MEMBER REPORT

ESCAP/WMO Typhoon Committee
8th Integrated Workshop/2nd TRCG Forum

REPUBLIC OF KOREA

Macao, China
2 - 6 December 2013

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2013(Free format)

1. Meteorological Assessment (highlighting forecasting issues/impacts)

The figures below show the track of typhoons such as LEEPI(1304), KONG-REY(1315) and DANAS(1324) that made impacts on the Korean peninsula in 2013. LEEPI(1304) and KONG-REY(1315) made indirect impacts on the peninsula on June 21 and August 30, respectively. Meanwhile, DANAS(1324) is recorded as a typhoon that made an unprecedented impact in October (Oct. 8 to 9) since 1998.

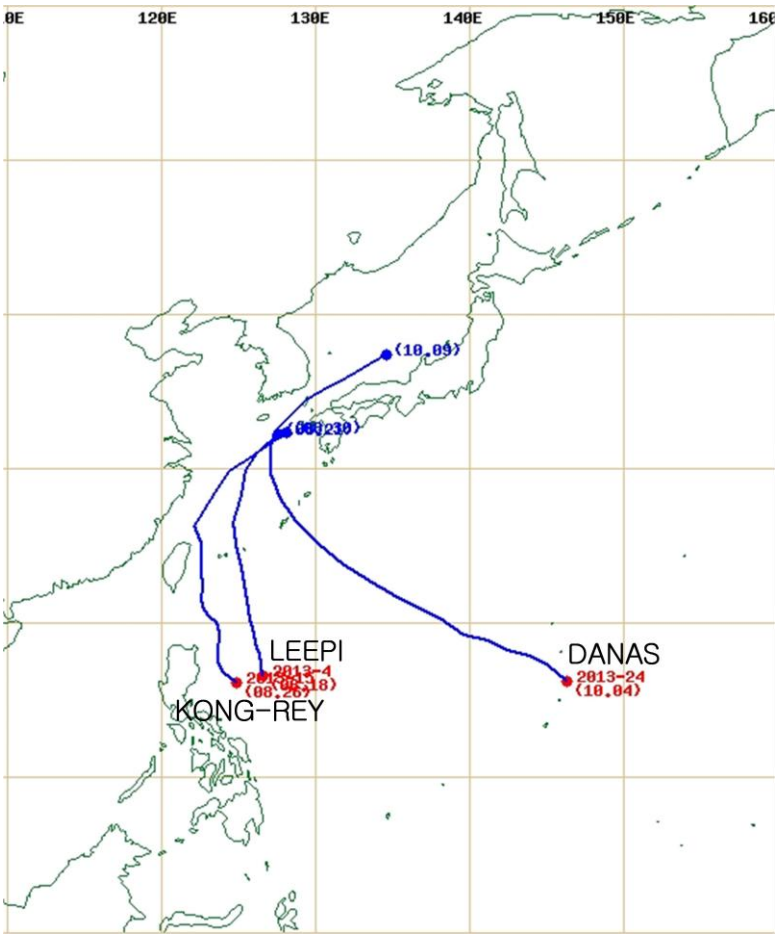

Fig. 1-1-1. TC track that affected Korean Peninsula in 2013

At the time when the Korean peninsula was under the influence of LEEPI(1304) and KONG-REY(1315), the amount of precipitation reached less than 100mm. However, more than 300mm of precipitation was recorded in Jeju island during DANAS(1324). When those three typhoons hit the peninsula, 10-15m/s wind gusts were accompanied mainly in Jeju island and the southern coastal areas.

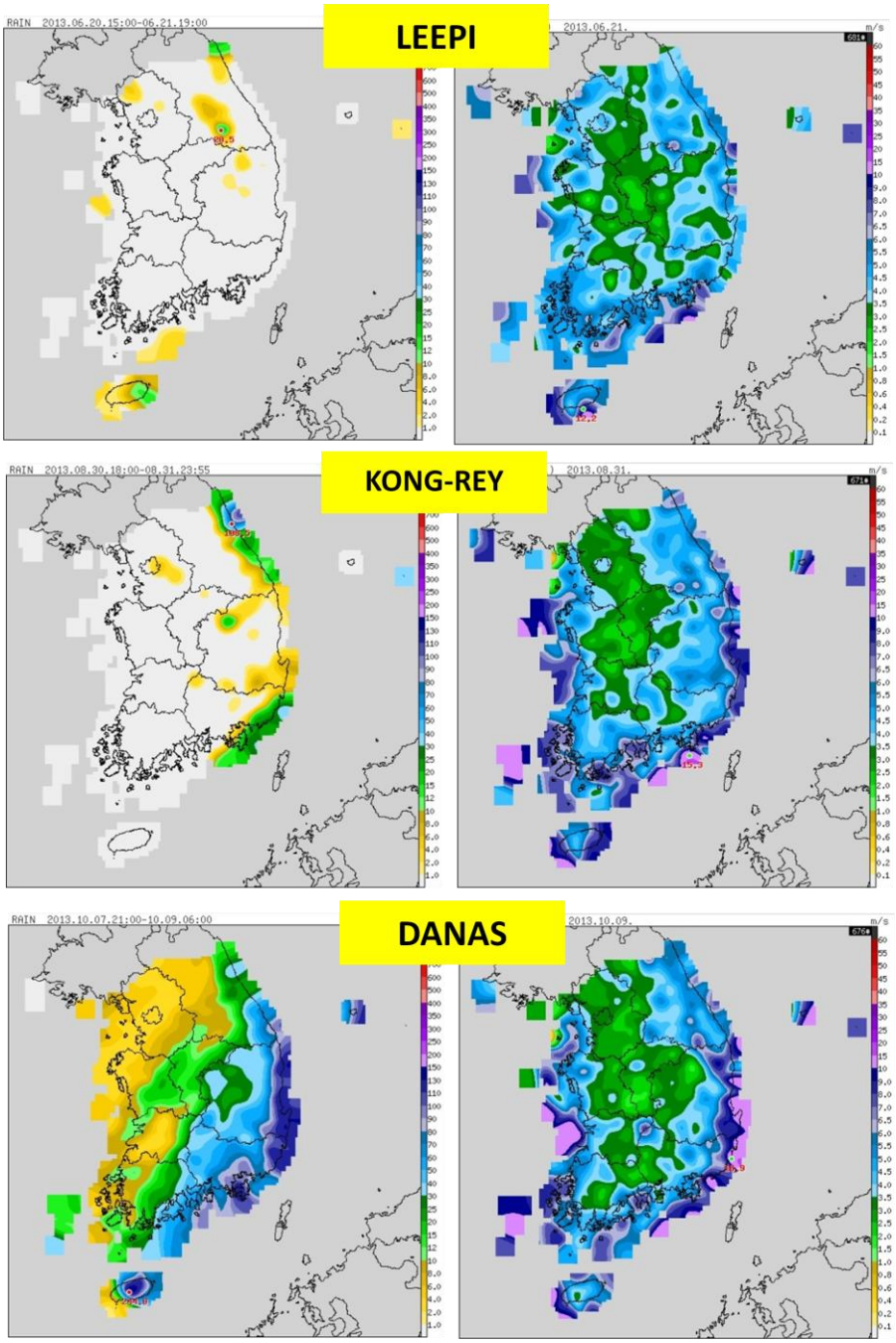

Fig. 1-1-2. Spatial distribution of rainfall(left) and wind gust(right) on the Korean Peninsula affecting typhoons.

2. Hydrological Assessment (highlighting water-related issues/impact)

- In 2013, Typhoon No.4 LEEPI (June), No.15 KONG-REY (August), and No.24 DANAS (October) have passed through the Korean Peninsula. The size and precipitation of these typhoons were smaller compared with other years' events, so that flood watching or warning was not issued and there were few damages.

3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

- In 2013, there was no Typhoon which landed on Korea, however, there was one Typhoon named as DANAS which affected on south part in Korea. The 24th

Typhoon DANAS was formed on 4. October around 360 km northeast of Guam and was expected to head northwest. Typhoon DANAS headed north and passed by the southern port city of Busan. Also, it brought heavy rain and strong gusts of wind to the southern part of Korea. However, there was no significant damages and losses of South Korea. Total damages by Typhoon DANAS are as follow;

4.

(Facility) Scoured breakwater : 50m in Jeju
(Road) Rockslide in two areas of Tongyoung and Ulleungdo
(Street trees) 74 street trees fallen (Busan : 18, Gyungnam : 56)
(Blackout) 22,182 houses

5.

It was evaluated that the governmental long term disaster risk reduction programs (e.g. Comprehensive plan for storm and flood damage reduction and so on.) having been conducted since Typhoon RUSA in 2002, helped local communities build capacity against typhoon-induced disasters. Also, the changes of public awareness on the natural disaster and disaster prevention by information sharing network using social media such as twitter, blogs, and SNS as well as central governmental disaster broadcast system were considered as good practices.

II. Summary of progress in Key Result Areas

Following discussion and recommendations in TC-45, AWG in its meeting in Bangkok in May 2013 has adopted a new Members' report format for input by Members. It is intended that through this new format, Members' report can be more focused and concise. This will in turn lead to the following benefits: (i) reducing paper consumption by controlling the report length; (ii) facilitating the compilation of summary reports at the TC Sessions; and (iii) simplifying the reporting of cross-cutting activities across different components for analyses by the working groups and under different KRAs for AWG's review of the Strategic Plan.

Instructions for input:

(a) Each member should provide NO MORE THAN 15 ITEMS (inclusive of all three components in meteorology, hydrology and DRR) for input, in consideration of the items' relevance to tropical cyclone issues and Typhoon Committee's initiatives (as highlighted in the seven KRAs).

(b) Each item should be no more than two pages, as given in the template attached and using font size of 12. As such, each Members' report should be no more than 30 pages in total. Supplementary material including diagrams or photos should only be included if absolutely essential, and to be appended in separate pages.

(c) Each item may cut across more than one component and may also involve "Training and research" or "Resource mobilization/regional collaboration" aspect. As such, more than one box can be ticked in the summary table at the end of each item input. In this connection, starting this year, no separate input for training and research activities will be called under TRCG. TRCG will collate its report based on the information as given in the summary table.

TC Members' Report
Summary of Progress in KRAs

Title of item:

Main text (one page or less, summarizing the activities and progress made, with diagram or supplementary material to be appended in separate pages if considered essential):

Republic of Korea, National Typhoon Center (NTC), Korea Meteorological Administration
KRA 5 : KMA has launched its first aircraft project for the targeted observation
KRA 6 : Improvement of typhoon information report
KRA 7 : Transfer of TAPS data supporting system to Vietnam
KRA 7 : Capacity Building of Typhoon Analysis and Forecast through the Typhoon Research Fellowship Program
KRA 7 : The 6th China-Korea Joint Workshop on Tropical Cyclones

Republic of Korea, WGH, Han River Flood Control Office(HRFCO), Ministry of Land, Infrastructure and Transport(MOLIT)
In terms of KRA1: *Reduced Loss of Life from Typhoon-related Disaster*, HRFCO has developed the extreme flood forecasting system since 2012 to mitigate flood damages in TC members. This year flood forecasting systems in TC members were assessed and establishment direction of the extreme flood forecasting system was set up through the 2nd field survey in Thailand, Philippines, and Laos for investigation on the past extreme flood data and the current status of forecasting system and water management in each country.
Considering KRA2: *Minimized Typhoon-related Social and Economic Impacts*, the Assessment System of Flood Control Measures (ASFCM) was already established, which is to evaluate various socio-economic factors and estimate the damage cost caused by flood. In 2013, the guideline and manual for ASFCM were written in English to encourage TC members to utilize the system conveniently and the English-version documents will be distributed at the TC session.
In addition, a waterfront zone flood information provision system was developed and this system will contribute to forecast and monitor flood at waterfront areas with more accurate and timely information. This year the system based on GIS and Smartphone was developed and applied in some areas of the Han river basin, and then consequently this system will be expanded to other major basins until 2017.
After the 1st Meeting last year, the 2nd Meeting of TC Working Group on Hydrology (WGH) hosted by the Republic of Korea in October, Seoul was held within the main theme; Extreme Flood and Flood Forecasting System in TC, and it provided an invaluable opportunity for participants from China, Japan, Laos, Malaysia, Philippines, Thailand, and Viet Nam to share information and discuss about extreme flood definition, flood indicators and flood vulnerability assessment in TC member to improve flood disaster risk management in KRA4: *Improved Typhoon-related Disaster Risk Management in Various Sectors*. At the same time, this meeting has contributed to enhance TC's efficiency and international cooperation among members.

