Japan's
Natural Disaster Early Warning Systems
and
International Cooperative Efforts

March 2006

Early Warning Sub-Committee
of
the Inter-Ministerial Committee on
International Cooperation for Disaster Reduction

Government of Japan

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Preface Need to Improve Natural Disaster Early Warning Capabilities

As large-scale natural disasters continue to occur around the world, there is a serious and growing need to improve natural disaster early warning capabilities.

The Indian Ocean tsunami of December 26, 2004 was a disaster of unparalleled proportions, wreaking havoc on several countries around the Indian Ocean and resulting in more than 220,000 dead and missing. This disaster acutely highlighted the lack of a tsunami early warning system for the Indian Ocean.

In response, active efforts by the nations affected, as well as a variety of international support and coordination activities intended to support those efforts, are being promoted. These are based on the "Common Statement" on the Indian Ocean disaster issued at the United Nations World Conference on Disaster Reduction (UN-WCDR) held in Kobe in January 2005.

The enhancement of early warning systems for natural disasters is included among the disaster reduction priorities for action stipulated in the Hyogo Framework for Action 2005-2015 that was adopted by the UN-WCDR.

The G8 Response to the Indian Ocean Disaster and Future Action on Disaster Risk Reduction, which was adopted at the G8 Gleneagles Summit in July 2005, also confirms the need to support improvements in global early warning capacity.

Throughout its history, Japan has experienced extensive devastation caused by a multitude of disasters including earthquakes, tsunamis, volcanic eruptions, typhoons, rainstorms, flooding, landslides, and snowstorms. Japan has therefore honored those who have perished in such events by applying the lessons learned from past disasters in the development of early warning systems for a wide range of disasters.

To take full advantage of this nation's experience, knowledge, and technologies, and to contribute to the improvement of early warning capabilities worldwide, the Early Warning Sub-Committee of the Inter-Ministerial Committee on International Cooperation for Disaster Reduction, comprised of relevant government ministries and agencies as well as disaster reduction organizations, was formed in October 2005, creating a structure that will further promote international cooperation in the early warning field.

For natural disaster early warning systems to be truly useful in mitigating disasters for those who are facing natural disaster risks, they need to: (1) enable the issuance of prompt and accurate early warning information based on more accurate, real-time measurements of various natural phenomena and scientific data analysis, (2) incorporate systems for sharing warning information among relevant organizations and disseminating it to residents (and others in at-risk locations, hereafter included in the term "residents"), and (3) incorporate disaster reduction awareness outreach and education activities to ensure that more timely and appropriate disaster reduction actions are taken based on the warning information issued.

These materials outline Japan's natural disaster early warning systems and its international cooperative efforts, compiled by the national government's Early Warning Sub-Committee of the Inter-Ministerial Committee on International Cooperation for Disaster Reduction. We hope that it will prove useful to efforts to enhance early warning capabilities both in Japan and around the world.

Early Warning Sub-Committee

Inter-Ministerial Committee on International Cooperation for Disaster Reduction

Members: Cabinet Office, Cabinet Secretariat, Ministry of Internal Affairs and Communications, Fire and Disaster Management Agency, Ministry of Foreign Affairs, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Fisheries Agency, Ministry of Land, Infrastructure and Transport, Japan Meteorological agency (JMA), Geographical Survey Institute

Observers: Asian Disaster Reduction Center (ADRC), Japan Aerospace Exploration Agency (JAXA), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Port and Airport Research Institute (PARI), Japan International Cooperation Agency (JICA), Japan Bank for International Cooperation (JBIC), National Institute of Advanced Industrial Science and Technology (AIST), Fisheries Research Agency (FRA), National Research Institute for Earth Science and Disaster Prevention (NIED)

Section 1 Natural Disaster Early Warning Systems in Japan
(1) Overview of the Early Warning Systems in Japan

1. Natural Disaster Risk Observations

Meticulous Structure for Responding to Various Disasters

To issue early warning information regarding earthquakes, tsunamis, volcanic eruptions, and severe weather disasters that is useful to the disaster reduction activities of residents and disaster management organizations, and to thereby mitigate disaster-related damage, it is essential that efforts be made to develop and strengthen the monitoring systems that provide accurate, real-time information about these phenomena, and that those systems be maintained and managed appropriately.

In Japan, organizations involved in disaster reduction, especially the Japan Meteorological Agency (JMA), use 24-hour systems to carefully monitor various natural phenomena and weather conditions.

Earthquakes, Tsunamis

The national government, local governments, and research organizations have installed seismometers, seismic intensity meters, and tsunami monitoring facilities throughout the country, and the JMA collects this observation data to monitor seismic activity and tsunamis.

Volcanic Eruptions

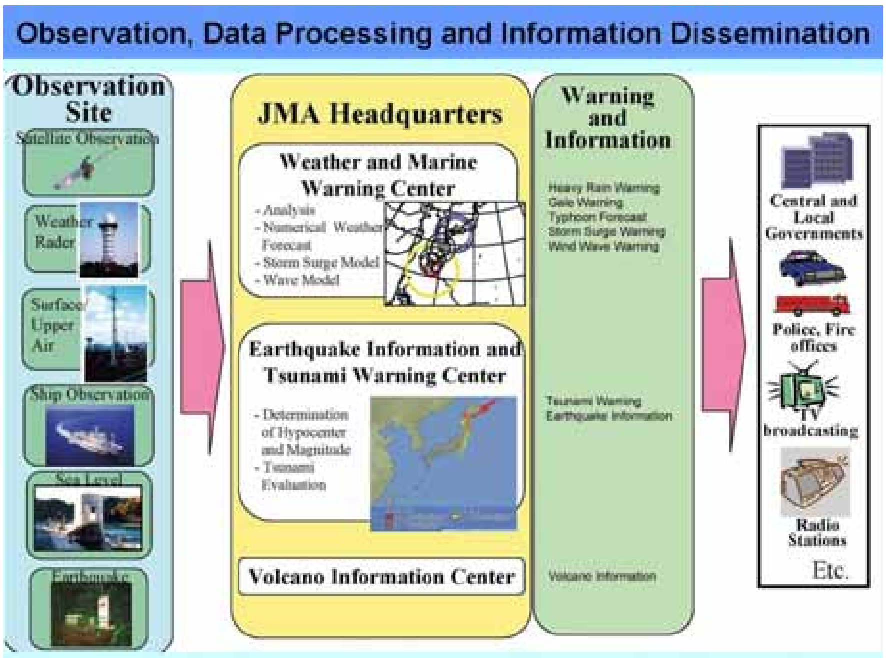
The JMA has installed seismometers and other volcano observation equipment at 30 of the most active of Japan's 108 volcanoes. It also has a 24-hour system for collecting and monitoring data, including the data from observation equipment installed by other relevant organizations, at its four Volcano Observations and Information Centers. The JMA routinely patrols other active volcanoes to check their activity status. If any abnormalities are detected, observations of the site are stepped up through the installation of observation equipment that can be monitored in real time. University and other research institutions are promoting volcanic eruption research through everyday observations of 36 active volcanoes.

Severe Weather Disasters

The JMA prepares weather forecasts, warnings, and advisories by collecting weather observation data such as the amount of rainfall and snowfall from weather observatories in Japan and abroad, and then analyzing that data and predicting future weather conditions. It disseminates that information to relevant weather and disaster management organizations, as well as broadcast organizations, both in Japan and overseas.

For this reason, the JMA has developed a system called the Computer System for Meteorological Services (COSMETS). It uses a telephone-line-based weather information transmission system to collect observation data and disseminate information, and a super computer system to conduct analyses and make predictions.

The JMA serves as the telecommunications hub for the Global Telecommunication System (GTS) that is being operated cooperatively by weather organizations worldwide, and thus is also exchanging observation data with other relevant nations.



2. Issuance of Early Warning Information

Issuance of Early Warning Information and Evacuation Orders

In addition to announcing observed information related to natural phenomena obtained from various monitoring systems, the JMA also issues forecasts, warnings, and advisories regarding earthquake-generated tsunamis and severe weather events such as heavy rain.

To provide detailed early warning information in addition to the advance warnings issued by the JMA, efforts are being made to develop ties between the JMA, the Ministry of Land, Infrastructure and Transport (MLIT), and local governments for the handling of floods and sediment-related disasters.

Municipal mayors are responsible for issuing evacuation orders and instructions to people in the at-risk areas based on this warning information. To enable mayors to decide on and communicate prompt and accurate evacuation orders, the national government has established guidelines that municipalities are to use in compiling their preparedness manuals, and provides these to municipal governments.

Types of Early Warning Information

When an earthquake occurs in or around Japan, the JMA immediately analyzes data from various seismometers and seismic intensity meters, and promptly and accurately releases seismic intensity information, tsunami warnings and advisories, and information regarding the hypocenter and scale (magnitude) of the quake.

With regard to volcanoes, the JMA announces three types of volcano information based on urgency: volcanic alerts, volcanic advisories, and volcanic observation reports. For some volcanoes, the JMA has introduced the "Volcanic Activity Level," an additional index ranging from 0 to 5 (dormant to large-scale eruption) which expresses the degree of volcanic activity.

For severe weather events, local meteorological observatories of the JMA issue weather warnings and advisories using observation data and weather forecasts for the prefectures under their jurisdiction.

There are seven types of warnings (heavy rain, flood, heavy snow, storm, snow storm, high waves, and storm surge) and 16 types of advisories (the seven listed above plus dense fog, avalanche, etc.), and they are issued for 370 different regions nationwide.

For floods, the MLIT and prefectural governments (which are responsible for managing rivers), designate rivers to be used for flood forecasting activities, and issue flood warnings jointly with the JMA. They also establish the special warning water level that serves as the trigger for the issuance of evacuation instructions along key small and mid-sized rivers other than those designated for flood forecasting activities, notify relevant organizations when the water reaches that level, and disseminate information to local residents. The MLIT and prefectural governments also designate rivers to be used as the basis for issuing flood prevention warnings, and issue flood prevention warnings that serve as guidelines for flood prevention activities.

Weather Warnings and Advisories

Warnings	Heavy rain, flood, heavy snow, storm, snow storm, high waves, storm surge
Advisories	Heavy rain, flood, heavy snow, gale, gale and snow, high waves, storm surge, dense fog, thunderstorm, dry air, avalanche, ice accretion, snow accretion, snow-melting, frost, low temperature

Warnings

Heavy rain	Issued when serious disasters are expected to occur due to heavy rain.
Flood	Issued when serious disasters are expected to occur due to high water caused by heavy rain, prolonged rain, or snow-melting.
Heavy snow	Issued when serious disasters are expected to occur due to heavy snow.
Storm	Issued when serious disasters are expected to occur due to winds of 20m/s or greater.
Snow storm	Issued when serious disasters are expected to occur due to winds of 20m/s or greater with snow.
High waves	Issued when serious disasters are expected to occur due to high waves and high swells.
Storm surge	Issued when serious disasters are expected to occur due to storm surges caused by tropical cyclones etc.

3. Information Dissemination (Information Sharing Among Relevant Organizations and Distributing Information to Residents)

Information Sharing Among Relevant Organizations

The development of a quick and accurate communications system is essential to the effective use of early warning information.

The JMA has therefore built an online system that links relevant ministries and agencies, local government bodies, and media organizations.

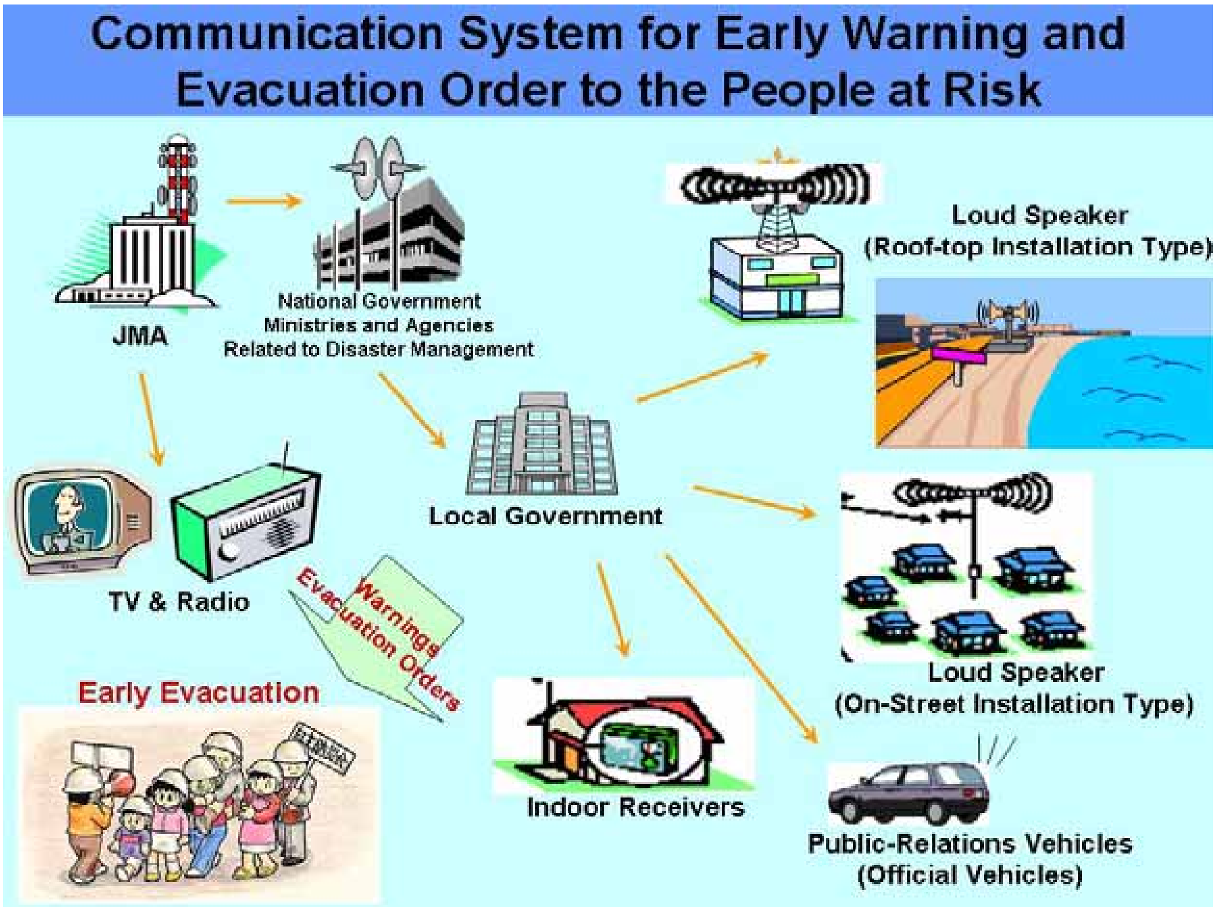
Because tsunami warnings in particular require prompt evacuation activities, the system also has a satellite-based backup network in the event that terrestrial networks are damaged.

