The 1st WMO RA II WGHS Meeting

Typhoon Committee Working Group on Hydrology

Annual Operation Plan(AOP) and Activities

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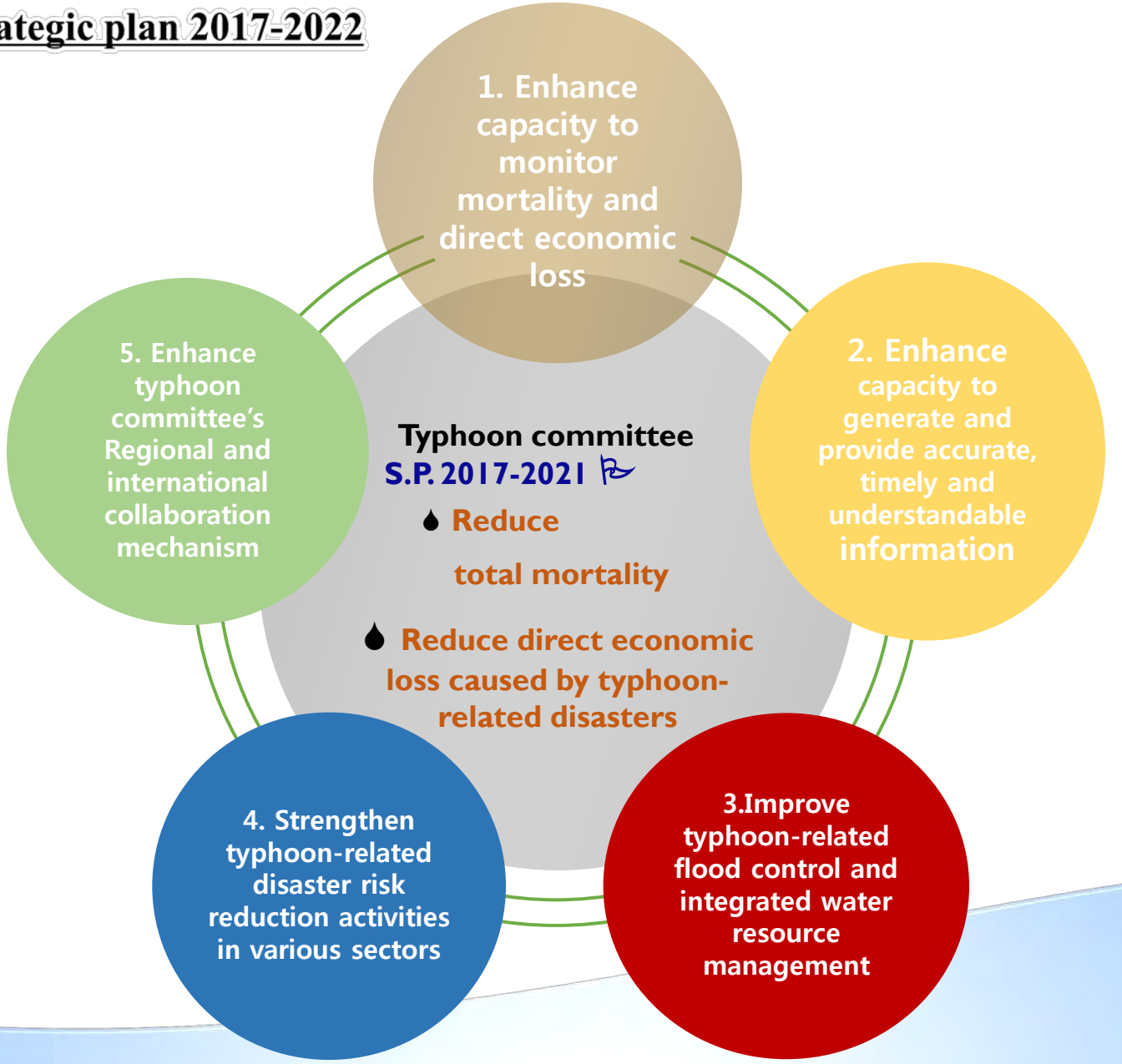
TC Strategic plan 2017-2022



TC WGH AOP 2017-2018

AOP in 2017	Objective
1	Flash Flood Risk Information for Local Resilience(Japan)
2	Extreme flood forecasting system(Korea)
3	Guidelines for extreme flood risk management in TC region(Korea)
4	OSUFFIM system development and trial operation(China)

AOP in 2018	Objective
1	Flash Flood Risk Information for Local Resilience(Japan)
2	Application of Hydrological Data Quality Control System in TC Members(Korea)
3	Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique(Korea)
4	OSUFFIM phase-II: extension of Application of OSUFFIM(China)
5	Impact Assessment of Climate Change on Water Resource Availability in TC Members(China)

