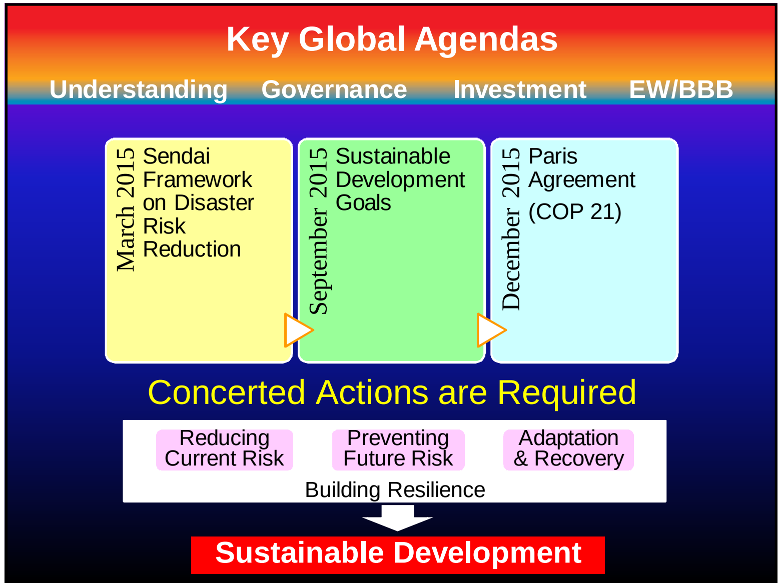
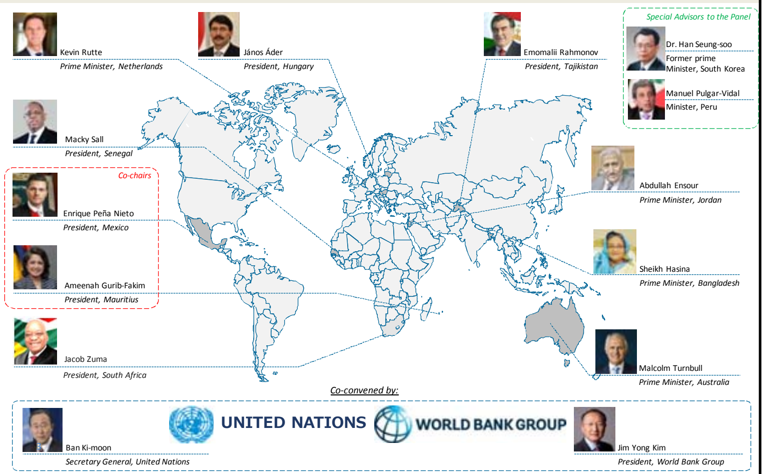
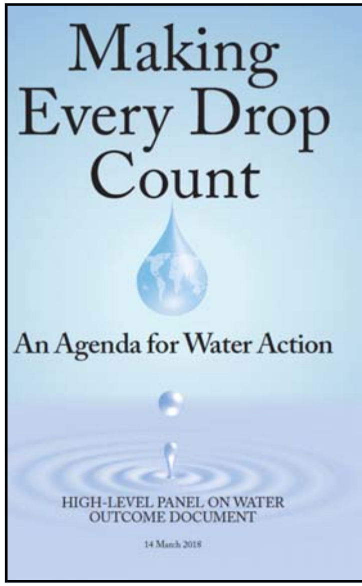
Opening Remarks

Toshio Koike
Director, International Centre for Water Hazard and Risk Management (ICHARM)
Professor Emeritus, the University of Tokyo
Council Member, Science Council of Japan (SCJ), Cabinet Office of Japan
Chair, River Council of Japan



HLPW Panel members (as of 3/21/2016)





Preface

The United Nations and World Bank Group convened a High Level Panel on Water (HLPW) to provide leadership in tackling one of the world's most pressing challenges – an approaching global water crisis. As leaders of our organizations, the challenge we put before the Panel was to identify ways in which the world could accelerate progress towards ensuring the *availability and sustainable management of water and sanitation for all* (SDG 6) as well as to contribute to the achievement of the multiple SDGs that also depend on the development and adequate management of our planet's water resources and thereby achieve the 2030[1] Agenda.

To ensure the highest level of political leadership, we invited 11 sitting Heads of State or Government, as well as a Special Advisor, to lead the Panel for a two-year period starting in April 2016.

During the United Nations General Assembly in September 2016, the Panel issued an Action Plan which called for a fundamental shift in the way the world looks at and manages water. Since then, the Panel members have explored ways to implement this Plan and have taken initiatives in many of the action areas, leading by example. This report presents a summary of the Panel's findings and recommendations.

Today, as we write this Preface, some parts of our planet are suffering from the misery of drought while others endure the destruction of floods. Climate change is exacerbating natural variability of the water cycle, increasing water stresses that constrain social progress and economic development. Our health, food security, energy sustainability, jobs, cities, and the ecosystems on which all life is based are all being influenced by the way water is being managed in different parts of the world.

The Panel's recommendations call for all stakeholders to be involved in crafting responses to these challenges, and to build on the work already underway. Governments will need to take the lead in many cases, including in cooperating across national boundaries, but citizens, civil societies, the private sector, and international organizations also have vital roles to play in meeting these challenges. At stake is our human right to access to safe drinking water and sanitation and our future survival. The International Decade for Action "Water for Sustainable Development", 2018-2028 gives new inspiration and opportunity to accelerate and enforce our efforts in this direction.

The Panel members and their respective member states have committed to take action on water, and are inviting their peer leaders, as well as other policymakers, and leaders from civil society and the private sector to find creative and collaborative solutions to better manage and value water. We wholeheartedly endorse this urgency to act.

António Guterres
UN Secretary-General

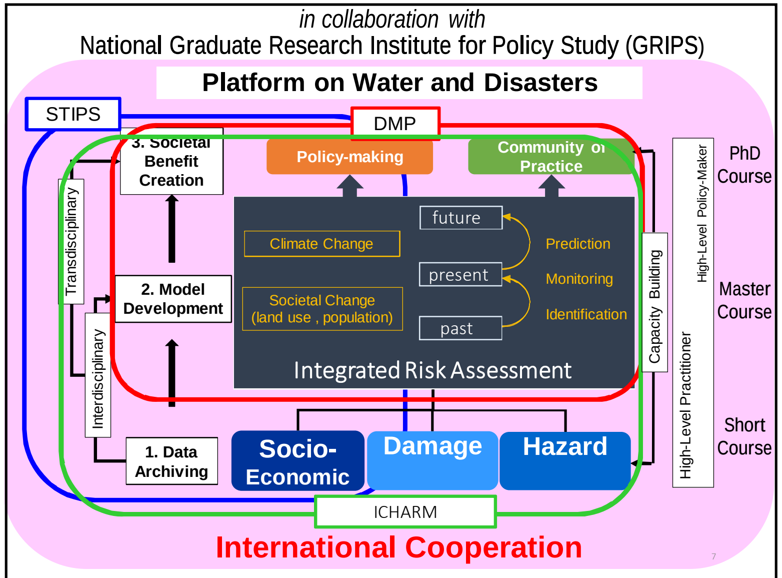
Jim Yong Kim
President of the World Bank Group

HEADLINE RECOMMENDATION

Shift focus of disaster management from response to preparedness and resilience.