Disaster management organizations within the national and local governments have been developing a Central Disaster-Management Wireless Network to serve as a dedicated wireless communications network for disaster-related activities, as well as Fire and Disaster Management Wireless Networks, Prefectural Disaster Wireless Networks, and Municipal Disaster Wireless Networks.

Communicating Information to Local Residents

The information issued by the JMA is conveyed to prefectures via local meteorological observatories, the Fire and Disaster Management Wireless Networks, or regional satellite communications networks, and then conveyed to municipalities via prefectural systems. Municipalities have established their own disaster management wireless networks that enable authorities to directly transmit warnings and evacuation orders to residents.

The most frequently used tools for disseminating information to the very end users, the residents, are simultaneous wireless communications systems used with outdoor loudspeakers or indoor private radio receivers (70% of municipalities have developed such systems as of March 2005). Tsunami and severe weather warnings are also conveyed by the JMA to media organizations, and are promptly distributed to the general public via TV and radio broadcasts.



4. Information Dissemination
(Links with Broadcast and Telecommunications Outlets)

Partnering with the Broadcast Industry

Broadcasts are an effective means of distributing early warning information to residents. The national government and local government organizations have concluded agreements with the Japan Broadcasting Corporation (NHK) and other broadcasting companies with regard to requests for disaster information broadcasts and have worked with them to establish cooperative systems for disaster management.

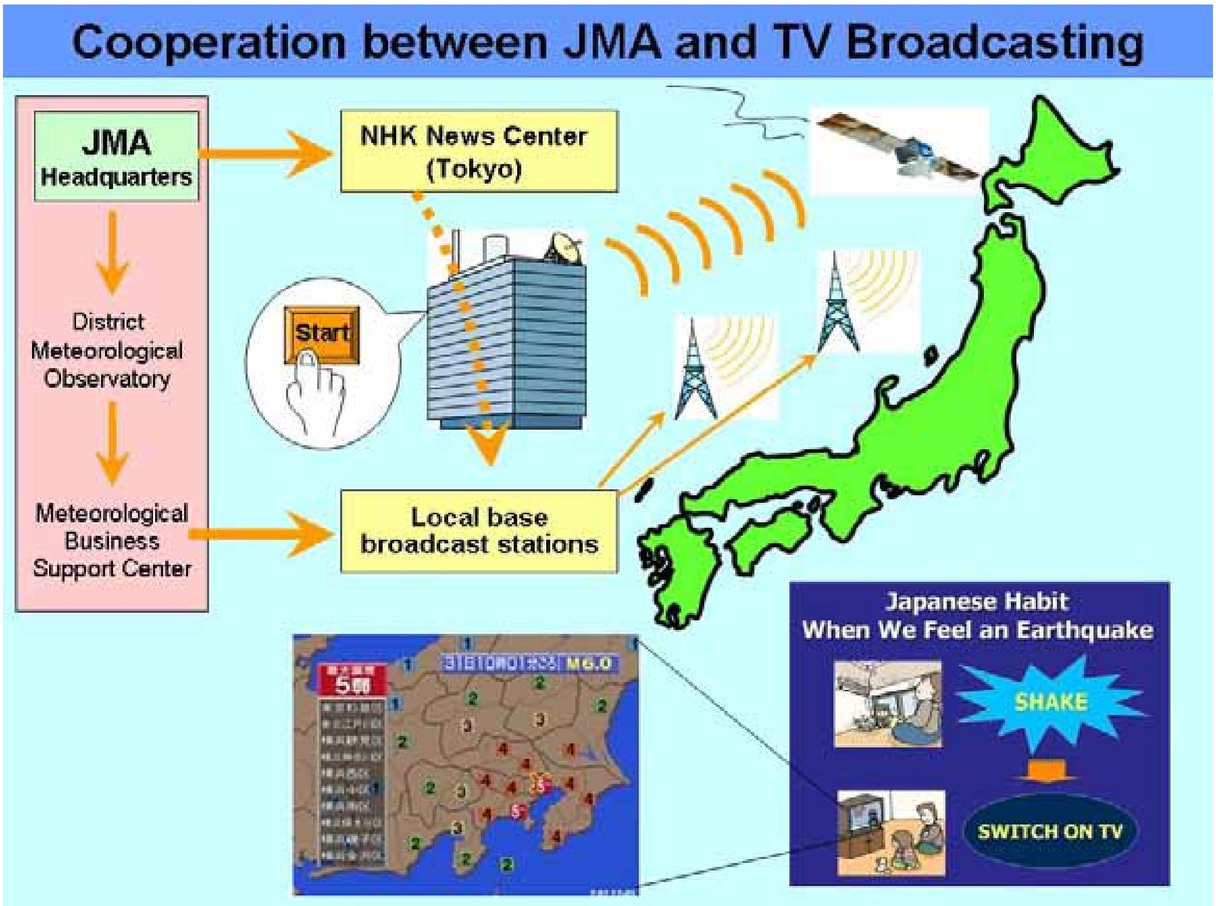
Information regarding disasters and evacuation is provided by interrupting regular programs and broadcasting textual information. Residents can easily access information regarding earthquakes, tsunamis, and severe weather events, as well as the well-being of affected residents and the status of lifelines via TV and radio broadcasts.

Some local government organizations also transmit disaster information via local CATV and community broadcasting services.

Partnering with the Telecommunications Industry

Given the usefulness of mobile phones and the Internet in information distribution, and thus in crisis management and information exchange at the individual level, efforts are being made to actively promote R&D and practical applications for the vast array of information technologies that have been developed in recent years.

The "My Rescue" Crisis Management Information Mobile Delivery Service uses information provided by weather agencies, fire prevention agencies, the public media, transportation information agencies, and volunteer groups to send users severe weather warnings and advisories, typhoon and earthquake information, and emergency aid information via e-mail. Users can receive customized information based on their usage area and their own personal needs.



5. Disaster Reduction Awareness Outreach Utilizing Early Warning Information (Use of Hazard Maps)

Disaster Awareness Outreach

To reduce disaster-related damage, it is important to make residents of at-risk areas aware of safe evacuation methods and nearby evacuation routes and sites ahead of time so that they will take appropriate actions based on early warning information. It is also important to develop systems by which autonomous community disaster reduction organizations or community-based fire brigades will guide the evacuation process in the event of an actual evacuation.

September 1 (the day of the 1923 Great Kanto Earthquake) has been designated Disaster Day in Japan, and the week from August 30 to September 5 has been declared Disaster Week. During this time, many disaster reduction drills and outreach activities are conducted.

Use of Hazard Maps

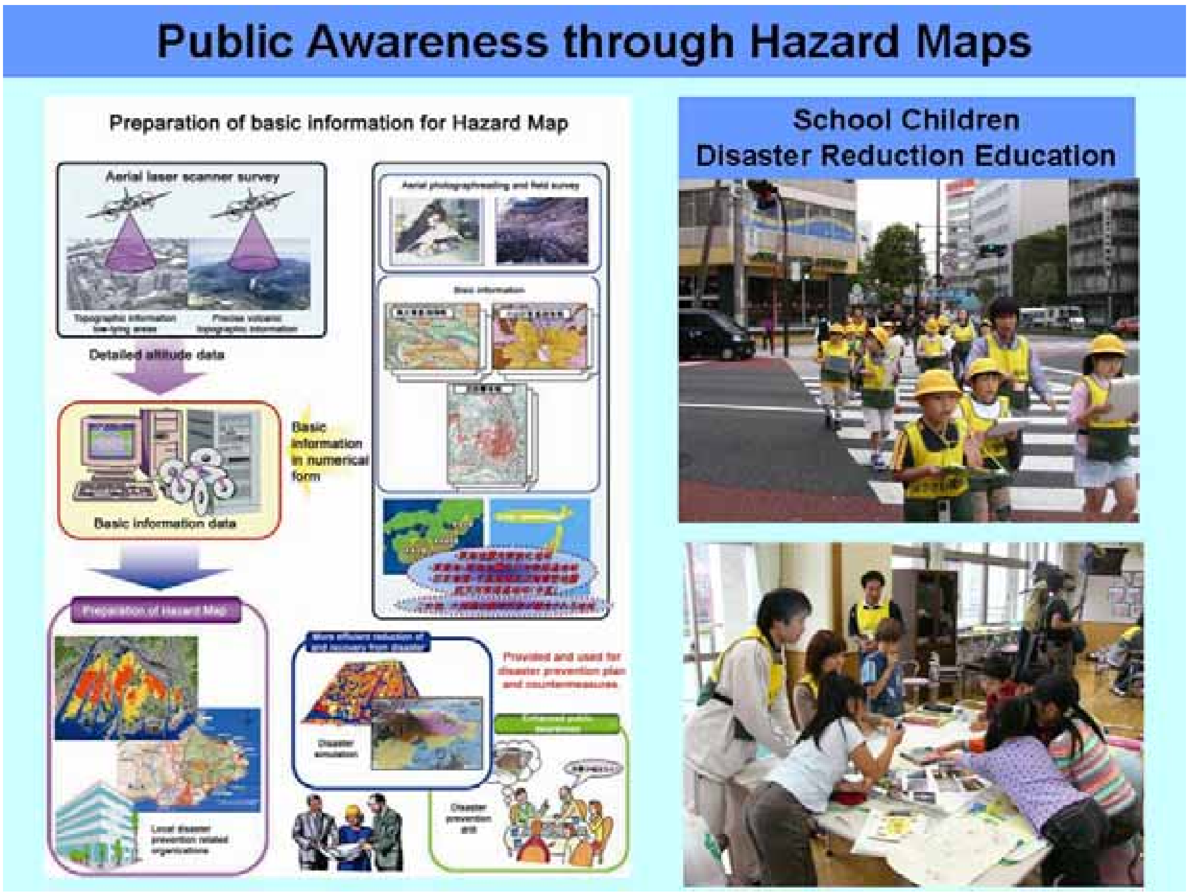
Japanese municipalities generally create and distribute hazard maps that show the areas most vulnerable to earthquakes, tsunamis, volcanic eruptions, floods, and landslides, as well as evacuation information.

The Geographical Survey Institute (GSI) conducts surveys that provide basic information for the creation of various types of hazard maps for the major Japanese plains and surrounding areas, and for active volcanoes. It creates thematic maps, such as topographical maps showing geographical information relevant for disaster reduction, and compiles statistical data.

The Importance of Community-Based Disaster Reduction Activities

Hazard maps are designed to ensure that the residents who use them better understand the hazards in their area and will take the appropriate actions when a disaster strikes. The maps are useless, however, if people do not know they are available.

Some communities therefore organize activities designed to increase public understanding of hazard maps and activities to create community-based disaster reduction maps. These include "town watching" activities in which people actually go around the town they live in and identify its disaster risks, and workshops on disaster reduction. Such activities raise local residents' awareness of disasters and disaster reduction, lead to suggestions for improving the community's vulnerabilities, and contribute significantly to improving the disaster reduction capabilities of the community.



1. Earthquake Observations and the Issuance of Earthquake Information

Earthquakes in Japan

Japan is located at the intersection of multiple oceanic plates and a continental plate, and is therefore well acquainted with the massive interplate earthquakes produced by plate subduction (such as the Great Kanto Earthquake of 1923 and the earthquake believed to be imminent in the Tokai region) as well as the inland crustal earthquakes caused by plate movements (such as the Great-Hanshin Awaji Earthquake of 1995). More than 20% of the world's largest earthquakes (magnitude 6.0 or greater) in the past decade have occurred in or around Japan.

Earthquake Observations

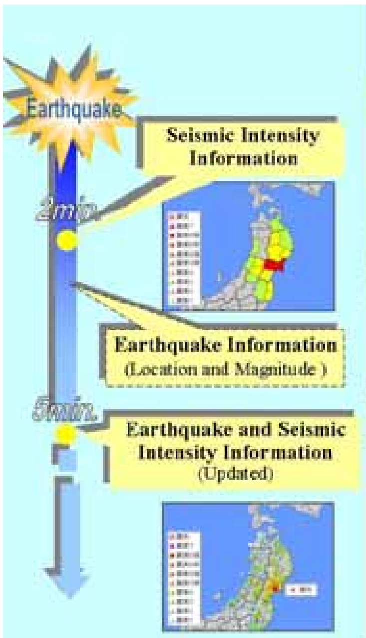
To quickly locate the hypocenter and estimate the magnitude of an earthquake after it occurs and to promptly issue tsunami forecasts, the JMA has installed seismometers at about 180 sites nationwide (approximately every 60 km). It also constantly monitors seismic activity by collecting observation data from online data sources, including high-sensitivity seismometers used by research institutions.