AOPs by HRFCO

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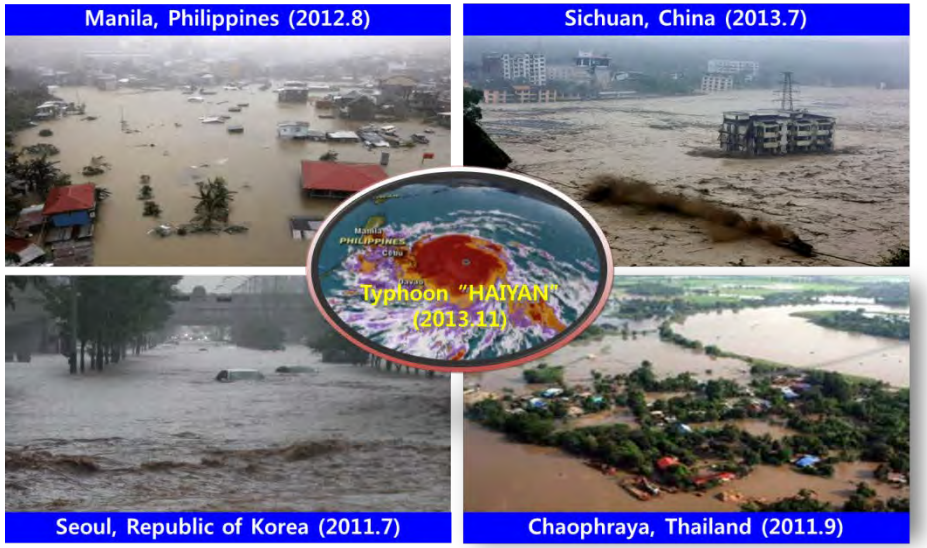


- **We have ever suffered by the unexpected flood**
- **At the 44th session(2012) of TC held in Hangzhou, China** Han River Flood Control Office proposed "Development of comprehensive counterplan for extra-ordinary flood" to reduce the flood damage in the member countries

- And we decided to divide it into "Extreme Flood Forecasting System" and "Guidelines for Extreme Flood Risk Management" for the effective working

- AOP2 : The suitable flood forecasting system as a non-structural countermeasure
- AOP6 : The guideline which involves the structural and non structural flood control measures

AOPs by HRFCO

AOP2

- ***To establish the system including flood forecasting methods and technologies*** for TC members ***from simple level to advanced*** in order to support members to develop the suitable flood forecasting system

AOP6

- ***To suggest the guideline*** for extreme flood management including the structural and non-structural plans (***establishment procedure of the flood forecasting system - link to AOP2, dam operation plan responding to extreme flood***)

- ✓ ***Definition*** of the Extreme Flood in various aspects (hydrologic, socio-economic, flood control capacity, climate change, etc)

- ✓ ***Analysis procedure*** for extreme flood characteristics with Flood vulnerability analysis, etc.

AOP2:Annual Plan(2012~2017)

2016
- Develop the platform of Extreme Flood Forecasting System(Cont'd)
- Develop the suitable Extreme Flood Forecasting System
- System application in TC regions

2015
- Develop the platform of Extreme Flood Forecasting System
- Field survey wrap-up meeting

2014
- Confirm the establishment direction
- 3rd Field survey (Thailand, Philippines, Laos)

2013
- An comparative analysis of the flood characteristics
- Suggest the establishment direction for the appropriate Extreme Flood Forecasting System
- 2nd Field Survey (Thailand, Philippines, Laos)

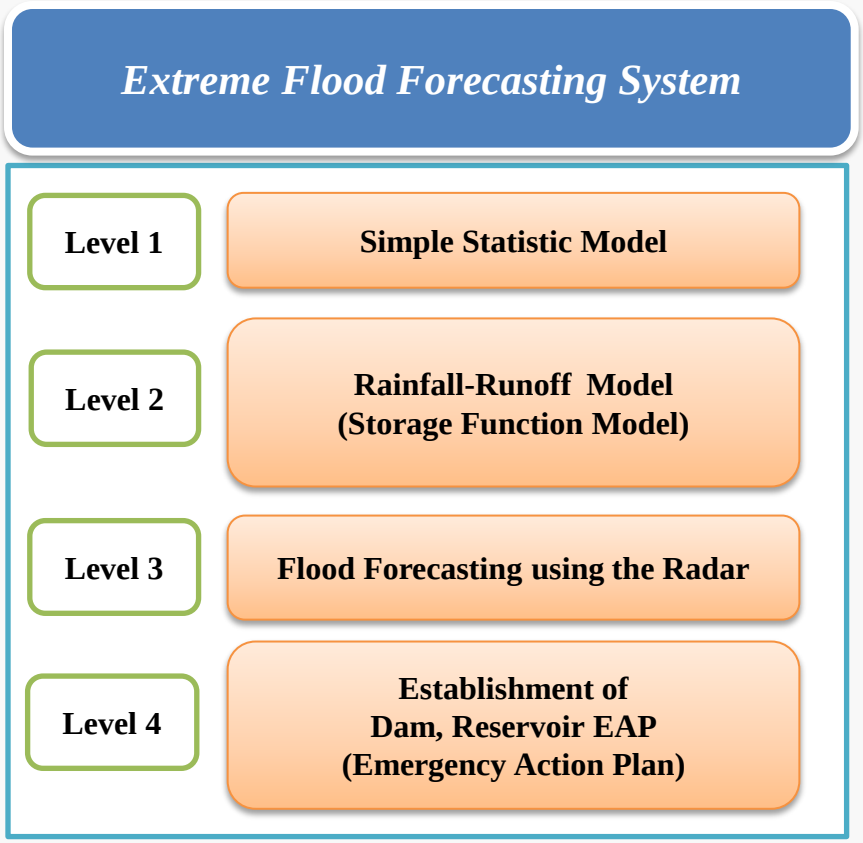
2012
- Investigation of the historical data(extreme floods data, dam operation data, etc.) and flood forecasting system
- 1st Field survey (Thailand, Philippines)

