GEOSS-Asian Water Cycle Initiative (AWCI)

Flood WG

- Activity Report -

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9th Meeting of the GEOSS-AWCI International Coordination Group (ICG),
Tokyo, Japan, 29-30 April 2012

Major Activities of Flood WG (2008-11)

- Preparation of Generic template for demonstration projects in GEO on use of satellite information for flood risk Management (led by Prof. Herath)
- **Demonstration projects**
- Identification of member countries' needs and resources for capacity building → shifted to capacity building WG
- APN-ARCP "Flood Risk Management Demonstration Project under the Asian Water Cycle Initiative for the Global Earth Observation System of Systems (FRM/AWCI/GEOSS)" for 2008-2010 (two years).
  - To enhance demonstration projects through holding meetings (ICGs) and workshops (GFAS/IFAS Validation WS)
- Contributions to 4th APHW (Beijing) and GEOSS-AP activities (typhoon and cyclone session)
- Contributions to APWF's Steering Group for climate change adaptation strategy → climate change WG

Goal of APN-ARCP (Flood, 2008-2010)

- To build up a scientific basis for sound decision-making and developing policy options for most suitable <u>flood risk management</u> for each country and region in Asia, through the full utilization of new opportunities on global, regional and in-situ dataset under the scheme of AWCI (contributing to GEOSS)

→ Key issue for next-generation integrated flood risk management under global climate change

Some examples of demonstration projects related to Flood WG (1/4)

from India

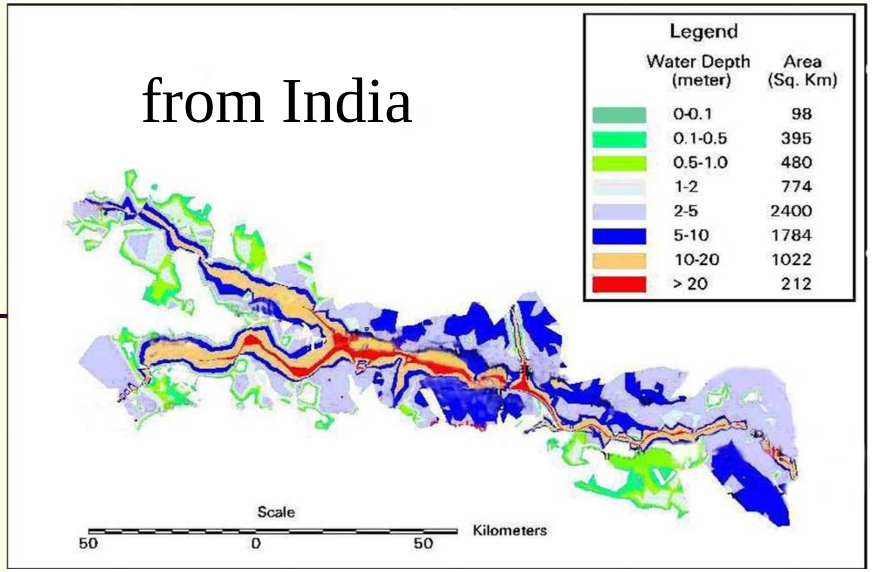
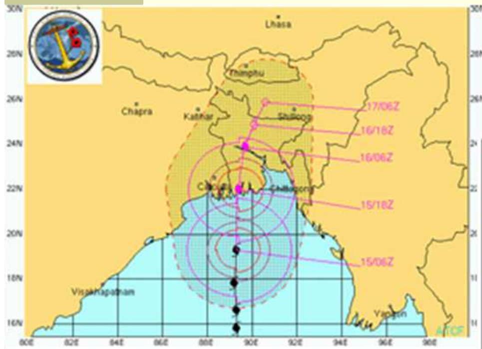
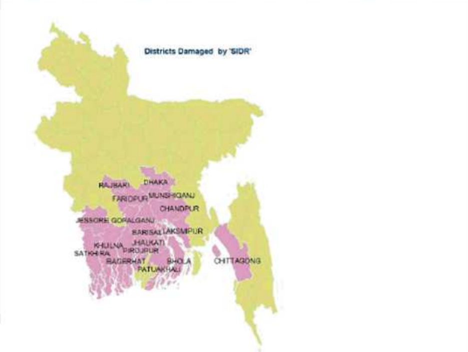


Fig.7 Example of flood inundation and depth mapping for 1000 year return period flood for the study area (Kumar, 2005)

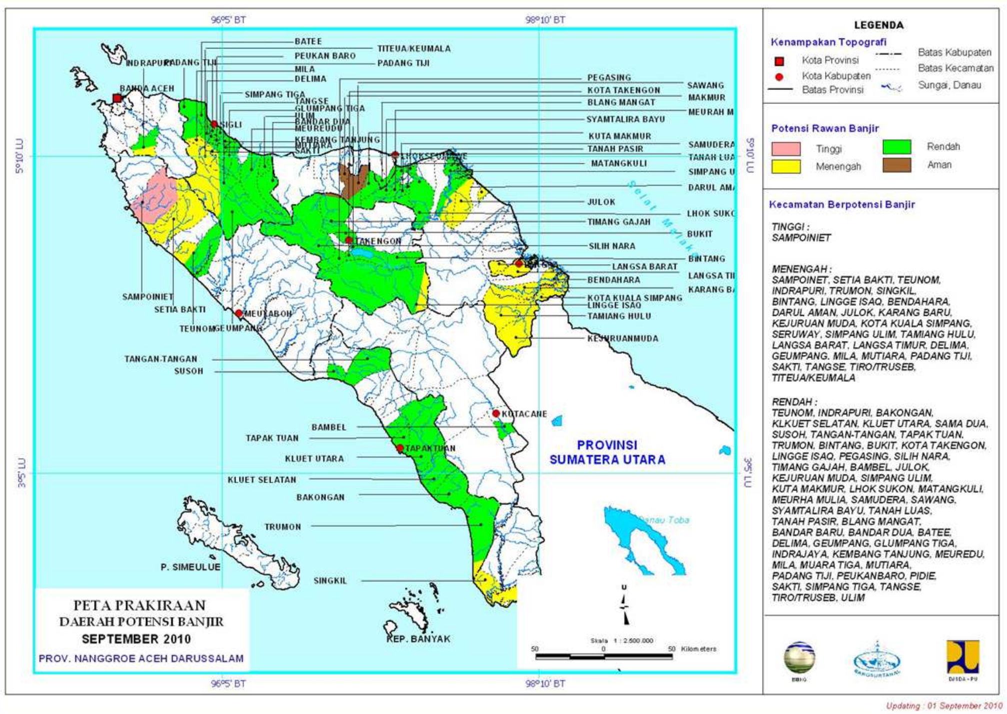


Cyclone -SIDR,12-16 Nov,07



Major districts affected by Cyclone 'SIRD'

from Bangladesh



from Indonesia

Some examples of demonstration projects related to Flood WG (2/4)