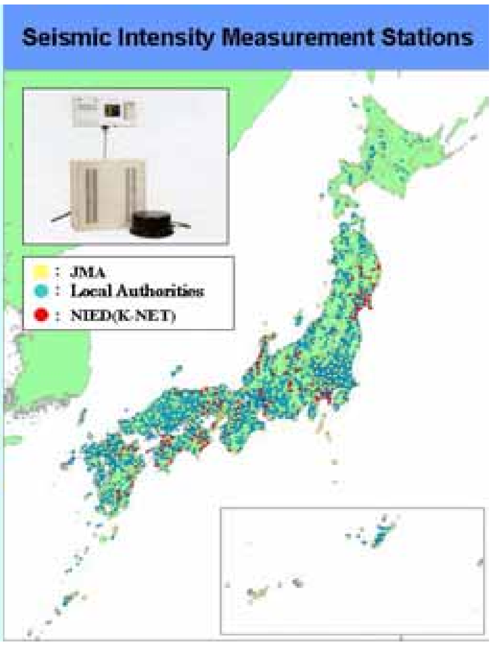
The JMA issues seismic intensity information for a total of approximately 3,900 locations nationwide. To do this, it uses data from its own seismic intensity meters, installed at about 600 sites nationwide (approximately every 20 km) to measure the intensity of ground motion, as well as data from seismic intensity meters installed by local governments at about 2,800 sites, and data from strong-motion seismographs installed by the National Research Institute for Earth Science and Natural Disaster Prevention (NIED) at about 470 of its approximately 1,000 strong-motion seismic observation (K-NET) facilities.

In addition, to gain a more thorough understanding of earthquakes and crustal activities and to provide basic observations for survey research, earthquake observations are conducted using high-sensitivity seismometers and broadband seismometers through partnerships with relevant research institutions such as the NIED, in accordance with the guidelines of the national government's Headquarters for Earthquake Research Promotion. The Geographical Survey Institute (GSI) has set up about 1,200 GPS stations all over Japan to form the GPS Earth Observation NETwork (GEONET), which it uses to monitor and analyze crustal movements based on regular field measurement data. These observation data are shared with relevant organizations.

Issuance of Earthquake Information

As soon as an earthquake occurs in or around Japan, the JMA analyzes the data from various seismometers and seismic intensity meters. Within about two minutes, it issues a "seismic intensity information" report for earthquakes of intensity 3 or greater, and within five minutes issues an "earthquake information" report indicating the hypocenter and magnitude of the earthquake, and the seismic intensity in the municipalities where strong shaking was observed.





2. Issuance of Earthquake Early Warning Information

Utilization of Earthquake Early Warnings

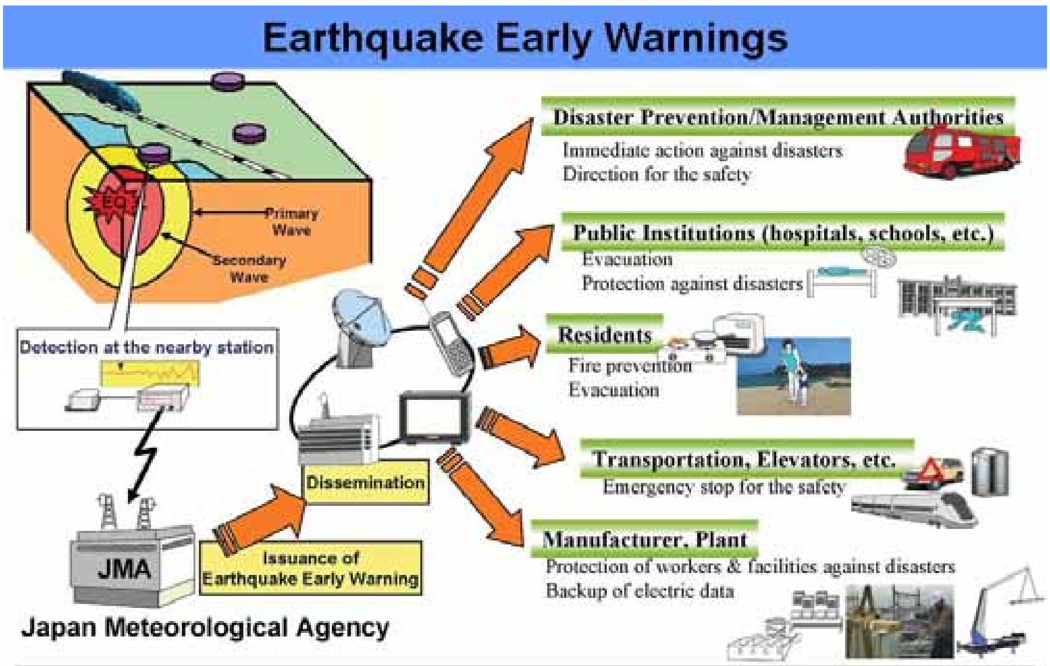
An earthquake early warning (EEW) announces the estimated arrival time of the S-wave of the earthquake and seismic intensity in each region. This information is based on the estimated hypocenter and magnitude of the earthquake quickly calculated from the P-wave data obtained at seismic stations near the epicenter. (The P-wave is a longitudinal wave that propagates 6-7 km/s through the earth's crust, while the S-wave is a transverse wave that propagates 3.5-4 km/s through the earth's crust, arriving later and causing the more severely destructive phenomena.) The time lag between the P-wave and the S-wave can make it possible to mitigate earthquake damage by enabling disaster prevention actions to be taken before the major shaking begins (when the S-wave arrives).

Currently the JMA provisionally provides EEWs to a limited number of organizations, such as railroad companies, construction companies, and local governments using data from its own seismometers specially designed for the EEW throughout Japan and from the high-sensitivity earthquake observation network (Hi-net) stations installed by the NIED in 700 locations nationwide.

The elapsed time between the issuance of the EEW and the start of major shaking will differ significantly depending on a location's distance from the epicenter. EEWs may not be issued in time to areas located just above the hypocenter of an inland earthquake. However, when a large earthquake occurs near an ocean trench, there may be a time lag, albeit a very short one (ten seconds to several tens of seconds), between the issuance of the EEW and the start of severe shaking. This may be just enough time to mitigate damage by triggering emergency stops on trains, plant operations, and elevators, or even just by allowing people to take basic risk-reduction actions, such as extinguishing flames or taking cover under a desk. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) is working with the JMA to implement a technology development project aimed at using EEWs to automatically trigger emergency disaster reduction measures.

Private Sector Efforts

Disaster reduction efforts using the difference in the arrival times of the S-wave and P-wave include research and efforts to apply that research even at the private level. A system has been installed for the JR Bullet Train (Shinkansen) lines by which independently installed sensors analyze P-wave information and then quickly transmit earthquake information to the train control system so that emergency braking can be initiated. Tokyo Gas is preparing damage estimates using information from sensors installed in the gas supply zones and a database of soil and pipe information. The company is using its findings to develop a system that supports gas shut-off decision-making and actually controls the shut-off process.



The Earthquake Early Warning (EEW) system quickly estimates the hypocenter and magnitude from the seismic waveform data observed at the seismic stations near the hypocenter. Based on the estimation, JMA immediately issues warning on the arrival of the strong motion (secondary wave).

3. Tsunami Observations

Tsunamis in Japan: Local and Distant Tsunamis

Surrounded by water on all sides, with a long and complex coastline, Japan is highly vulnerable to earthquake-related tsunamis. In the Meiji Sanriku Earthquake Tsunami of 1896, approximately 22,000 people perished. Even several decades later, the vast majority of the 104 fatalities attributed to the Japan Sea Earthquake of 1983 and the 230 fatalities of the Hokkaido Nansei-Oki Earthquake of 1993 were caused by tsunamis.

Most of the tsunami damage in Japan has been caused by "local tsunamis" which were generated by earthquakes near the coast and made landfall within only several minutes to several tens of minutes after the earthquake.

Because of this, tsunami early warnings require the development of data analysis and transmission systems that can operate in extremely short periods of time.

Also, it is important that residents immediately evacuate to higher ground if they feel severe shaking near the coastline, rather than waiting to receive early warning information.

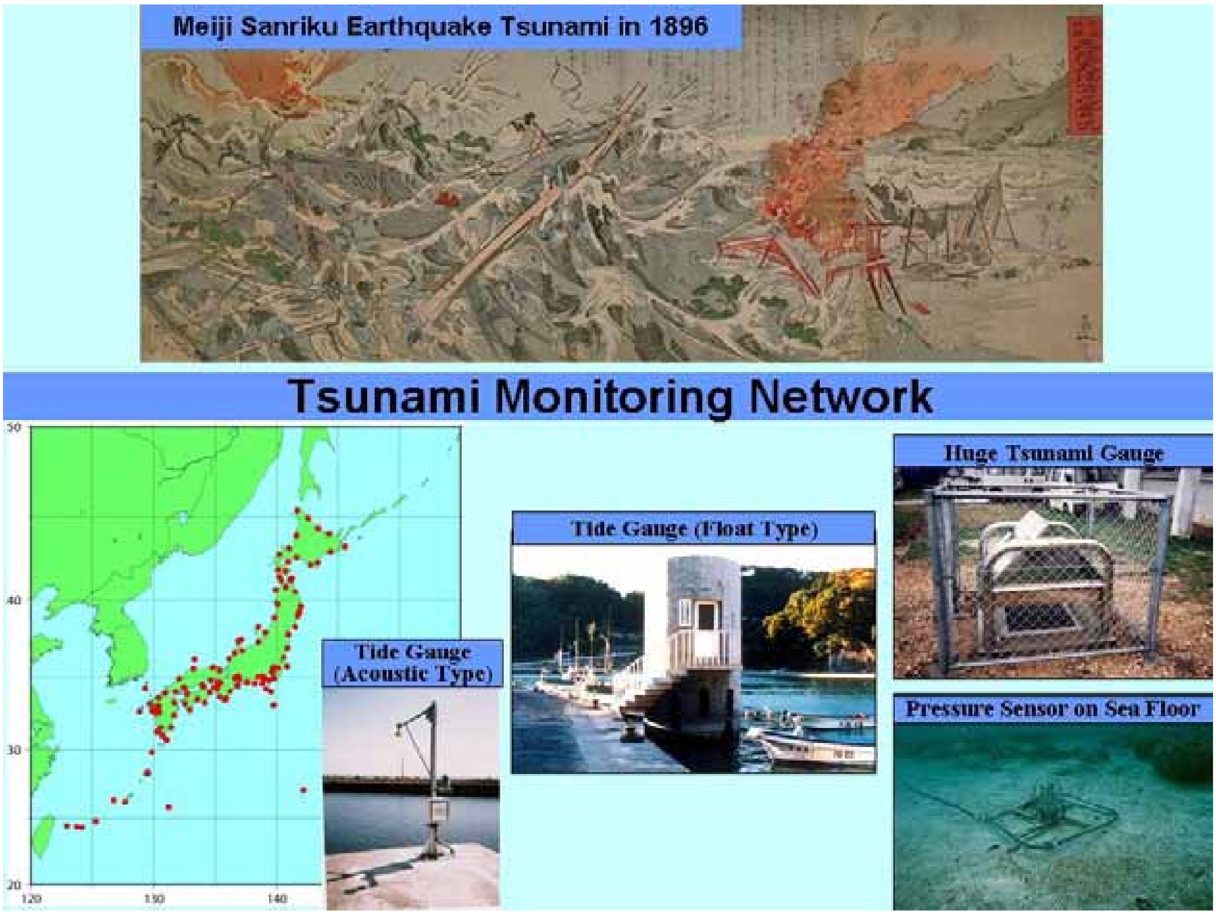
In addition to local tsunamis, Japan has also suffered major damage from the onslaught of distant tsunamis generated by open-sea earthquakes like that which caused the Indian Ocean Tsunami at the end of 2004. In 1960, a tsunami generated by an earthquake in Chile crossed the pacific ocean and reached the shores of Japan about 22 hours later, killing 142 people.

Early warnings for distant tsunamis require international cooperation in the form of international data exchange and information sharing.

Tsunami Observations

The JMA conducts tsunami observations at 100 sites nationwide, including about 70 of its own facilities as well as observation facilities installed by such organizations as the Japan Coast Guard and local government bodies.

The Port and Airport Research Institute and the University of Tokyo Earthquake Research Institute have jointly installed GPS tide gauges 13 km off the Cape of Muroto and are conducting demonstration experiments using those gauges. After an earthquake generated along the Pacific coast in September 2004, a tsunami with a height of 10 cm was observed.



4. Issuance of Tsunami Early Warning Information

Early Warnings for Local Tsunamis

When a large earthquake with the potential to cause a tsunami occurs, the JMA selects a corresponding scenario from the "tsunami database," which stores estimates of the tsunami height along the coast and the time it will take to reach shore. Tsunami forecasts can then be made based on this information.

When a tsunami is expected to cause coastal damage, the JMA issues a tsunami warning or advisory within about three minutes after the earthquake and then follows up with announcements about the estimated height and arrival time of the tsunami.

Tsunami advisories are issued when estimates indicate a tsunami wave height of about 0.5 m, while tsunami warnings are issued for wave heights of 2 m. Major tsunami warnings are issued for wave heights of 3 m or higher.

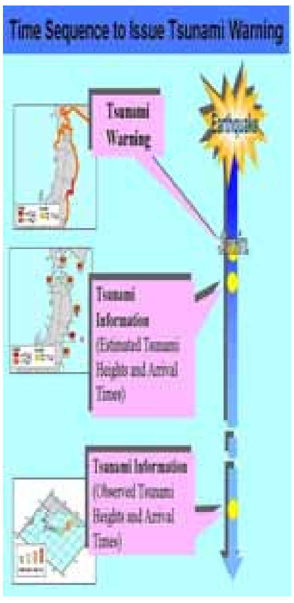
The tsunami warnings are transmitted immediately to disaster management organizations and media outlets using the Information Network for Disaster Prevention and satellite systems. The warnings are then forwarded to residents and maritime vessels by those organizations.