Republic of Korea, WGDRR, National Disaster Management Institute (NDMI)

KRA 2 : NDMI established DSI center (see Progress on Key Result Area 4) in August, 2013. During the 24 Typhoon DANAS, DSI set up the procedure for coping with Typhoon disaster.
KRA 4 : Establishment of Disaster Scientific Investigation (DSI) Center in NDMI
KRA 5 : A New Tool for Smarter Disaster Management - Smart Big Board –
KRA 6 : Renewal of Typhoon Committee Disaster Information System (TCDIS)
KRA 7 : 2013 NDMI ODA Project
KRA 7 : The 8th WGDRR Annual Workshop

Identified opportunities/challenges, if any, for further development or collaboration:

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology	Nil	Nil	Nil	Nil	v	v	v
Hydrology	v	v	Nil	v	Nil	v	v
DRR	Nil	v	Nil	v	v	v	v
Training and research	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Resource mobilization or regional collaboration	Nil	Nil	Nil	Nil	Nil	Nil	Nil

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1. **Progress on Key Result Area 1: Reduced Loss of Life from Typhoon-related Disasters.** (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2013 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results
- Nil

b. Hydrological Achievements/Results

The extreme flood forecasting system has been built in2012 as an integrated alternative against extreme flood occurrences to decrease the damages in the member countries of Typhoon Committee. In 2013, the 2nd field survey investigated the past extreme flood occurrences and flood forecasting systems, water management organization, and dam operation record during the flood occurrences in the three countries (Thailand, Philippines and including Laos P.D.R). The status of flood forecasting system of the member countries was investigated and analyzed at the 2nd Meeting of TC WGH. With these activities, flood forecasting system of TC member countries was assessed and establishment direction of the extreme flood forecasting system were set up. In order toanalyze the flood vulnerability of Thailand, Philippines, and Laos, the data from a variety of flood indicators were collected and analyzed. The flood vulnerability of these countries was analyzed by comparing them with Nak-dong river basin of the Republic of Korea.

Extreme flood forecasting system and an extreme flood management plan can be suggested, considering the technological advancement and social/economic conditions of the member countries by means of field survey, status identification of flood forecasting system, and analysis of flood vulnerability.

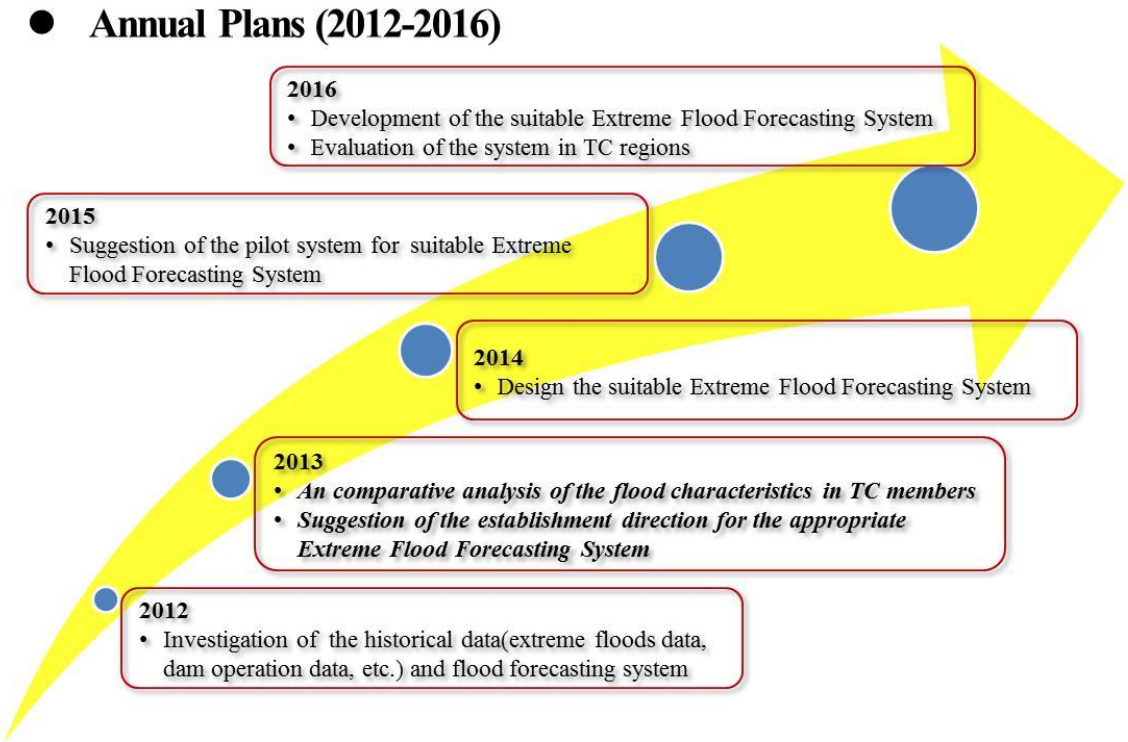


Fig. 1-b-1.Annual plans of extreme flood forecasting system(AOP2)

c. Disaster Risk Reduction Achievements/Results
- Nil

2. **Progress on Key Result Area 2: Minimized Typhoon-related Social and Economic Impacts.** (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2013 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

- Nil

b. Hydrological Achievements/Results

The occurrence of extreme rainfall events caused by global warming and greenhouse effect increases the flood risk and the occurrence of various disasters always causes social cost. When analyzing flood damage, social and economic elements should also be considered in addition to the hydrological aspect. The Republic of Korea established the ASFCM (Assessment System of Flood Control Measures) from 2008 to 2011. This system analyzes/evaluates various social/economic factors and estimates the damage cost during flood occurrences. The guideline and manual for ASFCM were prepared and should be improved in English so that member countries will be able to conveniently utilize the ASFCM.

The guideline will be published and distributed at the 46thTC annual session. A technical report will also be published in 2014 after finishing the revision of the user manual and the addition of the application cases of member countries.

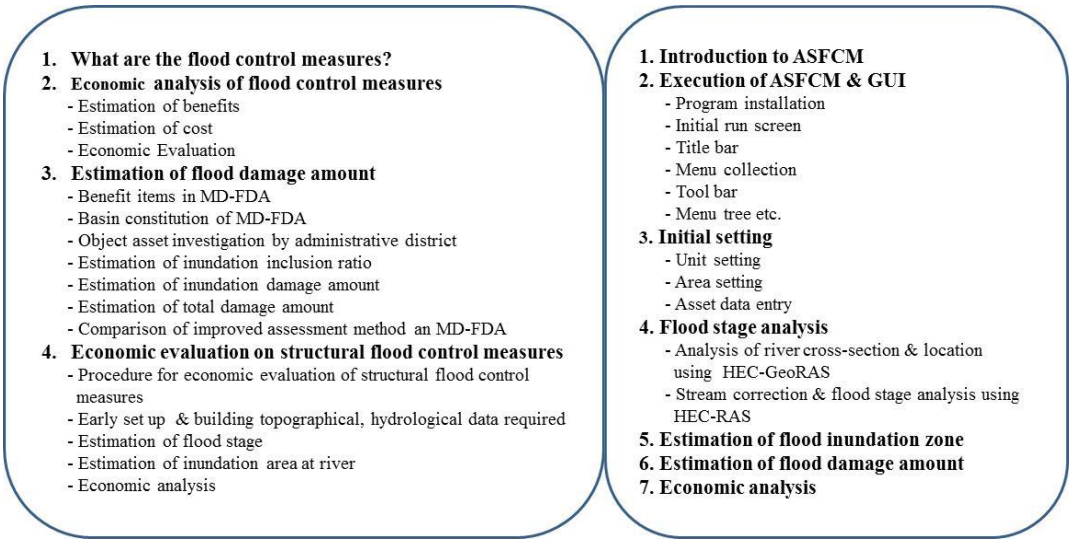


Fig. 2-b-1. Table of contents —Structural Flood Control Evaluation Work Guideline and Flood Control Evaluation System User Manual

c. Disaster Risk Reduction Achievements/Results

NDMI established DSI center (see Progress on Key Result Area 4) in August, 2013. During the 24 Typhoon DANAS, DSI set up the procedure for coping with Typhoon disaster. Following figures show Typhoon alert process. Level 1 represents that typhoon is occurred and Level 2 is the level for forecasting the direction of Typhoon. In Level 3, Typhoon is entering to the area where Typhoon can affect on Korea. Level 4 is issued when Typhoon is landed.

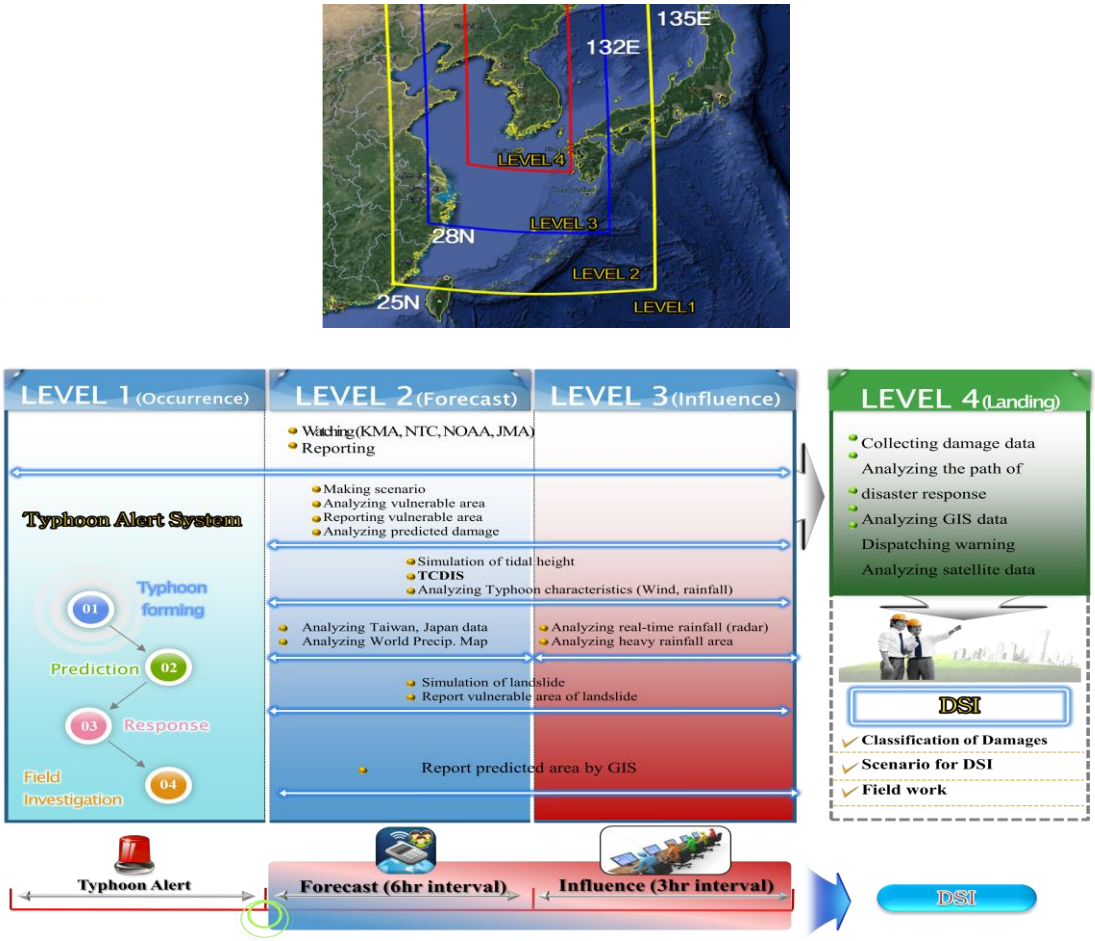


Fig. 2-c-1. Typhoon Alert Process

During the 24th Typhoon DANAS, NDMI analyzed the risk of DANAS by similar typhoon tracking. As a result of the analysis, 4 Typhoons in the past were selected as the 29th SETH(1994), the 15th MEGI(2004), the 18th SONGDA(2004), and the 14th NABI(2005). In the case of the 29th Typhoon SETH(1994), it shows the similarity among Typhoon which occurred in October. MEGI, SONGDA, and NABI have the similarity of the strength and direction.

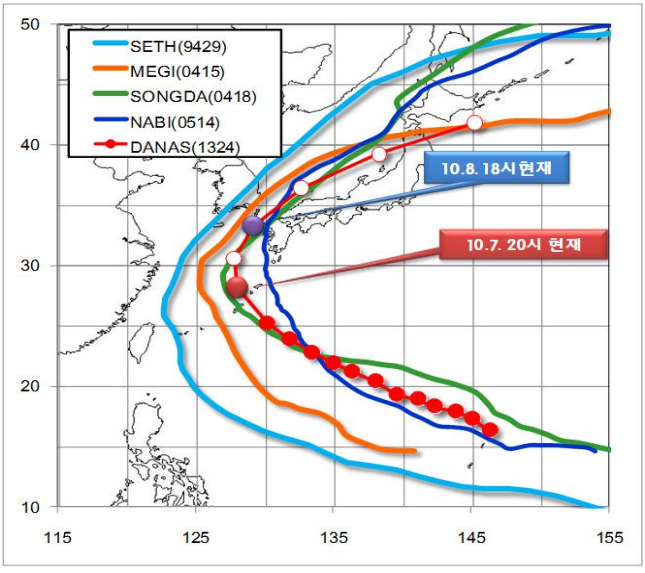


Fig. 2-c-2. Similar Typhoon Tracking

After finding the similar Typhoons, damages data for past Typhoons were selected and analyzed geographically.