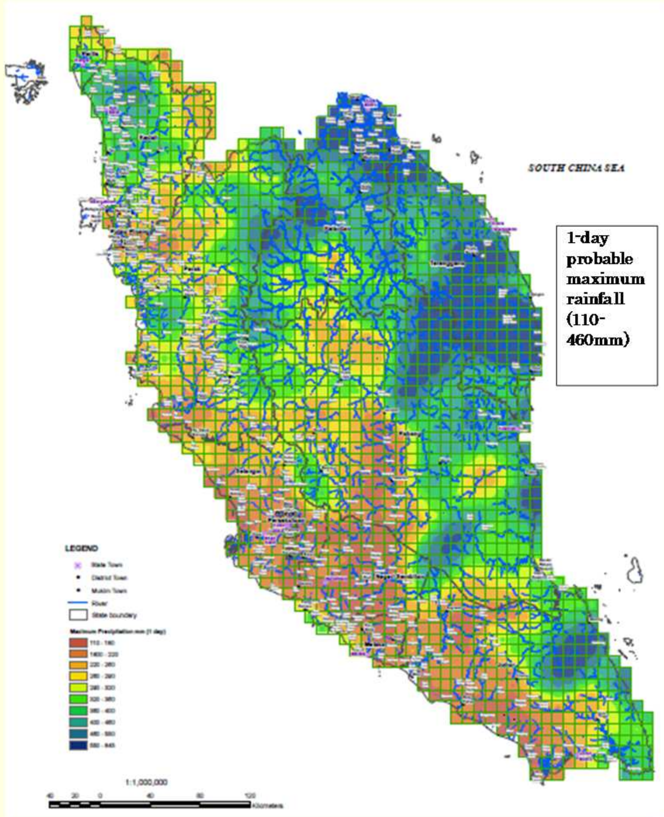
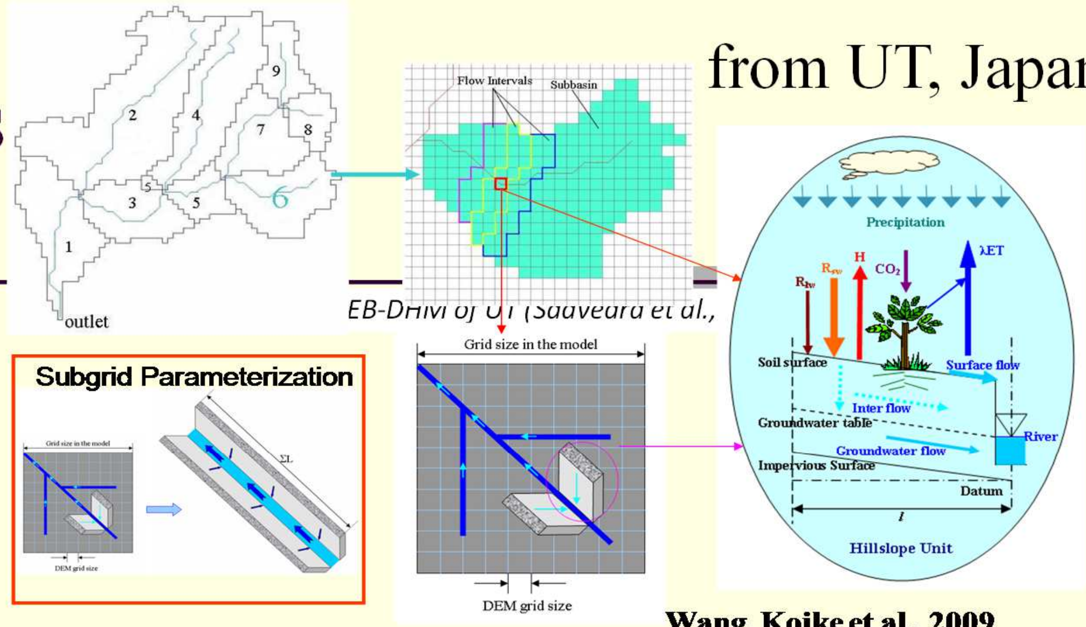


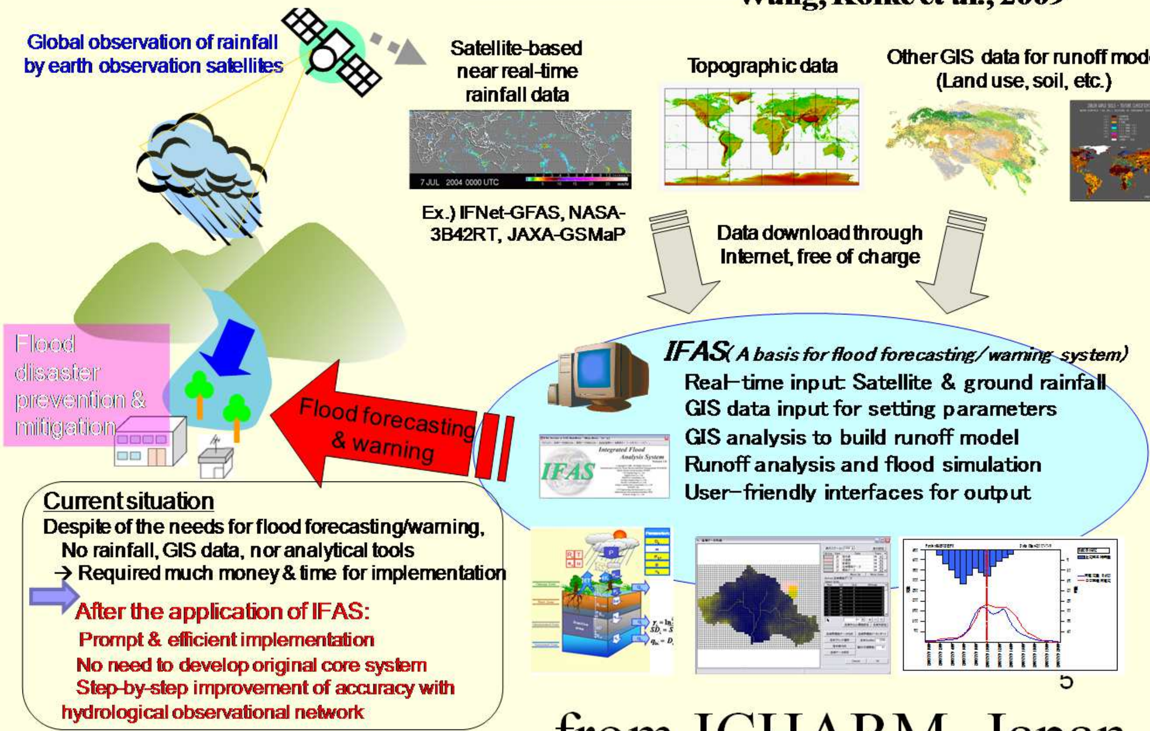
Fig.24 Maximum 1-day rainfall estimation over the peninsula of Malaysia in the future (2025-2034 & 2040-2050) (Amin, 2010)

from Malaysia

from UT, Japan



Wang, Koike et al., 2009



from ICHARM, Japan

Some examples of demonstration projects related to Flood WG (3/4)

