ICHARM CHALLENGES FOR CONTRIBUTION TO WATER RELATED DISASTER REDUCTION AND PREVENTION

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The 7th GEOSS Asia-Pacific Symposium WG1(AWCI)

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ICHARM
International Center for Water Hazard and Risk Management
under the auspices of UNESCO hosted by PWRI, Tsukuba
Mission of ICHARM  (newly established at the first governing board on February 25, 2014)

The mission of ICHARM is to serve as the Global Centre of Excellence for Water Hazard and Risk Management by, inter alia, observing and analyzing natural and social phenomena, developing methodologies and tools, building capacities, creating knowledge networks, and disseminating lessons and information in order to help governments and all stakeholders manage risks of water-related hazards at global, national, and community levels.

The hazards to be addressed include floods, droughts, landslides, debris flows, tsunamis, storm surges, water contamination, and snow and ice disasters.

We envision a Center of Excellence housing a group of leading people, superior facilities, and a knowledge base which enables conducting i) innovative research, ii) effective capacity building, and iii) efficient information networking. Based on these three pillars, ICHARM will globally serve as a knowledge hub for best national/local practices and an advisor in policy making.

ICHARM was established March 6, 2006 at Tsukuba
ICHARM’s Philosophy: **Localism** (Local Practices)
Delivering best available knowledge to local practices

**Efficient information networking**

**Global Centre of Excellence**
for Water Hazard and Risk Management

- Master Course
  - Hazard Mapping Course
  - River & Dam Course
  - Supported by JICA
- Ph.D. Course
- Innovative research
- Flood Preparedness Indicators/Standard
- Flood & drought risk assessment under climate change
  - Supported by MEXT (Sousei Program)

**Effective capacity building**

- IRDR
- UNESCO Centers
- IFI
- Sentinel Asia
- GEOSS AWCI
- WWAP, AWDO
- WWF, APWF
- UNISDR GP-GAR
- IFNet/GFAS

Working as a Knowledge Hub on W&D through Technical Assistance
Supported by ADB & UNESCO

Flood Alert system
Hazard mapping
(IFAS, BTOP, RRI models)
Early Warning - IFAS (Integrated Flood Analysis system) for insufficient observed basin

Global data: topography, land use, etc.

Import satellite rainfall and ground-gauged data

Model creation

Run-off analysis by PWRI distributed tank model

Output: River discharge, Water level, Rainfall distribution

Alert message by E-mail and on the display for river management authorities

Discharge reaches warning level

Evacuate from dangerous areas

Judge by River management authorities
JICA Training program

"2013 Capacity Development for Flood Risk Management with IFAS“ by using satellite-based & ground gauges rainfall data from 9 July to 6 August 2013 at ICHARM in Tsukuba, Japan

16 participants from 6 countries (Philippine, Thailand, Viet Nam, Bangladesh, Kenya, Nigeria)
IFAS Training for ASEAN countries by JICA/AHA center

“Capacity Development for Immediate Access and Effective Utilization of Satellite Information for Disaster Management”
on September 9-12, 2013 at the AHA Centre (ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management) in Jakarta

18 participants from 10 countries
(Singapore, Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand and Vietnam)
IFAS installation and identifying flood causes in Pampanga and Cagayan river basins in the Philippines

**Pampanga River**
- 10,454km²
- 18 rainfall stations
- 11 water level stations

**Cagayan River**
- 27,280km²
- 5 rainfall stations
- 5 water level stations

**Mayapyap station**
- IFAS results at Mayapyap station

**Gamu station**
- IFAS results at Gamu station
Two-dimensional model capable of simulating rainfall-runoff and flood inundation simultaneously.

The model deals with slopes and river channels separately.

At a grid cell in which a river channel is located, the model assumes that both slope and river are positioned within the same grid cell.

Emergency inundation Simulation in Chao Phraya river basin in Thailand as of Oct. 14, 2011

RRI (Rainfall - Runoff - Inundation) model by using satellite data (3B42RT) (Sayama 2011)

Two dimensional diffusion wave model

Nakhon Sawan
Ayutthaya
Bangkok

1: July 2
31: Aug 1
62: Sep 1
92: Oct 1
123: Nov 1
152: Nov 30
UNESCO Project (2 years: 2012-14) Strategic Strengthening of Flood Warning and Management Capacity of Pakistan

Satellite based rainfall (mm) vs discharge (m³/s) from 15 July to 18 August

Target area for IFAS

GSMaP (satellite rainfall data) is useful tentatively in the upstream of Kabul river basin with no rain gauges data
Indus-IFAS: flood forecasting system based on IFAS / RRI (UNESCO-Pakistan project 2012-13)