DETAILED RECOMMENDATIONS

- Political leadership is needed to raise awareness, strengthen science (that includes a gender perspective), policy and planning, upgrade education, and mobilize financing.
- The HLPW Action Plan should be utilized as useful guidance and a connector for advancing the actions towards achieving the Agenda 2030 (SDGs and Paris climate agreements and Sendai Framework) in an integrated manner. Platforms on Water Resilience and Disasters among all stakeholders should be formulated in countries to facilitate dialogue and scale up community-based practices.
- Disaster risk prevention and resilience should be integrated in long-term planning.
- Financing for and investment in water-related DRR and resilience should be doubled within the next five years. "Principles on Investment and Financing for Water-related DRR" should be used to make effective use of this increased investment and could help increasing investments in countries.
- Global research networks, global disaster database, integrated scientific tools for assessing risks, and a global platform integrating science and policy including higher education should be developed and put into support of countries.
- Special Thematic Sessions on Water and Disasters should be organized biennially in the UN General Assembly to raise global awareness.



InternationalDecade for Action "Water forSustainable Development" 2018-28

THE CHANGES WE NEED

Achieving SDG6 and other water-related goals requires coordinated and consolidated efforts of all stakeholders through different mechanisms. To support these efforts, UNGA has proclaimed the period 2018–28 the International Decade for Action: "Water for Sustainable Development"[1] .The Decade will start and end on World Water Day (March 22). It seeks to inspire action to achieve the 2030 Agenda, in particular SDG6, by facilitating access to knowledge and the exchange of good practices. Events under its aegis are to generate new information relevant to water-related SDGs; pursue advocacy and networking; promote partnerships and action; and strengthen communications for reaching the water-related goals.

HEADLINE RECOMMENDATION

UN member states and other stakeholders are encouraged to use the UN Water Action Decade as a platform for policy dialogue, exchanges of best practices and building partnerships to address water issues at all levels.

DETAILED RECOMMENDATIONS

Governments are encouraged to devote each year of the Water Action Decade to a water-related issue outlined in this document.

2nd Plenary Session for the Platform on
Water Resilience and Disasters in Sri Lanka

Review of the 1st Plenary Session for the Platform on Water and Disasters on August 24, 2017

Tetsuya IKEDA

Chief Researcher

E-mail: te-ikeda@pwri.go.jp

International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM)

March 28, 2018

Support for effective flood management in Sri Lanka

- **Background/ History**
  - ✓ Large-scale flood disaster occurred in Sri Lanka in late May 2017, leaving over 300 people dead or missing.
  - ✓ The Government of Japan dispatched the Japan Disaster Relief (JDR) Expert Team to help emergency efforts, to which PWRI has contributed.
  - ✓ ICHARM and EDITORIA will continuously provide **useful information for flood management** though newly developed Website on the DIAS, and will conduct capacity development for effective use of information.
  - ✓ **Plenary Session** was held on August 24 with the DGs from ID, MD, DMC, NBRO, Ministry of Megapolis & WD
- **Expected Outcomes**
  - ✓ This will lead to human damage reduction and efficient emergency recovery by disseminating effective flood forecasts and early evacuation alerts.

Support Menu for effective flood management in Sri Lanka (EDITORIA, ICHARM, JAXA-SAFE)

1) Rainfall forecasting information
   - ➢ Hourly 3 days prediction, possibly 16 days ahead at maximum
2) Rainfall observation data
   - ➢ Ground observation data through rain gauge installation
   - ➢ Satellite observation data
     - GSMaP_NOW (0 hour delay from observation)
     - GSMaP_NRT corrected data by using real time in-situ data
3) Calculated hourly information on flood & inundation forecasting
4) Cloud images from Himawari No.8 satellite
5) Information on large-scale inundation area from an emergency satellite observation by ALOS-2
6) DIAS: Real-time provision of flood hazard information
7) Capacity development for effective flood management

1st Plenary Session for the Platform on Water and Disasters”

Time: August 24, 2017
Venue: Auditorium, Irrigation Department, Colombo, Sri Lanka
Co-Chair:
Prof. Srikantha Herath, Ministry of Megapolis & Western Development
Prof. Toshio Koike, ICHARM
Agenda:

- Lessons and actions from 2017 flood disaster (Report from Sri Lankan institutions and Japan Disaster Relief Expert Team)
- Presentation on ICHARM’s activities
- Discussion on concept and framework of Platform on Water & Disasters
- Targeted Actions to be undertaken

Outcomes of the 1st Plenary Session

Platform Participating Organizations:

- Irrigation Department (ID)
- Meteorology Department (MD)
- Survey Department (SD)
- Disaster Management Center (DMC)
- National Building Research Organization (NBRO)
- Ministry of Magapolis and Western Development (MMWD)
- Ministry of Mahaweli Development & Environment (TBD, MMDE)

Platform Target Actions and Coordinating Bodies

1. Early Warning: rainfall, flooding, landslide:	ID, MD, NBRO
2. Adaptation Planning for Global Change: (such as Climate Change, Urbanization)	ID, MMDE, MMWDA
3. Economic Effect of Disasters:	MMDE, DMC
4. Contingency Planning and Mainstreaming DRR:	DMC

Demonstration Sites of Target Actions

1. Kalu River Basin (as rural basin)
2. Kelani River Basin (as urban basin)
3. Malvathu River Basin (as arid basin)

Global Forum on Science and Technology for Disaster Resilience 2017

Date: November 23 - 25, 2017 Venue: Tokyo, Japan
Organizers: UNISDR, ICSU, IRDR, SCJ, ICHARM, NIED
Participants: 228 from 42 countries
(including Dr. Asiri, DG of NBRO and Ms. Anoja, Director of DMC)
Objectives:

1) Guidelines for strengthening DRR national platforms and coordination mechanisms through enhanced contribution of science and technology

2) Periodic synthesis reports on the state of science and technology for reducing disaster risk.



IFI technical session at the World Bosai Forum

Platform on Water and Disaster – ICT, Economy, Community, Dynamics –

Date: November 28, 2017 Venue: Sendai, Japan
Objective:
To discuss how the Platforms can contribute to reduction of water-related disaster damage **from diverse perspectives**, and to discuss about **the international trend and the effort** by individual countries
Outline:

- Keynotes from different expertise of **ICT, economy, community, dynamics**
- Presentations by four government officials from **Philippines, Sri Lanka, Pakistan and Brazil**


3rd Asia-Pacific Water Summit Thematic Session

WATER AND DISASTERS IN THE CONTEXT OF CLIMATE CHANGE - From the Mountains to the Islands-

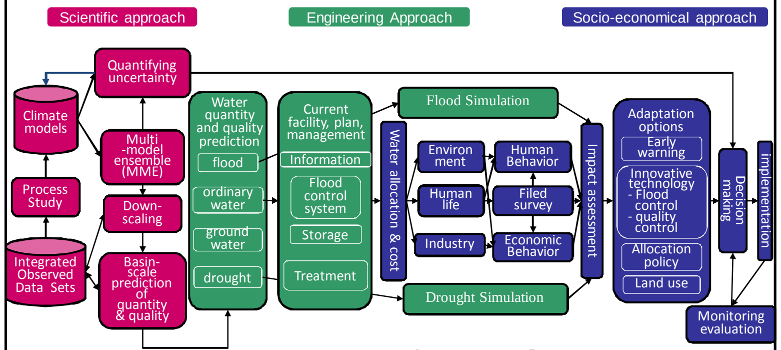
Time & Date: 13:30 – 17:00, December 11, 2017
Venue: Yangon, Myanmar
Co-organizers: ICHARM, ICIMOD, SPC, HELP
Session Framework:
Part 1: Keynote Speeches by High-Level Leaders (3 speakers)
Part 2: Country Presentations
(from 7 countries and 10 presenters)
Part 3: Panel Discussion (5 panelists)

