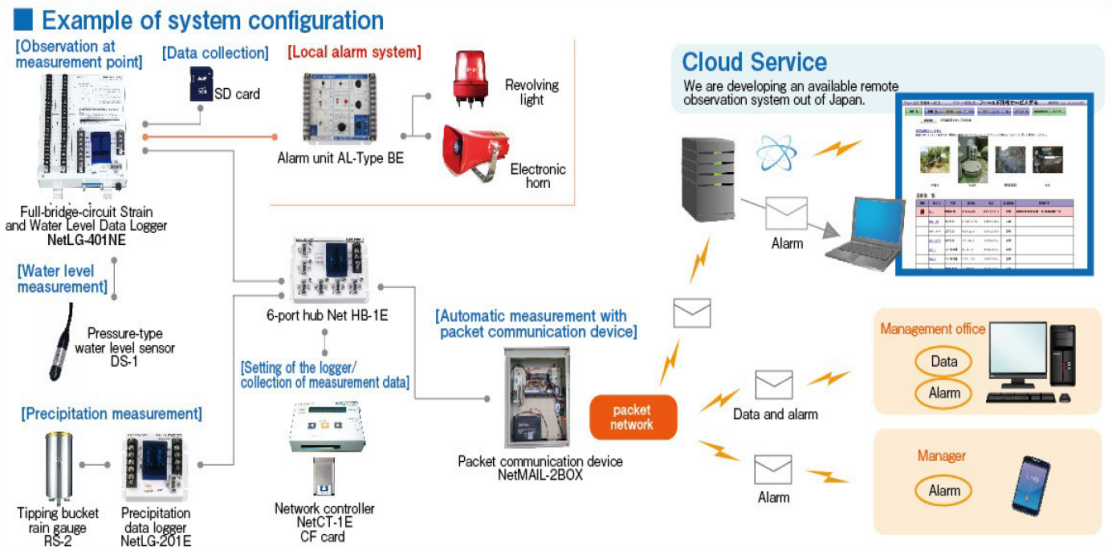
- Versatile alarm function: The setting of four alarm limits on each channel allows a wide variety of alarm settings Including stepwise alarm Issuance.

- Powered by a commercially-available battery: This Instrument can be operated for measuring at one-hour Intervals for approx, seven months with a commercially-available lithium battery (CR123A).

- Compatible with SD cards: It is possible to collect the recorded data onto an SD card.

- OSNET compatibility: Full-bridge-circuit strain transducer/thermocouple: 10 channels Water level gauge: 1 channel.





8. MANUAL FOR COMMUNITY BASED EARLY WARNING SYSTEM

The World Conference for Disaster Reduction (1995 Japan) emphasized the importance of community-based disaster management (CBDM) in that community operated early warning (COEW) should be a key component.

COEW is necessary especially for communities located in small steep river basins because:

- Floods/debris flows/landslides occur by localized heavy rainfall within the river basin where the communities are located. However in most countries the national observation network is not so dense to cover all such basins.

- Floods/debris flows/landslides occur shortly after heavy rainfall. Therefore people should be warned immediately after rainfall. However in most countries the national early warning system may not be so quick in operation.

To meet such necessity water level equipment and rainfall equipment were developed in the Central America and the Caribbean.

- Water level equipment with automatic alarm function was developed by CONRED (Guatemala)/CEPREDENAC[1]) after Hurricane Mitch (1998) and has since been in use for COEW in Central America.

- Rainfall equipment of similar type was developed by the University of West Indies (Trinidad & Tobago)/CDERA/JICA[2]) in 2004-2005 and has been distributed to Caribbean countries for COEW.

Of various types of equipments being used for COEW, these equipments may Bethe one suitable for a majority of communities because of the advantages mentioned in the next chapter. For a wider use of these equipments in developing countries, "Volunteers for the promotion of Community Early Warning (VCEW)" (Ref. End Note) has been producing them with some modification of the originals for donation to developing countries[3]). The equipments are also being sent to international organizations for information sharing among variety of users in the world[4]).

The intention of VCEW is not to provide the equipments to all communities of developing countries but to a limited number of organizations (government agencies, NGOs, academic institutes etc) in each country which will serve as the core for mass production and dissemination and will support communities in O/M, thus establishing a self-reliant system for production and use of the equipments in each country.

