2. Conditions and Issues of the Prediction Systems of Wind Damages and Flood in Various Countries

There are various types of wind damages and flood. Looking at the relations with the prediction and warnings they are not be discussed altogether. The biggest factor to sort the types of wind/ flood damages is the speed of damage occurence speed that indicates time lug to occur a damage. If the damage occurence speed is high, damage will occur in a short time after sings of damage occurence are found. In these cases big casualties are anticipated by such as debris flow, earth-fall, flood by levee break, or storm surge by Cyclones. The prediction and warnings system against these disasters requires speedy collection and process of observation data as well as timely disseminations of the prediction/ warnings. Once a timely prediction and warnings system has established, it will greatly contribute for reduction of damages.

On the other hand the damage occurence speed is low, it will be easier to take the responses such as evacuation to prevent casualties, the type of damages are featured to the economic phase or daily life inconveniences. Therefore, thecaution and warning system against such damages must be more accurate instead to be timely. Hereafter the prior wind/ flood disaster is urgent wind/ flood disaster and the latter is non-urgent wind/ flood disaster.

Which is the major disaster in a country, urgent or non-urgent? It depends on the country's land form, the meteorological condition, the degree of development of disaster countermeasures, etc. We will discuss several countries sorted into the two types as follows:

1) urgent wind/ flood disaster is major problems in: Bangladesh, China, Peru, USA, and Japan
2) non-urgent wind/ flood disaster is major problems in: Thailand, Republic of Korea, and Germany

Present state and perspectives of the caution/ warning system in the said countries are summarized below.

2.1 Cyclones in Bangladesh

Bangladesh is located at the ends of three world–famous rivers of Ganges, Brahmaputra, and Meghuna
on the Bengal Delta formed of the soil deposited by the three rivers. Hence its flat land area of less than 3 m above the sea level spreads to the inland of more than 100 km far from the cost line.

As this country is in the Monsoon area, they have plenty of rain as well as many Cyclones born in Bengaru Bay in April–May and October–November hit the lower area. Such Cyclones give damages every year and every 5–6 years they have great disaster to kill over 10,000. The 1970 Cyclones damage caused to kill 500,000 and in 1991 140,000 were killed.

Cyclones Disaster Prevention System in Bangladesh is gradually arranged from the lessons of the great damages in the past. The roles of the concerning ministries and agencies are described in the Standing Orders for Cyclones. The Ministry of Relief and Rehabilitation has a core role for Cyclones Countermeasures. Ordinary it prepares Cyclones Prevention Plans and composes the organization and at the time of disaster it makes orders to all the organs as well as to call the ad hoc committee to disseminate the Cyclones prediction/ warning and to direct evacuation instruction to the community.

The Cyclones observation is administered by the Bangladesh Meteorological Department reports to the Minister of Defence using 34 ground meteorological observatories, 11 upper air current observatories, 3 upper weather observatories and 3 weather observatory raders. The data are collected to the Storm Warning Center of the Meteorological Department to produce Cyclones forecasts. According to the forecasts Ministry of Relief and Rehabilitation takes the responsibility to present the Cyclones prediction/ warnings by adding some instructive information such as the danger scale or the evacuation order.

There are two kinds of Cyclones prediction/ warnings; one is for the ports at the coasts (11 kinds of signals for 5 levels) and the other is for the ports at the inland rivers and streams (4 levels). They have no prediction/ warnings directly for the people of the coastal area, the prediction/ warnings for the port are used instead. These prediction/ warnings are dispatched through TV, radio or newspapers as well as through the volunteers network organized according to the Cyclone Preparedness Programme. TV sets or radios are not popular and low literacy, information is dispatched to a limited extent through mass media. A local volunteers network for information dispatch was formed according to the lessons of 1970 great disaster in cooperations with the Ministry of Relief and Rehabilitation and the Bangladesh Red Crecsent (red cross). This network starts from the headquarters dispatched finally to the 2089 units (villages) through 24 Upazila and 207 unions. From the units about 20,000 volunteers are to announce the warnings orally and directly to the people by using megaphones or siren. Transmission to the union level depends on wireless or telephone. The transmission measures to the unit level are not completely organized yet. Once a warning is dispatched the terminal volunteers scatter into villages with megaphone in hand to call the people for evacuation to shelters. Their contribution was significant at the disaster in 1991, whereas 15 volunteers were killed due to their own delay for evacuation. The Divisions and Upasilas are responsible to evacuate people and animals from lowlands to safe places on plateaus such as schools, community centers, shelters, and other public facilities, still

the volunteers take larger role here again.