2017
- **Evaluate the system in TC regions**
- **Distribution & capacity building**

AOP2:2017 Activities

•Finalize the Extreme Flood Forecasting System

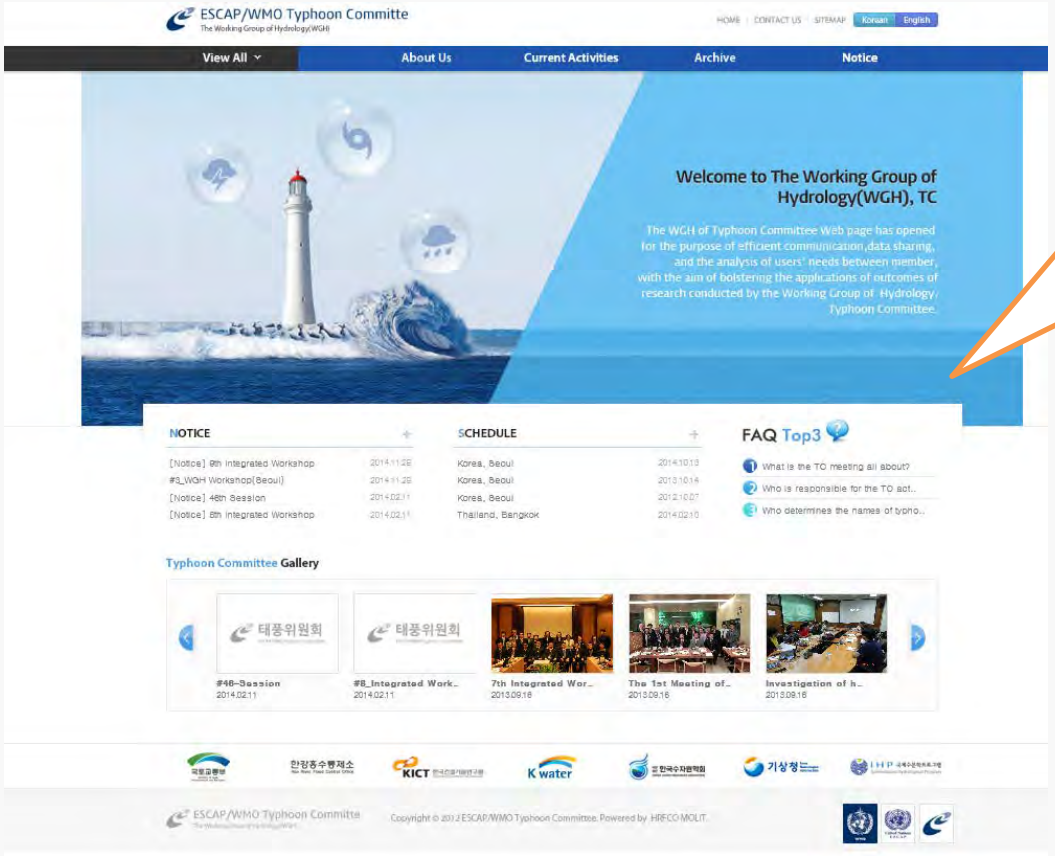
Apply Step by Step Based on the Flood Forecasting Capacity



- **Level 1 : Relationship of** Stage-Stage, Rainfall-Stage, Stage-Discharge, Discharge-Discharge
- **Level 2 : Relationship** between the runoff and storage at basins and channels with the equation of flood wave motion to estimate a continuity equation to decide the flood runoff
- **Level 3 : Input the Radar data** connected to Level 2, Rainfall-Runoff Model
- **Level4** : **EAP Flow Chart** and Simulation module of extreme flood (e.g. dam break scenario, bank collapse, etc.) using **FLDWAV**

AOP2: 2017 Activites

- Overall of TC WGH Webpage (http://tcwgh.hrfco.go.kr/eng)



If you have any contents to share with WGH members, please send to us by email.

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AOP6:Annual Plan(2013~2017)

2017
- **Finalize & Publish the guideline for extreme flood risk management**
- **6th Meeting of TC Working Group on Hydrology**

2015
- Draft guideline for extreme flood risk management in Korean
- 4th Meeting of TC Working Group on Hydrology

2016
- Review & Revision the guideline for extreme flood risk management
- 5th Meeting of TC Working Group on Hydrology

2014
- Suggestion of the structural and non-structural countermeasures for extreme flood
- 3rd Meeting of TC Working Group on Hydrology

2013
- *Define the Extreme Flood*
- *Flood Vulnerability Analysis in 4 selected river basins*
- *2nd Meeting of TC Working Group on Hydrology*

AOP6:2017 Activities

- To host 6th Meeting of TC Working Group on Hydrology
- Review the Guideline for extreme flood risk management

1) Introduction

2) Framework of Extreme Flood Risk Management
   - Extreme Flood Definition
   - Framework of Extreme Flood Management
   - Flood Forecasting in TC Member Countries

3) Hydrological Data Monitoring
   - Hydrological Data Monitoring Standard of International Organizations
   - Hydrological Data Monitoring in TC Countries

4) Forecasting and Warning
   - Standards & Rules of Flood Forecasting in International Organization
   - Status of TC member
   - Framework of Flood Forecasting System

5) Structural Extreme Flood Control Measures
   - General Structural Flood Control Measures
   - Status TC members of Structural Flood Control Measures

6) Non-structural Extreme Flood Control Measures
   - General Non-structural Flood Control Measures
   - Status TC members of Non-structural Flood Control Measures
   - Non-Structural Flood Control Measures for Extreme Flood

7) Dam Operation
   - Status of Dam Operation for Flood Control in TC Regions
   - Dam Operation for Extreme Flood Control

8) Extreme Flood Adaptation

9) Conclusions

Definition of Extreme Flood

" Extreme Flood is flooding which hasn't been frequent in the past, in terms of flood quantity and duration. Also it exceeds the volume of OO-year frequency flood as a result of frequency analysis."