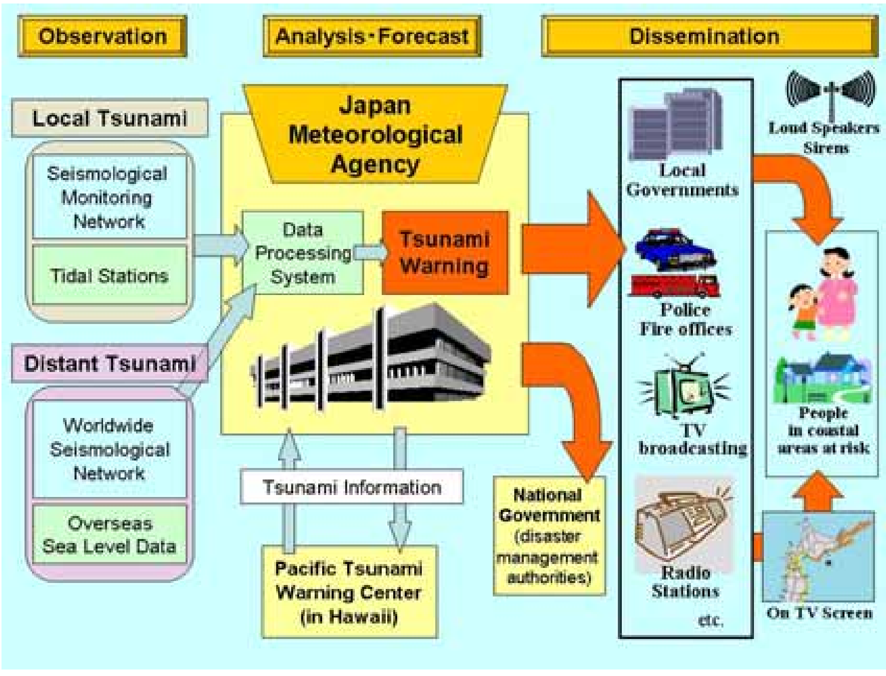
Early Warnings for Distant Tsunamis

For distant tsunamis generated by earthquakes in Pacific Ocean locations far from Japan, such as Chile or Alaska, the JMA works in close cooperation with the Pacific Tsunami Warning Center (PTWC) in Hawaii to estimate the effects of the tsunami along the Japanese coast, and to issue tsunami warnings.

Tsunami Early Warnings

Type of Forecast		Message	Heights of Tsunami in Message
Tsunami Warning	Major Tsunami is Expected	Height of the tsunami is more than 3 meters in the maximum. Greatest caution is required.	3m, 4m, 6m, 8m, 10m<
	Tsunami is Expected	Heitht of the tsunami is up to 2 meters in the maximum. Greatest caution is required.	1m, 2m
Tsunami Advisory		Height of tsunami is up to 0.5 meters in the maximum. Caution is required.	0.5m





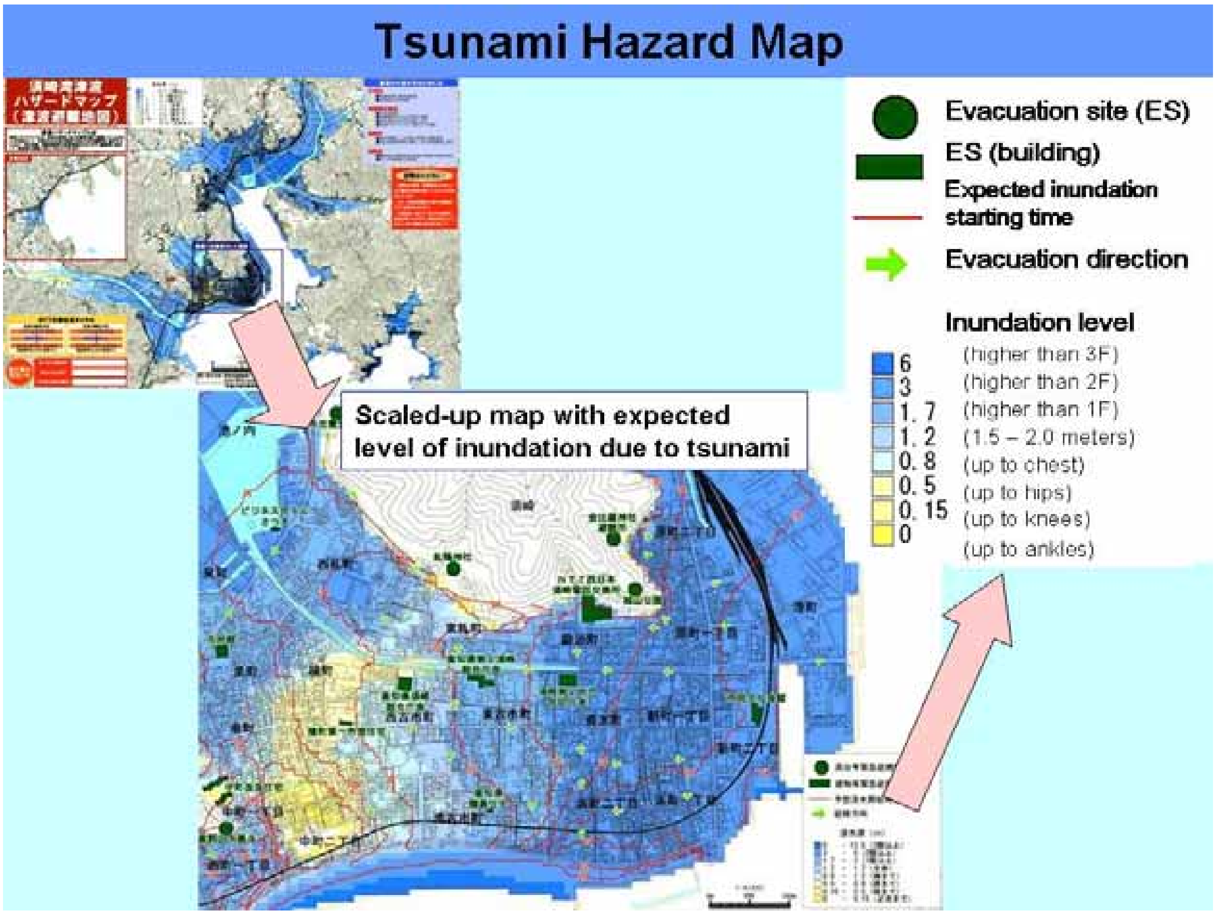
5. Tsunami Hazard Maps

Tsunami Hazard Maps

In the event of a massive trench earthquake such as those which are feared to be imminent in the Tokai region and the Tonankai/Nankai regions, the national government estimates that enormous damage will be sustained from the resulting local tsunami. To mitigate such tsunami damage, efforts must be made to develop technologies for even more rapidly issuing tsunami early warning information, and to raise awareness of the tsunami damage risks at the individual and community level so that warning information will be used appropriately by residents for evacuation.

The national government has set a goal of having tsunami hazard maps created for all municipalities that need to implement tsunami disaster reduction measures by 2010. To this end, it investigated several issues with regard to supporting the creation and use of hazard maps by local government bodies, and created a tsunami hazard map manual in 2004.

Also, to mitigate tsunami damage along the coast, the Japan Coast Guard is performing calculations for the tsunamis that would likely be generated by the kind of massive earthquakes believed to be imminent, and is working on developing tsunami disaster reduction information diagrams that map those results.



Section 1　Natural Disaster Early Warning Systems in Japan
(3)　Early Warnings for Volcanoes

1. Volcano Observations

Volcanic Eruptions in Japan

Located along the circum-Pacific volcanic zone (or so-called "ring of fire"), Japan has 108, or about 10%, of all the world's active volcanoes. Eruptions or other abnormal events are observed at about 15 volcanoes annually. Most recently, there were eruptions at Mt. Usu and Miyake Island in 2000 and at Mt. Asama in 2004.

Volcano Observations

The JMA conducts volcano observations at 81 active volcanoes excluding those on uninhabited islands and on the sea floor (seismometers and other observation equipment have been placed by the JMA and research institutions at 41 volcanoes).

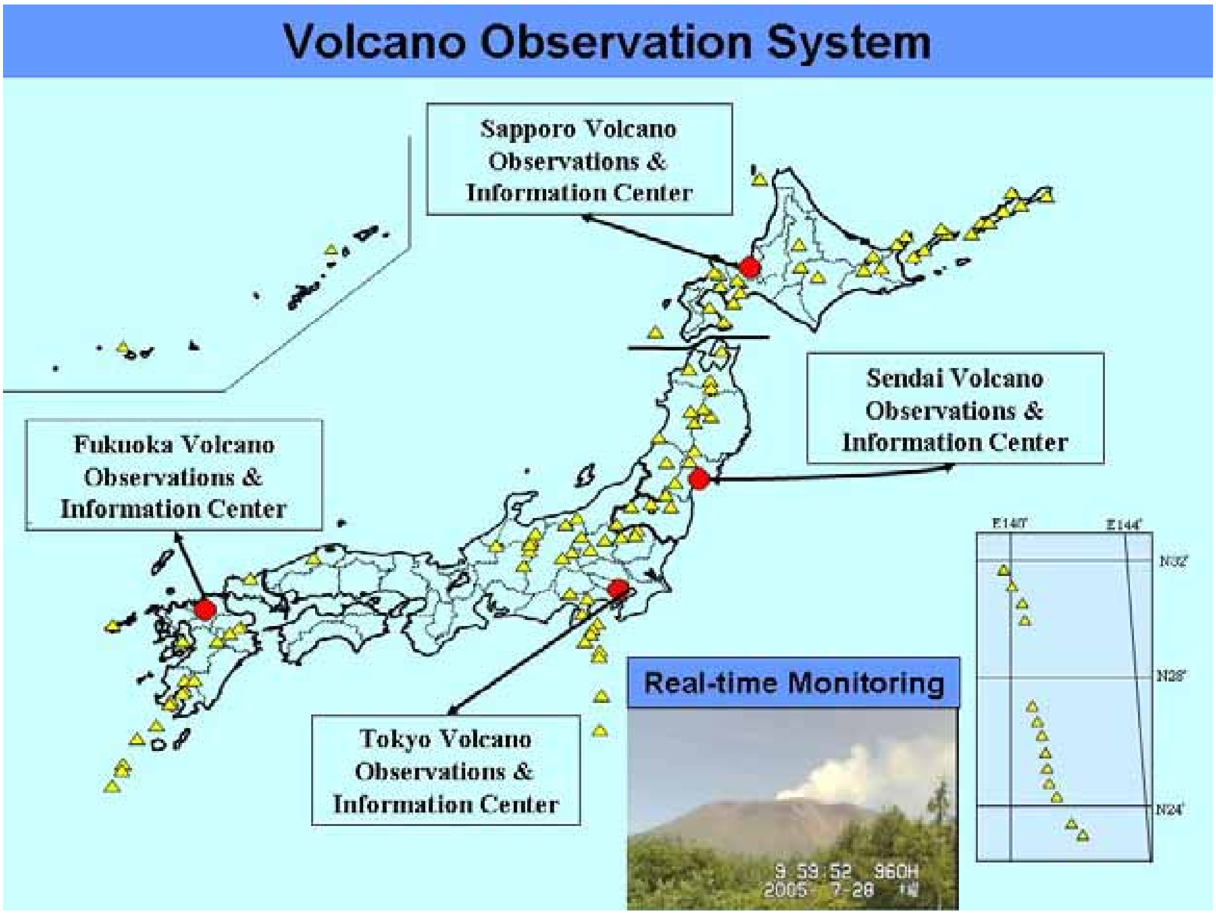
The 30 of these that are most active are monitored 24 hours a day at the JMA's four Volcano Observations and Information Centers, established in 2002.

For the other 51 volcanoes, mobile observation teams at the Volcano Observations and Information Centers conduct continuous observations using seismometers and other equipment and conduct systematic survey observations to monitor volcanic activity in the regions under their jurisdiction. When abnormal volcanic events occur, the mobile observation team is immediately dispatched and the observation and monitoring systems for that site are reinforced.

Also, the GSI monitors widespread crustal movements around major volcano sites, and conducts mobile observations at the time of an eruption or when the eruption risk is high, to gain a better understanding of crustal movements.

Research on volcanic eruptions through continuous regular observations of 36 volcanoes and occasional intense observations on restless volcanoes is conducted at national universities and the NIED.

The JMA, GSI, Coast Guard, universities and disaster management organizations are working together to try to strengthen the volcano observation and monitoring systems at volcanoes that continue to exhibit vigorous volcanic activity.



2. Issuance of Volcano Early Warning Information

Issuance of Volcano Information

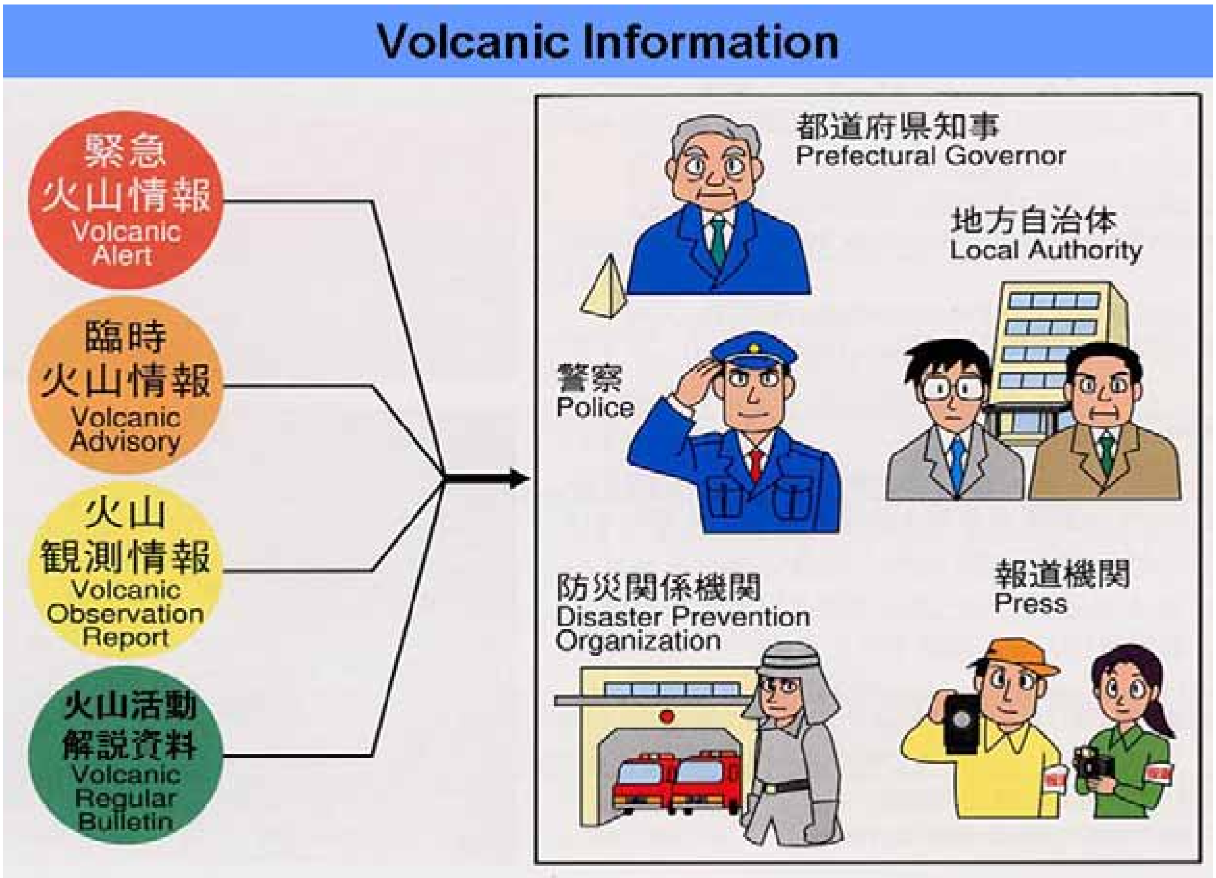
Volcano early warnings start with the JMA's four Volcano Observations and Information Centers, which work with relevant organizations to monitor observation data from seismometers installed near volcanoes and on crustal movements. When an abnormal phenomenon is detected, volcano information is released in three formats: volcanic alerts, volcanic advisories, and volcanic observation reports.