ICHARM PWRI ICIMOD Pacific Community Communauté du Pacifique

Innovative Science and Technology for Reducing Water-related Disaster Risk

Toshio Koike
Director, International Centre for Water Hazard and Risk Management (ICHARM)
Professor Emeritus, the University of Tokyo
Council Member, Science Council of Japan (SCJ), Cabinet Office of Japan
Chair, River Council of Japan

End to End Approach on Climate Change Adaptation

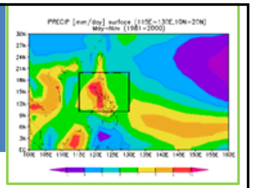


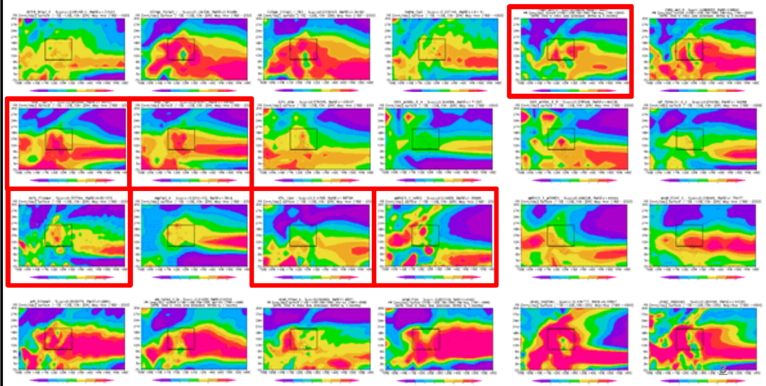
Data & Information

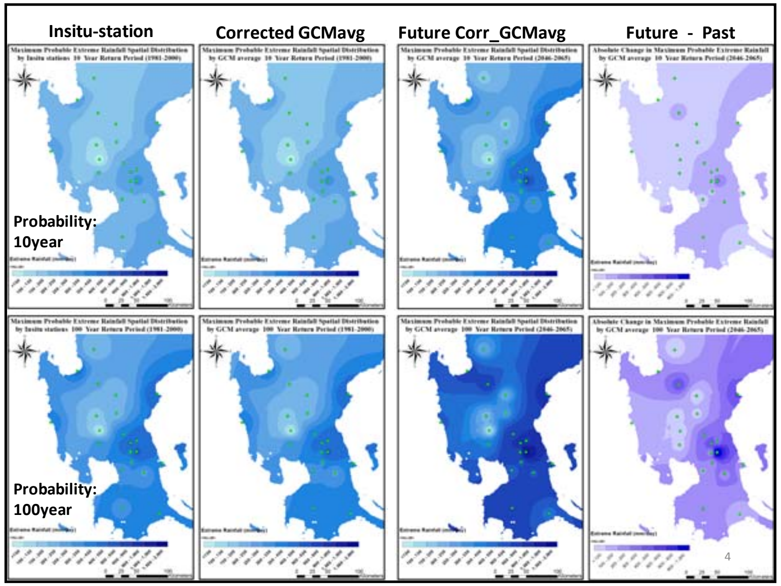
Volume | Veracity | Velocity | Variety | Visualization

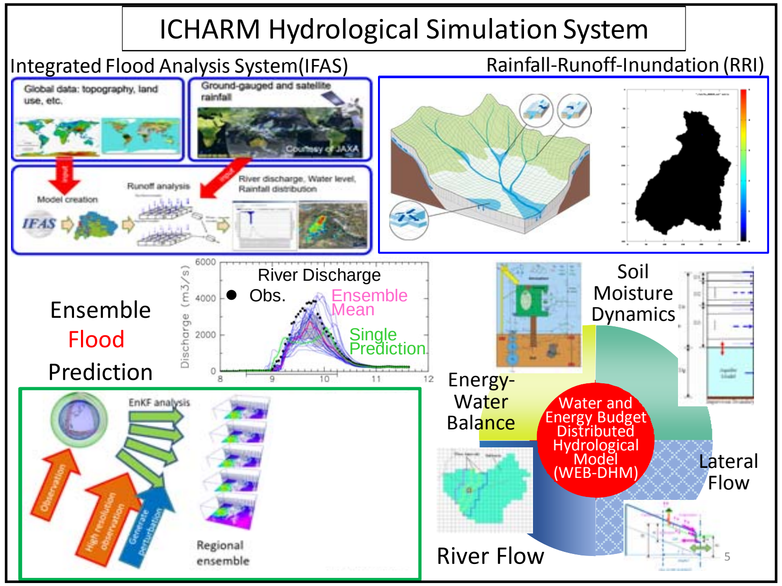
Working Together ⇨ Platform ⇦ Capacity Building

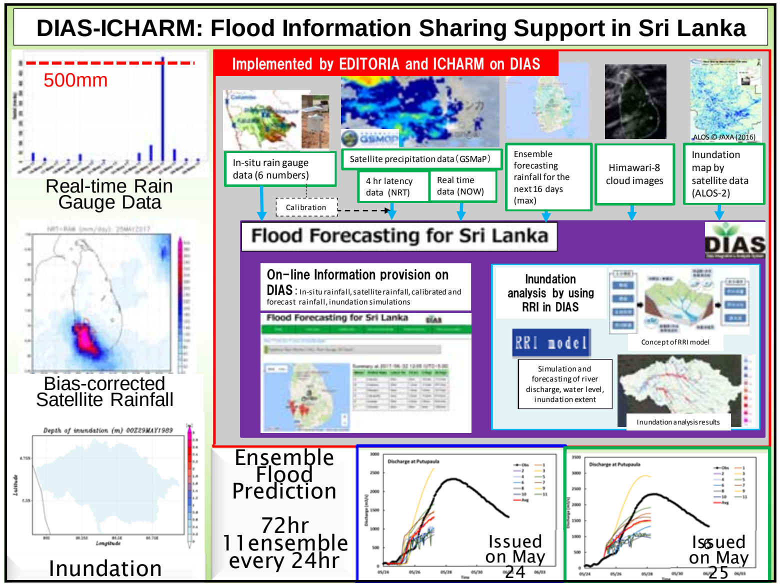
MODEL SELECTION: Precipitation (May-November)