Attached to revetment (Nepal)

Attached to a tree, (Costa Rica)

Installation on the concrete basement,(Guatemala)

Installation on a metal fabricated stand (Kenya)

Foot notes :

1) The development of water level equipment was initiated by Dr. Juan Carlos who worked for CEPREDENAC, UN Platform for the Promotion of Early Warning (UNPPEW) and is currently working for UN SPIDER. when he was working for CEPREDENAC.
2) The development of rainfall equipment was initiated by Prof. Jacob Opadeyi of University of West Indies, Trinidad and Tobago, He produced 50 units of rainfall equipment for distribution to CDEMA member countries and conducted training for concerned personnel of CDEMA member countries regarding the use of the equipment in 2007.
3) The equipment has been sent to Guatemala, El Salvador (SNET), Trinidad and Tobago (University of West Indies), Indonesia, Lao PDR, Sri Lanka, Nepal and Thailand (as of 1 October 2010)
4) The equipment has been sent to UN Platform for the Promotion of Early Warning (UN PEW), ESCAP, WMO, ICIMOD, CEPREDENAC and CDEMA (as of 1 October 2010).

8.1. Advantages

1. Parts availability

- The parts for making / replacing the worn out ones are easily available in most of the electronics shops near you, except the RELAY for the monitoring apparatus which may not be available anywhere in Kenya. But in its place we will use a Regulator (5-9 volts) depending on the buzzers voltage and a 10 ohms 2wats resistor (depending on buzzers voltage)

- Parts are cheap and affordable

2. Simplicity

Any lay parson can assemble this monitor, but one is advised to do so under a supervision of a technician or trained volunteer. All safety measures must be observed.

3. Easy to Operate and maintain

Any trouble in O/M can be solved by the persons who assembled the equipment, without resorting to external help (technician) 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, during a heavy down-pour and the observer is not near the monitor or at a distance. Due to the external LED rainfall/water level indicator.

- The observer can measure rainfall and water level safely in the house without going out to the observation sites under storm, mid-night, at a safe distance and other difficult conditions.

8.2. 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 COEW in Kenya due to “Advantages”, especially “Simple in structure” and “Easy O/M”. There are many cases where hydrological equipments are not working which were imported and installed with external assistance.

8.3. Assembly

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)

- 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.

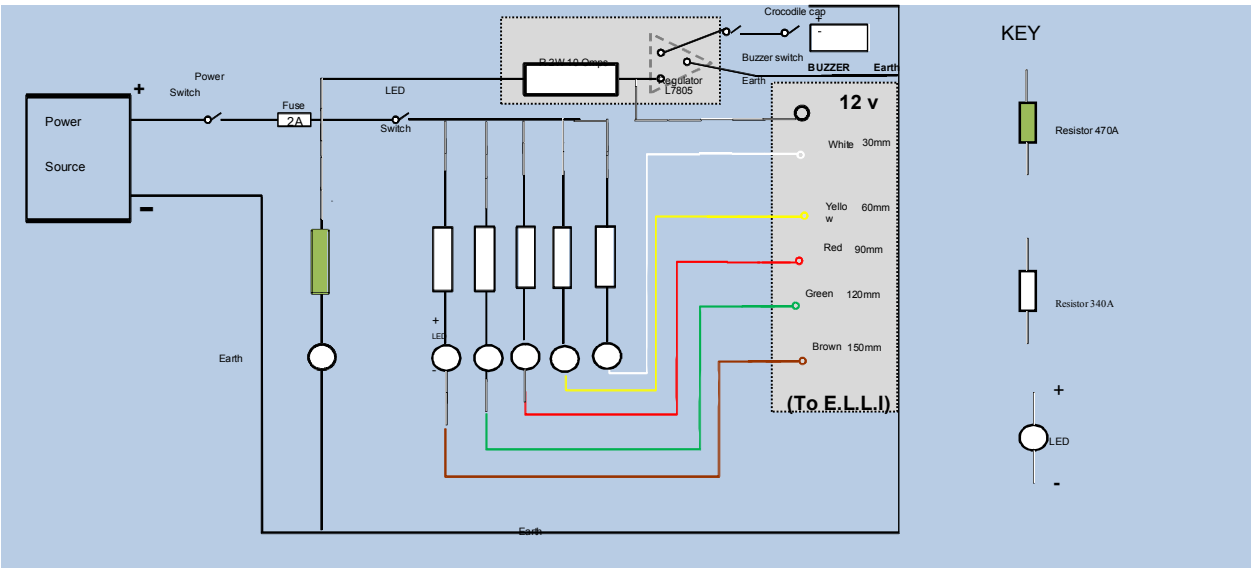
Circuit diagram of the monitor is given in Fig below.