**INPUT DATA:**
- Rainfall data (PMD ground-gauges, GSMaP and forecasted)
- Real-time observed discharges

**OUTPUT DATA:**
- Rainfall distribution maps
- Hydrographs at specified locations
- Inundation extents in mid-low Indus

**CHALLENGES:**
- Lack of trans-boundary data
- Null-Low rain gauges network density
- Uncertainty on snowmelt
Capacity Building for Pakistan (2012-13)

6 Pakistani officers (PMD, SPARCO & IPD) graduating from ICHARM/GRIPS MSc

ICHARM participation to international Workshop and Training in Pakistan

Short- training in Japan of 11 Senior Managers from Pakistan

Indus-IFAS training at FFD Lahore
A number of IDPs (Internally Displaced Persons) may currently live in high flood potential areas in South Sudan. As humanitarian and emergency aid to mitigate flood damages, a country wide flood hazard map is desired for effective evacuations. ICHARM rapidly analyzed a series of MODIS remote sensing images (a total of 506 images) obtained from January 2003 to December 2013.
Modification method to get more accurate elevation data using satellite observation product (PRISM DSM)

After removing structures, making moving average of DEM in plain area and then compounding the structures and the modified DEM with GPS.
Flood risk assessment in Climate change

Various GCM experimental on future/current climate

- Basin scale rainfall information
- Hydrological models IFAS / BTOP / RRI
- Projection of discharge variation
- Projection of water level variation
- Projection of water depth variation

Various scenarios
Downscaling/ Biais correction
Uncertainty assessment

Uncertainty assessment
Uncertainty assessment
Uncertainty assessment

Flood frequency map

- 1/10, 1/25, 1/50

Flood risk
Drought risk

- House, industrial, agricultural damages
- Water resources assessment, water stress, risk partition

Uncertainty assessment
Disaster Risk monitoring indices
Agriculture Damage Assessment in the Pampanga River Basin (Flood)

**Flood event period September 26\textsuperscript{th} to October 4\textsuperscript{th}, 2011**

<table>
<thead>
<tr>
<th></th>
<th>Pampanga River Basin (Total Affected Area 15,900ha)</th>
<th>Pampanga Province (Total Affected Area 1,250ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calculated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>1,754</td>
<td>54</td>
</tr>
<tr>
<td>Minimum</td>
<td>966</td>
<td>37</td>
</tr>
<tr>
<td><strong>Reported</strong></td>
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<tr>
<td></td>
<td>777</td>
<td>30</td>
</tr>
</tbody>
</table>

**Flood damage matrix (Bureau of Agricultural Statistics)**

**Comparison of reported and calculated damage values**

Reference:
ICHARM Challenges for contribution to Hyogo Framework for Action 2 & post-2015 MDGs: Development of Global Risk Indices

This consultation is planned to offer water-related risk assessment methods, and help policy-makers and investors take risk sensitive actions. We show that extreme flood risks are measured by using improved methods and risk indices, and provide practical implications for Asia Pacific region.

- **Type of disasters**: flood (and drought)
- **Spatial coverage**: Asia-Pacific region

The results of several river basin examples to be introduced for explaining success, difficulty and limitation as case study.

- **Risk concept**: fatalities (or economic damages) are functions of hazard, exposure, and vulnerability

in cooperation with MLIT and UNISDR Kobe office

◆ **Expected recommendations**

- Identification of methodological limitations and improvement plans
- Suggestion on the way to measure DRR-related targets in the HFA2 and post-2015 MDGs
- Suggestion on the practical and credible risk assessment methodologies
- Suggestion on the possibilities of improving national risk profiles, which include sub-national level information about risk indices, effectiveness of prevention efforts, and key risk drivers
- Suggestion on the water-related risk map for the Asia-Pacific region
OUTLINE OF GLOBAL FLOOD RISK INDICES
For a comprehensive, integrated, multi-disciplinary approach

Quantifying bio-physical aspects of risks
- **Hazard Assessment**
  - Key question
    - **How dangerous are natural conditions?**

- **Exposure Assessment**
  - Key question
    - **How many people or assets are affected by hazards?**

- **Risk Assessment**
  - Key question
    - **Flood risk indicator: GWDRIs**
    - **How seriously disasters would do harm to target areas?**
    - **Where are areas at particularly high risk?**

Vulnerability Assessment
- Key questions
  - *What socio-economic factors would significantly influence losses and damage?*
  - *How exposure and vulnerability are coupled into human losses or economic damages?*

Understanding risks in the human system
Flood risk indicator (Example)

GWDRIs (Global Water-Related Disaster Risk Indicators)
= Total number of fatalities due to the 50-yr flood
= children deaths + elderly deaths + other deaths
= \( f(\text{affected people at 50-yr-flood, fatality rate, population distribution ratios}) \)

Runoff and inundation simulation (water depth and area)
GIS data (Number of people)

National records about recent flood victims (epidemiological data)

Population Census data (10-yr stratified age-group population)
Thank you for your kind attention