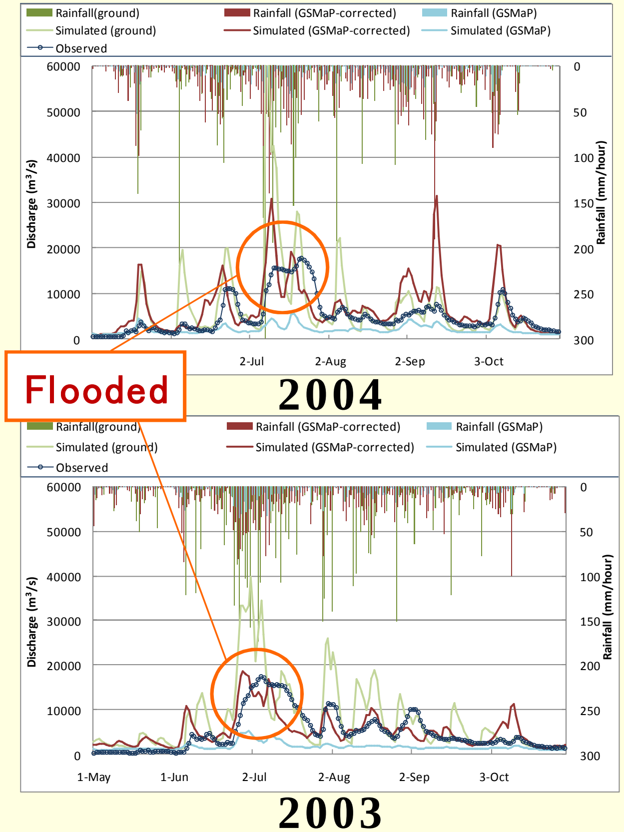
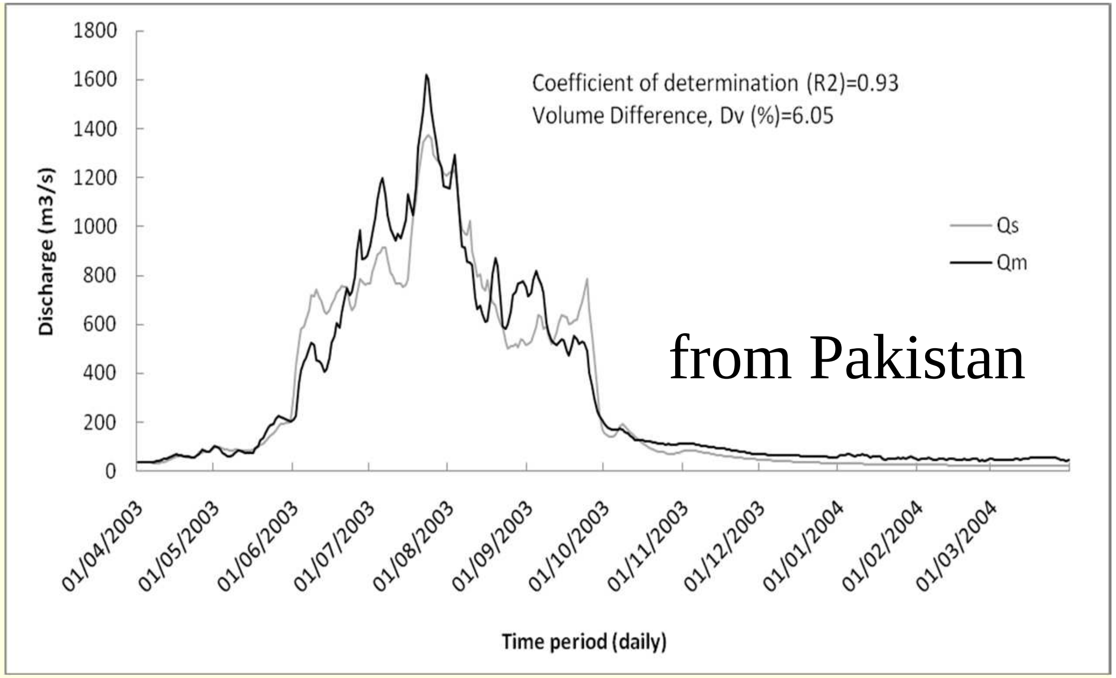
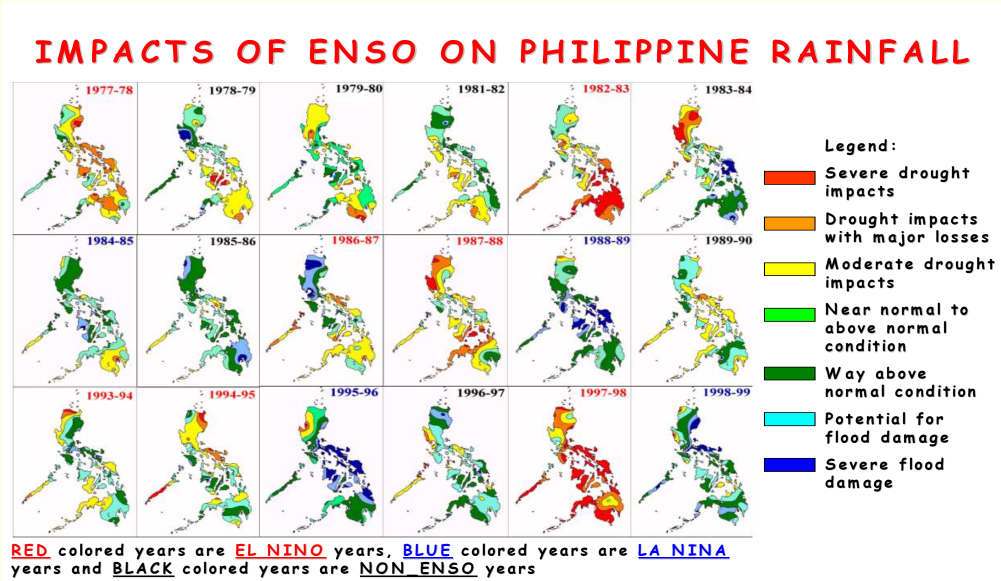