※ OO-year frequency flood is different from applied basin to basin

" Extreme Flood is flooding which exceed the Design frequency flood regarding a socio-economic aspects ."

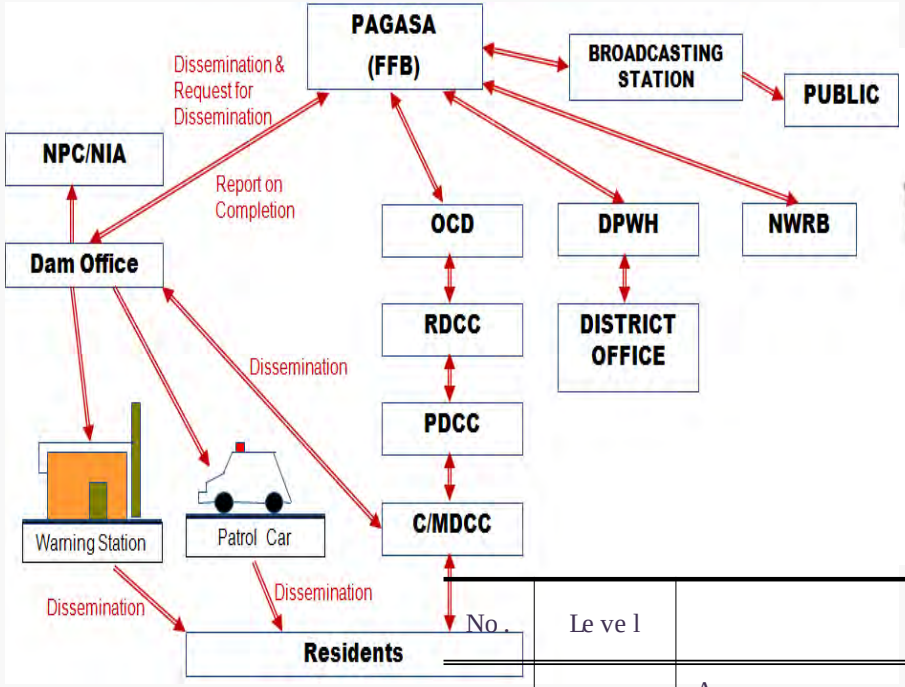
Flood Forecasting in TC Members

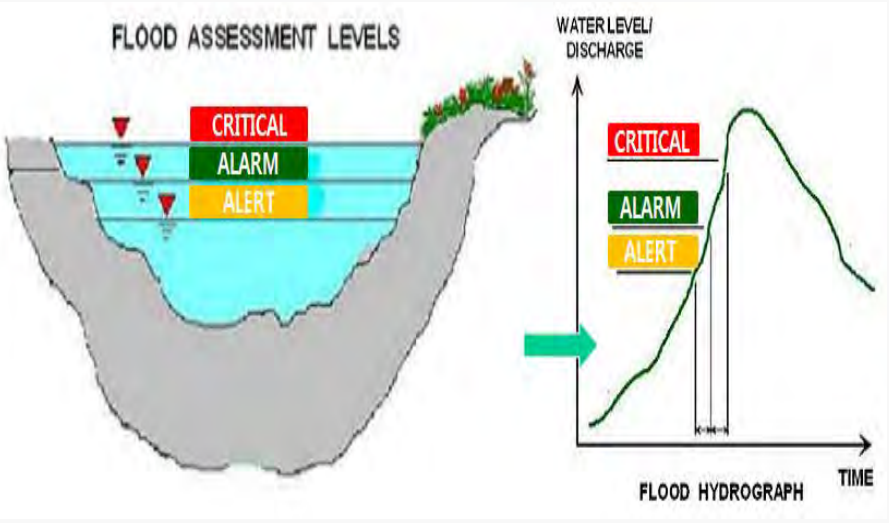
Flood Forecasting in mainly 3 target countries

Items	The Philippines	Thailand	Lao PDR
Automatic system	YES	YES	NO
T/M gauge	YES	YES	NO
Warning facilities	YES	YES	NO
Data of rainfall and water level	Hourly rainfall (2010- 2012)	Monthly rainfall	Daily discharge Daily rainfall Daily water level
Flood hazard map	NO	Limited area	NO
Agency in charge	PAGASA	RID	MoNRE