The acceptance of the people for the Cyclones prediction/ warnings are not high. At the 1991 disaster the evacuators were reported to be only 20 – 25 per cent of the total residents in the dangerous area. The reasons are: 1) they had many warnings of the same level since 1970, and had no affects, 2) there are many illegal–occupying residents, they are afraid to be occupyed their own houses or properties during their evacuation, 3) Muslim women do not like to be with men in a narrow space (in fact there found few women evacuators.), 4) concerns for the animals are too strong that people dare to stay home to protect them, 5) the Cyclone day was full moon, an important evening for shrimp fry fishing that farmer's workers were ordered to stay at the farm by the owners, etc.

The prediction/ warnings system, that was organized according to the lessons of the great disaster in 1970, organized based on the lessons from the 1970 disasters, has not only its basic issue of improving the accuracy but also their issues are pointed out as listed below:

1) the words in the Cyclones prediction/ warnings are not easily understood by the general public
2) the warning for the ports at the coasts, consists of 11 kinds of signals representing the 5 levels and passing points (to the north/ south of the port or direct), is not always understood correctly
3) the people tend to mix up the warnings for the coastal ports with the warnings for the riverside ports
4) warning dispatch for the people delayed in some areas
5) the 1991 disaster came to the areas other than the frequent disastrous area where the volunteer warning network was not formed to cause many disasters

The prediction/ warning system in Bangladesh is expected as the backbone for current disaster countermeasures as well as to organize and expand shelters. It is strongly expected to solve one by one of the above mentioned issues.

2.2 Floods prediction/ warnings system in China

China has big land and long riveres to suffer repeated floods. Statistics covering more than 2000 years indicate that they had water disasters almost every other year. Only recent experiences 30,000 died at 1954 Yangtze river disaster and immense flood in the southern China in 1975 caused more than 5,000 deaths. The government, since 1950, took steadily the countermeasures to construct various facilities such as levee, reservoir, reservoir area, spill area(retarding basin), evacuation road and " High Land" (a village constructed above flood level within retarding basin).

Concerning water/flood prediction/ warnings are the prediction/ warnings for severe rain and for floods. Prediction/ warning for severe rain are ranked into three; regular, big, and extra-big. The Central Meteorological Station takes the core role, 2,600 various local meteorological stations in the countries offer their observations for prediction/ warnings of severe rain. Flood prediction/ warnings, on the other hand, depends largely on the national government because there are many great rivers covering several regions. Prediction/ warnings concerning the flood of the seven great rivers with dangers of flood are dispatched by the Department of Water, National Science Academy. They are ranked into three levels; caution, warning, and particular warning. Warning is announced when water exceeds the warning water line, and particular warning at the time when damages are anticipated according to the water rising speed and/or past experiences.

The hierarchial structure of Chinese disaster system has the National Headquater for Disaster Response as its summit and regional Disaster Instruction Departments are placed underparts. Once the particular warning is announced, the Central Disaster Instruction Department with the Deputy President as its head decides to proceed dam diversion and breaking/ blasting the dike of the reservoir area and spill area(retarding basin). Practically decisions where will be broken/ blasted are made under negotiations with the basin regions. There are often found conflicts between the upper and lower regions because the breaking/ blasting the dike cause evacuation of the people or damage on the crops.

The breaking/ blasting points are decided by the Central Government, the Province and the County dispatch evacuation reccomendation/ order. In such cases information is disseminated also through government hierarchy route that starts from the provincial disaster Instruction Department,then to the County Disaster Instruction Department, the City Disaster Instruction Department, Highways, " Riro" (Block Association), and finally to the people in the dangerous area, in addition to TV and radio broadcasts. Dispatching measures are wireless and telephone, yet there are areas not equipped with them.