Fig.29 Comparison of IFAS simulation for 2003 & 2004 using ground-based and satellite-based rainfall data with observed river flow (Htay Htay Than, 2009)





from Myanmar

from Phillippines

Fig.36 Interannual variation of hydrological impacts from 1977 to 1988 in the Philinines (Hilario, 2009)

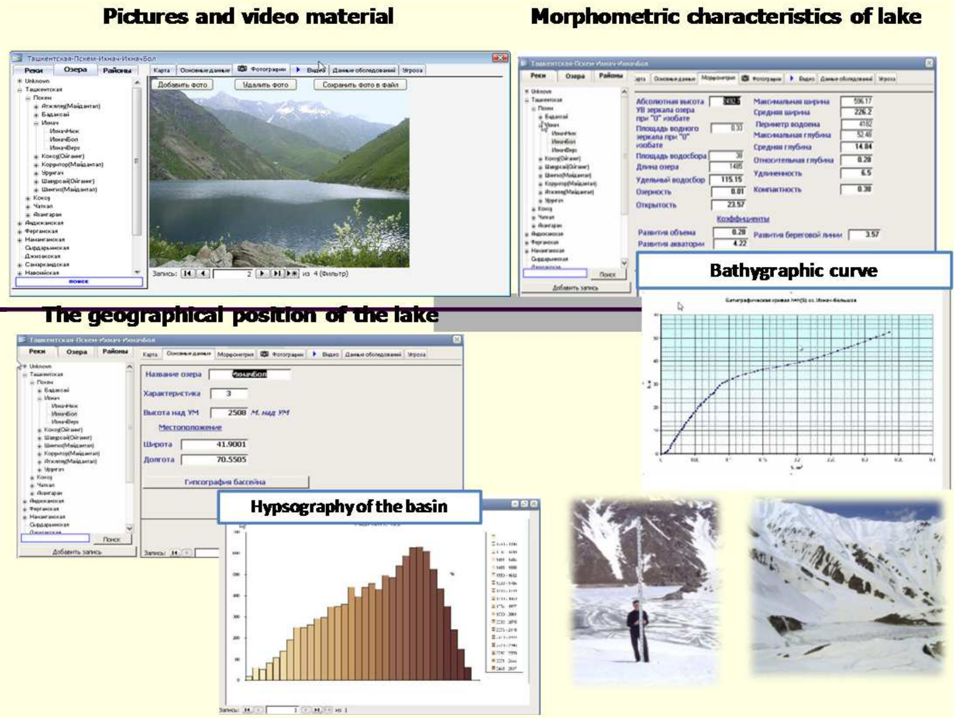
Some examples of demonstration projects related to Flood WG (4/4)

Fig.40 Colored staff gauge to easily identity flood risk (Thadu, 2009)

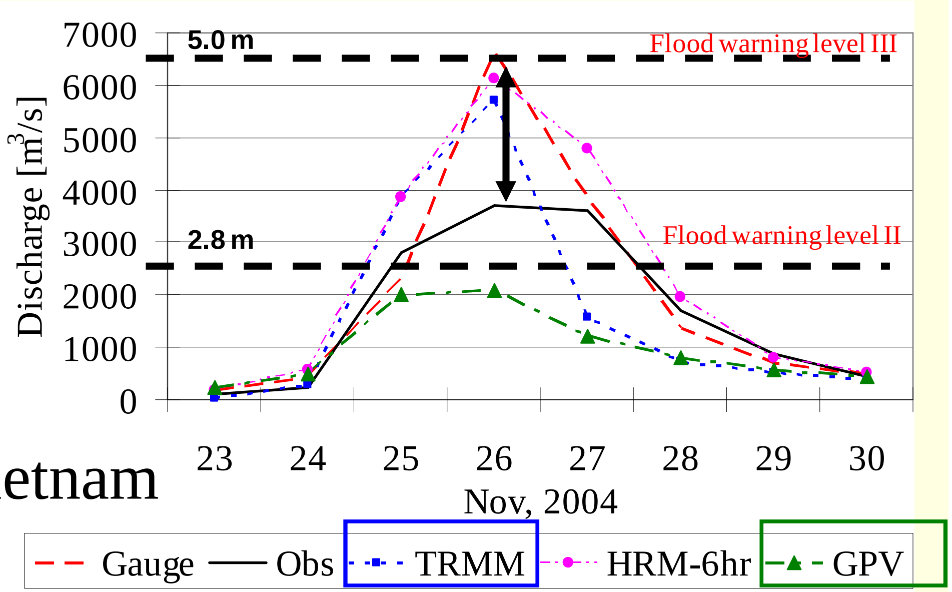
Fig.41 Flood information board for public

Fig.41 Flood information board for public

from Thailand

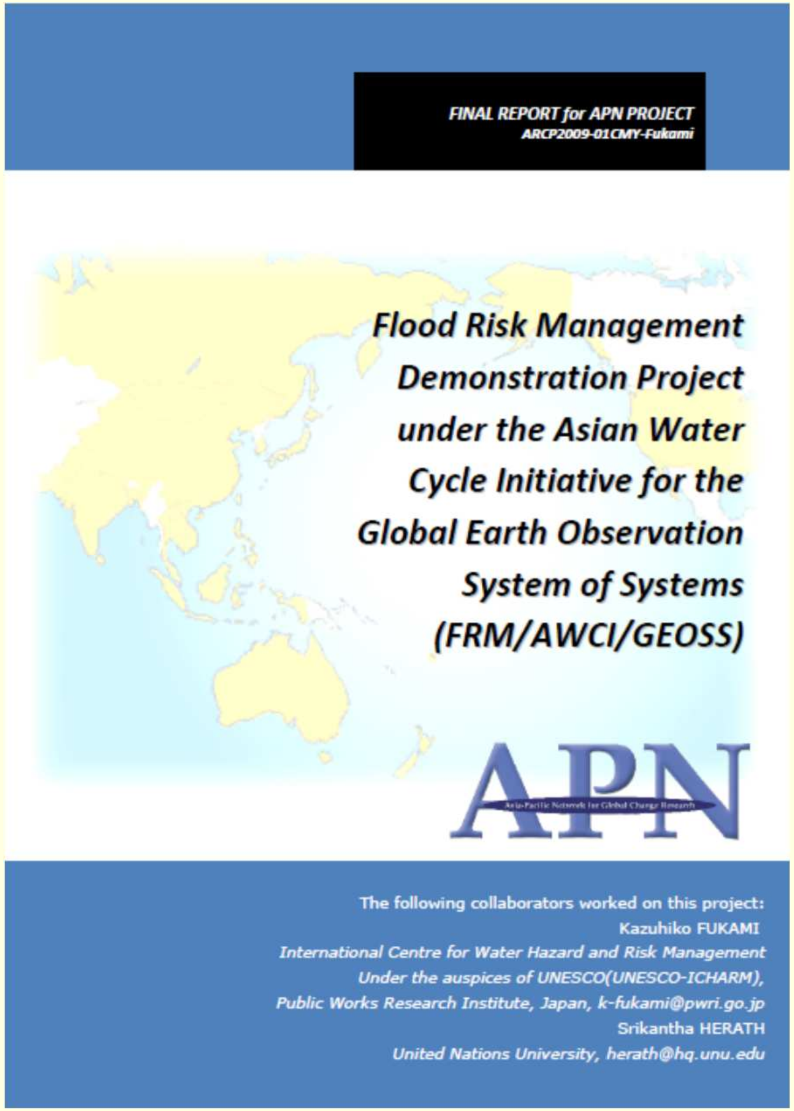


from Uzbekistan



from Vietnam

Final Report for APN-ARCP (1st Year, FY2008-2009)