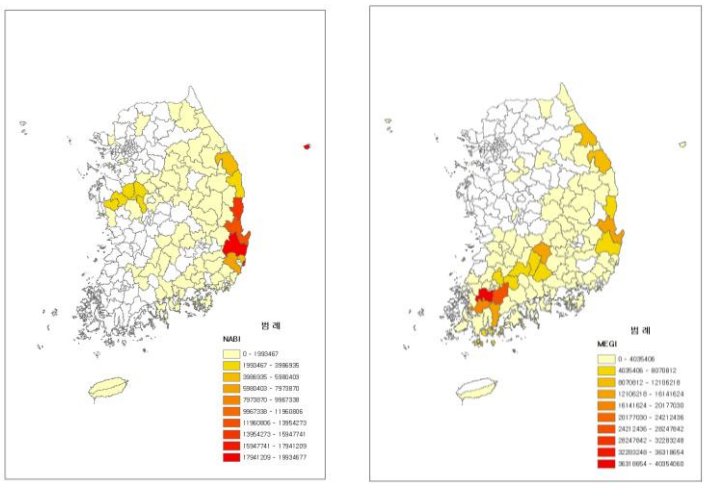


Fig. 2-c-3. Damage Distribution of Typhoon MEGI(L) and NABI(R)

3. **Progress on Key Result Area 3: Enhanced Beneficial Typhoon-related Effects for the Betterment of Quality of life.**(List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2013 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results
- Nil

b. Hydrological Achievements/Results
- Nil

c. Disaster Risk Reduction Achievements/Results
- Nil

4. **Progress on Key Result Area 4: Improved Typhoon-related Disaster Risk Management in Various Sectors**. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2013Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results
- Nil

b. Hydrological Achievements/Results

It is being reported that extreme rainfall events occur, rainfall intensity increases at the same frequency, and flood discharge of basin also increases because of climate change.

An extreme flood is an instance that has never occurred before. There is no clear definition for extreme flood until now. A suggestion on the definition of extreme flood was given after an analysis is conducted on its hydrological, social, and economic aspects. However, the conclusion formulated atthe2nd Meeting of TC WGH declared that the definition should be made in a general and more comprehensive way while the detail contents should be covered by including an analysis process in the extreme flood management guideline.

As the next step to define the extreme flood, flood indicators were selected and flood vulnerability would be analyzed in order to identify the flood response capability of TC member countries.

In addition, the2nd Meeting of TC WGH was held where member countries exchanged opinions about the extreme flood management plan, and user demand was analyzed. In 2014, structural and non structural extreme flood management plan will be established and the draft for its guideline will be prepared based on the research result of 2013.

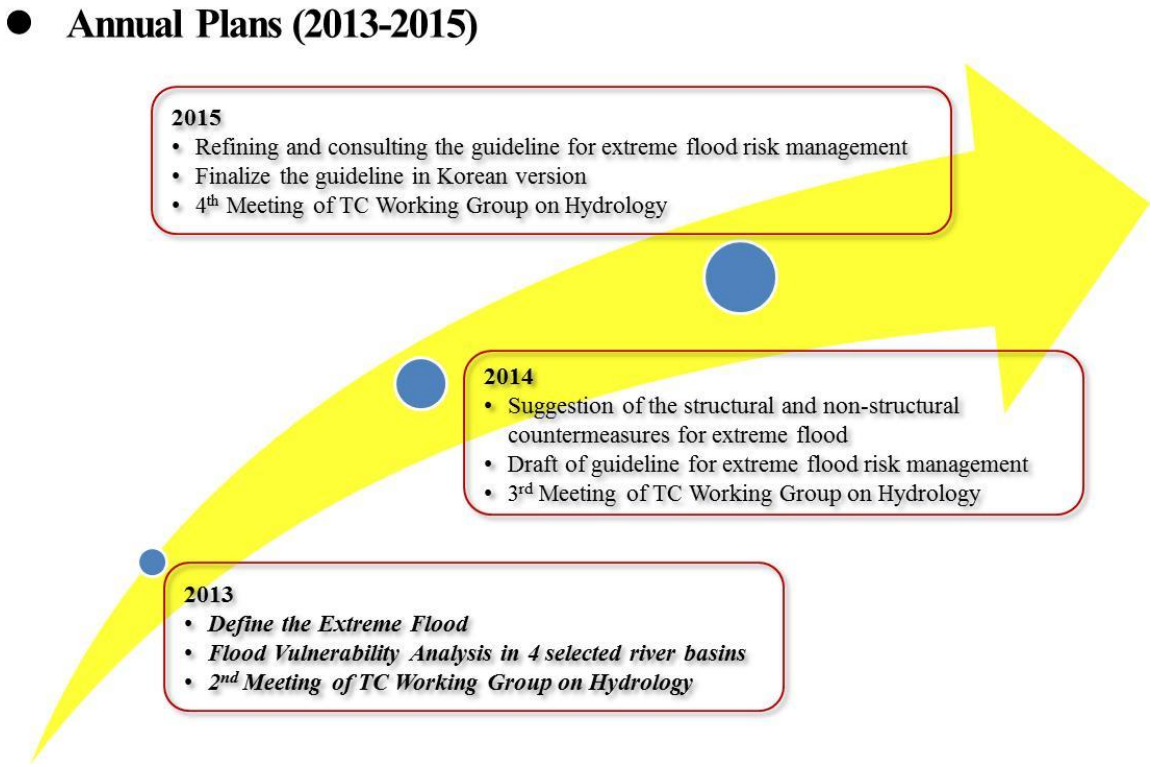


Fig. 4-b-1.Annual research content of extreme flood management guideline(AOP6)

c. Disaster Risk Reduction Achievements/Results

■ Establishment of Disaster Scientific Investigation (DSI) Center in NDMI

Even though there is Central Disaster Investigation and Assessment Council in Korea, there is often a lack of objectivity in assessing the cause of disaster and also, it takes often long time to report the disaster situation. Clarification of disaster cause by objective standard should be performed quickly throughout special team which is organized by disaster expert group. For this reason, NDMI established 'Disaster: Scientific Investigation (DSI)' center in August, 2013.

Main tasks of DSI center are as follow;

·Prevention of disaster recurrence and minimization of disaster damage throughout objective clarification of disaster causes based on scientific investigation

·Improvement of disaster management system

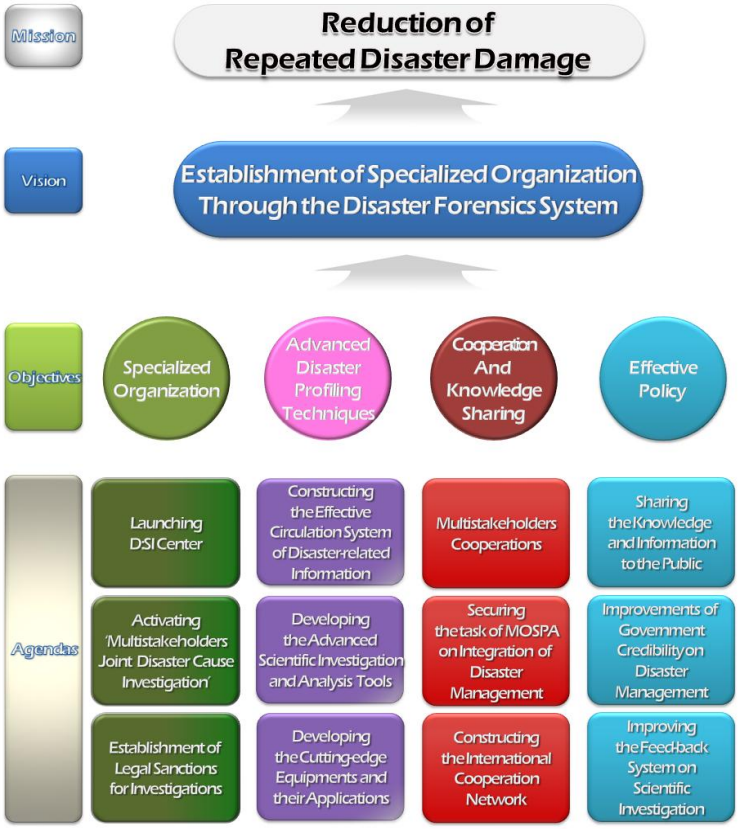


Fig. 4-b-1.DSI Vision and Main Objectives

DSI center consists of disaster assessment team, cause analysis team, and field investigation team. When disaster occurs, each team performs the analysis of disaster risk by scientific technique and field investigation with high-tech investigation tools such as UAV (Unmanned Aerial Vehicle) and satellite. Strategies for operating DSI center are as follow;

Strategy 1. Development of disaster profiling technique

- Data standardization of existing external data for systematic data management
- Standardization of disaster assessment procedure
- Objective and scientific cause analysis by high-tech investigation tools

(1) Development of Disaster Information-Data Ware House)

○ Data standardization for integrated data management

- Connection and sharing existing data which are created by different institutes such as KMA, HRFCO

(2) Development of Disaster Forensics/Disaster Profiling techniques

○ Development of the procedure for systematic disaster cause investigation

- Development of investigation techniques and manuals by different types of disasters for the standardization of tasks

○ Establishment of reporting structure based on mobile and real-time data transmission system to situation room

○ Post evaluation of disaster policy performance

- Economic analysis for different types of disasters

(3) Development of high-tech investigation tools

○ Prehension of disaster damages occurred in inaccessible areas

※ MMS(Multimedia Messaging Service), UAV(Unmanned Aerial Vehicle), CCTV, GPS, etc.

○ Simulation and 3-D visualization of disaster risks and exposed facilities to disaster
※ BIM(Building Information Model)
○ Development of auto reporting based on IT

Strategy 2. Data sharing and Collaboration with related organizations

- Establishment of the collaboration with related organizations
- Disaster data accumulation and management
- Expansion of international cooperation for scientific investigation

(1) Collaboration with related organizations
○ Activities of disaster cause investigation council
- Establishment of disaster cause investigation council (MOSPA, CSI)
○ Integration of the data of disaster and safety accident which are managed by different organizations
- Establishment of the collaboration with related organizations for different types of disasters
(2) Function of the director for disaster management
○ Accumulation and management of data for disaster cause and damage
- Management of disaster scene data, analysis data, and reports
- Development of effective management skill through the standardization of the data of different types of disasters
(3) International cooperation research
○ Introduction of know-how for enhancement of high-tech investigation tools
○ Expansion of international cooperation for advanced policy related to disaster and safety accidents

Strategy 3. Development of effective disaster policy through disaster scientific investigation

- Investigation of underlying causes of disaster and establishment of permanent measures
- Improvement of the reliability among public, government, and disaster management institutes
- Providing the field for information sharing with the public

(1) Data sharing with citizen participation
○ Publication of annual DSI report and holding a public hearing
○ Analysis of disaster causes and occurrence tendency by nationwide service
- Open information of the statistic data of disaster cause analysis
(2) Improvement of the governmental reliability
○ Presentation of quantitative assessment results
- Quantitative results by data standardization
(3) Improvement of feedback system of DSI
○ Improvement of standard operation plan (SOP) for investigation, analysis, and assessment
○ Analysis of the performance benefic of recommendation by DSI

5. **Progress on Key Result Area 5: Strengthened Resilience of Communities to Typhoon-related Disasters.**(List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2013 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

■ KMA has launched its first aircraft project for the targeted observation

Since 2012, KMA has begun the observation aircraft project for the purpose of severe weather observation, the precipitation enhancement experiment, and the characterization of the atmospheric climate change components. In May 2013, KMA has made up the contract of its first aircraft procurement with the bidder of Daejoo ENT (Korea) and SPEC (US) consortium. According to the contract, an aircraft, BeechCraft King Air 350 H/W that is already widely used in atmospheric research area, will be delivered to Korea by the end of 2015. KMA's aircraft will be equipped with 14 kinds of instruments at the wings, fuselage, and inside, which include a dropsonde system, glaciogenic and hygroscopic cloud seeding systems, four kinds of cloud physical property measurement systems, and atmospheric aerosol and pollutant gas monitoring systems. As the main purpose of this project is to observe the severe weather phenomena, this aircraft is going to fly over the seas around Korea peninsula and approach close to the upcoming storm systems as far as safety conditions permit. And it will also contribute atmospheric sciences and climate change monitoring. From the year of 2016, it is expected that KMA would produce three dimensional targeted observation data from this aircraft and these would be shared openly for regional or international operation and research purpose.