Volcanic alerts are issued when volcanic activity that threatens human lives has occurred or appears likely to occur. Volcanic advisories are provisionally issued when abnormal volcanic activity has occurred and caution is required. Volcanic observation reports are issued to supplement volcanic alerts and volcanic advisories to provide more detailed information about the volcanic activity that has occurred.

To ensure that volcano information is easy to understand, the JMA introduced the "Volcano Activity Level," an additional volcano index that expresses the magnitude of volcanic activity and the need for disaster response measures, in 2003. The JMA uses a 6-level scale to indicate the level of disruption, in ascending order, where 0 is dormant and 5 is a large-scale eruption. It had been introduced at 12 volcanoes as of December 2005.

Coordinating Committee for the Prediction of Volcanic Eruptions

Established under the JMA in 1974, the Coordinating Committee for the Prediction of Volcanic Eruptions exchanges results and information regarding the research and programs of relevant organizations, makes comprehensive decisions regarding eruption events when volcanic eruptions occur, conducts research on volcanic eruption predictions, and investigates the development of observation systems. Regular meetings are held three times a year, and decisions are made at these meetings regarding volcanic activities nationwide.



3. Volcano Hazard Maps

Volcano Hazard Maps

Creating volcano hazard maps that take into account the activity patterns of each volcano and the particular disaster hazards of a specific location is an effective way to ensure that residents are prepared to take prompt and appropriate evacuation actions based on volcano early warning information. Volcano hazard maps are useful for raising the disaster reduction awareness of people who live near volcanoes, facilitating the formulation of suitable disaster reduction plans by local government bodies, and encouraging appropriate land use. The creation of these maps is being promoted primarily by relevant local government bodies, with the technical support and cooperation of the national government, and they are currently available for 37 volcanoes.

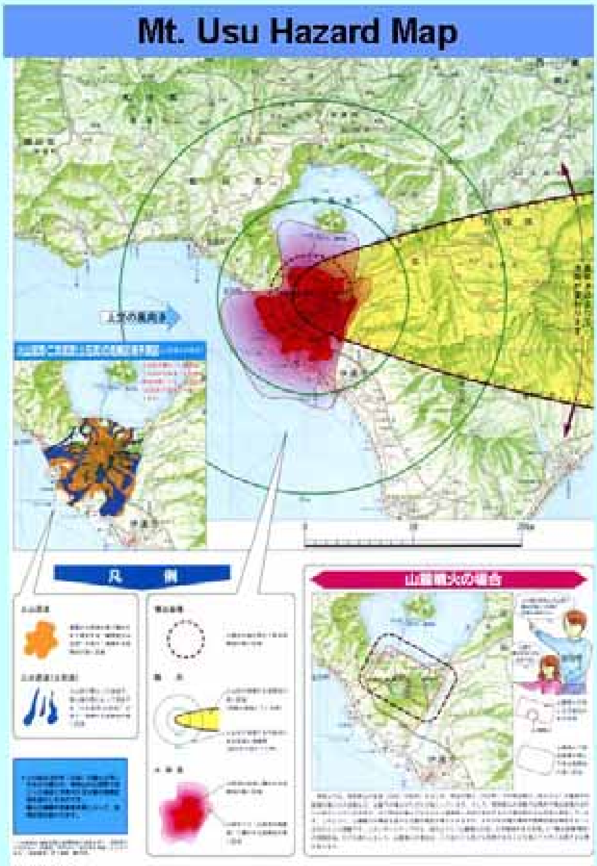
Best Practices at Mt. Usu

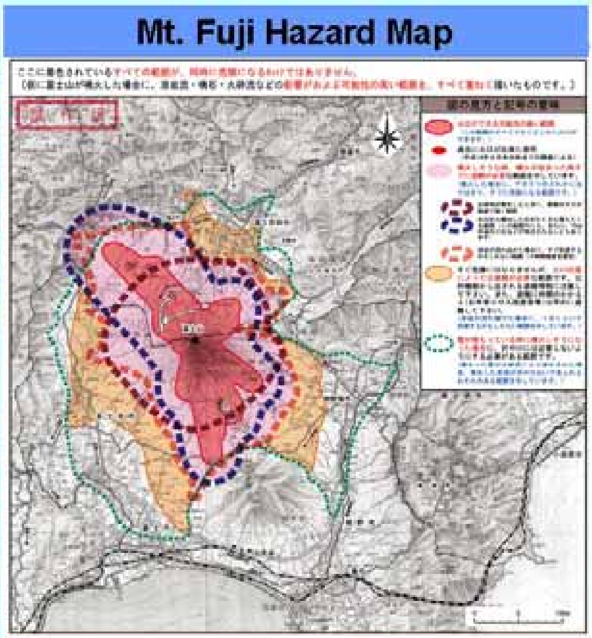
Before Mt. Usu erupted in Hokkaido in 2000, a Mt. Usu disaster reduction map had already been created and efforts had been made to conduct outreach and raise the disaster reduction awareness of local residents. When the volcanic activity intensified, about 16,000 people promptly evacuated in accordance with eruption activity predictions announced by volcanologists and a volcanic alert issued by the JMA two days prior to the eruption. As a result, not a single person was physically harmed by this event.

Mt. Fuji Hazard Map

Japan's tallest mountain, Mt. Fuji, is also an active volcano. In 1707, when it erupted 49 days after the Hoei Earthquake (M8.6), it caused enormous damages to the villages at the foot of the mountain and sent volcanic ash as far away as the town of Edo (old Tokyo).

If Mt. Fuji were to erupt today, there are serious concerns that the damage would extend all the way to the capital region. It is therefore necessary to establish disaster reduction policies across a wide area. An association comprised of relevant ministries and agencies as well as local government bodies created a volcano disaster reduction map for Mt. Fuji in 2005. This map shows the areas with a high likelihood of being impacted by lava flows, volcanic cinders, and pyroclastic flows in the event of an eruption, as well as the areas that would be covered by ash. Relevant municipalities are promoting efforts to create their own hazard maps based on this information.





1. Weather Observations of Typhoons, Rainfall, and Snowfall

Weather Disasters in Japan

In Japan, tremendous damage sometimes results from severe seasonal weather events, such as typhoons, heavy rains, and heavy snow.

Because of Japan's precipitous topography, rivers are remarkably sloped, making them especially prone to flooding when heavy rains fall. The large number of steeply sloped mountains and cliffs also make the country particularly vulnerable to landslides.

Thus, efforts are being made to reduce damage caused by severe weather disasters by strengthening various weather observation systems and improving forecasting technologies.

Surface Weather Observations

For surface weather observations, the JMA has created the Automated Meteorological Data Acquisition System (AMeDAS) to conduct automatic observations at weather observation stations nationwide. The AMeDAS measures rainfall at about 1,300 stations throughout Japan, and air temperature and wind direction/speed at about 850 of those stations. Snow depth is also measured at about 290 stations in heavy snowfall areas.

Observation data is generally collected every 10 minutes, and is used by the various meteorological observatories about five minutes after the observations are made. Observation data is also posted on the JMA's website, provided to broadcast organizations, and used on weather forecasting programs.

Weather Radar Observations

The JMA uses weather radar in 20 locations nationwide to ascertain from several kilometers in the air where and at what intensity rain or snow is falling. Observations are obtained at 10-minute intervals, and the data is used by the various meteorological observatories about four minutes after the observations are made.

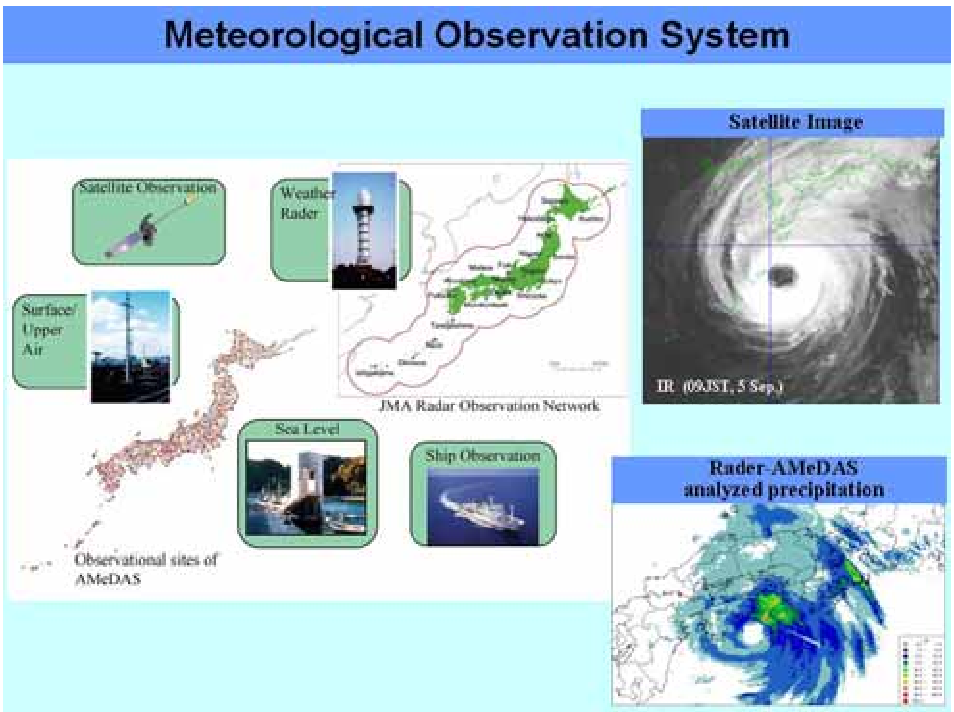
Geostationary Meteorological Satellite Observations

The JMA uses a geostationary meteorological satellite to determine the location of typhoons, to estimate their intensity and the size of their cloud systems, and to monitor the activities of convective clouds causing heavy rains or snowfall. Observations of the northern hemisphere over the western Pacific Ocean are taken every 30 minutes and those of the southern hemisphere every hour.

Ocean Observations

The JMA observes the height and frequency of waves using coastal tide gauges installed at 11 locations nationwide, and measures the sea level at 66 tidal observatories nationwide.

To accurately ascertain the atmospheric conditions over the ocean, the JMA also conducts observations using ocean observation vessels and ocean buoys.



2. Issuance of Early Warning Information for Typhoons, Rainfall, and Snowfall

Weather Warnings and Advisories

The JMA issues "advisories" when it determines that heavy rains or storms could cause damage, and "warnings" when it has concerns about potentially serious damage. There are seven types of severe weather warnings and 16 types of weather advisories.

Severe weather warnings and advisories give brief descriptions of the weather conditions that are expected and precautions that may need to be taken. Predicted weather condition descriptions include the anticipated event start time, end time, peak time, and maximum measurements.