FINAL REPORT for APN PROJECT
ARCP2009-01CMY-Fukami

Flood Risk Management Demonstration Project under the Asian Water Cycle Initiative for the Global Earth Observation System of Systems (FRM/AWCI/GEOSS)

APN
Asia-Pacific Network for Global Change Research

The following collaborators worked on this project:
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Feb. 2011

TECHNICAL REPORT

Preface

Asian Pacific countries have been suffering from flood disasters every year, which have been big barriers not only to reduce natural disaster casualties/damages but also to promote social welfares and economy in those countries. This project was proposed to contribute to flood disaster reduction through enhancing sustainable flood risk management with GEOSS data. Under the cooperative framework of GEOSS-AWCI, information exchanges and cooperative studies were promoted, and lots of new developments and local studies were conducted in each AWCI member country. The report summarizes the outline of those research activities. Please refer to references for more details of each study.

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Conclusions (from the APN-ARCP final report)

- As a result of 2 to 3 years' cooperative research activities among Flood WG of GEOSS-AWCI, there have emerged many promising technologies and practices for the future sustainable flood risk management.
- Typical examples of new technologies developed and/or validated through those activities are WEB-DHM, DRESS & FLOWSS of UT, IFAS of ICHARM, RegHCM-PM of NAHRIM, and so forth. Through our repetitive meetings, discussions and cooperative activities, advanced technologies and many other innovative practices have been shared among all the members of Flood WG of GEOSS-AWCI, which will be expected to lead to updating and enhancing a variety of science- & data-based foundations toward sound decision-making and developing policy options for effective flood disaster risk reduction in Asia.

Objective of APN-ARCP (Flood, 2008-2010)
→ Key technologies for integrated flood management

1. To convert observations and data, both through space borne platforms and data integration initiatives, to usable information for flood reduction - coupling global data with in-situ data
2. To improve quantitative forecasts for coupled precipitation – flood forecasting systems
   - rainfall forecasting with GPV and downscaling, GIS-based precipitation-runoff-inundation analysis
3. To facilitate flood risk assessment through the provision of scenarios and data for exposure estimation – flood hazard and risk analysis under climate change with hydrologic/hydraulic and socioeconomic analyses

Mechanism of global warming and climate change

Source: MLIT

Large volumes of greenhouse gas emissions cause CO_2 concentration in the air to rise and increase heat absorption, resulting in temperature rise. Thus, global warming occurs.

- Melting of glaciers, ice caps and ice sheets
- Thermal expansion of sea water
- Change in evapotranspiration
- Change in snow accumulation condition

Sea level rise (Maximum rise: 59 cm)

More intense typhoons

Increase of precipitation by a factor of 1.1 to 1.3*

More frequent heavy rains and droughts

Earlier snow melt and reduction of discharge

Increase of river flow rate

Change in water use pattern

More frequent high tides and coastal erosions

More frequent floods

More serious debris flow

Higher risk of drought

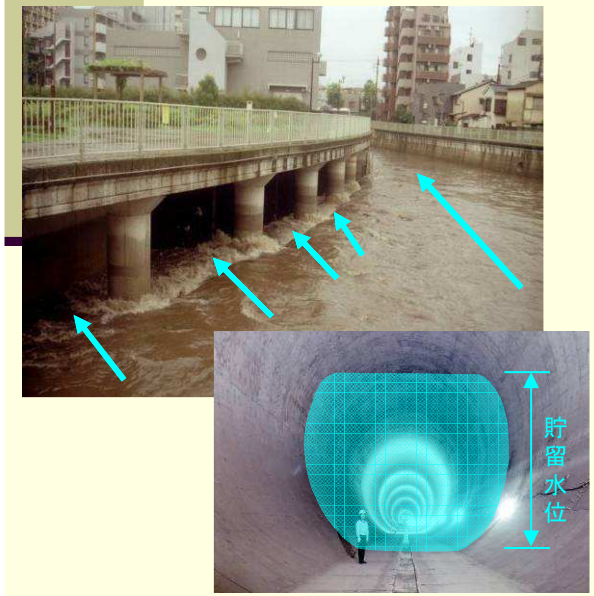
Adaptation by using structures

Improvement of the reliability of structures, full and long-life utilization of existing structures

Constructing new structures

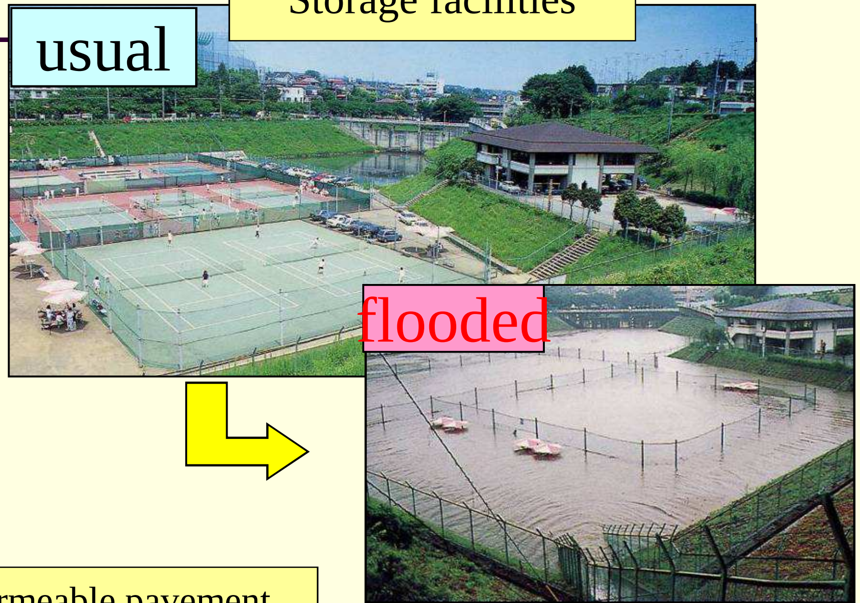
Flood control(Dam)