Following problems are raised concerning the flood countermeasures:

1) the breaking/ blasting the dike has become difficult
due to the increase of people living in reservoir area, spill area(retarding basin) is increasing
2) in some area it takes more than 2-3 days for evacuation due to the insufficient evacuation roads and the poor road conditions
3) insufficiece of both number of High Land and their space
4) unequipped / fading of communication facilities disturb smooth communication in an

emergency

Also pointed out are the necessary improvements for prediction/ warnings system listed below:

1) improving the flood forecasting model: the accuracy is good for those rivers with data of more than 60 years, yet the changes of the river bottoms cause difficulties. New model for the flood forecast need to be developed for each basin/ area.

2) developing methods to speed up and to increase the accuracy of rainfall estimate: To complete a rainfall estimate system to forecast three days ahead by using data from radar rainfall observation and satellite observation.

3) speeding up the collection/ analysis of rivers water level: To apply computers to speed up the collection/ analysis of water level observations currently undertaken by man power.

4) developing an Expert System concerning evacuation recommendation: For the reference in making decisions of emergency evacuation experiences concerning the evacuation recommendations should be organized into a kind of Expert System.

5) improving the warning dispatch system: Wireless system should fully be equipped in case of power downs.

2.3 Debris Flow in Peru

The Land of Peru are devided into three zones, the costal desert zone, Andes mountain zone, and the tropical rain forest zone. Half of the total population concentrates into the costal desert zone covering only 10 percent of the whole land. Peru is a country with not only many earthquakes. They suffer disasters caused by avalanches, avalanches followed debris flow and landslides as well. About 30 rivers rise from Andes cross the coastal desert zone of Peru. Among others debris flow and flood of the Rimac River pass through the Lima capital area are big problems. Rimac River is a rapid stream of 150 km long and comes down 5650m. Usually it flows a little, but it is a dangerous river that only a few rain even cause disasters such as debris flow.

In 1983 and 1987 they had two large scale disasters with debris flows and flood. At the 1987 disaster 12,414 were killed or injured. The Peru Government, getting cooperation from the Japanese government, prepared a Disaster Countermeasures Plan for Rimac River and started the disaster countermeasures.

The Meteorological Agency undertakes the meteorological and the water level observations of the Rimac River. 14 rainfall Observatories out of 18 are normal observatories by the staff, and the rest 4 equipped with self-recording rain gages supplied from Japan. There is a water level observatory at Chosica with permanent staff. In case of flood water level is reported to the National Disaster Agency through the Meteorological Agency every 1-2 hours by wireless band. Matucana area located at the middle of the Rimac River had damages by debris flow in the past. In 1990 a warning equipment against debris flows was set up here to start a basic survey to prepare the prediction/ warnings and the evacuation systems.

The Civil Disaster Prevention Act was promulgated on the 1970 earthquake disaster. The National Disaster Prevention Agency administers the national disaster countermeasures and is responsible for providing with information of prediction/ warnings to the concerning organs and the heads of the local governments when deemed necessary. The concerning organs and the heads of the local governments are to evacuate the people in the dangerous zone, but few cases are found to prove this real function.

In March 1991 there came a small debris flow. At this time, due to the delay of meteorological information dispatch from the National Disaster Prevention Agency, the Mayor of Lima controlled traffic in the dangerous area and evacuated the people by his own decision.

In 1991 the Division of Disaster Prevention was established in the National Disaster Prevention Agency to proceed the system organization, still following problems are expected to solve in future:

1) establishing the system for disaster information dissemination: Due to fading wireless band facilities, different waves standard from one organ to another, and poor power back up, information communication system is not reliable even in ordinary time. Operation system should be discussed including the satellite use.
2) establishment of warnings/ evacuation system: Severe rain in a dry zone accompanies precursor such as thick clouds, yet the same system in the Matucana area are required to spread into other areas.
3) intensifying the meteorological/ water observation: It is expected to intensify the bservation system of local severe rain including facilitating radar gages as well as to analyse records of severe rain in the past.

2.4 Flood in Thailand

Thailand is divided into 25 basins. Eight basins out of 25 form the Chao Phraya basin. The Chao Phraya basin spreads to a huge space of 15.8 square kilometers. Major cities like Bang Kok, Chiang Mai, and Ayutthaya have grown along the river.