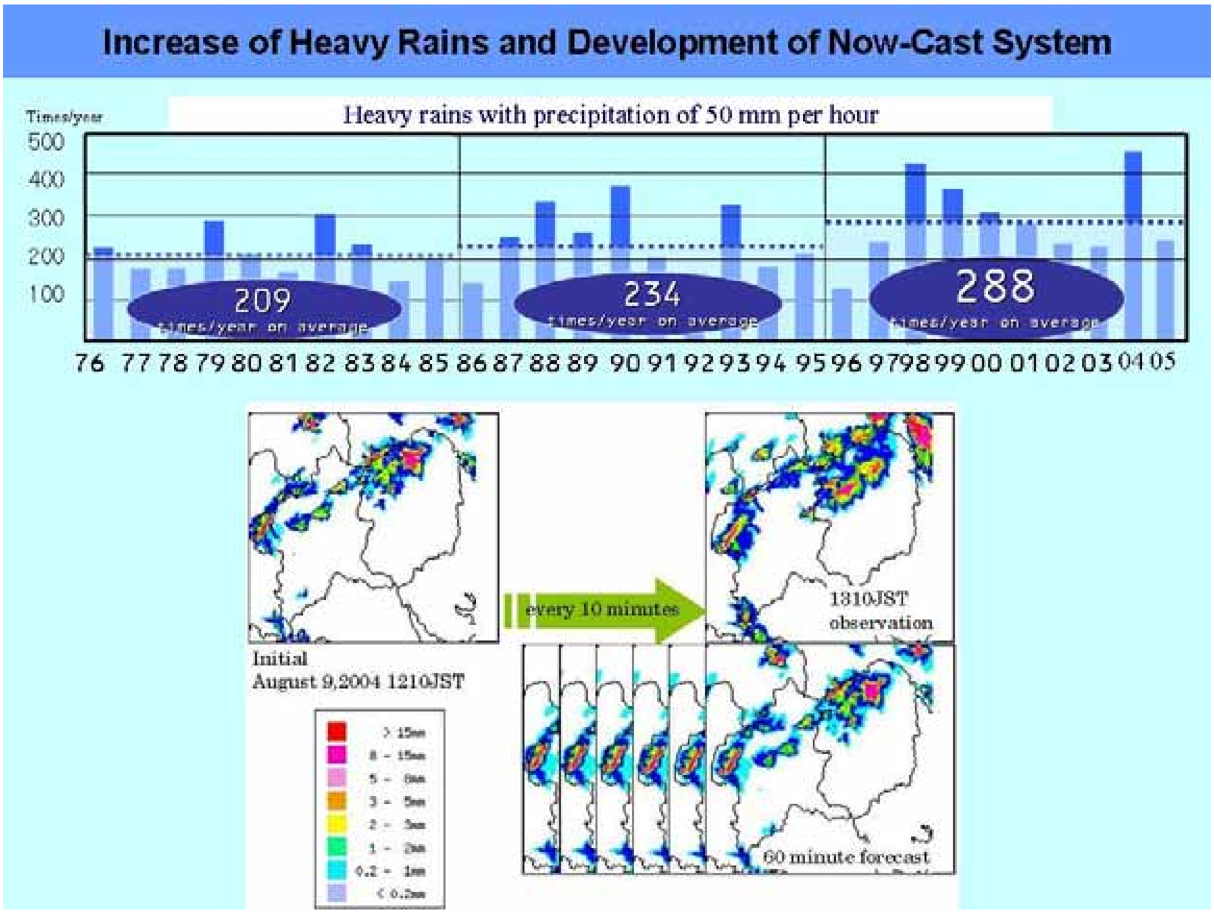
The JMA also provides graphical weather information that shows conditions like heavy rains, where they are anticipated to occur, and where precautions need to be taken, all in an easy-to-understand visual format.

Strengthening Torrential Rainstorm Policies and the Rainfall Nowcast System

In recent years, localized torrential rainstorms have been occurring with increasing frequency in Japan, and in 2004, more than 400 torrential rainstorms (producing 50 mm/hour or more of precipitation), a greater number than had ever been recorded before, were reported. It is therefore important that forecasters be able to predict such storms accurately.

The JMA issues very short-range forecasts of precipitation every 30 minutes that predict the amount of hourly rainfall with 1km resolution for the next six hours. To reduce rainstorm damage in urban areas caused by sudden downpours, the JMA began issuing a precipitation nowcast every 10 minutes to predict the amount for every 10-minute period over the next hour with 1km resolution.

The JMA is striving to improve its torrential rainstorm forecasting accuracy by installing a weather Doppler radar for continuously identifying rain and wind movements in 3D and by enhancing the capabilities of its super computers.



3. Issuance of Flood Early Warning Information

Observing Rainfall, Water Levels for Flood Monitoring

The MLIT and prefectural governments observe the rainfall and water level in the rivers that they manage for disaster reduction monitoring purposes.

The MLIT assesses the rainfall situation (distribution and strength) throughout Japan for the rivers managed by the national government from 26 radar rainfall observation stations nationwide. It also conducts observations at about 2,500 rainfall observation stations and about 2,000 water level observation stations all over Japan using visual observation methods, mechanical observation equipment, and a wireless telemeter system that transmits automatically observed data from remote locations.

Flood Forecasts

Hazard zones have been designated for those rivers deemed important to disaster reduction, and the MLIT or prefectural government, whichever manages each river, works with the JMA to issue forecasts regarding flooding.

The JMA handles the water conditions (rainfall, snow melt) while the MLIT or prefectural government handles the water situation (river water levels and flow volumes). By working closely together, they can issue flood forecasts that include predictions of future rainfall, water levels, and flow volumes. This information is communicated to residents via the municipal flood prevention management entities that conduct flood prevention activities (flood prevention corps), and via the media.

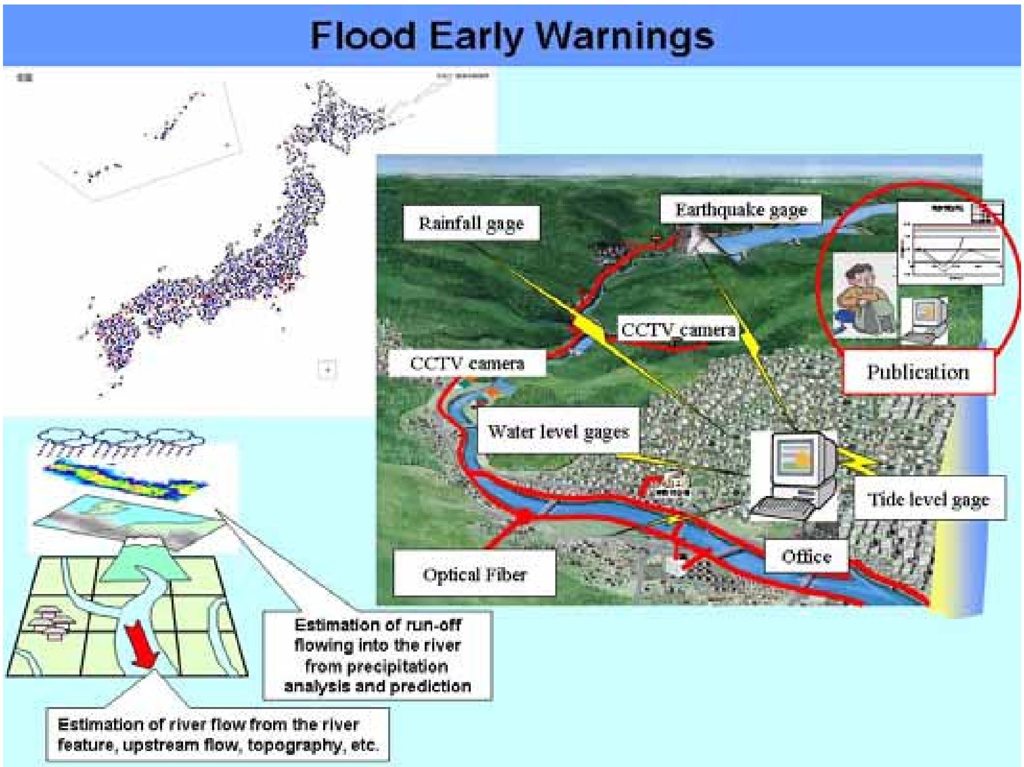
Dissemination of Water Level Information

For small and medium-sized rivers deemed important to disaster reduction but whose specific features make it difficult to predict flooding, either the MLIT or prefectural government responsible for their management designates hazard zones and establishes the special warning water level (the water level at which evacuation becomes necessary), and issues notices when those levels have been reached. This information is also communicated to residents.

Flood Prevention Warnings

Flood prevention warnings are issued for the purpose of enabling river managers to provide guidelines for activity preparations and deployment to municipal flood prevention management entities and other organizations involved in flood prevention.

When serious flood damage is expected to occur along a river, the MLIT or prefectural government responsible for that river designates hazard zones and issues flood prevention warnings when the water level rises to the pre-designated water level (preparations for flood prevention activities) or the warning water level (implementation of flood prevention activities). Based on these warnings, municipal flood prevention management entities and other organizations involved in flood prevention can take the necessary disaster response measures or begin to make preparations to do so.



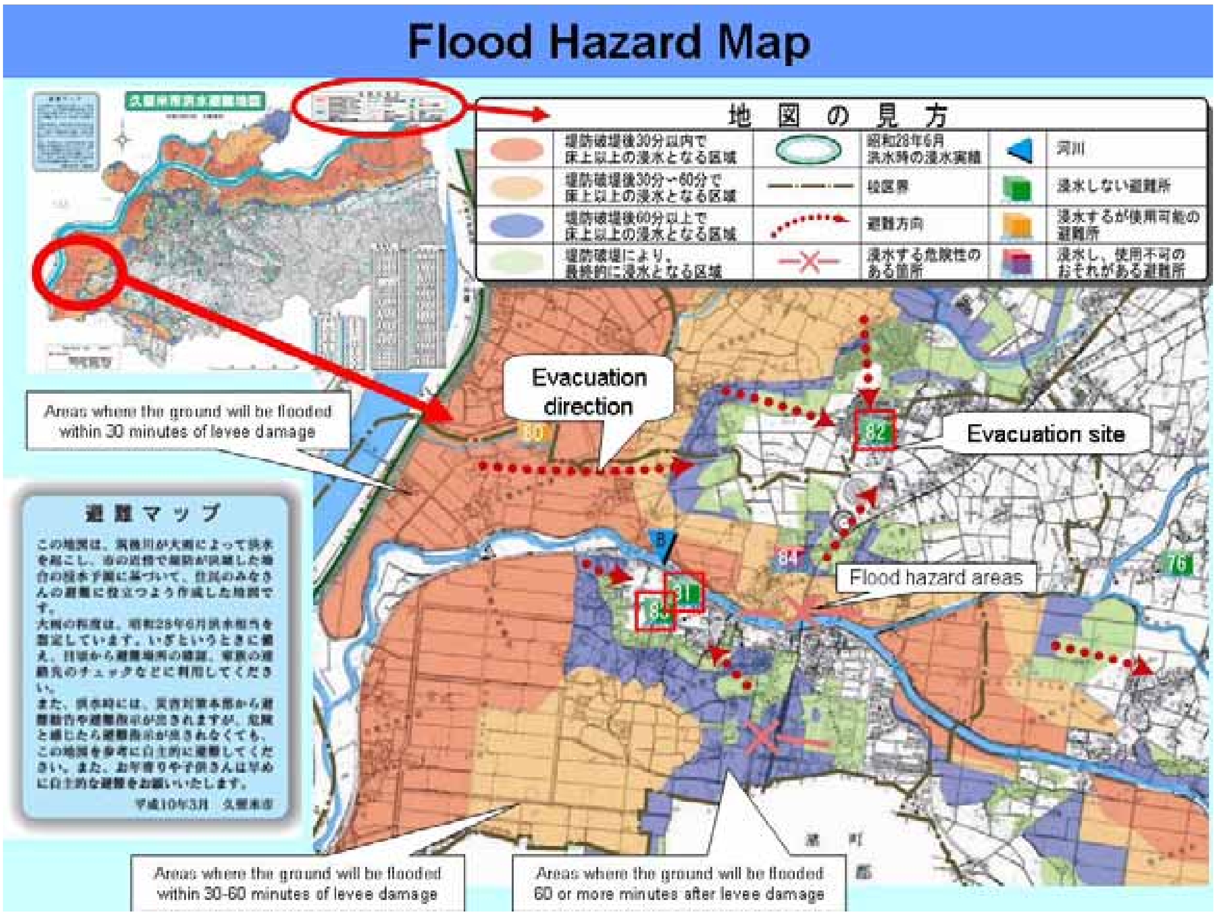
4. Flood Hazard Maps

Flood Hazard Maps

To ensure that residents know the flood risk in advance and can take prompt and appropriate evacuation measures in the case of a disaster, the MLIT and prefectural governments (which are responsible for managing rivers) identify flood hazard areas along rivers designated for flood forecasting and water level reporting activities, based on flood simulations using the planned rainfall for those rivers.

Municipalities that contain areas where flooding from rivers is expected to occur are creating flood hazard maps that include such information as flood hazard areas and probable water depths (provided by river managers), evacuation sites, and flood forecast communication methods.

Municipalities are working to distribute their flood hazard maps by displaying and distributing them at government offices, distributing them to individual homes, displaying them at civic halls and hospitals, publishing them in newsletters, on websites, and in phone directories, conducting evacuation drills using the hazard maps, using them as teaching materials in elementary and junior high schools, and holding community meetings about them.



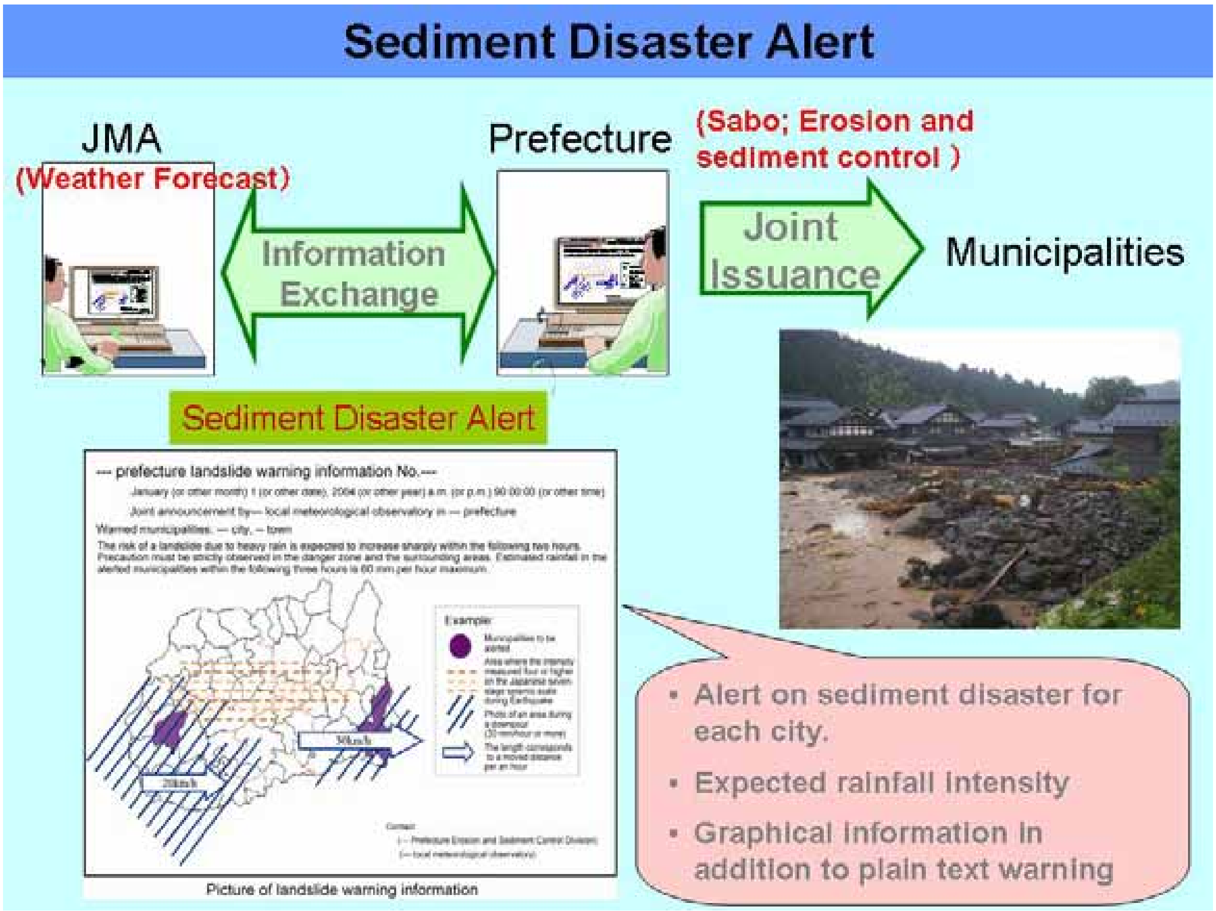
5. Issuance of Early Warning Information for Sediment-Related Disasters

Issuance of Early Warning Information for Sediment-Related Disasters

The JMA announces heavy rain warnings and calls for vigilance against widespread rain-related disasters when there are concerns that massive landslides could occur. Now, however, it is working with the MLIT to provide early warning information for sediment-related disasters that will improve support for disaster response activities.