High standard embankments



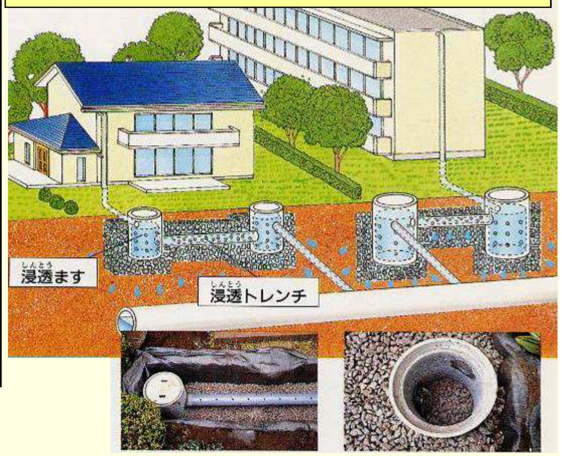
Underground discharging Channel

Storage facilities



Permeable pavement

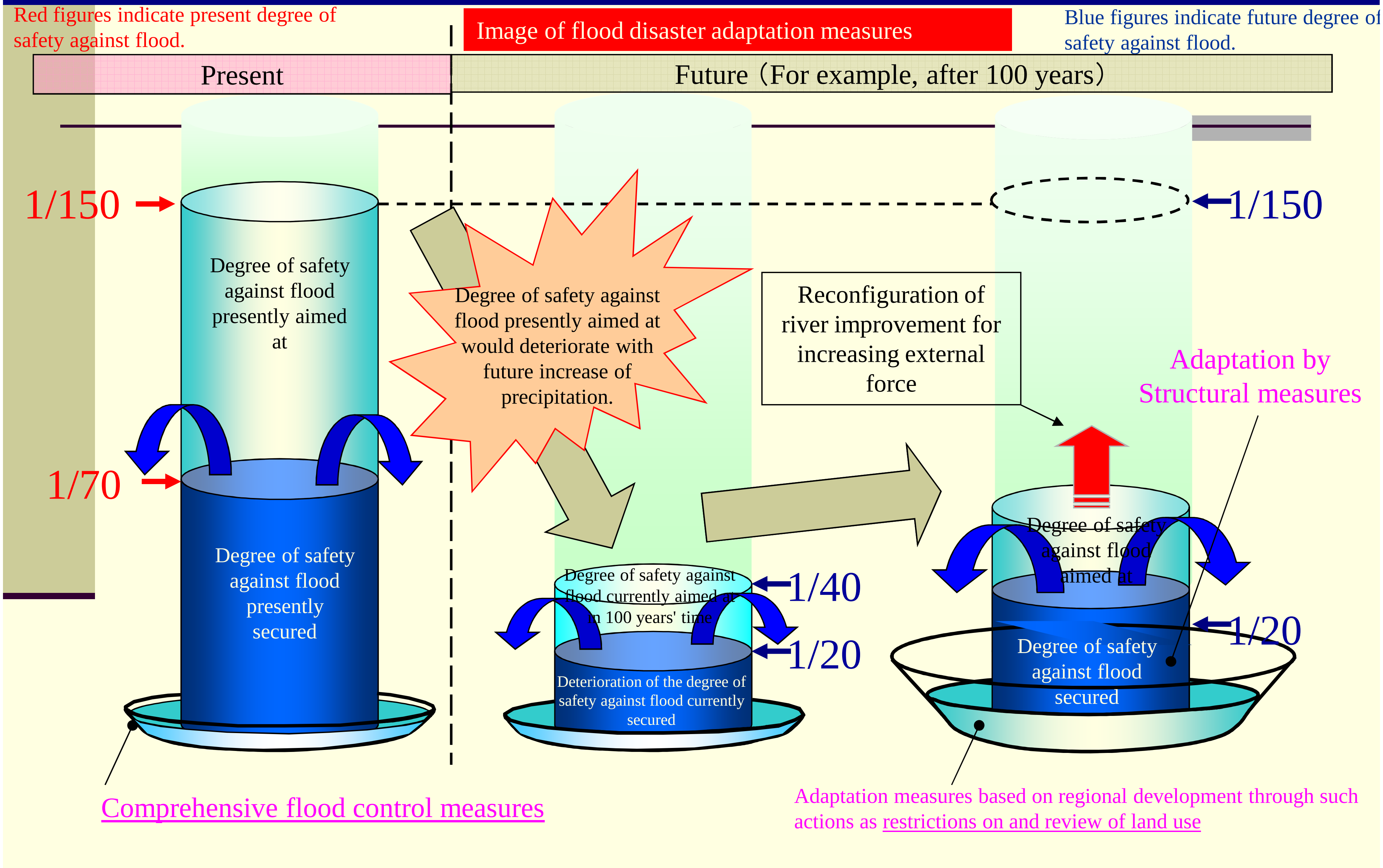
Infiltration trench and inlet



trench inlet

Multiple measures for increasing in risk

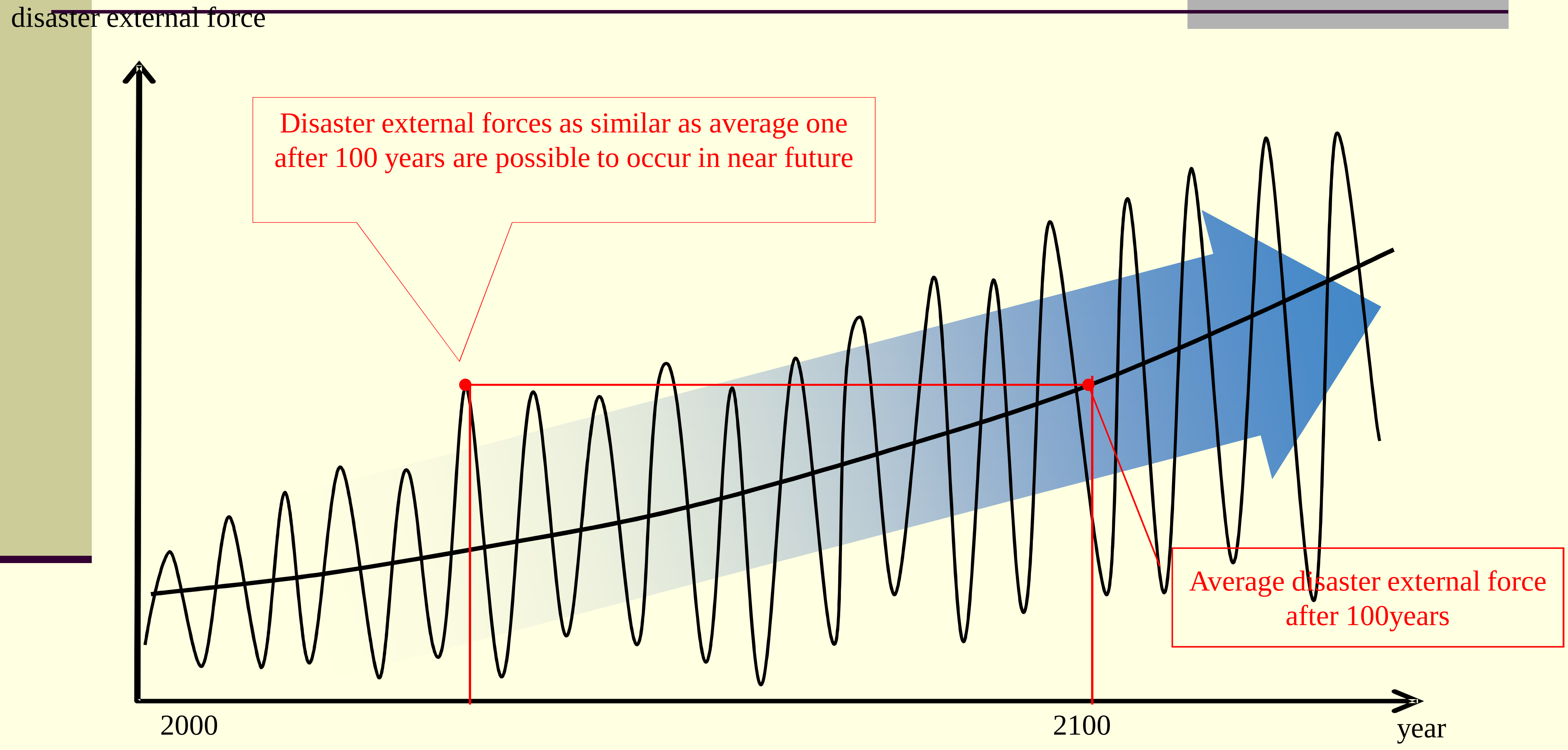
Source: MLIT



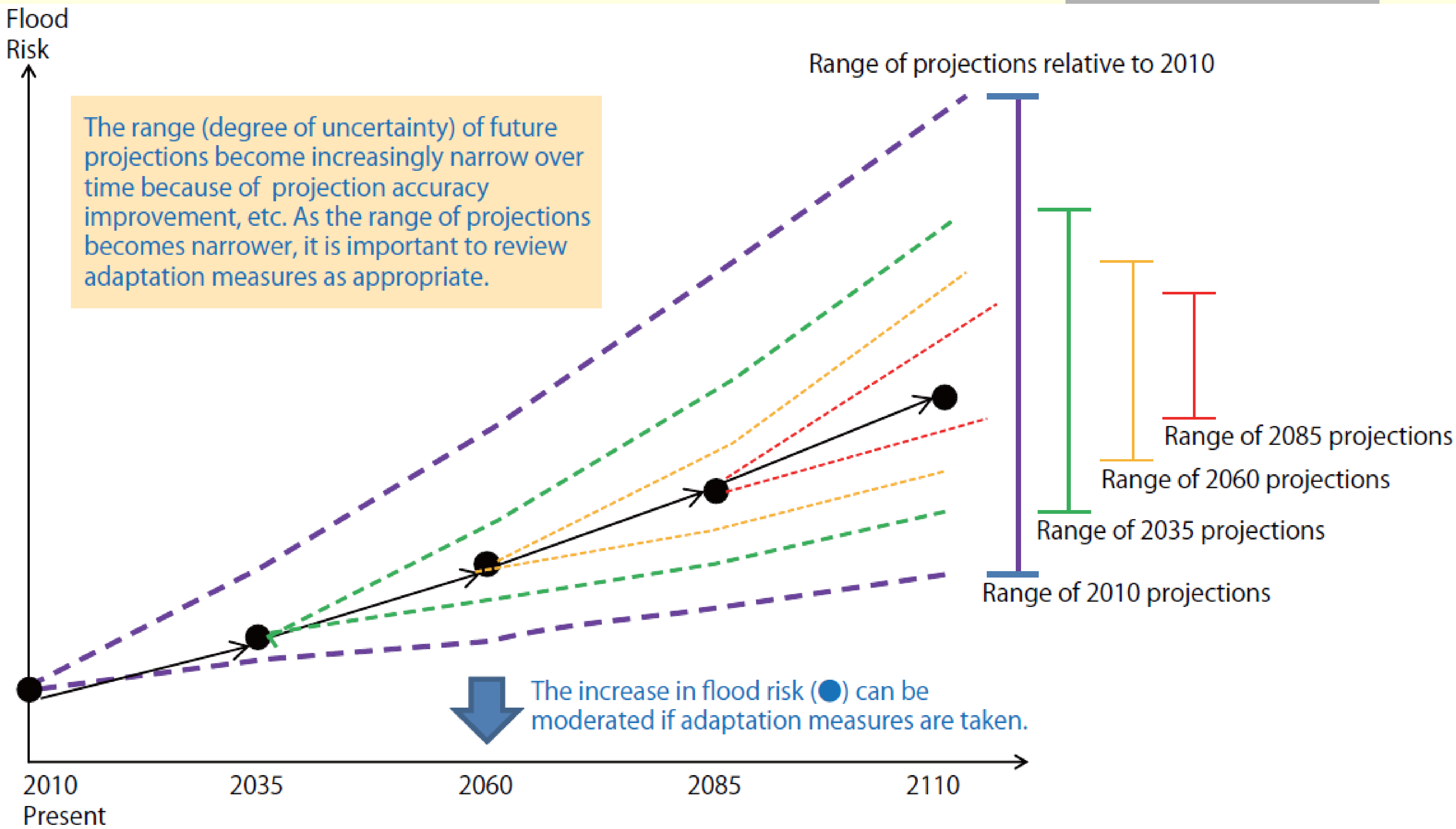
Variability of hazard (disaster external force)

Source: MLIT