Flood Forecasting in TC Members

Flood Forecasting in the Philippines

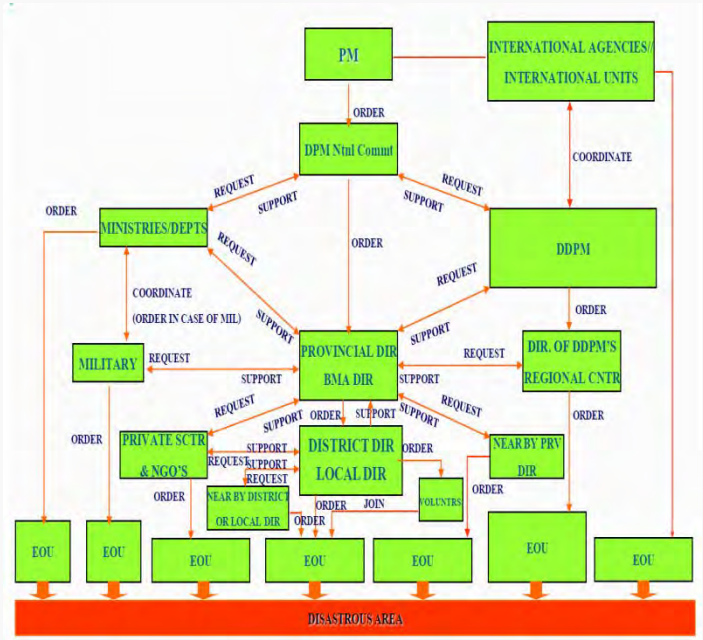


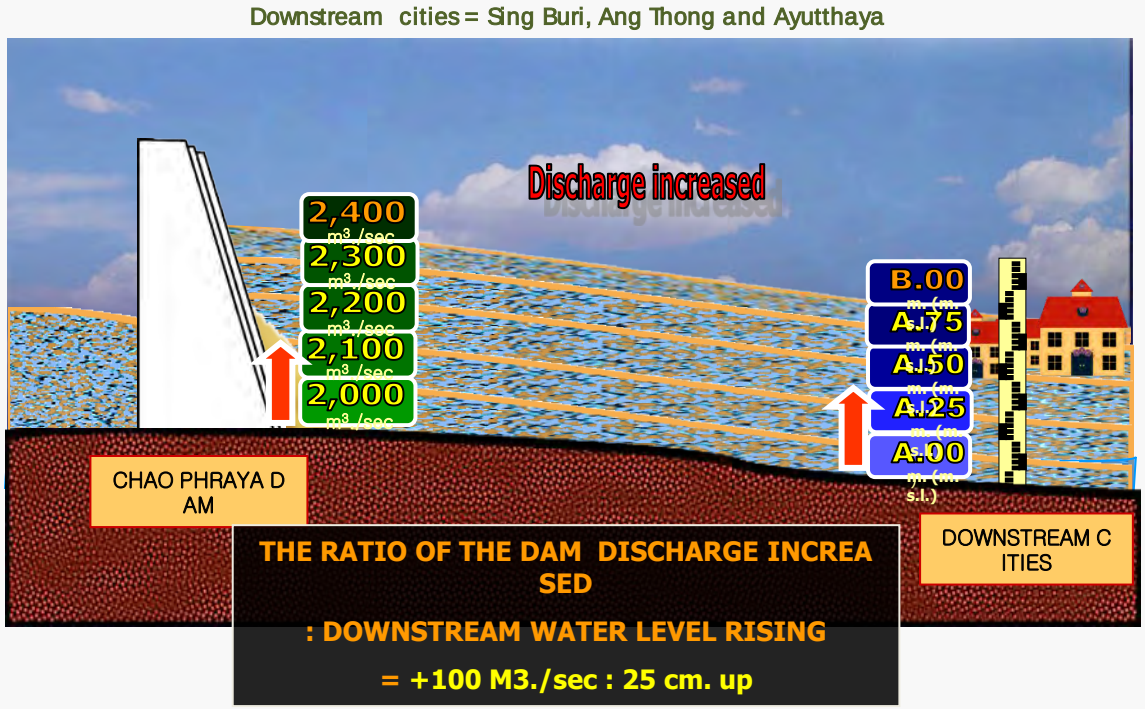


No.	Level	Meaning	Flood Warning
1	Alert	Awareness : Possibility of flooding within next 24 hours	READY
2	Alarm	Preparedness : Threat of flooding within next 24 hours	GET SET
3	Critical	Response : Flooding expected within next 24 hours or Flooding has occurred	GO