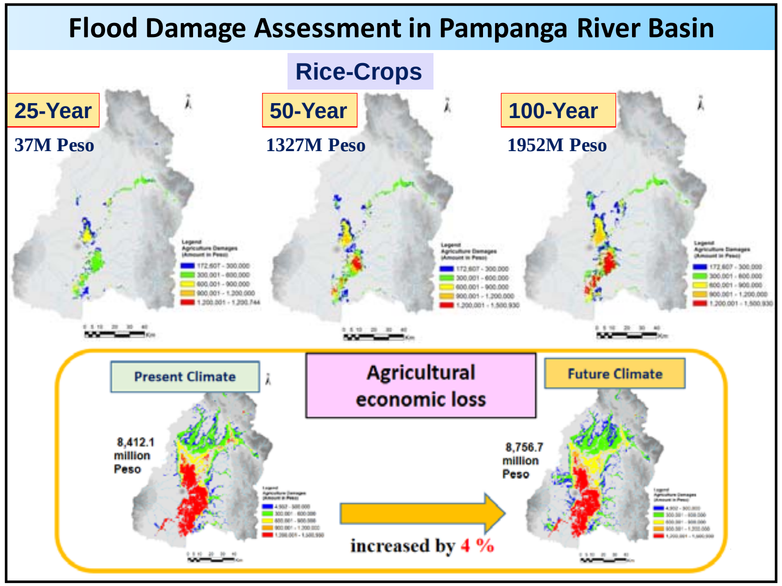


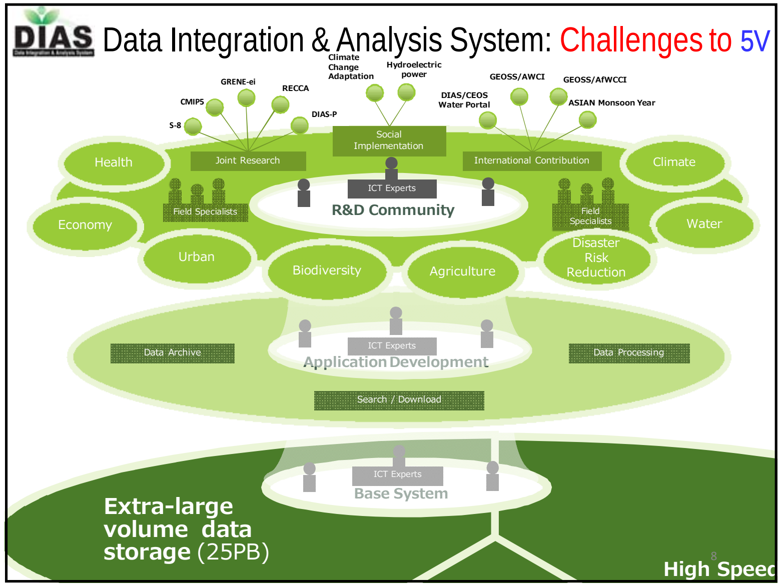





ICHARM Hydrological Simulation System
Integrated Flood Analysis System(IFAS)
Rainfall-Runoff-Inundation (RRI)
Global data: topography, land use, etc.
Ground-gauged and satellite rainfall
Courtesy of JAXA
Model creation
Runoff analysis
River discharge, Water level, Rainfall distribution
IFAS
Ensemble
Flood
Prediction
River Discharge
Obs.
Ensemble Mean
Single Prediction
Discharge (m3/s)
EnKF analysis
Observation
High resolution observation
Generate perturbation
Regional ensemble
Soil Moisture Dynamics
Energy-Water Balance
Water and Energy Budget Distributed Hydrological Model (WEB-DHM)
Lateral Flow
River Flow


DIAS-ICHARM: Flood Information Sharing Support in Sri Lanka
500mm
Real-time Rain Gauge Data
Bias-corrected Satellite Rainfall
Inundation
Implemented by EDITORIA and ICHARM on DIAS
In-situ rain gauge data (6 numbers)
Satellite precipitation data (GSMaP)
4 hr latency data (NRT)
Real time data (NOW)
Calibration
Ensemble forecasting rainfall for the next 16 days (max)
Himawari-8 cloud images
Inundation map by satellite data (ALOS-2)
ALOS © JAXA (2016)
Flood Forecasting for Sri Lanka
DIAS
On-line Information provision on DIAS: In-situ rainfall, satellite rainfall, calibrated and forecast rainfall, inundation simulations
Flood Forecasting for Sri Lanka
Inundation analysis by using RRI in DIAS
RRI model
Concept of RRI model
Simulation and forecasting of river discharge, water level, inundation extent
Inundation analysis results
Ensemble Flood Prediction
72hr
11ensemble
every 24hr
Discharge at Putupaula
Issued on May 24
Issued on May 25

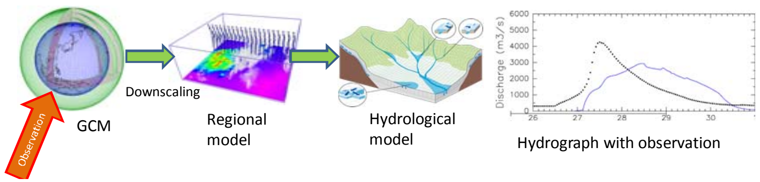

Flood Damage Assessment in Pampanga River Basin
Rice-Crops
25-Year
37M Peso
50-Year
1327M Peso
100-Year
1952M Peso
Present Climate
8,412.1 million Peso
Agricultural economic loss
Future Climate
8,756.7 million Peso
increased by 4 %

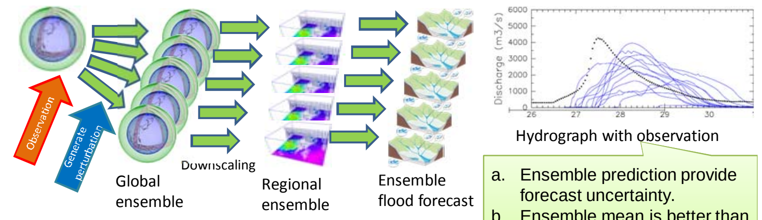

DIAS Data Integration & Analysis System: Challenges to 5V
S-8
CMIPS
GRENE-ei
RECCA
DIAS-P
Climate Change Adaptation
Hydroelectric power
DIAS/CEOS Water Portal
GEOSS/AWCI
GEOSS/AfWCCI
ASIAN Monsoon Year
Social Implementation
Joint Research
International Contribution
Health
Climate
Economy
Water
Field Specialists
ICT Experts
R&D Community
Urban
Biodiversity
Agriculture
Disaster Risk Reduction
Data Archive
Application Development
Data Processing
Search / Download
Base System
Extra-large volume data storage (25PB)
High Speed

Ensemble Rainfall prediction

Tomoki Ushiyama (ICHARM, PWRI)
Mar. 28, 2018 at Sri Lanka plenary meeting

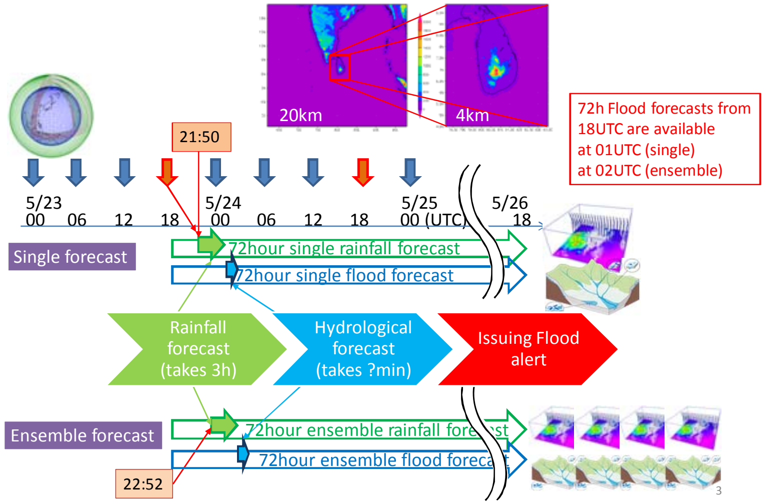
Single and Ensemble prediction system





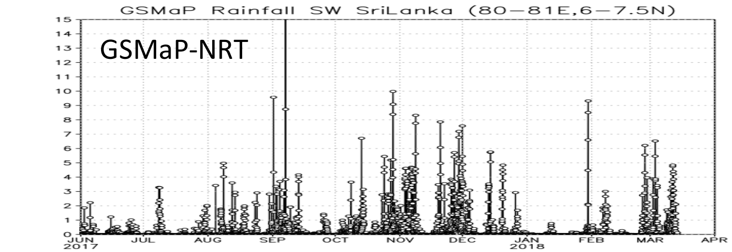
a. Ensemble prediction provide forecast uncertainty.
b. Ensemble mean is better than a single control run.