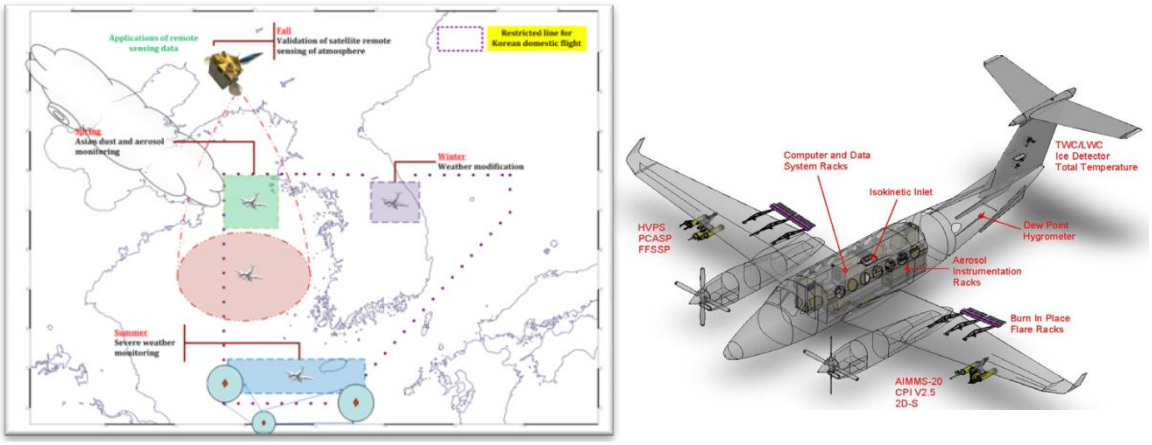


Fig. 5-a-1. (left) Schematics of the aircraft operation over the Korea peninsula, (right) a preliminary design of equipment installation onto King Air 350 H/W aircraft to be procured by KMA

b. Hydrological Achievements/Results

- Nil

c. Disaster Risk Reduction Achievements/Results

■ A New Tool for Smarter Disaster Management - Smart Big Board -

Many current disaster control headquarters often lack enough information for Disaster Status Management (DSM) due to financial, administrative and technical restrictions. Particularly, it is regarded as being nearly impossible to implement an integrated monitoring and analysis platform, because information sources available for a DSM are scattered in many authorities and organizations. Therefore, the National Disaster Management Institute (NDMI) started a project to develop the Smart Big Board (SBB) to improve such situation. It is intended to make effective monitoring and warning for multi disaster situations by maximizing the use of real-time field oriented information.

The SBB can be characterized as three parts. The first is the integrity of existing disaster information such as weather, CCTV and disaster history via multi data base sharing technique. The second is the utilization of big-data represented by Twitter for inspiring public participation by networking of human-sensored disaster information. Lastly, various spatial data from satellite, unmanned aerial vehicle (UAV) and mobile mapping system (MMS) are

combined to obtain multi-scale disaster scene information. The basic contents and pilot tests were completed. Currently it is expecting to complete the SBB by application verifications and various component developments.

(1) Background and Objectives

○ Lack of enough information for Disaster Status Management

○ Difficulty for implementing an integrated monitoring and analysis platform

○ NDMI (National Disaster Management Institute) started a project to develop the Smart Big Board

- To make effective monitoring and warning for multi disaster situations by maximizing the used of real-time field oriented information

Fig. 5-c-1. Smart Big Board

Item	AS-IS	TO-BE
Data utilization	Use of individual data (e.g. CCTV, weather report)	Integrating individual data
Status decision	Empirical decision	Analyses based on simulation
Warning system	Uniform warning depending on the Metrological Agency	Smart warning considering localities
Field information source	The mass media such as TV and news	Various spatial information (e.g. satellite, UAV and MMS)
Display	Mainly paper work such as report	GIS map by local based service
Method for Public-private partnership	Almost no	Two way communication by SNS

(2) Expectation and Future work

○ SBB allows effective performance for disaster relief activities

○ It is expecting to complete SBB by application verifications and various component development

6. **Progress on Key Result Area 6: Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats.**(List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

■ Improvement of typhoon information report

Notices of typhoons were improved to enhance the awareness of the uncertainty of real time locations of typhoons and improve the legibility of typhoon information.

To improve the legibility of notices of typhoons, the radius of strong winds(15m/s or higher) and the radius of 70% probability(70% of forecast errors) were improved in expression method from complicated rounds to shadow forms and the 70% radius of 70% probability was applied with updated data for the last three years(2010-2012). When the uncertainty of the center position is high, an inserted phrase will be provided as follows; “Please be careful since the typhoon is being weakened and thus the uncertainty of the location of the typhoon is high”.

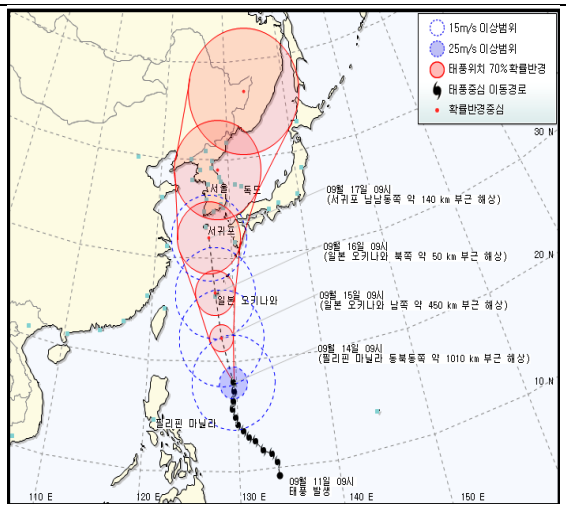
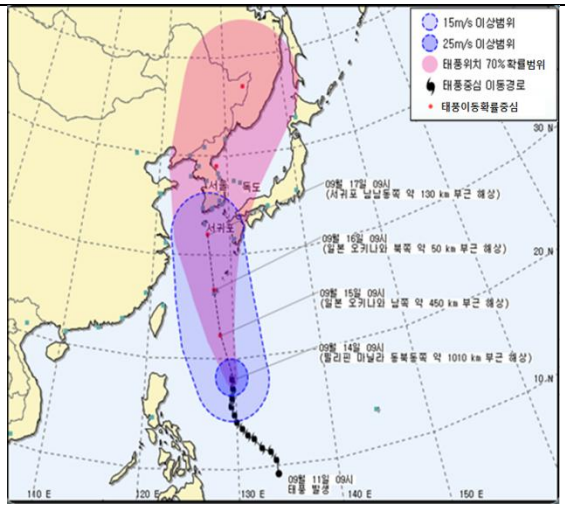
Before	**After**
	

Fig. 6-a-1. Comparison of before and after of improvement of typhoon information report.

b. Hydrological Achievements/Results

The risk of flood damage is increasing because the accessibility to river increases and more waterfront facilities are built in the rivers. Accordingly, a response system for such damage was urgently required. A waterfront zone flood information provision system was built by selecting application areas and linking it to existing systems, such as flood forecast model and flood information system.The new system enables the forecasting and monitoring of flood at waterfront areas as well as in various parts of the rivers.

In 2013, a waterfront zone flooding forecast information system based on GIS and smart phone was developed for the section from Ipo dammed pool to Yeoju dammed pool in the Han river basin that includes functional camping ground for leisure, ecological camping ground, parking ground for cars, and ecological wetland park. This system will be expanded to Han river, Yeongsan river, Nakdong river and Geum river until 2017.

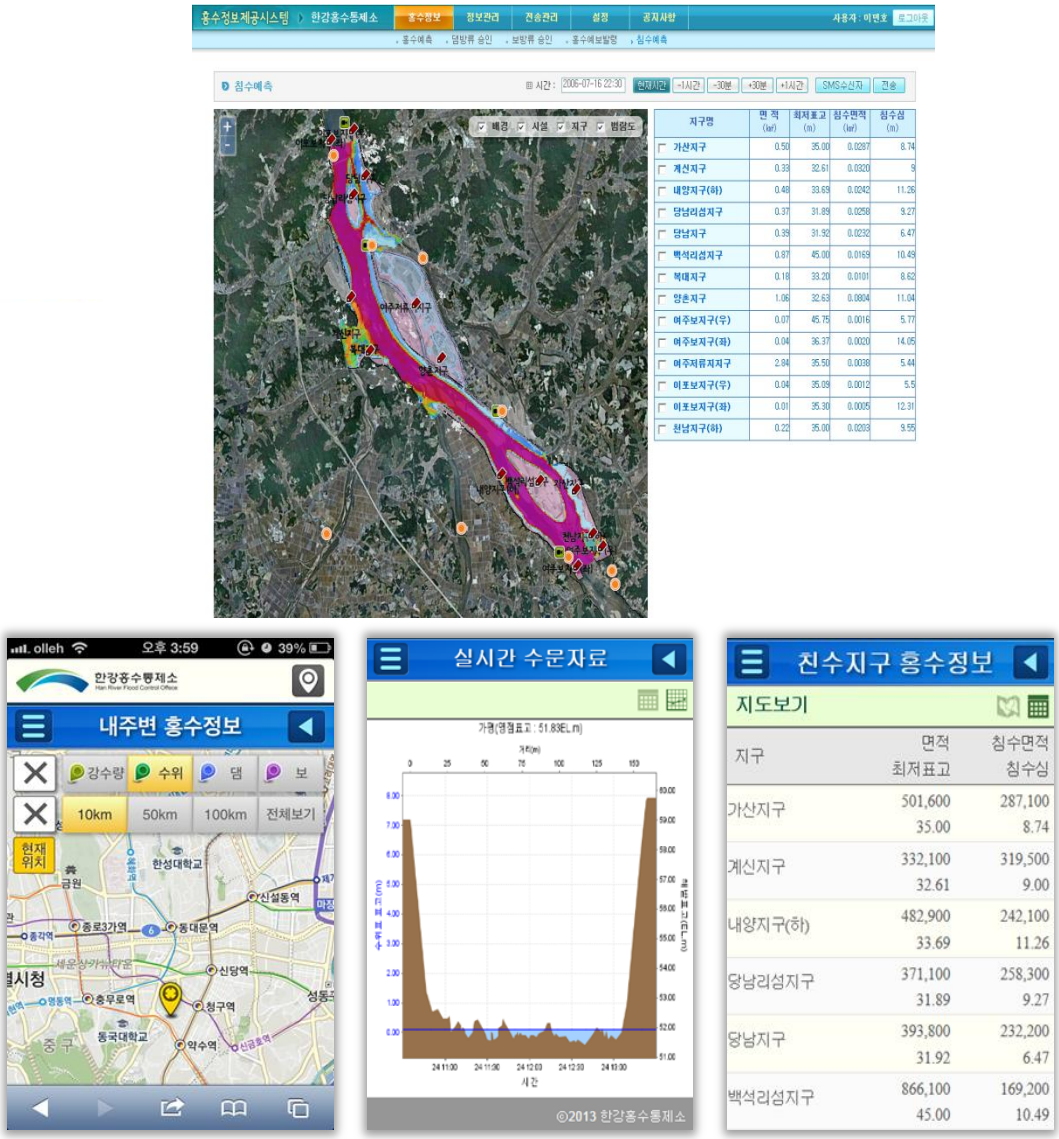


Fig. 6-b-1. Real-time typhoon-related information provision

c. Disaster Risk Reduction Achievements/Results

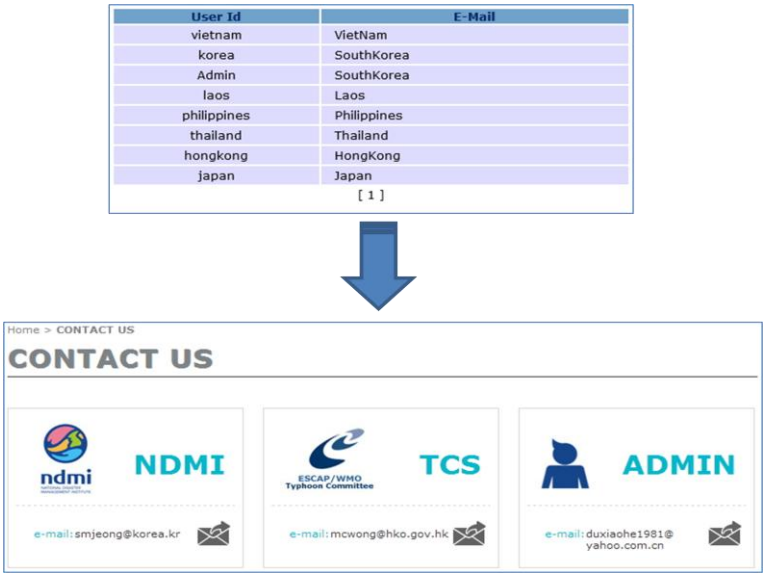
■ Renewal of Typhoon Committee Disaster Information System (TCDIS)

TCDIS (Typhoon Committee Disaster Information System) has been developed since 2009 for sharing disaster information with member countries throughout disaster management portal site. However, there is operational degradation by a lack of continuous management and it has the difficulty to access the system because TCDIS website can be only operated in Window Explorer. Also, even though similar typhoon tracking option in TCDIS could be applied to various fields related to disaster risk management, usability of the system is low because of overload of the system. For these reasons, NDMI has been started the work for upgrading TCDIS since 2012.