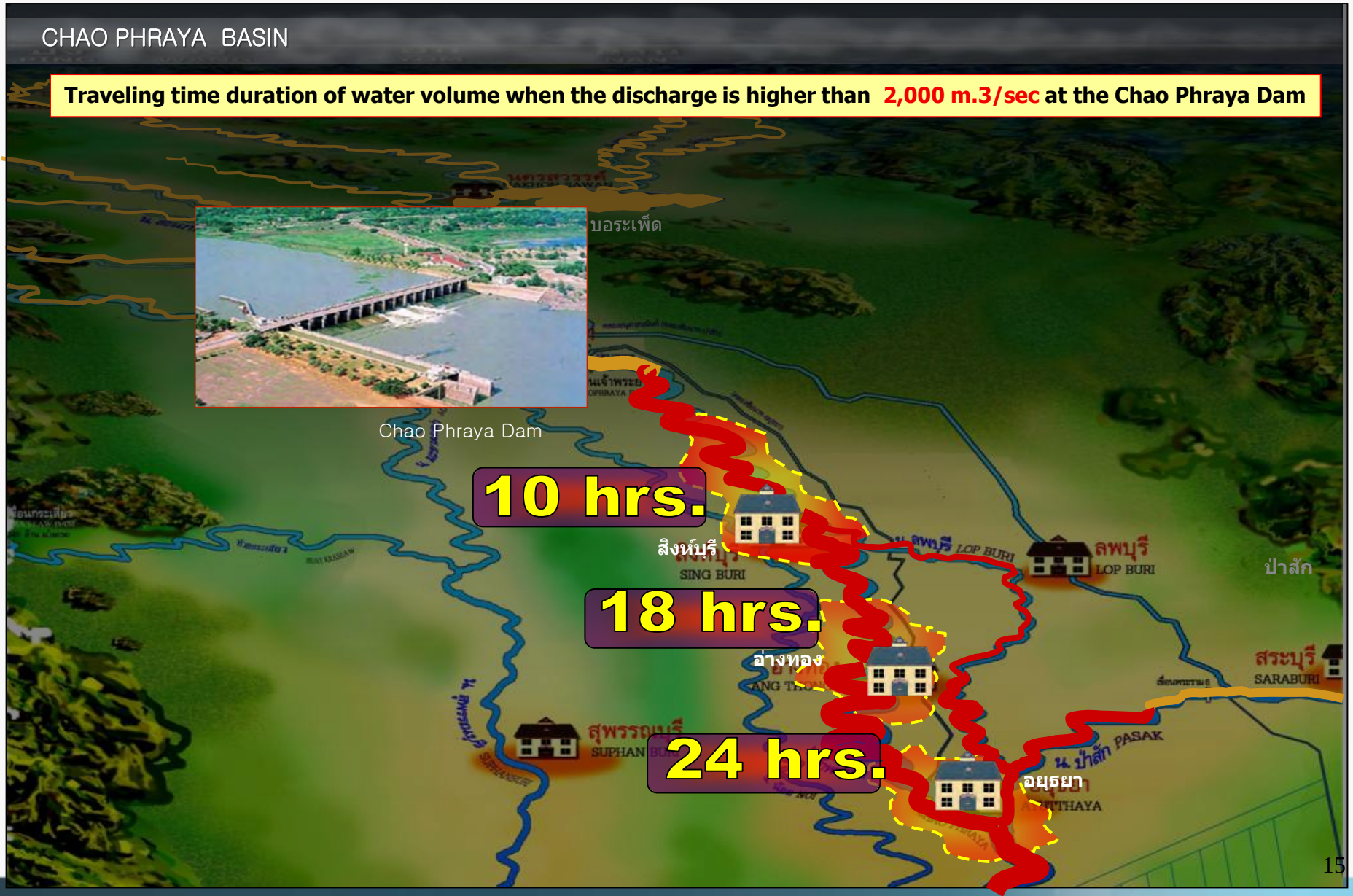
Flood Forecasting in TC Members

Flood Forecasting in Thailand





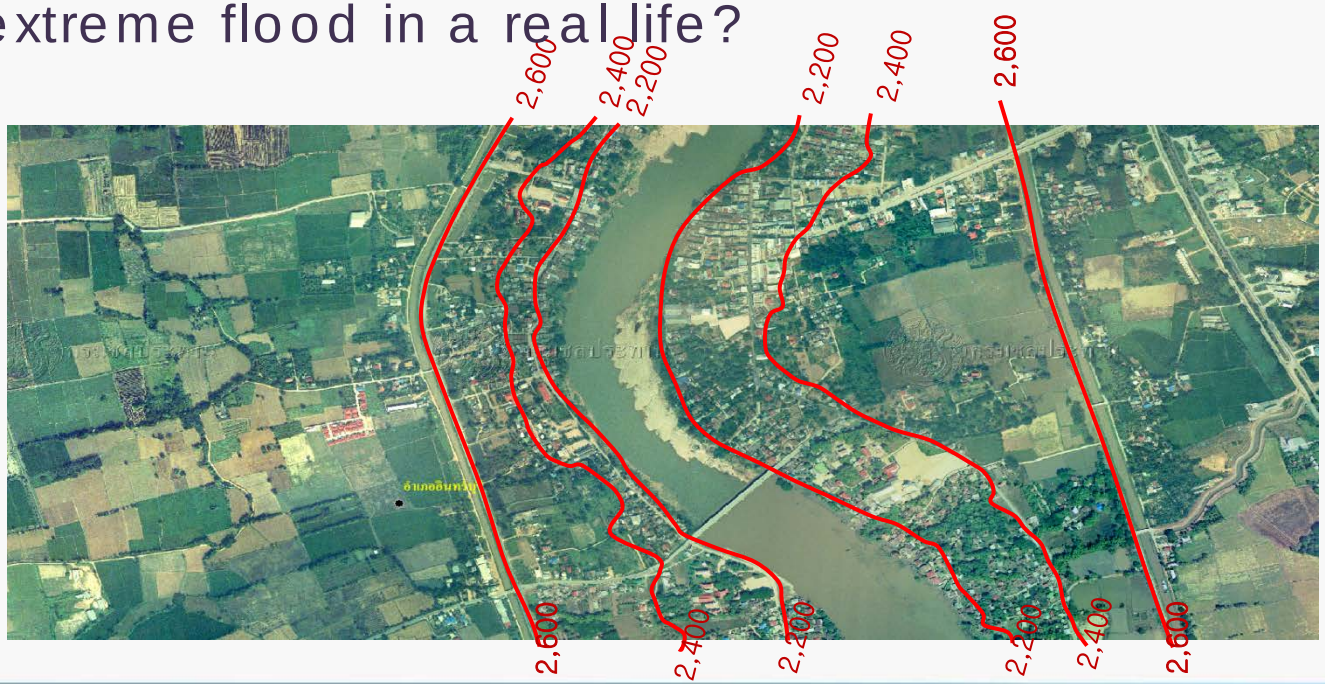
Flood Forecasting in TC Members



Extreme Flood Adaptation

Flood adaptation in the Philippines

How adapt to extreme flood in a real life?