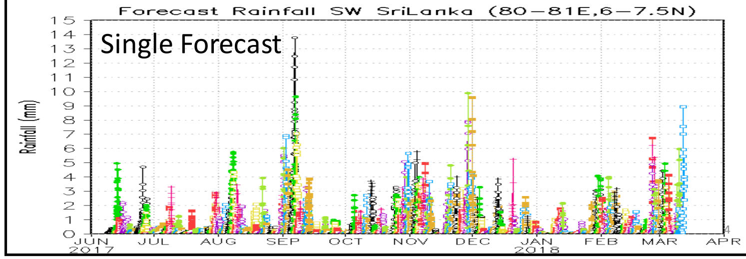
Numerical Weather Prediction in Sri Lanka



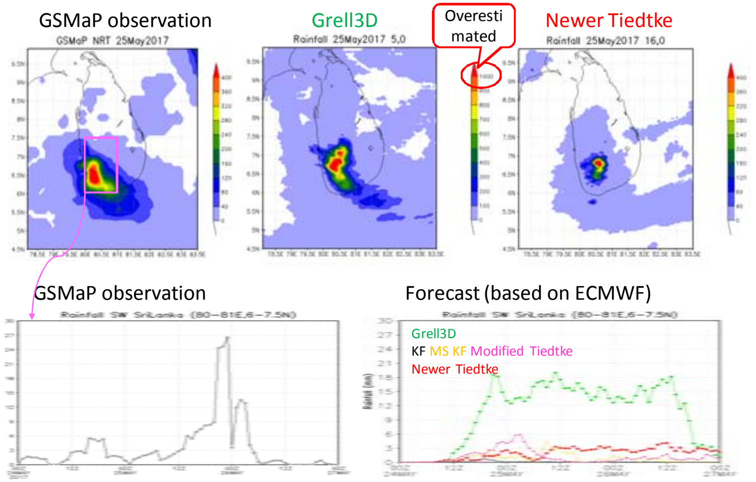
72h Flood forecasts from 18UTC are available
at 01UTC (single)
at 02UTC (ensemble)

GSMaP vs. Forecast (single)





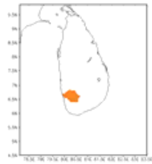
Rainfall forecast in 25May2017



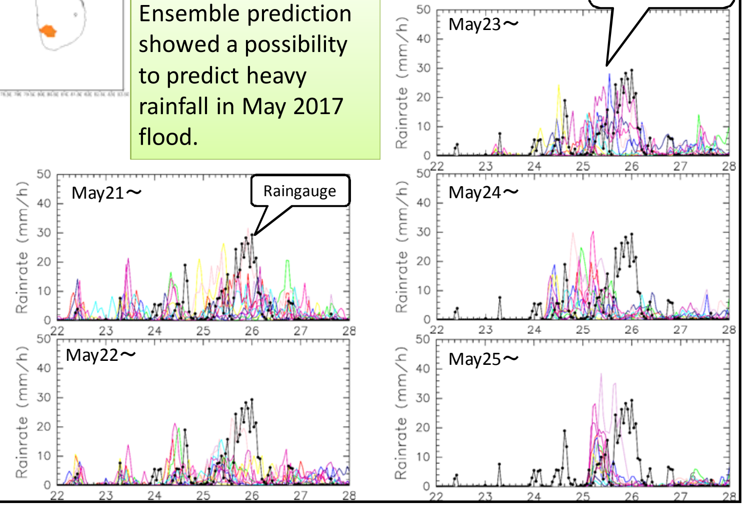
Local time difference: UTC+5.5h

5

Ensemble Forecast



Ensemble prediction showed a possibility to predict heavy rainfall in May 2017 flood.



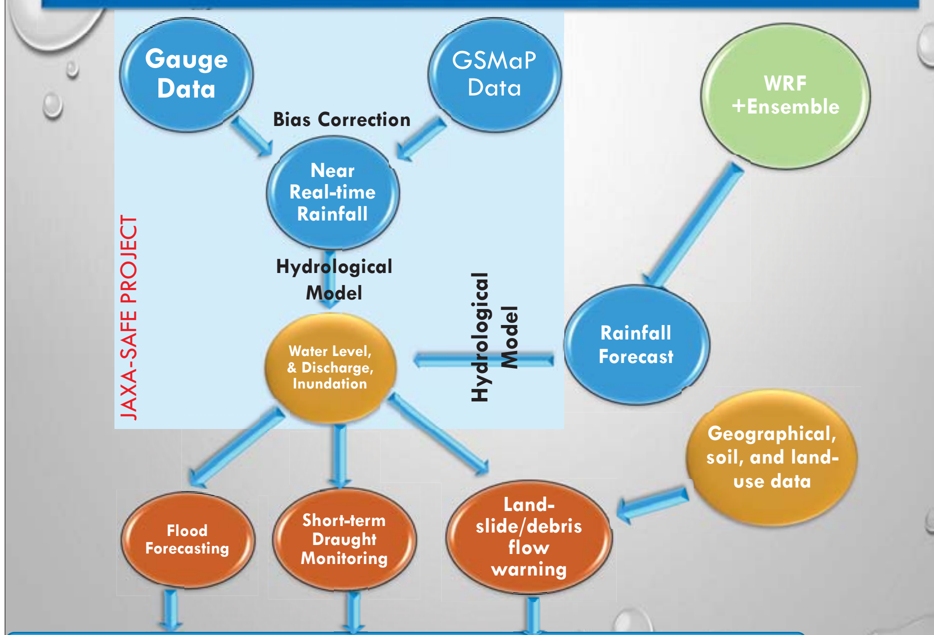
REAL-TIME RAINFALL MONITORING & HYDROLOGICAL MODELING IN KALU RIVER BASIN

Mohamed Rasmy (Senior Researcher)

International Centre for Water Hazards and Risk Management (ICHARM)

Public Work Research Institute (PWRI)

SYSTEM DEVELOPMENT & APPLICATIONS

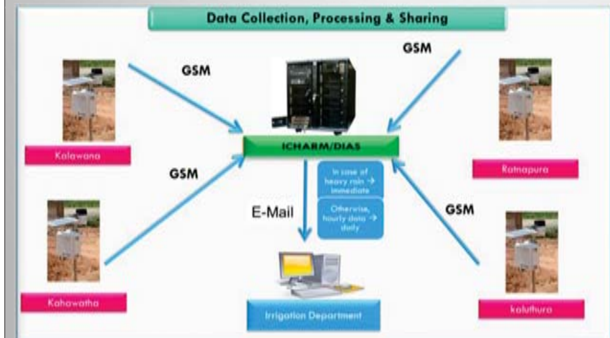


Socio-economic Benefits:
Hazard Maps & Disaster Early Warning, Assessment of Risk and Damages

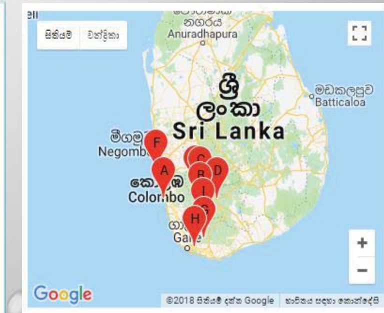
2

Technology upgrade for rainfall monitoring

Gauge Data



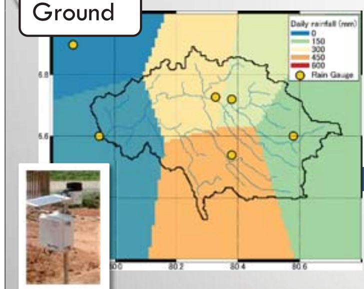
real time rainfall data observing system