Circuit diagram of the external LED level indicator is given in Fig below.

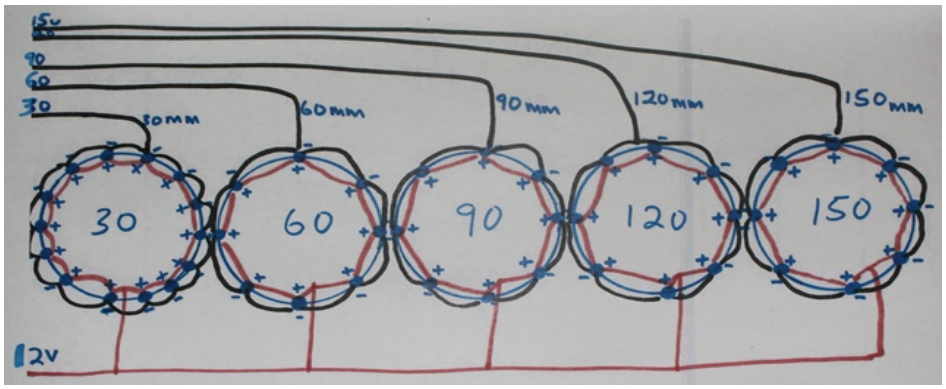
Details of tools for assembly and parts are given from Table.

→ One day will be enough to assemble a set of the monitoring apparatus, rainfall equipment and water level equipment. (After experience in assembling several sets of equipment) If all tools and parts are readily at hand.

Monitor Circuit Diagram



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



8.3.1. Rainfall equipment

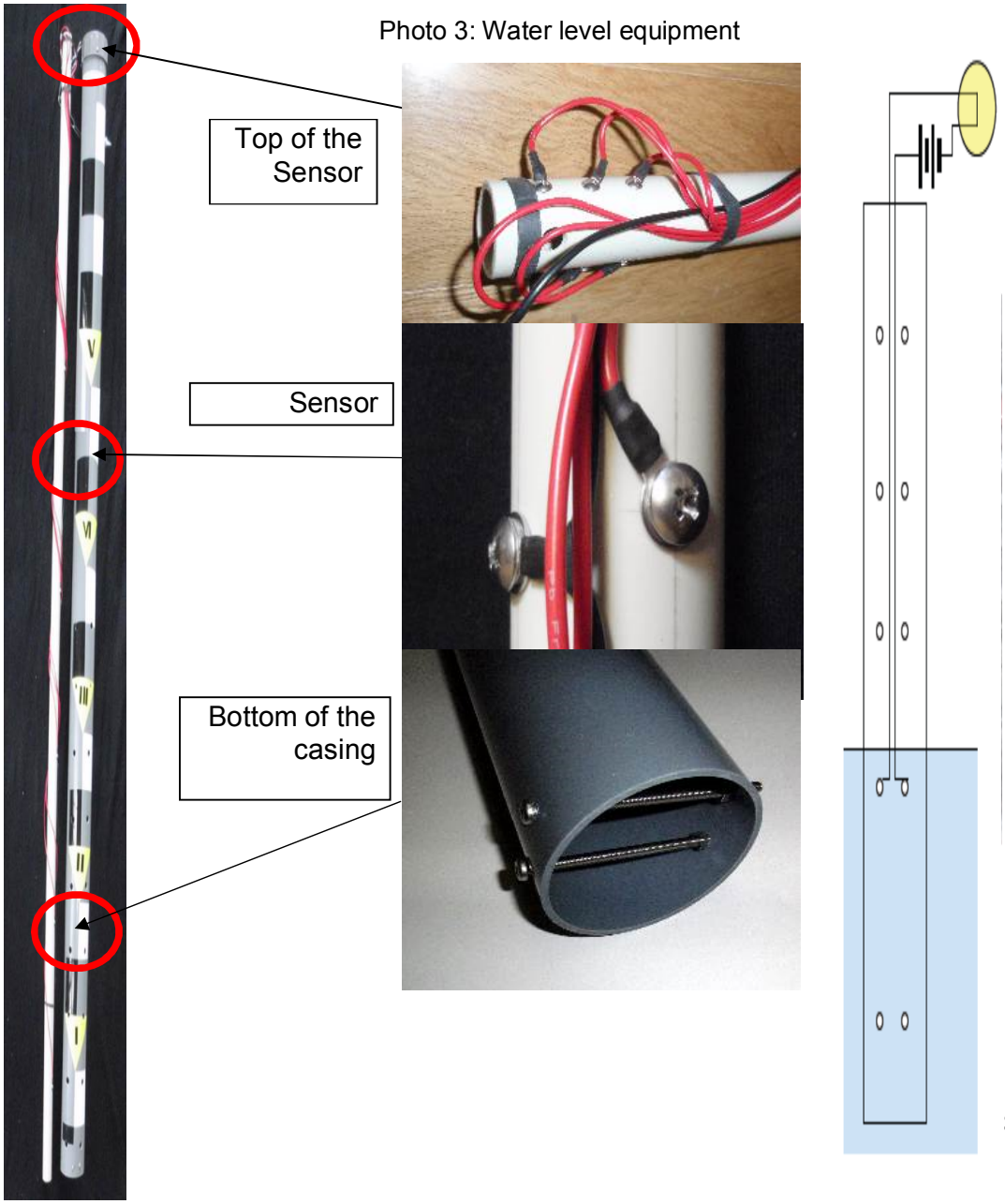
- The size of the bottle depends on the rainfall amount 2 liter bottles might be appropriate for many cases, but 3 litter or more can also be considered. When it is necessary to measure a larger amount of rainfall than the depth of the bottle, a smaller bottle can be used for the receiving part. The throw-in type equipment was developed for easier assembly and maintenance.