Floods in Thailand occur in this basin during the rainy season from the middle of May to November. Floods occur slowly in Thailand that the water level goes gradually higher and overflow the levees. The disaster is the long staying water stay for 2–3 months. It is respectable that along with the progress of urbanization and industrialization and the change of agriculture, the economic damages, unseen previously, has become obvious. Industrialization was to construct many plants in the paddy field zone. Though these plants themselves have equipped with water proof measures, they have indirect damages from the traffic cuts. The agriculture, floating rice are converted into regular rice, is changing into fruit grow with assuming the needs of the urban. This means they become weaker against flood.

The core of the disaster countermeasures for Chao Phraya basin is number of dams with more than 100 billion tons of their total capacity. In the rainy season the 600 rain gauges and 244 water gauges in the basin are used to control these dams to increase their water storage as much as possible in order to preserve irrigation water and at the same time they are effective for preventing floods. Whereas flood control by dams has its limit that they suffer flood once several years. After the 1983 great flood, the Government established a Flood Prevention Committee (composed of members from Royal Irrigation Bureau administering the dams and Public Service Bureau) was established to discuss emergency flood countermeasures and the countermeasures proposed and partly already being undertaken are listed below:

1) building the green belts: the 3 meters high soil levees are built in order to prevent flood waters coming outside of the green belts (already completed)
2) building drainage stations and drainage gates: Drainage plants were set up at canals to reduce the quantity of flood water. They are already completed to reduce the flood to the 1/3 to 1/5 scale of the 1983 flood.
3) building diversion channels: To construct a bypass canal for Chao Phraya River. It requires enormous cost and is not completed yet.
4) building storm surge dikes: To construct a levee to prevent a back surge. It also requires enormous cost and is not completed yet.
5) building flood observatories and drainage facilities: To set up rainfall/ water level observatories in Bangkok as well as to equip with drainage pomps and detectors for water gate switch in order to prevent floods in the area of 600 square kilometers. Completed.

2.5 Flood in Republic of Korea

Most disasters in Korea are by typhoons, by severe rain, and by storms. During the 1981–1990 decade par year average reaches to 238 deaths, 110,000 affected, and loss amount of USD 5.5 billion. As its economy grows, the economical damage amount increases rapidly.

Investment for disaster prevention has been progressing by five year plan basis since 1977. The fourth programme starting in 1992 plans to spend more than ten times of the amount spent for the third programme mainly to establish disaster prevention support systems, to speed up/ to obtain more accurateness of the disaster report, to proceed the study of disaster prevention science/ technology, and to enrich the education/ training of disaster prevention. Among them about 3% of the amount are planned for the prediction/ warning related budget to be spent for improving/repair of communication facilities, modernizing the meteorological equipments, and improving the facilities for flood prediction/ warnings.

Korean disaster system is included as a part of the civil defence system. The Disaster Countermeasures Committee in the Central Civil Defence Council (headed by the secretary general of the Department of Interior) is followed by the Central Headquarter for Disaster Countermeasures consists of 17 ministries and agencies at its below, and the headquarters of the designated cities/ provinces and of the cities/ counties are set up in each region. 3,558 towns/ villages and the 29,750 flood–fighting groups are to be organized below.

The Korean Meteorological Agency is responsible for meteorological prediction/ warnings to present cautions and warnings concerning 13 factors such as severe rain, strong wind, storm, or typhoon according to a clear standard. Meteorological observation is undertaken by 42 observatories in the country. Overseas data obtained from Tokyo is added to the above and used for forming the prediction/ warnings. The prediction/ warnings are dispatched to the public through the mass media route. On the other hand forming flood prediction/ warnings is undertaken by the flood control station of the department of construction. Referring to the warning/ danger water levels set up for each river,a caution is presented when it is anticipated to reach to the warning water level and a warning at danger water level. The information is dispached all over the country through the mass media and for the people in the coastal area the headquaters for disaster countermeasures of the city/ province/ county and the warning stations on the coast announce them the information directly. Concerning the four major rivers including Han–Kang,the telemeter system equipped in the division of disaster countermeasures in the Ministry of Interior (responsible for comprehensive coordination of disaster counter measures in the central government) indicates rainfall and water level of respective observation points to lead quite timely instructions to the city/ province/ county to take necessary actions. The evacuation recommendation for the people is presented by the terminal city/ county according to the decision of the central government.