Installed gauges

Bias correction of satellite rainfall using ground observation

Ground



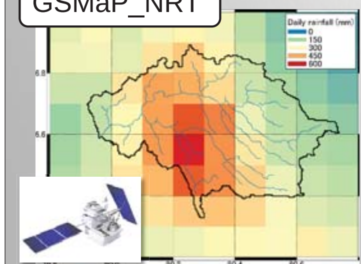
Error of rainfall area location (Geolocation error)

corrected by comparison of rainfall pattern

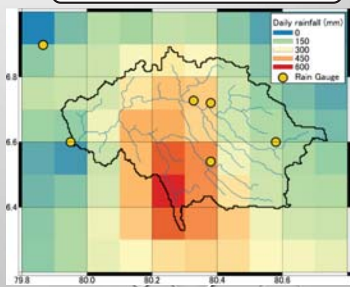
Bias of rainfall intensity

Corrected using information of real-time ground observation

GSMaP_NRT



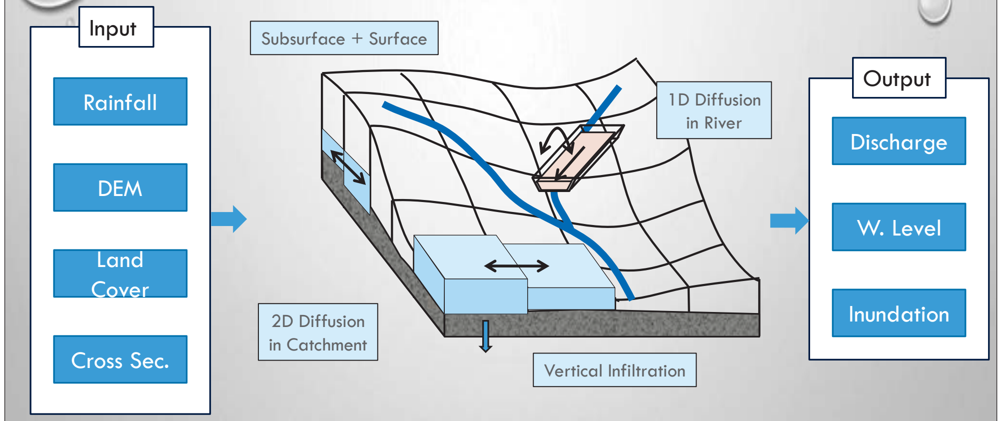
Bias corrected GSMaP



Bias correction (GSMaP-IF2)

25 May 2017, Kalu basin

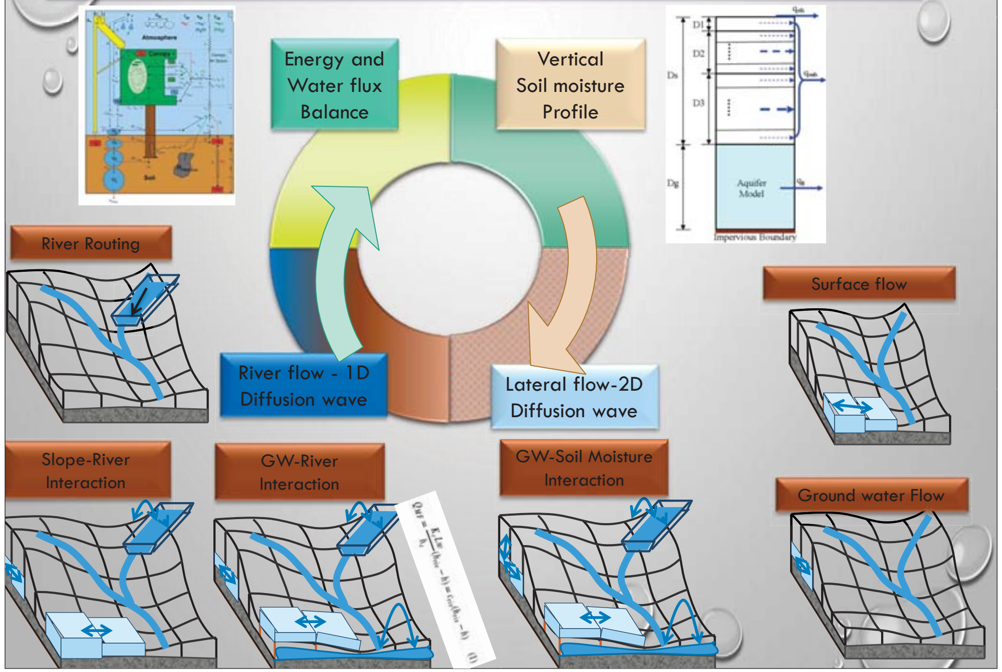
Rainfall – Runoff – Inundation (RRI) Model



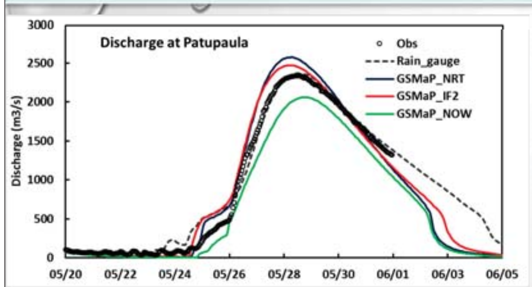
- Two-dimensional model capable of simulating rainfall-runoff and flood inundation simultaneously
- The model deals with slopes and river channels separately
- At a grid cell in which a river channel is located, the model assumes that both slope and river are positioned within the same grid cell

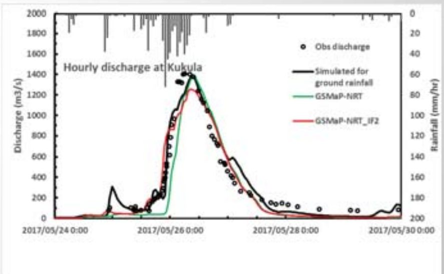
Sayama, T. et al.: Rainfall-Runoff-Inundation Analysis of Pakistan Flood 2010 at the Kabul River Basin, Hydrological Sciences Journal, 57(2), pp. 298-312, 2012.