- The sensor is to be installed outside the house and connected by a cable to the monitoring apparatus in the house. The connecting cable can be extended to more than 150 m.

8.3.2. Water level equipment

- Depth/velocity/floating rubbish etc. should be taken into account in the design and installation.

Photo 3: Water level equipment



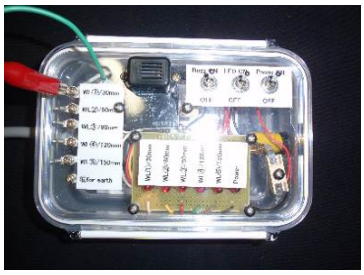
- The sensor is to be installed by the river bank attached to the revetment/ a tree/ an artificial basement or a fabricated iron stand.

- The sensor is connected by a 6 line cable to the monitoring apparatus in the house in the same manner as the rainfall equipment.

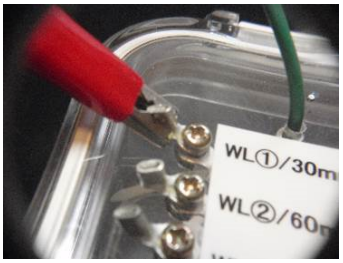
- It is important to ensure that the cable and the sensor is installed in a safe zone (should not be stolen or damaged).

8.4. Details Of Apparatus

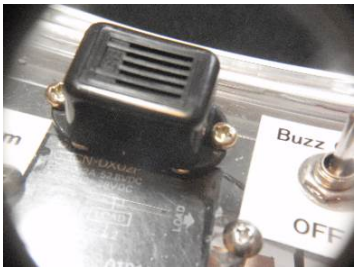
8.4.1. Monitor



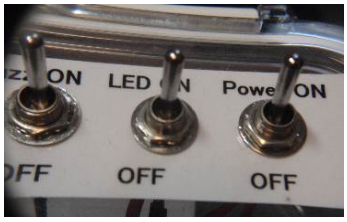
Front face



Selective terminal

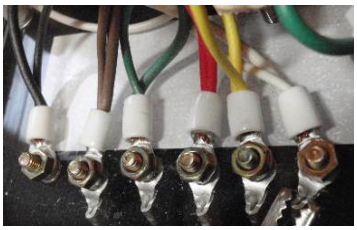


Buzzer

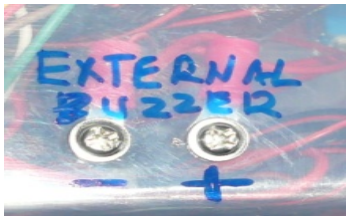


Tong switch

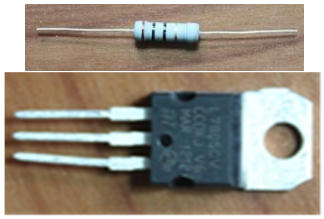
I.L.L.I line



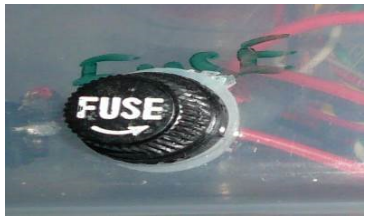
Selective terminal (back)