The issues for the prediction/ warnings system in Korea are to speed up forecasts and to increase the accuracy as well as to revise evacuation recommendation. The flood evacuation recommendation presented by the central government is highly claimed to be impractical due to the rough areal division. As the people in the coastal area have details of the dangerous area from their own experiences, the rough evacuation recommendation from the government is taken only for their reference.

They have failed also in the water level arrangement for a dam due to poor accuracy of rainfall estimate. It must be improved, too.

2.6 Hurricane in the United States of America

The hurricane prediction/ warnings in the United States become more and more important, as the continuous increase of the population into the coastal area leads the increase of the potential danger by hurricane. The National Hurricane Center(NHC) in Florida is responsible for the hurricane prediction/ warnings programme. They observe the hurricanes by the traditional observatory vessels as well, by collecting information from the radio sonde, the reconnaissance planes, the meteorological observation satellites, radars, and buoys by the involving institutions and then the information are concentrated into NHC. The prediction/ warnings of hurricane are finally produced by NHC through phone discussions with the involving institutions. Further to forecast the storm surge damages at hurricane attacks, prediction models are developed for each cove considering the differences of the course of attack, the wind scale, or the air pressure. The state/ county governments and the army undertake the evacuation study for the floody districts (analysing the traffic network and shelters, the behaviour study of the residents, etc).

When the announcement of the hurricane caution/ warning is decided, the prediction officer of NHC, through the hot line of the federal information dissemination system, call to all the state/ local governments to be influenced to hold a telephone conference. The county and the city/ town/ village may be given general explanations on the covering area for the warnings, date, or anticipated state. The local governments feed back the information to NHC of the present state. NHC uses them to coordinate the covering area of warning and the timing for the warning announcement. The information from NHC is immediately dispatched to the people in the coastal district. The present system is designed that the organ announcing the warning disseminate the information directly to the residents in order to solve various problems they had in the past (the meteorological information was interpreted into various ways and dramatized to cause a rumor and not disseminated accurately).

Following points are left to be solved for the hurricane countermeasures in the United States:

1) Education of people in the coastal districts: 44 million live in the hurricane dangered area, whereas 80 to 90 percent have experiences of small hurricane or passed by a big one and without the experience of big hurricane attack. Therefore they may much underestimate the hurricane threat. Education is required to have them correct knowledge on hurricane threat.

2) Reduction of evacuation time: The evacuation roads from the coastal districts are left old that their capacity does not meet for the evacuation of the increased residents in a short time. There are some places even difficult to evacuate from the dangerous area. Organizing the evacuation roads and construction of safe shelters are necessary.

3) Improvement of the forecast accuracy: In order to reduce the necessary cost for overwarning and the effect of the boy who cried wolf, the more accuracy is required.

4) Untertaking the reduction measure against the damage of properties: In order to reduce the damage of properties restriction of the areal development in the dangerous area and establishment of anti-hurricane building standard are important.

2.7 Flood in Germany

In Germany flood occurs, though not frequently, mainly at the Elbe and Rhein rivers. Humburg, a big urban in the Elbe basin, is attacked by high–water, upstreamed tide of the North Sea backstreams along with the north west wind. Rhein river may provide flood damages for the houses in a part of its basin in April and May during the snow melting time as the water level comes up gradually.

German disaster prevention systems are well decentralized and largely different from one region to another due to the less damage in general and the disaster environments are different from one another.

The City of Hamburg, with its 10 on–line water level gauges in the down stream area (including the Netherlands) and observation data from the Federal Marine Meteorological Station and the Meteorological Agency, issues its own prediction against high water. This prediction has four categories according to the estimated water level(4.5m, 5.0m, 5.5m, 6.5m). Category I is a kind of caution. Cat. II represents the danger of flood at first to start evacuation for the port labourers. Anticipation of levee break appears at cat. III. Cat. IV is tied up with the evacuation recommendation for the residents. The Headquarter for the Emergency Disaster Countermeasures of the City may, through TV conference system covering seven districts, timely decide a controlled countermeasure. When an evacuation recommendation to the residents is issued by the Headquarter for the Emergency Disaster Countermeasures, sirens are blown to let people to obtain detailed information from TV and radio and call to gather at 40 evacuation points. 20,000 people living in the dangerous area will leave for near shelters (primary schools) from the 40 points by bus. The evacuation is assumed to be easy because the prediction with a very high accuracy is issued as early as about nine hours prior to the disaster.