Flood adaptation in Thailand

Standards provided by WMO

- ✓ The World Meteorological Organization classifies floods into the following types:
  - flash flood
  - Fluvial [riverine] flood
  - single event flood
  - multiple event flood
  - seasonal flood
  - coastal flood
  - estuarine flood
  - urban flood
  - snowmelt flood, ice- and debris-jamp flood

- ➢ To build a flood forecasting system, the following 3 essential elements must be filled up. First, the system should be able to provide detailed rainfall forecasting (including quantitative and temporal characteristics), which is required in numerical analyses of the of weather prediction models. Second, automatic flow rate stations (or network systems between stations) that allow telemeter-based central control should be built. Finally, flood forecasting models linked to station networks should be built.

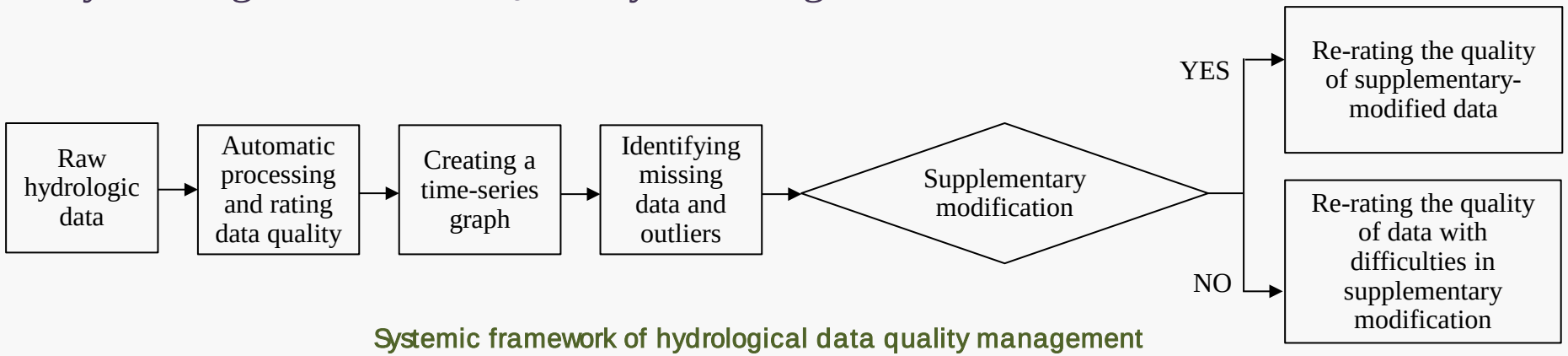
Standards provided by WMO

- ✓ Essential factors to be considered when building flood forecasting and warning systems:
  - meteorological considerations
  - hydrological considerations
  - nature of risks and impacts
  - dissemination of forecasts and warnings
  - institutional aspects
  - legal aspects

- ✓ To provide more significant flood forecasting and warning services it is necessary to: 1) understand the characteristics of the hydrologic physical structure of rivers (basin, topography, geological features, soil, degree of structural development, etc.), 2) equip the service operation supervision institutions with the necessary capacities and technologies to identify and evaluate the main physical variations in case of hydrologic physical events and, 3) perform appropriate demand survey in relation to particularly required or implementable forecasting and warning services, giving consideration to technical and economic aspects.

Hydrological Data Monitoring

Hydrological Data Quality Management, Korea



Systemic framework of hydrological data quality management

- ✓ Automatic quality control on hydrological data automatically collected from rainfall and water level stations
- ✓ Statistical data analysis and quality ratings
- ✓ Annual report on national hydrological survey

Hydrological Data Quality Management, Korea

Outliers and missing data checking standard for rainfall and water level data

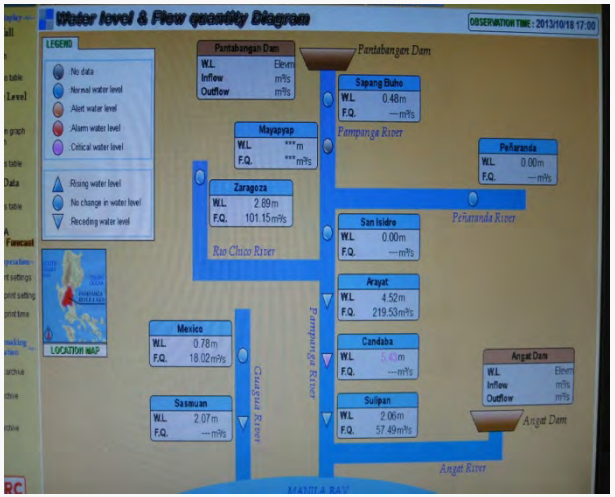
Category	Content		Remarks
	Flow	Water level	
Missing data / Outlier checking (Automatic)	- Outlier (excessive values, excessive differences with RDS(Reciprocal Distance Squared) weighted average values) and missing data checking	- Outlier (gradients, equivalent water levels, comparison with historical data, etc.) and missing data checking	
Missing data / Outlier processing (Manual)	- Correction based on regular observational values - Correction of outliers and missing data based on data obtained from near hydrometric stations (arithmetic mean, RDS weighted average method, relation with values from near stations) - The necessary corrections are done by the person in charge (lack of judgment basis and correction methods recording)	- Correction based on regular observational values - Correction by linear interpolation - Correction by irregular curves - Correction using the relationship with data from near hydrometric stations - The necessary corrections are done by the person in charge (lack of judgment basis and correction methods recording)	·Preliminary processing/complementation ·Secondary verification
Quality rating	- Data to be corrected or supplemented are quality rated in accordance with the correction method - Other data are quality rated in accordance with its conditions	- Data to be corrected or supplemented are quality rated in accordance with the correction method - Other data are quality rated in accordance with its conditions	·Final quality grade is granted
Other information	- Both first quality grades (indicate the automatically checked data condition) and final quality grades (granted to manually corrected or supplemented final data) are granted - Data condition reference details are recorded		