External buzzer



Regulator and Resistor



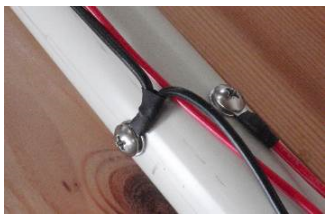
Fuse

8.4.2. Water Level Sensor (Equipment)

Casing(L:2 m, φ: 75mm) tube and Sensor pole(L:2m, φ:40mm)

Head cover and connecting terminal

Bottom of casing tube



Sensor terminal

8.4.3. Rainfall Sensor (Throw-in Type)

Total view

Installation

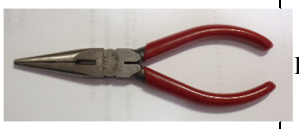
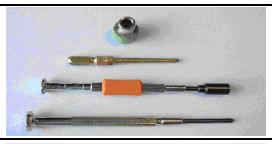
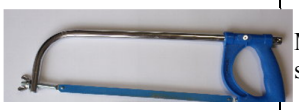
Details of sensor

Tin-can model

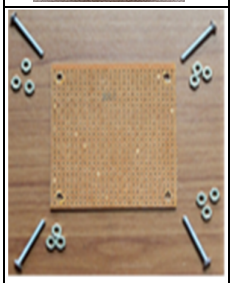
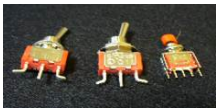
8.4.4. External LED Level Indicator (E.L.L.I)

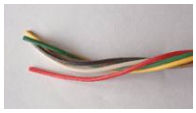
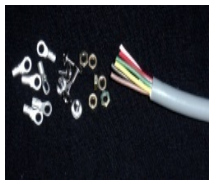
8.5. Tools And Parts

8.5.1. Table 1: Tools for assembly

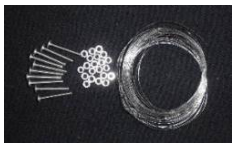
	Soldering iron for electric work Solder for electric work Flux for soldering		Screw driver
	Radio pliers		Mini driver Hexagonal nut driver for M3
	Rasp		Tap for M3 screw
	Metal cutting saw		Electric driver drill
	Cutter (small) Cutter (large)		Awl
	Drills 2mm, 2.5mm, 3.1mm, 4.5mm 6.5mm, 9mm etc.		Press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

8.5.2. Table 2: Parts for Monitoring Apparatus

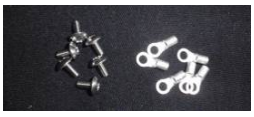
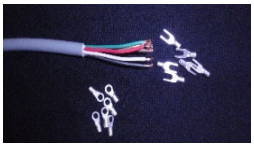
Appearance	Item	Model	Standard		No.	Reference. Price Kshs	Reference Cost Kshs
	Plastic case	Lunch box	0.5 litter	Pc	1		
	Universal basis	Standard	2.54mm pitch 72x47mm	Pc			
	Spacer for Basis	M3 6mm bolts And nuts	4 bolts 12 nuts	Pcs pcs	4 12		
	Regulator	(regulator number)	6 – 9volts	Pc	1		
	Heat sink	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		

Appearance	Item	Model	Standard		No.	Reference. Price Kshs	Reference Cost Kshs
	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		
TOTAL							

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

Appearance	Item	Model	Standard	Unit	No.	Reference price (Kshs)	Reference cost (Kshs)
	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		
TOTAL							

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

Appearance	Item	Model	Standard	Unit	No.	Reference Price (Kshs)	Reference cost (Kshs)
	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		
TOTAL							

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

Appearance	Item	Model	Standard	Unit	No.	Reference Price (Kshs)	Reference cost (Kshs)
	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		
TOTAL							

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.

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