In the case of Rhein river the River Safety Agency issues accurate predictions according to the date from the on–lined water level gauages and at the same time the local entities along the river bank predict floods by themselves. At confluences of Rhein with other branched streams it is difficult to predict the water level. In Koblenz, the confluence with Mosel, for instance, the local elder persons issue the flood predictions by considering the wind etc. to respect the past experiences. The prediction in Koblenz has three steps according to the water level (4.5–6.5m/6.5–8.5m/more than 8.5m). The first step is to prepare warning, the second step is dissemination of warning to the people and stting out of the disaster prevention organs, and the third step is to take the countermeasures such as to insure traffic by boats.

2.8 Severe Rain Damage in Japan

Severe rain damage caused by typhoons or by local severe rains during the rainy season occur every year in Japan. The Meteorological Agency, the Ministry of Construction and the prevfectures have taken the leaderships in organizing observation system to issue prediction/ warnings.

The Meteorological Agency has a dense network of observation consisting of AMEDAS, the automated ground observatoris network; 20 radar stations, including the one at the top of Mt. Fuji, covering the country; and the meteorological satellite. It issues two kinds of predictions concerning severe rain according to the observation data: one is a prediction of short time water fall (to predict the rain fall until three hours ahead for each mesh of 5 km by 5 km) and the other is a caution/ warning for the heavy rain (calls to the warnings issued according to the standard decided by the past rainfall data in each district). The prediction of short time water fall and the composed data with the current data from the radars and from AMEDAS are visualized and distributed by fax or on-line, then disseminated to the general public through TV and radio.

The Ministry of Construction is responsible to administer has 1,766 telemeter rainfall observatories(in 1991) and 18 on-lined radars (in 1990) for rivers/ dams administration. The water level is observed at about 1,500 observatories, 80 percent of these observatories are telemeterized. The observation data is used for rivers/ roads administration. Flood predictions for major rivers are issued after discussion between the Meteorological Agency and the Ministry of Construction. However, sometimes it takes a long time for discussion and adoption procedures within each organization.

Prefectures have 2,239 rainfall observatories (1,213 are telemeterized) and 3,040 water level observatories (1,427 are telemeterized) in 1990. The observation data is used for the flood prediction of the rivers administered by the prefectures or roads administration. Observation data of the Ministry of Construction and the prefectures are distributed to the contracted cities/ towns/ villages through the Videotex System of the Foundation of River and Basin Integrated Communications, Japan.

Prediction/ warning for the severe rain in Japan has steadily progressed, yet there are various problems listed below:

1) Conquering weak points of telemeterization: Automated and telemeterized data collection is popular. Cables (NTT circuit) is used for the communication. It may perhaps be impossible to collect the data due to the communication down at a disaster time. To switch to reliable wireless band is necessary.

2) Reduction of the time of flood prediction and information distribution: Currently it takes 20-30 minutes from data input to obtain flood prediction result and the distribution time is added as well. The prediction might be delayed in the case of rivers in urban area whose time lug for flood is short.

3) Development of prediction techniques for severe rain disaster: Debris flows and earth falls provide big casualties in recent Japan. Due to the extremely low rate of the successful prediction of these disasters it is neither sufficient to call evacuation to the residents nor effective. Technical development is required so that more accurate prediction may be issued.

4) The importance of educating people by hazard mitigation maps: It is extremely important for the residents to get sufficient understandings on the disaster dangers of their residential area in order for smoother responses at emergencies. In some communities flood maps are opened to the public. In Kanagawa prefecture avoid maps are used for the education of people. These methods are recommended for the education of people.