(1) Changes in the design of TCDIS

Past TCDIS included the system of Active-X, so, there was the limitation for users to access the system. In renewed TCDIS, cross browsing environment is developed and users can access the system through any web browsers such as Google Chrome, Fire Fox, and Window Explorer. Also, design of TCDIS website is changed. Simplicity is emphasized and it is easier for users to assess the system and find the information in renewed TCDIS than in past TCDIS website.

Fig. 6-c-1. Past TCDIS(L) and Renewed TCDIS(R)



User Id	E-Mail
vietnam	VietNam
korea	SouthKorea
Admin	SouthKorea
laos	Laos
philippines	Philippines
thailand	Thailand
hongkong	HongKong
japan	Japan

[1]

Fig. 6-c-2. Renewed category menu in TCDIS

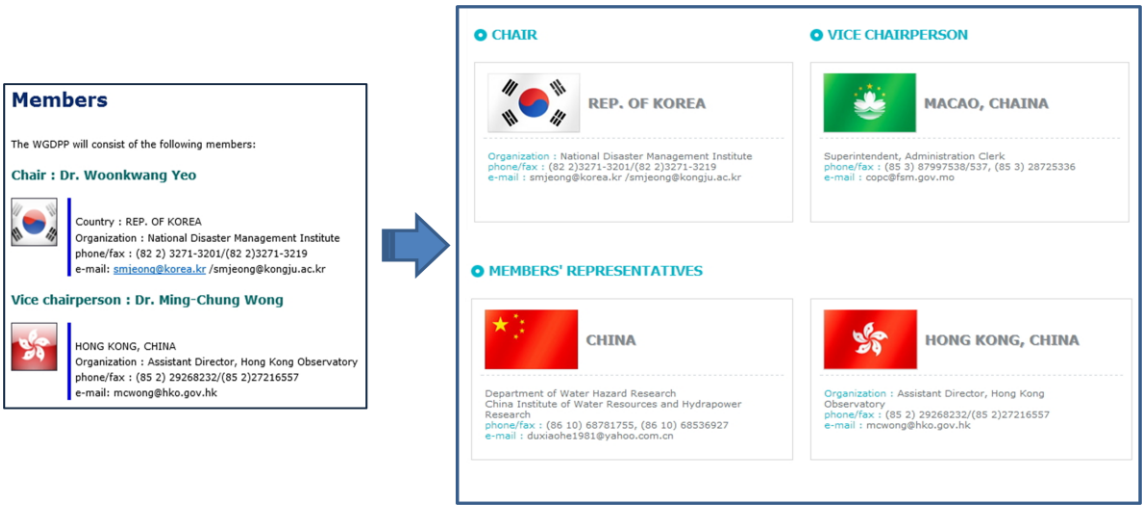


Fig. 6-c-3. Introduction of member countries in renewed TCDIS

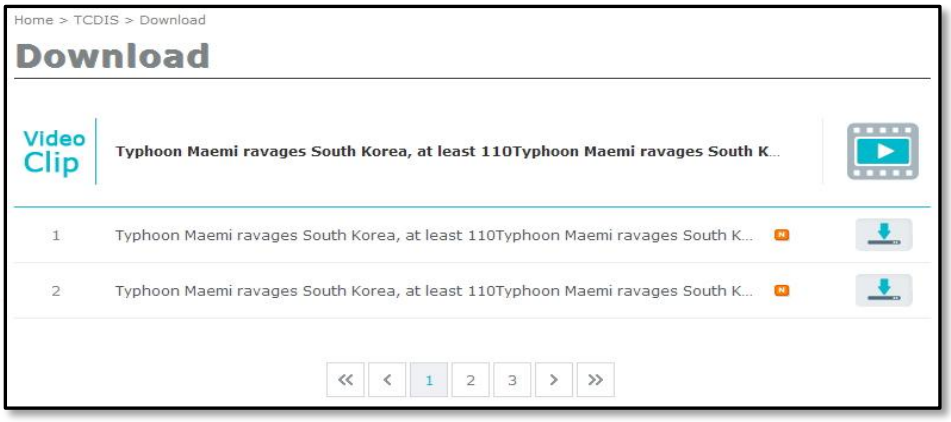


Fig. 6-c-4. Download tap for disaster information in renewed TCDIS

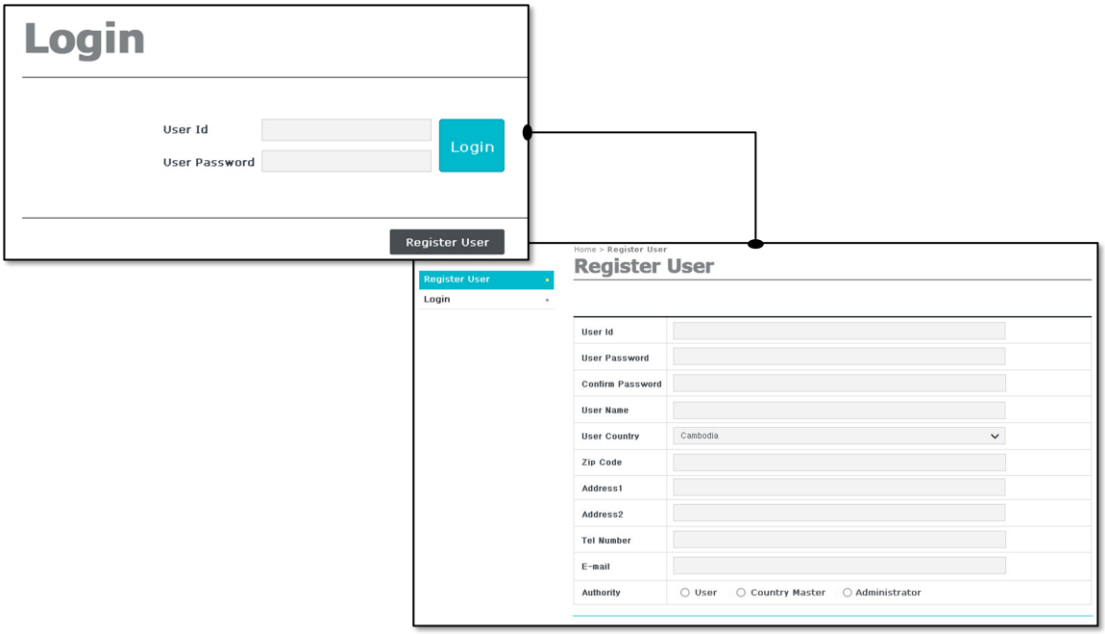


Fig. 6-c-5. Login menu and account management

(2) Changes in search option of past Typhoon in TCDIS

Search option of past similar Typhoon is primary tool in TCDIS. However, in past TCDIS, there are many limitations of use such as low speed by overload of the system, limited web browsing. Also, in past TCDIS, data of past Typhoon include all Typhoons since 1950 and this makes the speed and accuracy of the system is lowed. So, in renewed TCDIS, affected Typhoons are defined to each member country and TCDIS uses different past Typhoon information for different member country to reduce the overload of the system. In case of search algorithm in past TCDIS, it used 4 data of central pressure, wind speed, location of Typhoon, and direction. However, in this case, because of the combination of various parameters, it might be the problem of the accuracy for finding similar past Typhoon. For this reason, in renewed TCDIS, users can choose each data. For example, if user would like to consider only direction for searching similar past Typhoon, user can choose only direction.

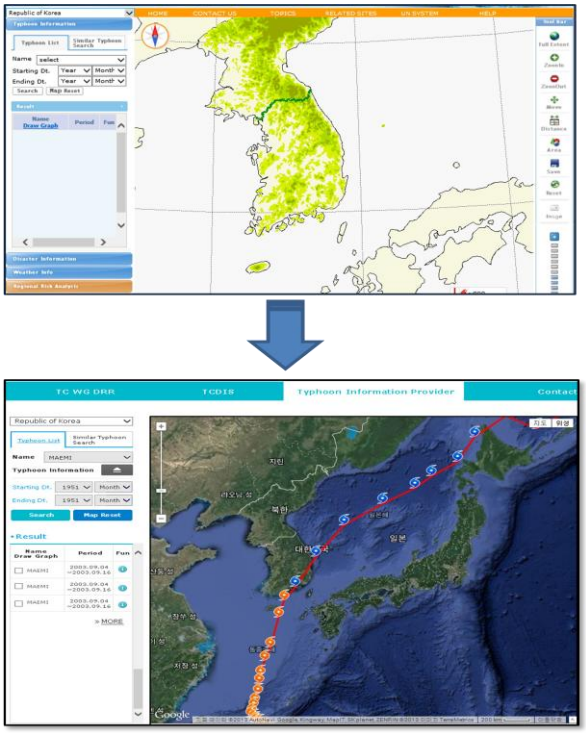


Fig. 6-c-6. Changed design in renewed TCDIS

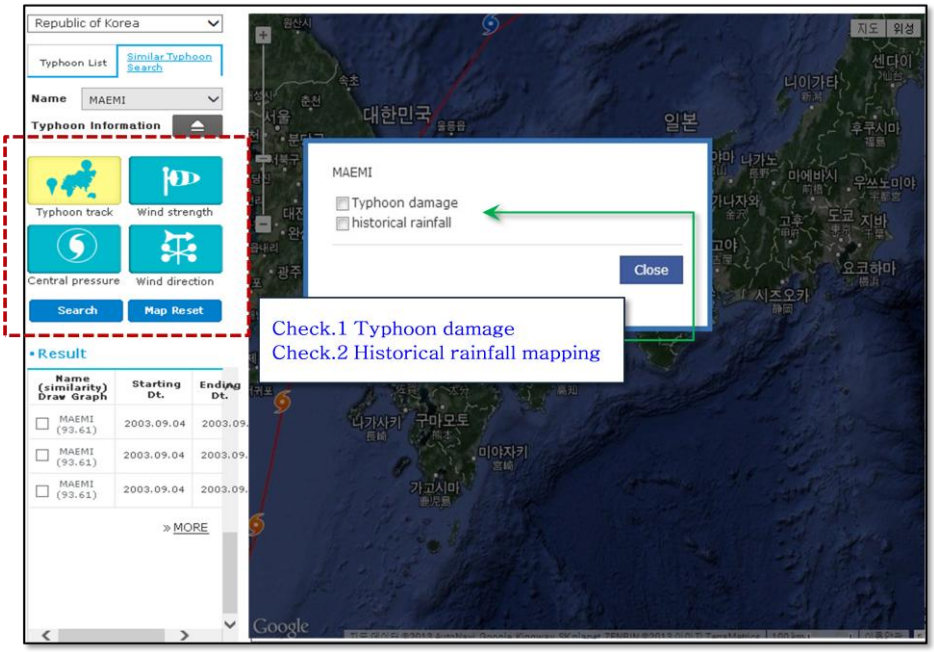


Fig. 6-c-7. Search option in renewed TCDIS

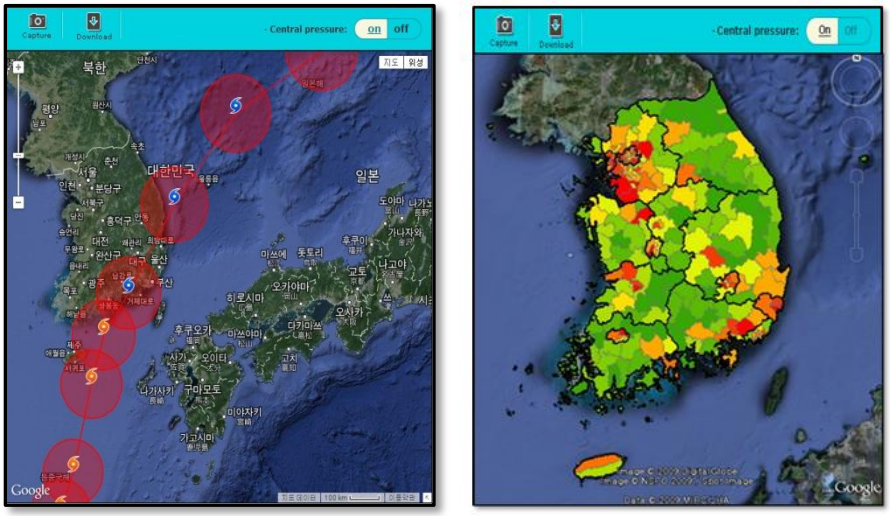


Fig. 6-c-8. Display of central pressure, direction (L) and damaged area (R)