Image of increasing in hazard (disaster external force)



Necessity of flexible (adaptive) approach considering uncertainties



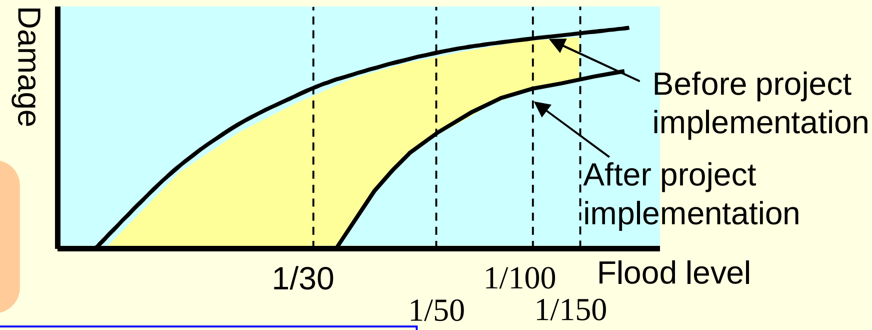
Example of Economic Loss Evaluation Protected by Infrastructures: Calculating Expected Average Annual Damage Reduction Source: MLIT

- Amount of damage reduction is the difference between damage before and after project implementation for a specific flood level.