2.9 Summary and Comparisons by Countires

The above described state, needs and problems of the prediction/ warnings systems for wind/ water disasters in various countries are assumed in the exhibit below:

country	present state and requirements	problems
Bangladesh	big importance of prediction/warning system prediction issue well progressed, yet system of information dissemination insufficient	improve standard warning level organize/spread volunteer information dissemination network increase shelters
China	techniques of issuing flood pred./ warning system well progressed, yet inf. dissemin. system for residents in the retarding basin unorganized.	intensify the rainfall observation system improve flood prediction model organize information dissemin. system organize evacuation road and village plateau
Peru	just begun to organize observation system pred./ warning dissemin. system undeveloped	organize mutual wireless band system among disaster organs set up basic observ. facilities
Thailand	centered non-urgent water disaster industrialization/ urbanization lead to weakness	connect flood watching and drainage facilities in urban
P.R. Korea	sufficient watching/ pred./warning for major rivers rainfall prediction concerning dam control is not sufficient yet	more sophisticated zoning of evacuation recommendation area establish pred./ warning system of sudden disaster like earth falls
U S. A.	increasing importance by increase of population in coastal area highly developed pred./warning system	increase accuracy of prediction reduce evacuation time (roads organization, etc.) educate people in coastal area
Germany	extremely accurate pred. of floods decentralized observ./ pred./ warning system cored by cities	large scale evacuation plan by bus really function?
Japan	extremely dense observation developed to issue/ dispatch of pred./ warning large needs for hazard mitigation against sudden disaster like debris flow/ earth fall	develop pred. techniques for sudden disasters insure disaster-proofness of telemeter system reduce time to issue/distribute flood pred.

3. Conclusion –for the Future Development

In the previous chapters the state and problems concerning volcanic eruptions and wind/ flood disasters in many countries,including both developed and developing, have been analysed. Among them it is common for an effective function of the prediction / warning system that the system to issue and dissemination of prediction/ warning; the measure for issuing/ announcing the evacuation recommendation/ direction; and the facilities concerning evacuation, all these three factors are required to be well balanced and organized. The accurate prediction/ warning cannot be used well without advices and instructions for the evacuation needs in order to insure the safety of the residents. Without organized facilities for smooth evacuation, a timely evacuation call would not prove its precious value.

Furthermore, when the residents have correct image of disasters and trust on the prediction/ warnings, then they would accept the evacuation recommendation/ direction. As already described, all the developed and the developing countries have problems related to some points in this aspect to be improved.

For the issue of prediction/ warning the developed countries have various prediction techniques and models that may be applied into developing countries. The technical transfer should be encouraged. The sudden disasters like debris flows and earth falls are difficult to predict even in the developed countries. Fundamental studies on the sudden disasters should be promoted international cooperation.

For prediction/ warning dissemination it is necessary to organize wireless band facilities considering the disaster–proofness. At the same time application of satellite communication techniques, expected to develope quickly, is also be considered. Organizing volunteers is proved to be effective from the case in Bangladesh. In order to disseminate the prediction/ warning correctly, particular consideration is required that names and rankings should be easy to identify. It is necessary to revise them by undertaking a fact finding survey how the residents accept the prediction/ warning. Enormous efforts are already paid to build up evacuation facilities (shelters, etc.), yet more efforts are needed to reduce evacuation cost of the residents and to increase their acceptance of the prediction/ warning.

To undertake education activities on a continuing and repeating basis is important to let them have a correct image of disasters.

Finally, by promoting international comparative survey/studies and by holding international symposia, it is expected to improve the prediction/ warning system through exchanging the experiences and information from various countries.

Japan National Committie for IDNDR

What is the "Natinal Committie for IDNDR" ?

The United Nations designated the 1990s as "Internatinal Decade for Natural Disaster Reduction" at the 42nd United Nations General Assembly, through concerted international action, especially in developing countries, to reduce damages caused by natural disaster, and the resolution was adopted.

In Japan, "the Goverment Headquarters for the International Decade for Natural Disaster Reduction" headed by the Prime Minister as President was established, various measures are being undertaken.

But in order to succeed the International Decade for Natural Disaster Reduction, of course, the Japan goverment should be leading, both "Academic sectors wisdom and experience" and "Industrial sectors activity" are important to promote the decade.

The "Natinal Committie for International Decade for Natural Disaster Reduction" was established by industrial and academic sectors in August 1990 in order to widely acquaint by the public with the purpose of this movement.

1. This Logo was designed and authorized by the Japanese Goverment Headquarters in order to promote educatinal activities in relation to the IDNDR.
2. The circle in the logo for the IDNDR represents our globe, while the wavy lines in the lower half symbolize the natural disasters which occur all too frequently.
3. The triangular figures in the center represent the people of the world, working together to achieve the objectives of the IDNDR - a reduction of the damage caused by natural disasters.