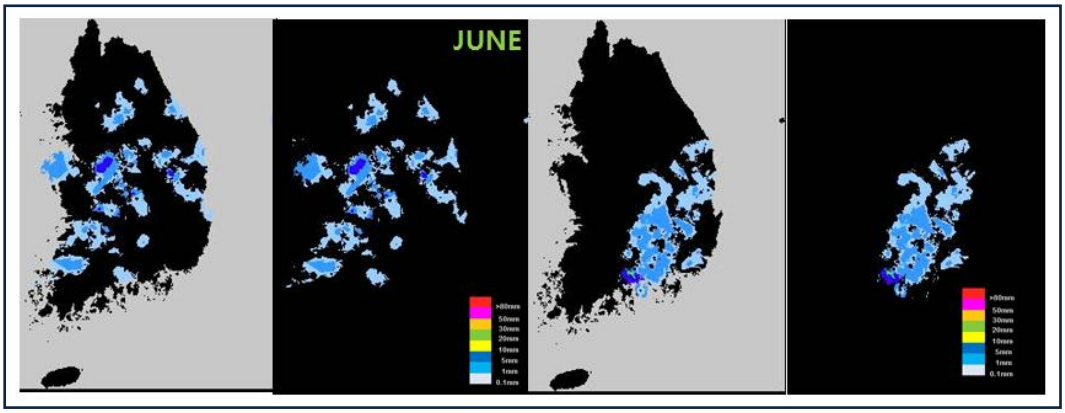


Fig. 6-c-9. Display of rainfall distribution during past Typhoon

7. **Progress on Key Result Area 7: Enhanced Typhoon Committee's Effectiveness, Efficiency and International Collaboration.**(List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

■ **The 6th China-Korea joint workshop on tropical cyclones**

Staffs of National Typhoon Center/KMA participated and made presentations in the 6th China-Korea Joint Workshop on Tropical Cyclones held in Shanghai Typhoon Institute in China on May 27 and 28. In the workshop, approximately 30 presentations were made under the themes of typhoon models, typhoon analyses using satellite data, and typhoon climates. After the presentations, the two countries agreed to exchange the newest typhoon analysis and forecast technologies and promised to jointly cope with typhoons that would occur later. On May 29 and 30, the staffs of National Typhoon Center/KMA visited Zhejiang Meteorological Observatory, Zhejiang Institute of Meteorological Science, and Zhejiang Lightning Protection Centre to identified the present state of meteorological forecast science and thunderbolt stroke alarms in Zhejiang Province. On May 31, the last day, the staffs of National Typhoon Center/KMA visited the head office of the Meteorological Office in Beijing, China to discuss measures to cope with typhoon disasters and dangers and the present state of use of typhoon prediction models. In that visit, measures to quickly exchange typhoon forecast information between the two countries were prepared such as the establishment of a hot line between the Meteorological Office in China and National Typhoon Center/KMA

Fig. 7-a-2. (upper) Discussion with Shanghai Typhoon Institute and (lower) Typhoon and Marine Weather Forecasting Center.

■ Capacity building of typhoon analysis and forecasting through the typhoon research fellowship program

The 2013 Typhoon Research Fellowship Program, as part of the Training and Research Coordination Group (TRCG) Fellowship Program of the ESCAP/WMO Typhoon Committee was successfully completed. Three typhoon forecasters who are from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Vietnam National Center for Hydro-Meteorological Forecasting (NCHMF), and the Thailand Meteorological Department (TMD) were trained during two months (1 May to 30 June 2013) by the staffs of the National Typhoon Center of the Korea Meteorological Administration (NTC/KMA). The trainees carried out training and research on optimizing typhoon forecast using TAPS as well as on Development of method of typhoon intensity and track forecast using model ensemble, Development of correction method of typhoon model track forecast bias according to synoptic pattern, and Analysis of synoptic feature and typhoon model forecast error on anomalous typhoon tracks. They performed enthusiastically their missions, drafting a training report in spite of the short period. They improved their typhoon analysis and forecast skill as well as shared their ideas and plans for applying the TAPS system. Since 2011, the NTC/KMA had carried out the Fellowship Program for a number of typhoon experts from Asian countries. The Fellowship Program will be continued in the next year in the beautiful Jeju island of South Korea where the NTC/KMA are located (the period may be from May to June). Overall expenses (including round-trip ticket and living expense during their stay (if available, accommodation) will be supported by the KMA. The circular letter or offering the KMA's fellowship will be sent to the members by the TCS at least one month before the commencement. Anyone who has an operational experience of TC forecast can apply to the fellowship.

Fig. 7-a-2. Three experts awarded the Typhoon Research Fellowship in 2013.

■ Transfer of typhoon analysis and prediction System (TAPS) data supporting system to Vietnam

For effective support of TAPS operation of Vietnam, Vietnam made a request of additional outgoing of data that Korea Meteorological Administration (KMA) has (2012.6). The old TAPS server was removed in computer resources center in KMA and then the TAPS data supporting system server to provide to Vietnam of KMA′s data that optimized in TAPS was constructed (2013.6). The TAPS data supporting system server in computer resources center/KMA was installed (2013.6). The webpage to support Vietnam and linkage to TAPS was constructed (2013.7). The constructed webpage and test on stabilization was performed (2013.8-10). Experts on TAPS data supporting system to Vietnam and the construction of computer environment was dispatched for the period from November 11 to 14.

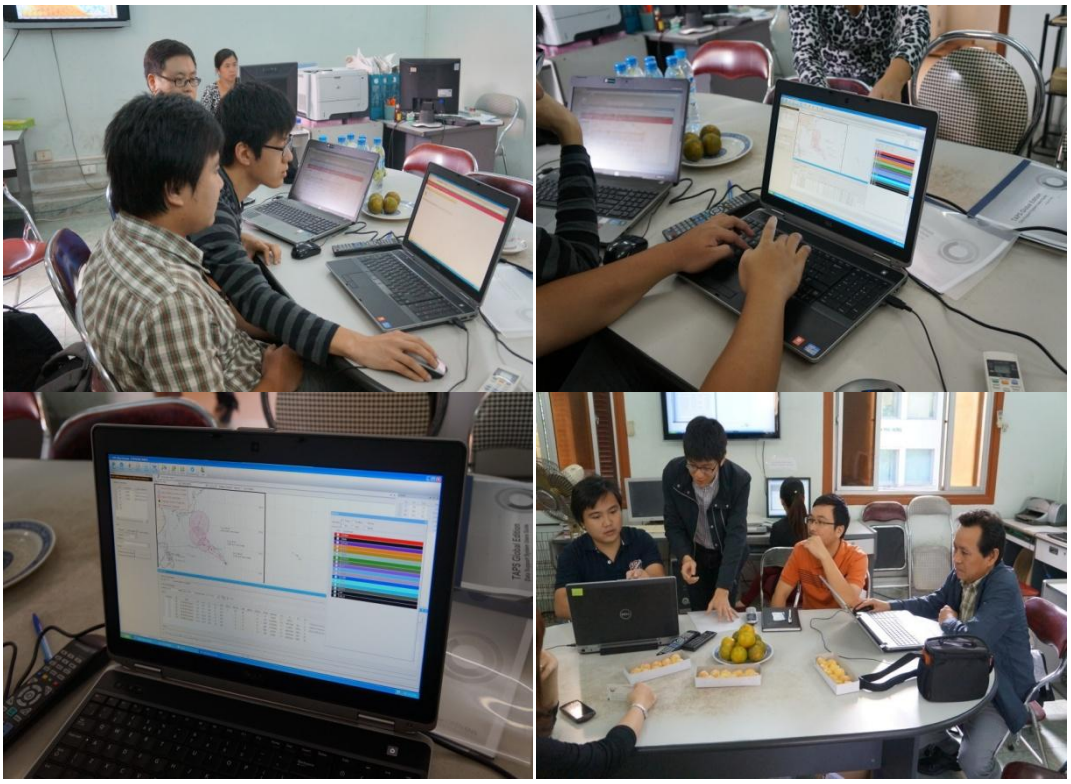


Fig. 7-a-3. Photos of visit to National Center for Hydro-Meteorological Forecasting (NCHMF) of Vietnam

b. Hydrological Achievements/Results

After the 1st Meeting of TC WGH in 2012, the 2nd UNESCAP/WMO Typhoon Committee Meeting of TC WGH was held at Han River Flood Control Office of the Republic of Korea from October 14–17, 2013. With the theme, ‘Extreme flood and flood forecasting system of the member countries of the Typhoon Committee’, it was participated by the22 delegates from

the member countries (Japan, Korea, Laos, Malaysia, Philippine, Thailand, Vietnam), Typhoon Committee Secretariat, etc. An in-depth discussion went on about the status of flood forecasting system and 2013 AOP activities. It is expected that the results of the meeting will make a big contribution in the water resource management and disaster forecast of the member countries.

Fig. 7-b-1.Participant in the 2nd meeting of TC WGH

The web-page for TC Working Group on Hydrology (WGH) was developed to share opinions and exchange data among TC member countries (please visit to http://tcwgh.hrfco.go.kr). All of members can find and download the documents of TC Sessions, Integrated Workshops, and AOP activities operated by TC WGH.

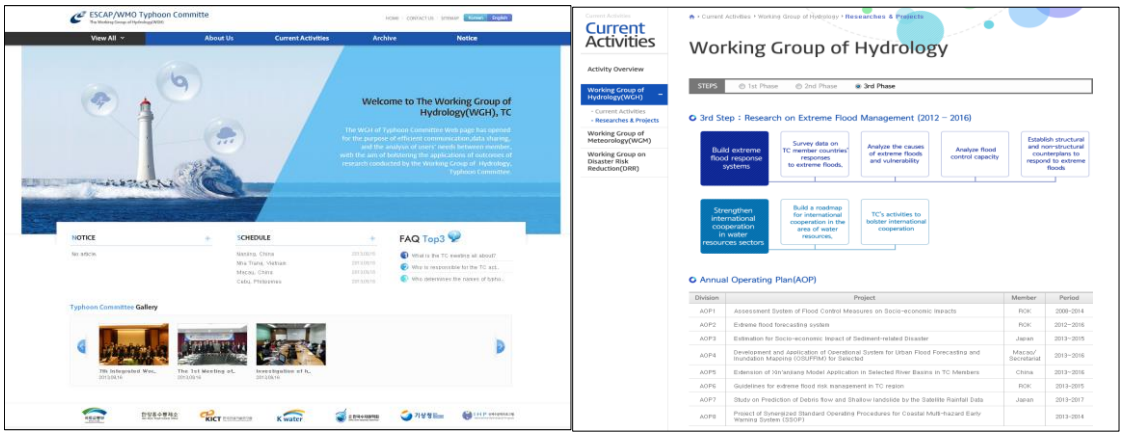


Fig. 7-b-2.TC WGH Web-page

c. Disaster Risk Reduction Achievements/Results

■ 2013 NDMI ODA Project

Introductions

The 1st ODA project currently being performed by NDMI is named as 'Northern Mindanao Project.' With the damage by Typhoon WASHI in Philippines as a momentum, the Working Group on DRR was asked for the field investigation on the 44th meeting of Typhoon Committee, 2nd of Dec. The WGDRR established and proposed the mid-long plan for countermeasures on the Typhoon induced disaster risk reduction, particularly storm and flash flood, through the field investigation and cause analysis. PAGASA asked to establish the Flash Flood Alert System (FFAS) customized for the Mindanao Island. In 2013, NDMI launched the

1st ODA project on DRR for Cagayan de Oro, Mindanao Island, including the installation of Automatic Rainfall Warning System (ARWS) and the construction of Flash Flood Alert System customized for Cagayan de Oro River Basin in Northern Mindanao Island where were enormous damage caused by Typhoon WASHI.

Fig. 7-c-1. Project Area (L) and pictures (R) on damages due to Typhoon 'WASHI'

In this project of 3 years, the first year's project concentrates on the selection of pilot area, the installation of Automatic Rainfall Warning System, the test operation of Flash Flood Alert System, and the education and training of their operations for the public officers in Philippines. In the second year's project, rain and water stage gages are installed for more accurate Flash Flood Alert System operation. Finally, in the last year, the Automatic Rainfall Warning Systems will be added and the criterion on flood warning for the Mindanao Island is proposed and established.

Field investigation for installing Flash Flood Alert System (FFAS) and Automatic Rainfall Warning System (ARWS) in Philippines

Field investigation for installing Flash Flood Alert System and Automatic Rainfall Warning System in Philippines was performed for checking (1) the computational resources, (2) the appropriate locations for Automatic Rainfall Warning System installations, (3) the status of rain and water level gages currently being operated by PAGASA, and so on. Through several discussions by NDMI, TCS, ESCAP, and PAGASA, NDMI established the plan for their installation plan including the design of system and facilities based on possible resources and technique.