> Amount of damage reduction by flood level =
> Estimated damage before project implementation – Estimated damage after project implementation

- The amount of damage reduction for each flood level is multiplied by its probability of occurrence to obtain the expected amount of average annual damage reduction.

> Expected amount of average annual damage reduction =
> Σ(Amount of damage reduction by flood level) x (Probability of occurrence)



Scale at the time of assessment E.g. 1/10

Overall stock effects of flood control project

Scale of discharge	Exceedance probability	Amount of damage: Before project implementation (1)	Amount of damage: After project implementation (2)	Amount of damage: Amount of reduction (3) = (1) - (2)	Interval average of damage amount (4)	Interval probability (5)	Average annual damage (4) x (5)	Cumulative total of average annual damage = Expected amount of average annual damage reduction
Q_0	N_0			$D_0(=0)$				
					$\frac{D_0+D_1}{2}$	N_0-N_1	d_1	d_1
Q_1	N_1			D_1				
					$\frac{D_1+D_2}{2}$	N_1-N_2	d_2	d_1+d_2
Q_2	N_2			D_2				
					$\frac{D_{m-1}+D_m}{2}$	N_m-N_{m+1}	d_m	$d_1+d_2+\cdots+d_m$
Q_m	N_m			D_m				

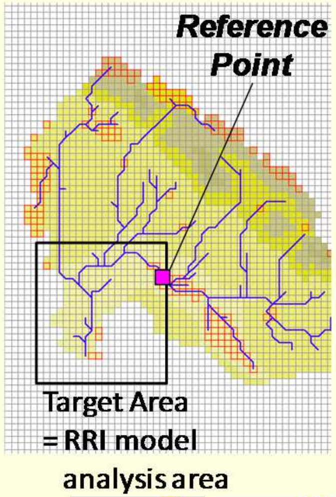
Target of river improvement plan (plan scale) E.g. 1/150

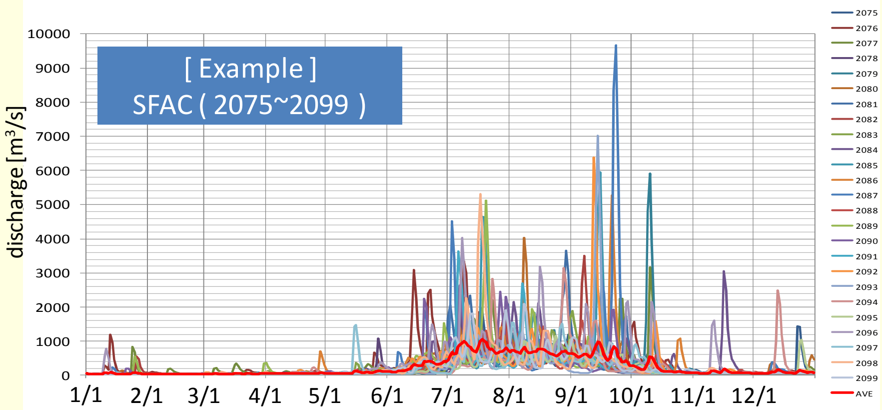
Expected amount of average annual damage reduction

※治水経済調査マニュアル（案）より作成

ICHARM-NDRI Workshop on Assessment of Flood and Inundations under the Effect of Climate Change in Lower West Rapti River Basin in Nepal

5 March, 2012
at The Himalayan Hotel, Kathmandu, Nepal

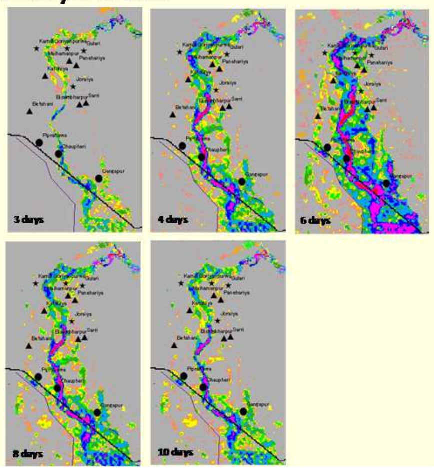


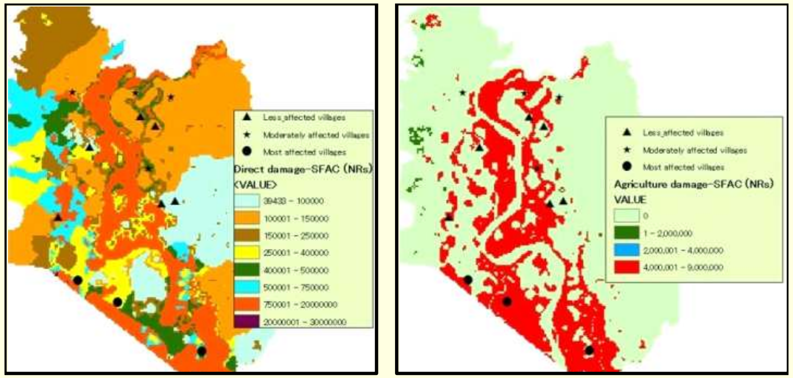


KAKUSHIN

(MEXT)

- ✓ MRI-AGCM3.1S&3.2S
- ✓ IFAS-PDHM(Ver.2)
- ✓ RRI (Rainfall-Runoff-Inundation Model





1) households　　　2) rice

Projection of future damage as of 2085

Considerations to be taken for implementation toward integrated flood management under climate change

Source: MLIT (modified)

(1) Best mix of structural & non-structural measures

(2) Priority investment in preventive measures

(3) Preparation of road maps

(4) Adoption of a flexible approach

(5) Cooperation with related organizations and the public

(6) Developing new technologies through coupling in-situ data with global data

(7) Promotion of research and application of their results (demonstrations) to plan integrated flood management.

Your active commitments, studies, practices, implementations and feedbacks to AWCI-Flood WG are very welcome!

Thank you for your efforts and international cooperation to promote integrated flood risk management under GEOSS-AWCI-Flood WG.

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