Water-Energy budget-RRI (WEB-RRI) Model



Hydrological Modeling – Real-time modeling

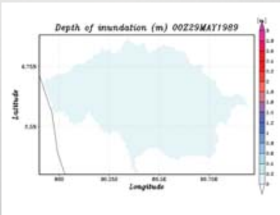




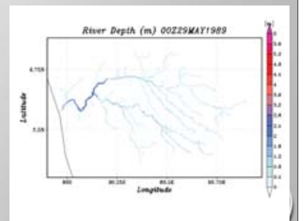
Hourly discharge at Putupaula

Hourly discharge at Kekula

Inundation depth



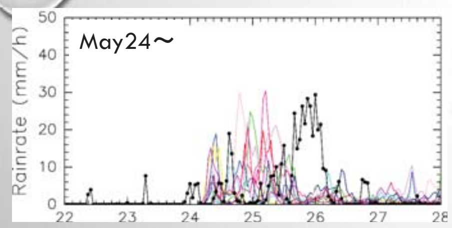
Inundation depth



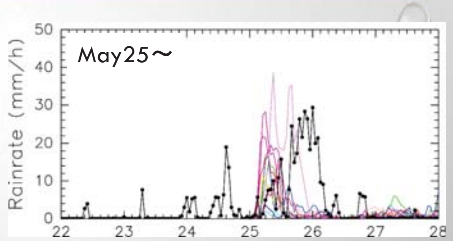
River Water Level

Need accurate DEM data for better results

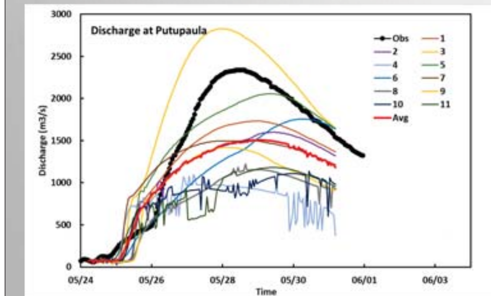
ENSEMBLE FLOOD FORECAST



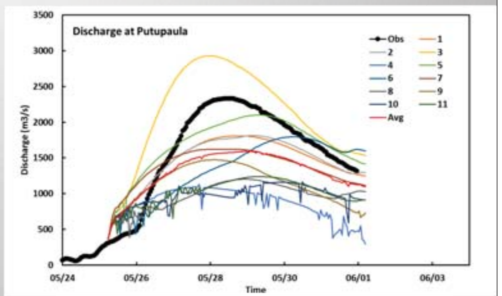
From 24th May ~ 31st May



From 25th May ~ 1st June



ENSEMBLE FLOOD FORECASITNG



ENSEMBLE FLOOD FORECASITNG

A Method to Estimate Sediment Runoff due to Heavy Rainfall in A Mountainous Watershed

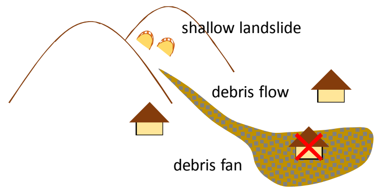
ICHARM Yusuke Yamazaki

- The present study proposes a method for predicting sediment runoff to mountain streams during heavy rainfalls based on an estimation of landslides and associated debris flows.
- We formulated developing and decreasing of debris flow along a stream using a mass point system as well as an erosion and deposition formula of debris flow.
- The method is applied to a mountainous watershed during heavy rainfall event and it successfully reproduces the actual behavior of debris flow. The result shows the method enables to estimate sediment production and runoff spatially in a mountainous watershed.

Warning and evacuation for sediment disasters

Timing for evacuation and warning
Required information: a relationship between the rainfall conditions and the occurrences of shallow landslide and debris flow.

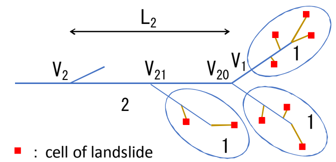
Locations of safe places and paths
Required information: spatial distributions of the occurrences of shallow landslides, the runout path of debris flow and the debris fan.



Schematic view of sediment hazards

Methodology
To obtain the above information, the following methods are proposed.
One method is to predict occurrences of shallow landslides and debris flows based on stability analysis for an infinite slope, rainfalls, surface topography and soil properties.
Another method is to predict spatial distributions of sediment volume associated with debris flows based on an estimation of developing and decreasing of debris flows produced by landslides.

Sediment runoff on river network



- ■ : cell of landslide
- ◯ : drainage of 1st order channel
- — : distance from landslide to stream

Sediment runoff volume of V_1

$$V_1 = B_1 D L_1 + B_0 D \sum_{i=1}^{n_t} \sqrt{s_i^2}$$

B_0: width of land slide, n_t: number of landslide
s_i: distance form landslide to stream
B_1: width of stream, L_1: length of stream

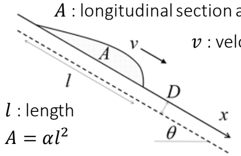
Sediment runoff volume of V_2

$$V_2 = V_{20} + V_{21} + A_2 B_2$$

V_{20} : sediment runoff volume at the top of the second order stream
V_{21} : sediment runoff volume at confluence point
A_2 : longitudinal section area
B_2 : width at the end of the second order stream

This procedure is employed for the third and larger order.

Governing equations for debris flow (mass point system)



Schematic view of debris flow

Erosion rate $E/v = c_* \tan(\theta - \theta_e)$ c_* : sediment concentration of bed, θ_e : equilibrium slope

$$\tan\theta_e = \frac{(\sigma/\rho - 1)c_c}{(\sigma/\rho - 1)c_c + 1}\tan\phi$$

ϕ: internal friction angle
ρ : mass density of mixture of water and fine sediment
σ : mass density of sediment

Mass conservation of debris flow

$$\frac{dA}{dx} = \tan(\theta - \theta_e)\, l$$

Mass conservation of coarse sediment

Erosion: $$\frac{dc_c A}{dx} = p_c c_* \tan(\theta - \theta_e)\, l$$

Depotition: $$\frac{dc_c A}{dx} = c_* \tan(\theta - \theta_e)\, l$$

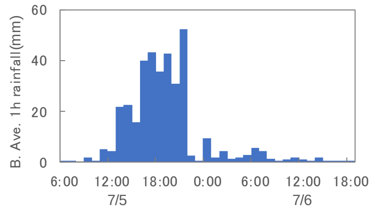
Mass conservation of fine sediment

Erosion: $$\frac{d(1 - c_c)c_f A}{dx} = p_f c_* \tan(\theta - \theta_e)\, l$$

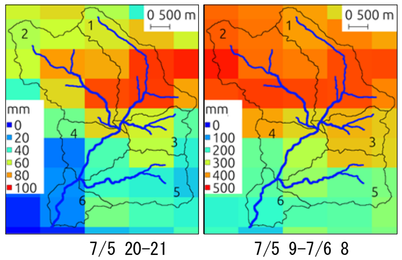
Depotition: $$\frac{d(1 - c_c)c_f A}{dx} = (1 - c_*)c_f \tan(\theta - \theta_e)\, l$$

c_c, c_f : concentration of coarse and fine sediment
p_c, p_f : composition rate of coarse and fine sediment

Heavy rainfall in northern Kyushu, July 2017



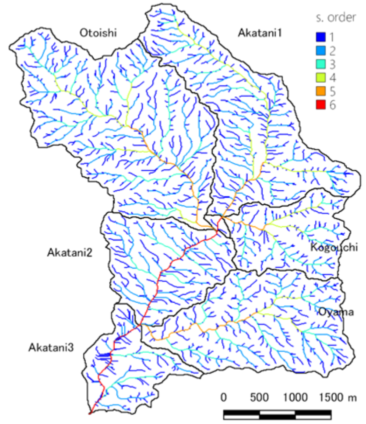
Temporal changes in basin average rainfall



Spatial distribution of 1-hour rainfall and 24-hour rainfall

- C-band JMA
- The maximum 1-hour rainfall ranged from 5 mm to 96 mm.
- 24-hour rainfall ranged from 190 mm to 480 mm within the basin.