Fig. 7-c-2. Discussion on the computational circumstances for operating the flash flood alert system

Fig. 7-c-3. Investigation of candidate sites for installation of the automatic rainfall warning system

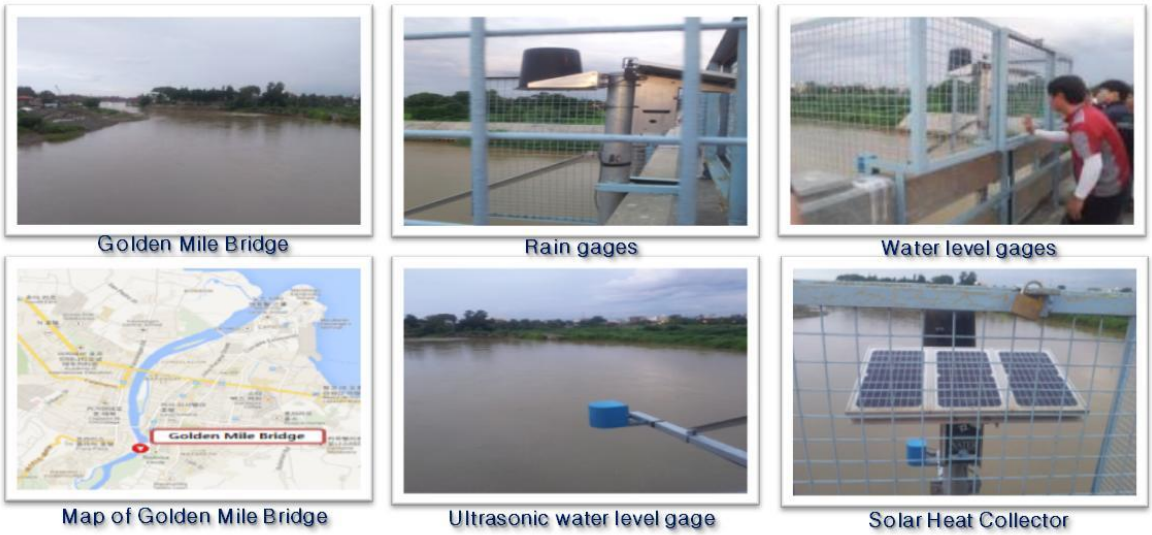


Fig. 7-c-4. Investigation of the status of rain and water level gages currently being operated by PAGASA

Overview of Flash Flood Warning System and automatic rainfall warning system customized for Northern Mindanao

(1) Flash Flood Warning System

NDMI has been operating the Flash Flood Alert System using QPE data based on radar measurements and extrapolation method frequently used in now-casting system. Actually, the system requires lots of meteorological, hydrological, and geophysical data such as point rainfall, radar rainfall, water stage, DEM (Digital Elevation Model), land use, soil type, population, and location of infrastructure etc. In the case of meteorological and hydrological data, it is essential to have enough data lengths for setting the reliable criterions.

As the first trial, the critical rainfall depths for each rain gage are used to check the flood risk on the downstream area with high population in Cagayan de Oro River Basin, Northern Mindanao. The schematic overview of Flash Flood Alert System is shown as below. After operating Flash Flood Alert System of the first version, more detailed process using available all data will be added to improve the system performance.

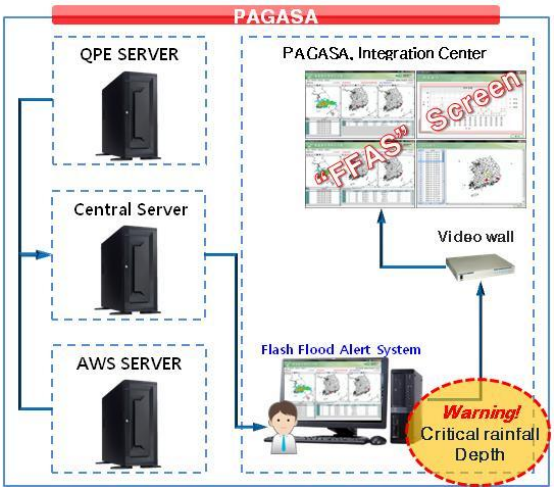


Fig. 7-c-5. Schematic diagram on FFAS to be installed in the Mindanao Island

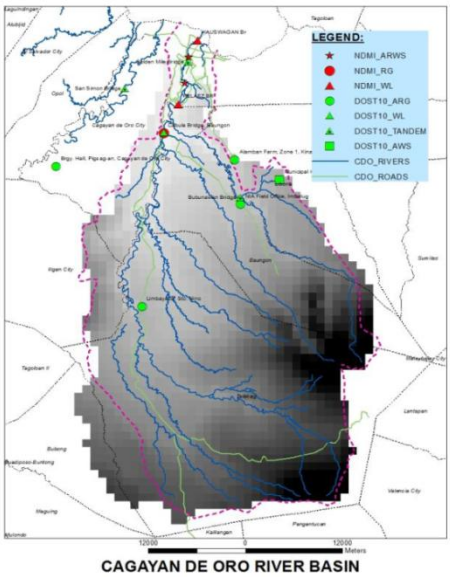


Fig. 7-c-6. DEM and stream flow network for project area in the Philippines

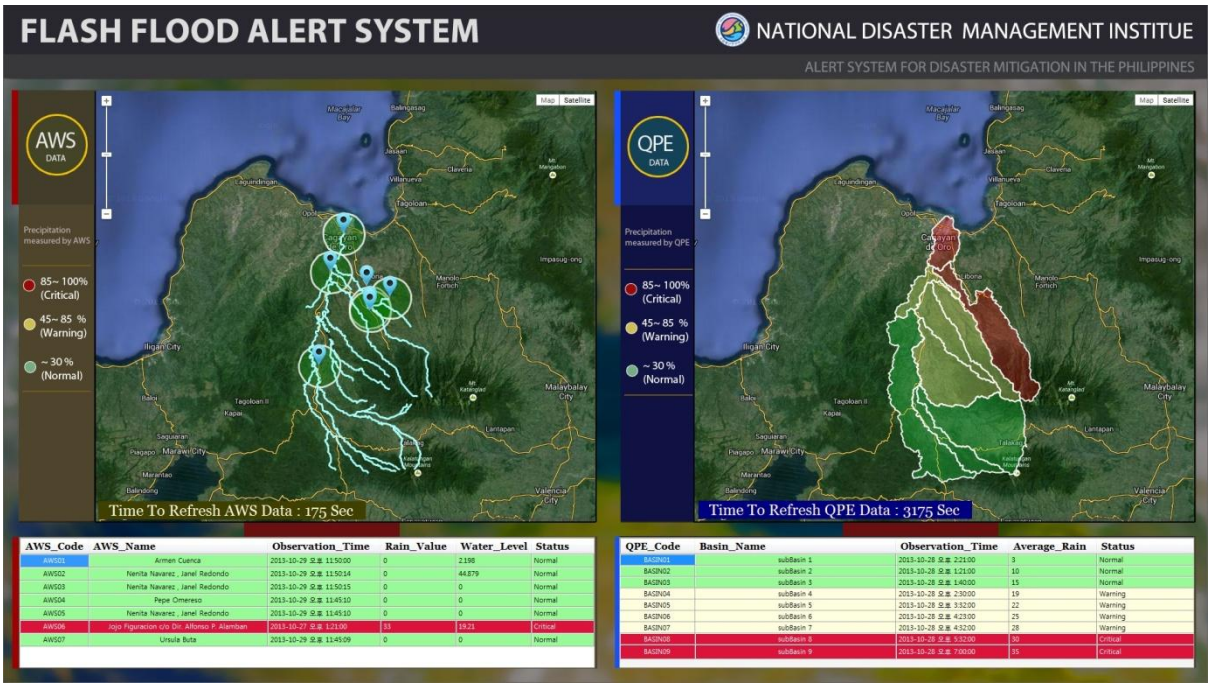


Fig. 7-c-7. Screen of Flash Flood Alert System customized for the Northern Mindanao

(2) Automatic Rainfall Warning System

Rainfall characteristics of Philippines have high spatio-temporal variations with downpour. Therefore, the securing lead-time for the activities such as dissemination of flood risk to the public is essential to achieve the effective flood management. Even though Flash Flood Alert System can monitor the flood risk, the real-time measurements for localized rainfall and rapidly-increased water stage can provide more reliable information for successful flood management.

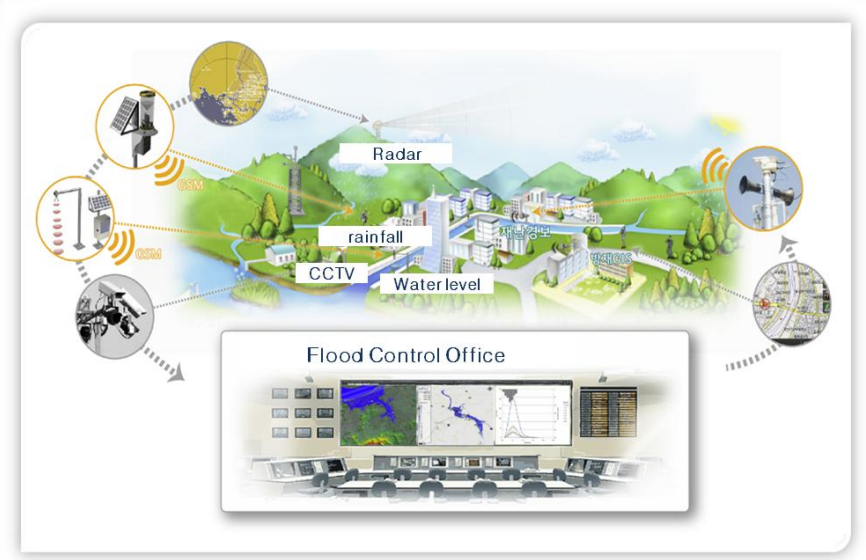


Fig. 7-c-8. Schematic Diagram on Automatic Rainfall Warning System

From the field investigation for the installations, NDMI selected several proposed sites to represent the rainfall and the river flow characteristics for downstream of the Northern Mindanao watershed. The examples of proposed sites and facilities are shown as below;