The information will be announced jointly by local meteorological observatories and prefectural governments so that when there is an increased risk of sediment-related disasters (debris flows and landslides) due to heavy rains, municipal mayors can promptly and appropriately provide evacuation orders or instructions to residents. Municipalities that need to be vigilant will be designated, and announcements will include such information as the following: "Predictions indicate that there is an extremely high risk of sediment-related disasters due to heavy rains during the next two hours. Be extremely cautious in and around sediment-related disaster hazard areas."

These efforts were first implemented on a trial basis in 2002, and in 2005 they began to be fully implemented by those prefectures that had completed their joint announcement protocols.



1. Natural Disaster Risks Observations (Earth Observations)

Contributions to a Global Earth Observation System of Systems

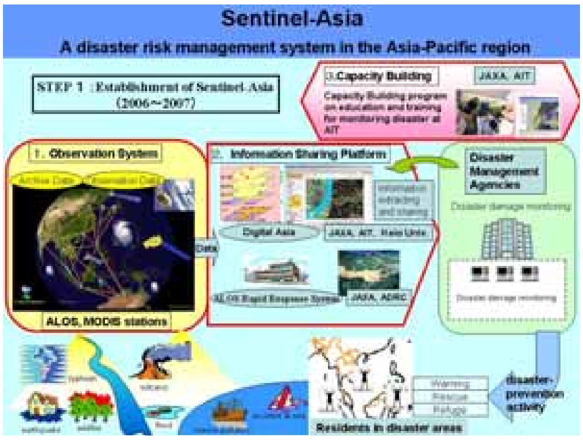
To ensure that the best response measures possible are being taken against natural disasters such as earthquakes, tsunamis, typhoons, and torrential rainstorms, we need to conduct accurate and widespread observations of phenomena occurring all over the world and to use those results to develop better policies.

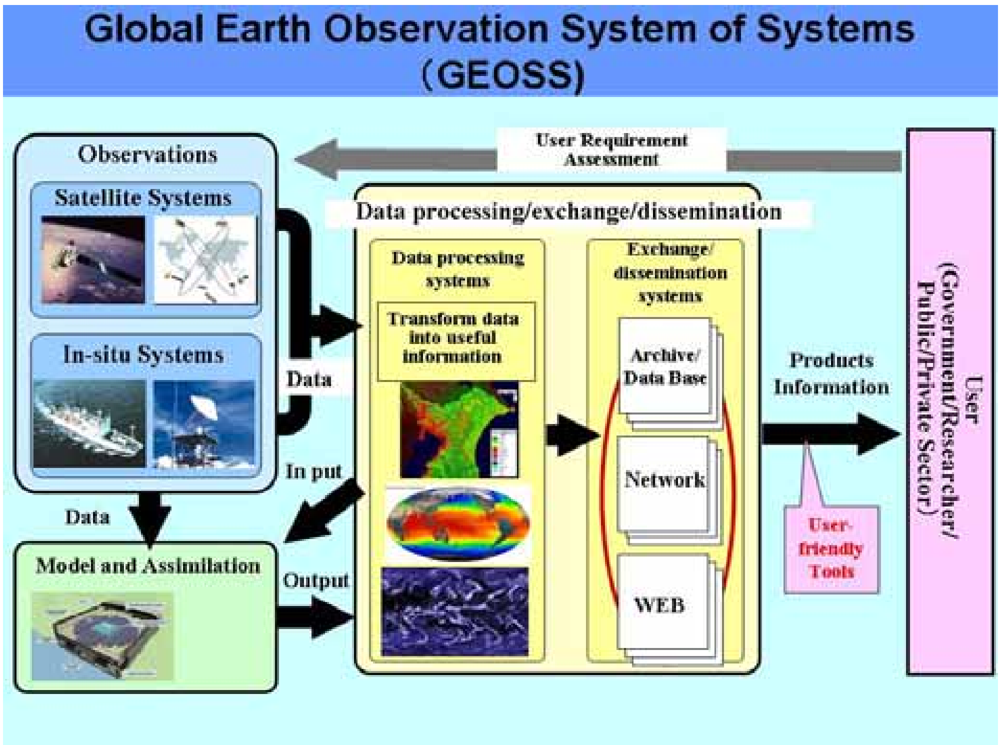
Toward that end, the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan was formulated at the 3rd Earth Observation Summit. Today, the Group on Earth Observations (GEO) is promoting efforts to establish the GEOSS. Japan is taking an active role in the system's establishment by serving as a member of the GEO executive committee.

Use of Earth Observation Satellites

The earth observation satellite Daichi (launched January 2006) is equipped with three kinds of observation sensors that are expected to allow monitors to identify flood and landslide disaster conditions as well as topographical changes caused by earthquakes and volcanic eruptions. The satellite will also facilitate the prompt dissemination of data and disaster information to disaster management organizations. Japan is participating in a cooperative framework for global disaster observation known as the International Disaster Charter, by which it will provide Daichi data free of charge when large-scale disasters occur.

In an effort to achieve a system for disaster crisis management that uses earth observation satellites such as Daichi, Japan is striving to cooperate and form ties with other countries in the Asia-Pacific region while actively striving to develop a Disaster Management Support System in the Asia Pacific Region. The first step in this process is the Sentinel Asia Project, an effort to develop an information infrastructure that allows member countries and organizations to share information on disasters such as forest fires and floods.





2. Sharing Information and Knowledge About Early Warnings

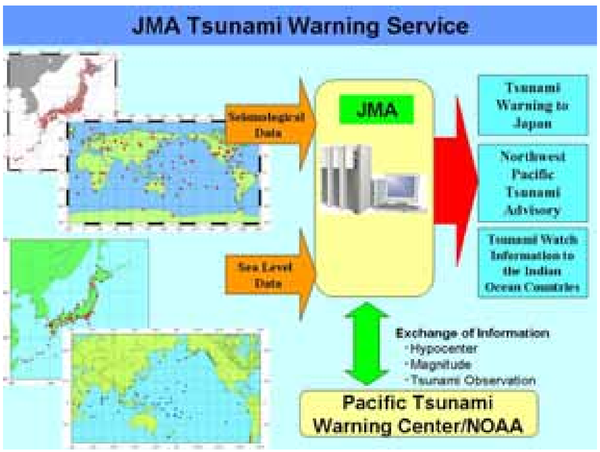
Contributions to UNESCO's Intergovernmental Oceanographic Commission

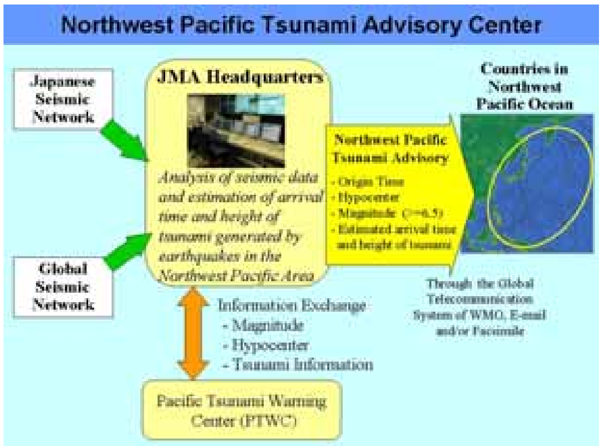
International cooperation in the form of information sharing is essential for the provision of early warnings about distant earthquakes, such as that which caused the Indian Ocean Tsunami in December 2004, and UNESCO's Intergovernmental Oceanographic Commission (IOC) is developing and strengthening such cooperative systems. Based on the lessons learned from the 1960 Chilean earthquake tsunami, efforts are being made to share tsunami early warning information among member countries of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS), established under the IOC, through the Pacific Tsunami Warning Center (Hawaii). The JMA is serving the role of a regional center for the northwestern Pacific region, and in March 2005 it began providing tsunami advisories to the countries involved.

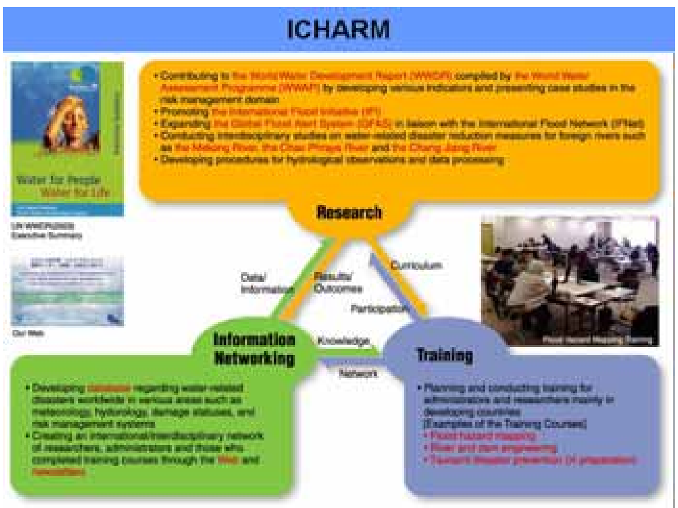
Japan is also actively providing technical support for the activities of the Intergovernmental Coordination Group (ICG/IOTWS) established as part of the IOC for the purpose of constructing an Indian Ocean Tsunami Early Warning and Mitigation System (IOTWS).

International Cooperation in the Field of Water Disasters

The International Centre for Water Hazard and Risk Management (ICHARM) of the Civil Engineering Research Institute has begun developing a system that uses satellite data to support the preparation of flood forecasts, warnings, and advisories for river basins in developing countries that lack observation data. To increase the effectiveness of flood forecasts, warnings, and advisories, efforts must be made to educate residents so that they can identify flood risks in advance and take prompt and appropriate evacuation measures when flooding occurs. ICHARM has therefore begun conducting flood hazard map preparation trainings, with the support of JICA, for river managers and disaster management personnel in the countries of South and Southeast Asia.







3. Community-Based Disaster Reduction Activities Using Hazard Maps

Cooperative Projects Through ODA

At the UN World Conference on Disaster Reduction (January 2005, Kobe), Japan announced the Initiative for Disaster Reduction Through ODA which provides basic guidelines for disaster reduction cooperation using ODA.

Japan is developing various efforts to improve the early warning capabilities of developing countries that are vulnerable to disasters, and to improve their disaster reduction capacity by sharing our hazard map know-how and expertise.

The Caribbean Disaster Management Project that was conducted from 2002 to 2005 provided guidance in the methods of creating flood hazard maps and help with manual compilation, and also contributed to the formulation of a community disaster management plan regarding the use of hazard maps in model regions and the compilation of a related manual. In addition, the project covered efforts to install IT-related equipment such as telecommunications devices, and to strengthen databases and information networks. Seminars and training workshops on the creation of hazard maps and community disaster management plans were also held.

Community-Based Disaster Reduction Activities by the Asian Disaster Reduction Center (ADRC)

Japan is promoting efforts to strengthen regional disaster reduction cooperation through the Asian Disaster Reduction Center (ADRC), an organization with 25 Asian-country members.

To promote community-based disaster reduction activities and improve the general public's awareness of disaster reduction issues, the ADRC holds trainings on disaster-reduction-oriented "town watching" as a tool for community-based hazard map production. Specifically, this involves the following:

1) Residents, local government officials, and disaster reduction specialists who participate in the training walk around their town together and identify areas that are especially vulnerable to and resistant against disasters.
2) Each group makes a visual representation of their findings by attaching photos or other materials to a map. Participants work as a group to create a hazard map, and increase their information sharing capabilities and disaster reduction awareness.
3) All participants discuss problems, policies, and the responsibility for policy implementation with regard to disaster reduction from the perspectives of self-help, mutual help, and public help.

Attachment

Japan's International Cooperation in the Establishment of the Indian Ocean Tsunami Warning and Mitigation System

- Activities in the Year Since the Indian Ocean Disaster and the Basic Approach to Future Contributions –

On 26 December 2004, a massive earthquake registering magnitude 9.0 occurred off the coast of Sumatra Island in Indonesia, triggering an enormous tsunami that caused an unprecedented level of damage in the countries around the Indian Ocean. The international community responded with an unprecedented level of support, and Japan played a part by providing the maximum possible level of international emergency relief and by dispatching delegations of government survey teams to the area.