Dam Operation

Dam Operation in the Philippines

- ✓ Two main dam & Flood propagation time Pantabangan dam
  - Propagation complete with in 10hrs, from dam to about 100km

Angat dam
- Propagation complete within 9 hrs, from dam



PANTABANGAN DAM
FLOOD PROPAGATION TIME
(FROM SPILLWAY OF MASIWAY RE-REGULATION DAM DOWN TO THE CRITICAL FLOOD PRONE AREAS ARE AS FOLLOWS:)

RIZAL (11.0 kms.)	2.7 hrs.
SAPANG BUHO (33.2 kms.)	5.2 hrs.
CABANATUAN (70.0 kms.)	7.2 hrs.
STA. ROSA (82.0 kms.)	9.1 hrs.
SAN ISIDRO (101.98 kms.)	10.1 hrs.

ANGAT DAM
FLOOD PROPAGATION TIME
Angat Dam to the following stations:

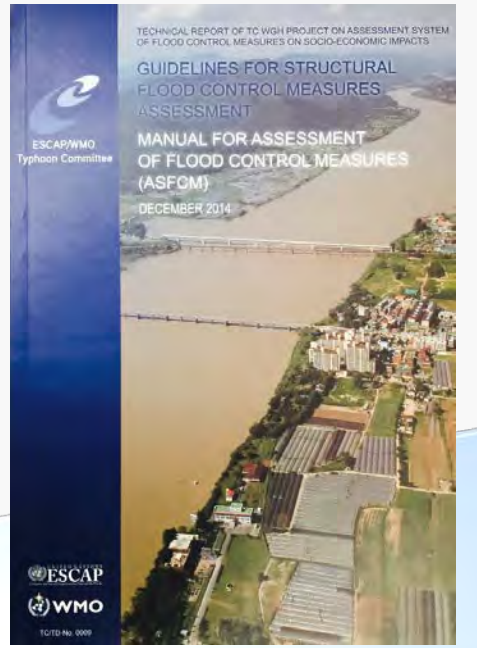
PADLING	2 hrs. 16 mins.
MATICTIC (28 kms)	2 hrs. 30 mins.
ANGAT	3 hrs. 14 mins.
BINAGBAG	3 hrs. 44 mins.
MARONQUILLO	4 hrs. 14 mins.
DONACION	4 hrs. 49 mins
SAN RAFAEL	5 hrs. 14 mins.
BUSTOS (46 kms)	5 hrs. 40 mins.
SABANG	5 hrs. 53 mins.
BALIWAG	6 hrs. 5 mins.
STA. BARBARA	6 hrs. 27 mins.
BINTOG	7 hrs. 12 mins.
PLARIDEL (62 kms)	8 hrs. 20 mins.
PULILAN	8 hrs. 47 mins.
TIBAG (NLEX)	9 hrs.

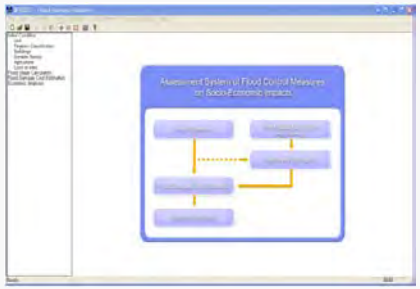
WGH workshop and meeting

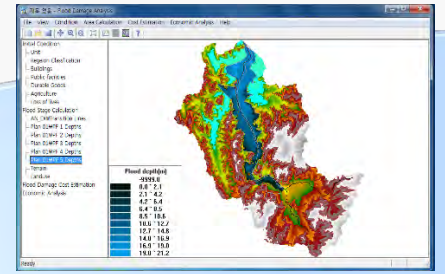
Achievement


Winning Kintanar Award

The Publication of ASFCM







New AOP by HRFCO

❖ Implementation plan in 2018

- To improve the EFFS module continuously
- To conduct new AOPs

New AOP 1 : **Hydrological Data Quality Control System**

New AOP 2 : **Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique**

	2018	2019	2020	2021	2022
New AOP (1)	The Status of TC Members in Monitoring Hydrological Data	Suggestion of the Establishment Direction & Techniques	Development of Hydrological Data Quality Control System (1)	Development of Hydrological Data Quality Control System (2)	Distribution of the System & Publication, Training
New AOP (2)	The Status of TC Members using Radar Rainfall Data	Suggestion of the Establishment Direction & Techniques	Modify the LEVEL 3 of EFFS	Produce the Rainfall Ensemble in TC Members	Development of Stochastic Flood Forecasting System


Thanks for your attention