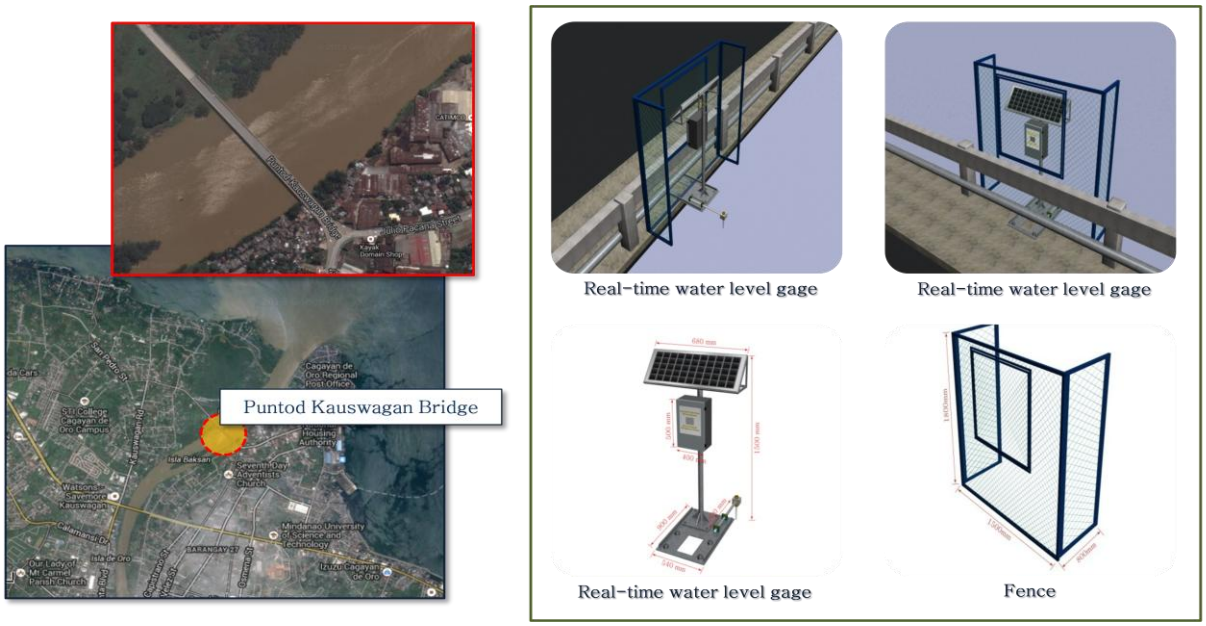


Fig. 7-c-9. Real-time water level gage and proposed site

Fig. 7-c-10. Real-time rain gage and proposed site

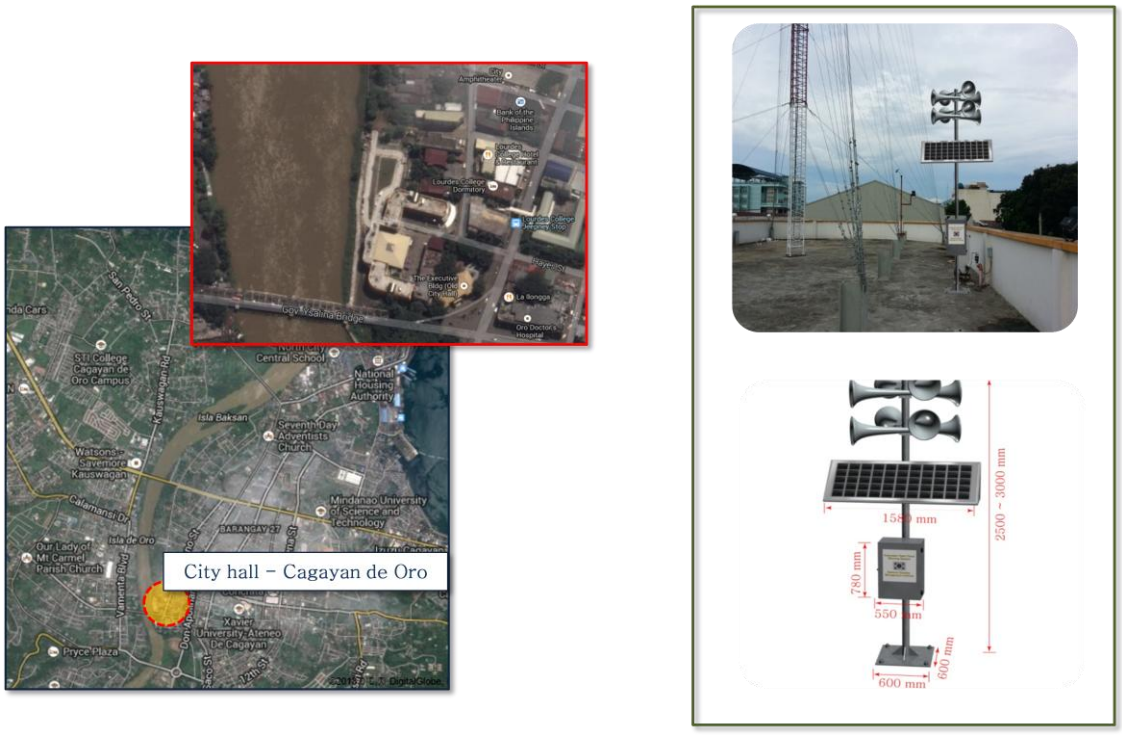


Fig. 7-c-11. Warning siren and proposed site

■ The 8th WGDRR Annual Workshop

The 8th Working Group on Disaster Risk Reduction Annual Meeting was held in Seoul, Republic of Korea from 29 May to 30 May. Total 8 member countries including China, Hong Kong, Japan, Macao, Malaysia, Philippines, Republic of Korea, and Viet Nam participated on the workshop. Also, there were participants from international organizations of WMO (Mr. Koji Kuroiwa), ADRC (Mr. Junji Moriwaki), and UNESCAP (Dr. Yejin Ha). The workshop started with the welcome address by Dr. Yeo, Woon Kwang, president of NDMI. Mr. Jae Yul Lee who is the director of Safety Management Headquarters in Ministry of Security and

Public Administration (MOSPA) had a congratulatory address and also, there were valuable congratulatory addresses from Mr. Koji Kuroiwa of WMO and Mr. Olavo Rasquinho of TCS.

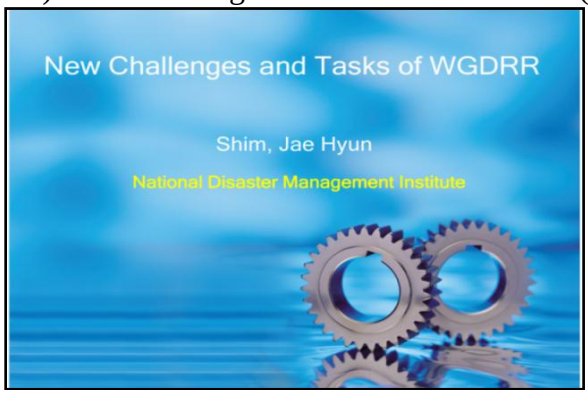
The main theme of the 8th WGDRR Annual Workshop was "New Challenges and Tasks of WGDRR". In the workshop, the ways of strengthening on international cooperation for DRR were mainly discussed. With reference to the main theme, Dr. Shim, Jae Hyun from NDMI suggested the future ways of WGDRR which include 1) New concept of Expert Mission, 2) Upgrade of TCDIS, 3) International Cooperation for DRR, and 4) Post-2015 DRR Framework.

The presentations in the 8th WGDRR Annual Workshop are as follow;

1) Review of WGDRR Action Sheet (Mr. Olavo Rasquinho)

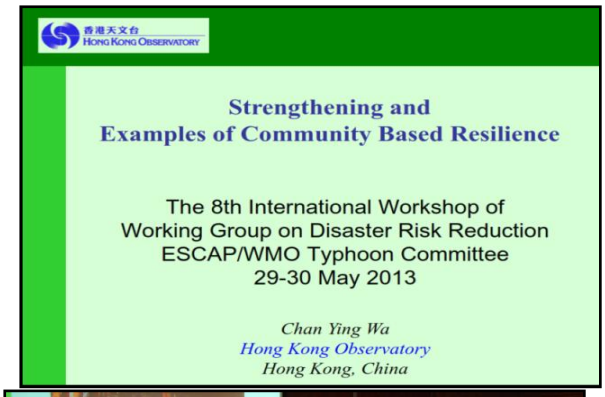
- Introduction on 2013 WGDRR annual operation plan

2) New Challenges and Tasks of WGDRR (Dr. Shim, Jae Hyun)



- Introduction on 2013 Expert Mission plan
- Upgrade of TCDIS
- International cooperation activities in NDMI

3) Strengthening and Example of Community Based Resilience (Dr. Ying-Wa CHAN)



- Disaster risk reduction in Hong Kong
- Examples of community based resilience

4) Member reports

○ China

- ZHAO Fei / National Disaster Reduction Center of China

- Natural disaster forecasting system in China
- Collaboration with related organization and data sharing

○ Hong Kong, China

- Ying Wa CHAN / Hong Kong Observatory

- Disaster risk management in Hong Kong
- Disaster prevention technologies

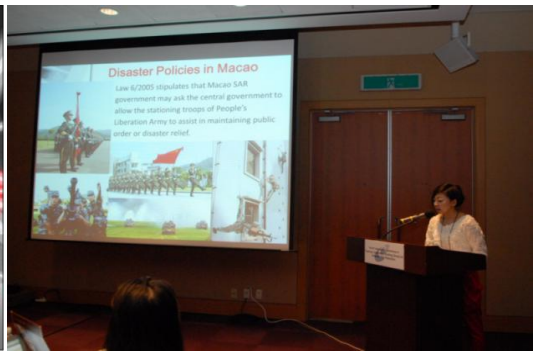
○ Japan

- Oe SHINICHIRO / International Office for Disaster Management, Cabinet Office

- Recent natural disaster in Japan
- International cooperation for DRM

○ Macao

- Fong Peng LEONG / Security Forces Coordination Office



- Disaster Management in Macao
- Disaster prevention technologies and governmental organizations

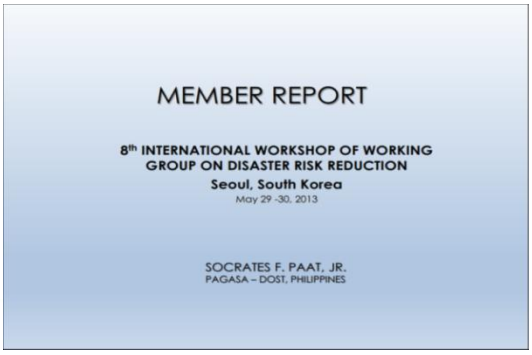
○ Malaysia

- NURUL FATIEN RUSLY / National Security Council

- Disaster Management in Malaysia
- Disaster prevention technologies (SMART, MERS999)

○ Philippines

- SOCRATES F. PAAT, JR. / PAGASA



- 2012 Flood in Philippines
- Damages by Typhoon Bopha

○ Republic of Korea

- Lee, Chul Kyu/ National Disaster Management Institute

- Disaster management system in Korea
- Disaster prevention technologies (SBB, TCDIS, FFAS) and policies

○ Viet Nam

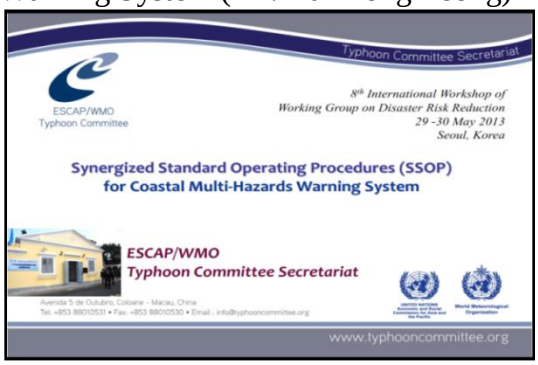
- Thanh Tung NGUYEN / Department of Dyke Management and Flood, Storm Control

- Natural disasters in Viet Nam
- Disaster prevention technologies and policies in Viet Nam

5) Planning on the 2nd TRCG Forum (Dr. Ying-Wa CHAN)

- Introduction on the 2nd TRCG Forum
- Future work in TRCG

6) Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Warning System (Mr. Kai Hong Leong)



- Introduction on SSOP project
- Current situation of SSOP project

7) Proposed WGM Field Experiment (Mr. Kai Hong Leong)

- Introduction on SCMREX
- Field experiment and measurement

<Participants>

No.	Photo	Name	Nationality	Organization
Domestic Relative Organizations				
1		Jae Yul Lee	Korea	Ministry of Security and Public Administration
No.	**Photo**	**Name**	**Nationality**	**Organization**
TC Members				
3		Fei ZHAO	China	Ministry of Civil Affairs
4		Ying-wa CHAN	Hong Kong	Hong Kong Observatory
5		Thanh Tung NGUYEN	Vietnam	Department of Dyke Management and Flood, Storm Control

6		Su Hon HO	Macao	Security Forces Coordination Office
7		Jose LAM	Macao	Security Forces Coordination Office
8		Fong Peng LEONG	Macao	Security Forces Coordination Office
9		Oe SHINICHIRO	Japan	International Office for Disaster Management, Cabinet Office
10		NURAL FATIEN BINTI RUSLY	Malaysia	National Security council
11		Socrates, Jr. PAAT	Philippines	PAGASA

International Organizations				
12		Junji MORIWAKI	Japan	Asian Disaster Reduction Center
13		Olavo RASQUINHO	Macau	TC Secretariat
14		Denise LAU	Macau	TC Secretariat
15		Kai Hong LEONG	Macau	TC Secretariat
16		Yejin Ha	Australia	United Nations Economic and Social Commission for Asia and Pacific
17		Koji KUROIWA	Japan	World Meteorological Organization








예방

B1
2013 기후변화 방재산업전

Ⅲ. Resource Mobilization Activities

NDMI has been performing the Expert Mission for supporting disaster prevention technologies, training-education of WGTCDIS, and strengthening the global network for disaster risk reduction since 2008. In 45th session, there were requests for Expert Mission from Guam, Lao PDR, Thailand, and Viet Nam. NDMI made the plan for 2013 Expert Mission from 18, November to 22, November. Expert Mission team consists of 4 experts from NDMI (3) and TCS (1) who are related to disaster prevention technologies and policies. Main tasks of 2013 Expert Mission are as follow;

(1) Training and application of renewed WGTCDIS

(2) Urban flood damage analysis

(3) Integrated inundation analysis technology on ground and underground in inland area

(4) Use of radar and satellite for disaster prevention

(5) Introduction and education of FARD (Frequency Analysis for Rainfall Data)

(6) Introduction of disaster prevention policies and recovery system in Korea

Ⅳ. Update of Member's Working Groups representatives

1. Working Group on Meteorology

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Tel : +82-070-7850-1372
Fax : +82-2-836-2386
E-mail : pbint@kma.go.kr

2. Working Group on Hydrology

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Tel : +82-2-590-9970
Fax : +82-2-590-9989
E-mail : simplemind@korea.kr

3. Working Group on Disaster Prevention and preparedness

Dr. Yeo, Woon Kwang
President of National Disaster Management Institute (NDMI)
#135, Mapodaero, Mapo-Gu, Seoul, Republic of Korea
Tel : 82-2-2078-7701
Fax : 82-2-2078-7719
E-mail : yeo602@korea.kr

4. Training and Research Coordinating Group

Dr. Ji-Young Kim
Senior Researcher, National Typhoon Center, Korea Meteorological Administration
1622-1, Hannam-ri, Namwon-eup, Seogwipo, Jeju, 699-942, Republic of Korea
Tel : +82-070-7850-6355
Fax : +82-64-805-0366
E-mail : aceasia@korea.kr