Because this disaster was exacerbated by insufficient knowledge about tsunamis and the lack of tsunami early warning systems, special sessions on the disaster were held, at the recommendation of Prime Minister Junichiro Koizumi, at the UN World Conference on Disaster Reduction held in January 2005. The “Common Statement” was delivered following the plenary session to promote cooperation among relevant countries (including the affected countries and Japan) and organizations, under the coordination of the UN System, on the establishment of a tsunami early warning system for the Indian Ocean.

Based on this, independent efforts by relevant countries and an array of international aid and coordination activities implemented to support those efforts are being promoted to establish such a system. The G8 Gleneagles Summit held in July 2005 addressed the G8's response to the Indian Ocean Disaster and confirmed the need to support international efforts to improve global early warning capability. Japan is taking advantage of the practical knowledge, expertise and technologies on tsunami disaster reduction it has acquired from its extensive experience with such disasters to make multipronged international contributions of financial resources, knowledge and expertise as well as human resources to this effort.

Now, one year after the Indian Ocean Disaster, this Early Warning Sub-Committee reviewed the major support activities implemented by Japan thus far, and to actively promote continued international cooperation on improving tsunami early warning capabilities so as to prevent a recurrence of this kind of tragedy in this region in the future.

I Activities in the Year Since the Indian Ocean Disaster

1. Provided financial resources and technological support for international coordination activities by the UN System

Applying its experience with regional cooperation on a tsunami early warning system for the Pacific Ocean learned as a lesson of the Chilean earthquake and tsunami disaster of 1960, the UN System, under the leadership of the UNESCO Intergovernmental Oceanographic Commission (IOC), is working with the International Strategy for Disaster Reduction (ISDR) and the World Meteorological Organization (WMO) to develop international coordination activities aimed at the establishment of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS).

International coordination meetings held in March 2005 (Paris) and April 2005 (Mauritius) were attended by relevant nations, including the countries in the Indian Ocean region and Japan, and organizations. Here participants began to investigate the establishment of a framework for regional cooperation suitable for the natural and social characteristics of the Indian Ocean region. The meetings confirmed several points. First, there is an inadequate technological and social environment and a lack of accumulated know-how regarding tsunamis to allow the unilateral provision of information from a single regional center to the various relevant countries. Thus, capacity building among the meteorological and disaster reduction authorities in each country is essential. The meeting also confirmed that there are two epicentral areas for earthquakes that might cause teleseismic tsunamis across a wide region: (1) the Sunda trench, which includes the waters off of the coast of Sumatra where this last major earthquake occurred, and (2) the Makran subduction zone off the coast of India, Pakistan and Iran. Given the characteristics of these regions, an international assessment was conducted of the current conditions in and challenges facing each of the countries that would be covered by the IOTWS, and the results would be used to expand discussions of ways to support capacity building and ways to develop a regional cooperative framework.

The UNESCO/IOC Assembly in June 2005 (Paris) established the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS). Its first session was held in August 2005 (Perth, Australia), and the second session was held in December 2005 (Hyderabad, India).

Japan is providing the following financial and technological support for the international coordination activities of the UN System:

(1) Contributed US $4 million toward international coordination activities by the UN System (Ministry of Foreign Affairs (MOFA))

Japan contributed US $4 million to the activities of the ISDR and the UNESCO/IOC (covering the expenses of holding the international coordination meetings in Paris and Mauritius mentioned above) to promote international coordination activities by the UN System and the establishment of the IOTWS.

(2) Provided technological know-how and advice on coordination activities (Cabinet Office, MOFA, Japan Meteorological Agency (JMA), Asian Disaster Reduction Center (ADRC), and others)

In addition to providing technological know-how at the various coordination meetings held by the UN System, experts from Japan have participated in the country assessments conducted by the UNESCO/IOC in conjunction with the ISDR and ADRC, and have provided technical advice to contribute to capacity building in various countries (Japanese experts participated in assessment survey teams for eight of the 16 countries (Bangladesh, Indonesia, Malaysia, Mauritius, Myanmar, Pakistan, Sri Lanka, and Thailand)).

(3) Dispatched a JMA expert to UNESCO/IOC tsunami unit (MOFA, JMA)

Japan sent an expert from the JMA to the newly established tsunami unit of the UNESCO/IOC in October 2005, has supported compiling the assessment results, and is planning and coordinating the implementation of specific international cooperation projects based on the results.

2. Provided training to build tsunami early warning capacity

(1) Supported UN-organized tsunami disaster reduction training (Cabinet Office, MOFA, JMA and other related government agencies, ADRC, and others)

To effectively promote UN-led international coordination activities and the establishment of tsunami early warning systems in each country, it is necessary to disseminate basic knowledge and know-how regarding tsunami early warnings in those countries and to cultivate shared knowledge that will be useful for coordination activities. Thus, one of the UN-organized projects was to hold a policy dialogue (February 2005) and a study tour (July 2005) in Japan for high-ranking officials in the nations surrounding the Indian Ocean, including those struck by the tsunami, and in UN-related organizations. During these events, Japanese tsunami disaster reduction know-how and technologies were transferred to those who need them.

(2) Implemented JICA Regional Seminars on Tsunami Early Warning System (JICA, Cabinet Office, MOFA, JMA and other relevant government agencies, ADRC, and others)

The JICA regional seminars were held (in March 2005 and in January – February, 2006) for government officials involved in meteorological and disaster reduction activities in the nations surrounding the Indian Ocean. In conjunction with institutions such as government agencies and the ADRC, comprehensive training was provided in a variety of fields ranging from basic knowledge about tsunamis, to observations, information transmission, hazard maps, education, and drills.

(3) Dispatched a JICA expert (Fire and Disaster Management Agency specialist) to the Thai Disaster Management Academy (JICA, Fire and Disaster Management Agency (FDMA), MOFA)

Japan dispatched a specialist from the Fire and Disaster Management Agency (FDMA) in September 2005 and is contributing to the enhancement of tsunami policy training and education at the Thai Disaster Management Academy.

(4) Carrying out research on the Restoration Program from Giant Earthquakes and Tsunamis and the International Workshop related to the program (Earthquake Research Institute of the University of Tokyo, National Research Institute for Earth Science and Disaster Prevention (NIED), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and others)

Motivated by the Indian Ocean Disaster, Japanese research institutes including Earthquake Research Institute of the University of Tokyo, NIED, JAMSTEC as well as governmental organizations including the JMA started researches on mechanism of giant earthquake and tsunami generation, human resource developments for capacity building against natural disasters, effective applications of tsunami early warning system, etc, under international collaborations. (The period of the project: from April 2005 to March 2008) As one of its activities, the Memorial Conference on the 2004 Giant Earthquake and Tsunami in the Indian Ocean was held in Tokyo (in December 2005), in which more than 160 researchers from Indonesia, India, Malaysia and other affected countries as well as Japan participated.

3. Strengthened systems for observing earthquakes and tsunamis and disseminating warnings

(1) Provided tsunami watch information (JMA)

The JMA, in corporation with the US Pacific Tsunami Warning Center (PTWC) in Hawaii, has been providing tsunami watch information on a 24 hour x 7 day basis since March 2005 in response to requests by the countries in the Indian Ocean region as an interim measure until those countries begin to operate a fully functional tsunami early warning system. If an earthquake of a magnitude 6.5 or greater occurs in the Indian Ocean, the JMA provides the origin time, the location and the magnitude of the earthquake, and the possibility of the generation of tsunami, using the existing seismic and sea level observation networks and communication systems. If a tsunami is expected to be generated, the JMA also provides the estimated travel time at 43 coastal regions around the Indian Ocean. As of the end of February 2006, tsunami watch information was being provided to 26 countries in the Indian Ocean region, and had been issued 9 times.

(2) Managed the earthquake observation network (NIED)

Japan is working with seven countries in the Asia-Pacific region including Indonesia and Australia to develop an expansive and internationally linked earthquake observation network, and is promoting the development of technologies that will allow data to be exchanged in real time using the Internet. For example, Japan is contributing to the establishment of a tsunami early warning system in Indonesia by setting 15 large-area earthquake observation stations with a satellite telemetry system. The JMA is experimentally promoting the use of this data in tsunami watch information.

(3) Transferred know-how and technologies related to tsunami observation, such as the monitoring of movements in the earth's crust using GPS observation data (Ministry of Land, Infrastructure and Transport (MLIT), the Geographical Survey Institute, and the Port and Airport Research Institute)

Research institutions in Japan and Indonesia are jointly conducting GPS observations to ascertain the changes in the earth's crust caused by the Sumatra earthquake and the shifts that have taken place since that event. They are also using GPS observation data to analyze fault models, and radar to analyze vertical movements in the earth's crust, and are making the results of these analyses available to others. In addition, the Permanent Committee on GIS Infrastructure for Asia & the Pacific (PCGIAP), which is headed by the director general of the Geographical Survey Institute, is implementing special joint geodetic observations to monitor changes in the earth's crust attributed to the Sumatra earthquake and tsunami.

The transfer of Japanese know-how and technologies related to earthquake and tsunami observation is also being promoted through bilateral seminars with Indonesia and India (held in each of those countries in March 2005).

4. Strengthened information transmission systems

(1) Utilized information communications technologies (ICT) in disaster reduction, standardized disaster reduction management communication systems, and transferred know-how and technologies related to disaster reduction communications systems (Ministry of Internal Affairs and Communications)

The Asia-Pacific Telecommunity (APT) and the International Telecommunication Union (ITU) held a Joint Meeting on the Role of ICT for Disaster Reduction (February 2005, Bangkok), have made efforts to share information on communications systems and technologies, and have compiled an action plan for promoting the development of effective disaster communications systems in the Asia-Pacific region.

The APT Standardization Program (ASTAP) accepted a Japanese proposal to establish a meeting of experts on disaster management communication systems (DMCS) and is promoting investigations of the standardization of a disaster management radio communication system in the Asian region.

Japan contributed to the strengthening of the information communications systems for disaster reduction by presenting Japanese case studies during the Asia-Pacific Economic Cooperation (APEC) Workshop on Tsunami and Disaster Response and Preparations (June 2005, Hawaii) and the Workshop on IT-Based Disaster Warning Systems held at the 32nd APEC Telecommunications and Information Working Group Meeting (TEL32, September 2005, Seoul), as well as by conducting various trainings on Japanese disaster management communications systems in Japan (Seminar on the Latest Trends in Disaster Management Communications Systems for communications personnel in the APT Member States (September 2005) and Technology Seminar for Establishing a Disaster Network in five countries including India (October 2005)).

5. Disseminated tsunami knowledge and helped improve people's understanding of and ability to prepare for tsunami risks

(1) Provided tsunami education materials using the tale of “Inamura no Hi” ("Fire in Rice Sheaves")

To promote tsunami disaster reduction education using the tale of “Inamura no Hi” ("Fire in Rice Sheaves") introduced by Prime Minister Junichiro Koizumi at the World Conference on Disaster Reduction, an English-language CD-ROM containing picture stories and puppet theater was created. Japan also worked with local NGOs in eight Asian countries including Indonesia and Sri Lanka to create and distribute picture books for children and pamphlets for adults that were adapted so they could be easily understood by local residents. These are used for local disaster reduction efforts conducted by those NGOs.

II Basic Approach to Future Contributions

Through its international cooperative efforts over the past year, Japan has promoted the acquisition of basic know-how and technologies by various countries, including those that were affected by the tsunami. Using these as a common base, Japan will continue to promote international coordination activities centered around the UN System for the purpose of establishing and operating a full-functioning tsunami early warning and mitigation system created at the initiative of countries in the Indian Ocean region.

In areas that have a high risk of nearby earthquakes, like Indonesia, it is urgent that preparations be made for the next seismic event, which could occur at any time. Even areas where teleseismic tsunamis only occur once every several decades or every several hundred years, could sustain massive damage like that seen in this last event if such an earthquake were to strike. Thus, establishing appropriate early warning systems in these areas can also significantly reduce devastation in the event of a disaster. It is therefore essential that efforts be made to develop and strengthen continuous systems through the accumulation of basic knowledge and technologies, and to pass the lessons learned down to future generations. These kinds of consistent efforts are only in their infancy in the Indian Ocean region, and supporting them requires that due consideration be given to ensuring the sustainability of the system's management and the enhancement of each country's independent management capabilities through adapting knowledge and technologies tailored to the specific circumstances of the Indian Ocean and the individual requirements of countries.

The majority of the relevant countries, including those that were affected by the tsunami, are developing countries that face problems of poverty eradication and other sustainable development issues. However, efforts to comprehensively develop and strengthen disaster reduction systems, which include not only restoring the affected areas to be even better than they were before in order to make preparations for unforeseeable disasters, but also developing and improving comprehensive disaster management systems including tsunami early warning capabilities, contribute significantly to sustainable development. It is therefore essential to design and develop systems and organizations for these purposes, and to cultivate personnel who are capable of managing them.

Three types of systems are needed for establishing a tsunami early warning system based on such a long-term perspective:

(1) Systems for observing earthquakes and tsunamis and disseminating warnings

(2) Systems for communicating information between relevant governmental and non-governmental institutions

(3) Systems for implementing disaster reduction education and outreach to spread disaster knowledge, to ascertain disaster risks, and to ensure that people are prepared to evacuate when a disaster strikes.

Further efforts must be made to promote the improvement of disaster management capabilities and the construction of a cooperative regional framework through the independent efforts of nations with their ownership mind.

As the host of the World Conference on Disaster Reduction, Japan appealed to the international community to implement the “Hyogo Framework for Action 2005-2015” and to spread a culture of disaster prevention as a foundation for sustainable development. The establishment of the Indian Ocean Tsunami Warning and Mitigation System is the symbol of such efforts, and Japan, a country that has experienced more tsunamis than another other in the world and which has developed advanced and progressive measures based on that experience, is expected to contribute its technologies and know-how to this effort. In the future, it will be further needed for Japan to efficiently and effectively promote international cooperation on all three of the components listed above through cooperation and collaboration between domestic government agencies and other institutions, as well as through bilateral and multilateral projects.