Stream order of Akatani River



Spatial distribution of stream order(Horton-Strahler)

Length(L) , area(A), width(B), gradient(G)

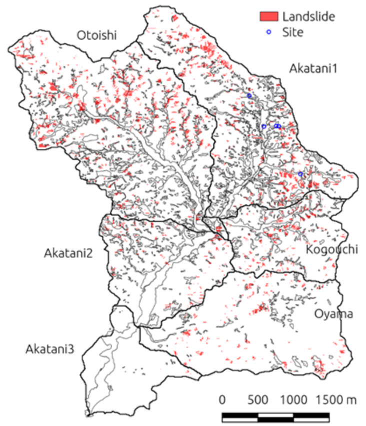
	L (m)	A (ha)	B (m)	G (˚)
1st	63	1	10	16
2nd	204	4	10	12
3rd	406	19	10	8.9
4th	958	82	10	6.4
5th	1702	397	11	2.3
6th	4366	1990	25	0.9

- The equilibrium gradient of the debris flow becomes $\theta_e = 8$, when $p_f = 0.4$.
- 1st and 2nd order river : erosion

  3rd and larger order river: deposition

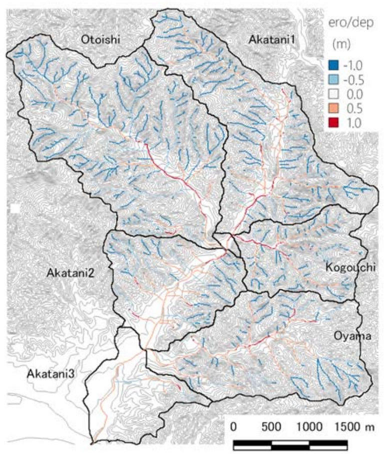
Condition and results of simulation

Parameters	Value
Mesh size (m)	10×10
D: Soil layer depth (m)	1.0
c_*: Sediment concentratin	0.6
λ: Porosity	0.4
f_s: Infiltration rate of surface layer (mm/h)	200.0
K: Saturated hydralic conductivity (cm/s)	1.0
N: Equvalent roughness coefficient	0.60
ϕ: Internal friction angle (degrees)	35.0
c: Cohesion (kN/m^2)	3.0
σ: Soil density (kg/m^3)	2650
ρ: Water density(kg/m^3)	1000



Simulated landslide and runout mark by aerial photo

Simulated erosion and deposition



Otoishi	
Produced	630,000 m^3
Deposited	280,000 m^3
Runoff	350,000 m^3

Akatani1	
Produced	420,000 m^3
Deposited	220,000 m^3
Runoff	200,000 m^3

Kogouchi	
Produced	140,000 m^3
Deposited	60,000 m^3
Runoff	80,000 m^3

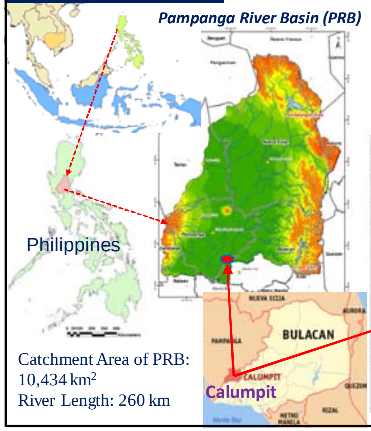
Sediment runoff 630,000 m^3

Evidence-based Flood Contingency Planning:

A Case of Calumpit Municipality in the Pampanga River Basin of the Philippines

- Badri Shrestha, Senior Researcher
International Centre for Water Hazard and Risk Management (ICHARM), Public Works Research Institute (PWRI), Japan

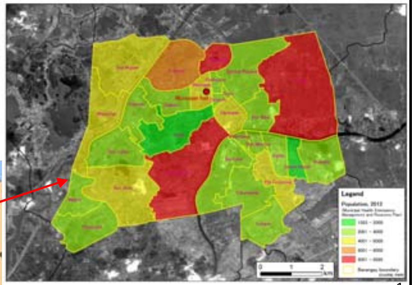
Calumpit Municipality: General Features



Catchment Area of PRB: 10,434 km^2
River Length: 260 km

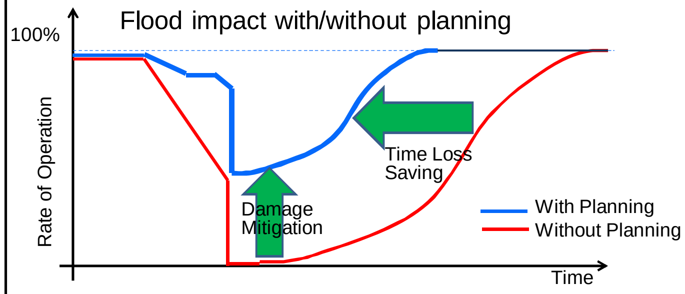
- **Calumpit Municipality is located in the Pampanga River Basin of the Philippines**

Number of Barangays (Villages): 29
Population: 112,007 (based on Municipality data)
Households: 22,402
Area: 5,625 ha

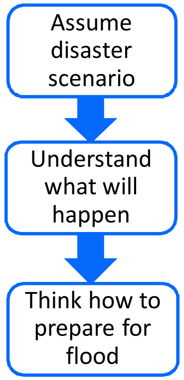


Aim of Flood Contingency Planning

1. Protect people/property/activity from damage
2. Quickly recover from damage
3. Reduce impacts due to disaster



Six steps of Contingency Planning



(Formulation of Plan)
Step 1: Understanding current conditions
Step 2: Risk identification

Step 3: Impact analysis

Step 4: Developing coping strategy

(Documentation and Sharing)
Step 5: Developing contingency plan
Step 6: Sharing and updating contingency plan

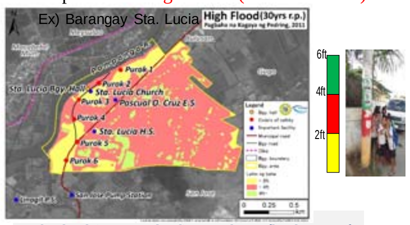
Reference: ISO22301 Societal Security
– Business continuity management systems –.

Step 1: Understanding Current Conditions

1) Understand Natural Environment
2) Collect data on social environment
(Barangay Profile: Population, Number of family, etc,)
3) Collect information on past flood damage

Step 2: Risk Identification

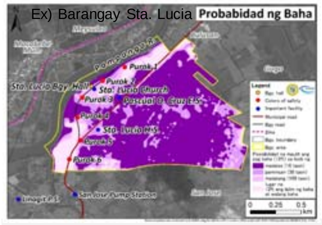
Flood depth due to High Flood (30 Years Flood)



High Flood (30 Year Flood) is similar to flood event of Typhoon Pedring (September 2011)

- Check water level at key facilities (Barangay hall, evacuation center, schools etc.)
- Check water level at residential area by comparing normal map and high flood map.

Inundation Probability Map

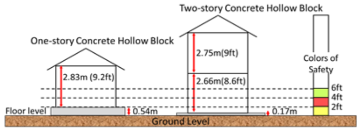


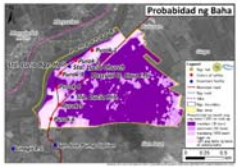
The figure shows the probability of inundation from most frequent inundation areas (dark purple color) to areas of rare inundation (light purple color).

- Check frequently inundated area with more than 2ft flood by using inundation probability map.

Step 3: Impact Analysis

❑ Result of household survey for measuring average floor height





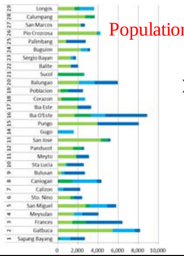
Ex) Barangay Sta. Lucia

	One Story	Two Story
Yellow (less than 2ft)	Not inundated	Start inundated
Red (2-4ft)	Start inundated	Inundated
Green(more than 4ft)	Inundated	Inundated

➢ Inundation probability map means the area frequently inundated above first floor level of one/two story houses.

❑ Population according to expected inundation height by High Flood

Inundation Height (m)	One Story House	Two Story House
0.0-0.17	Not inundated	Not inundated
0.17-0.54	Not inundated	Start inundated
0.54-1.55	Inundated	
1.55-2.83	Inundated (Cannot use electricity)	



Population

➢ Prepare for evacuees considering expected inundation height.

Step 3: Impact Analysis

➢ Check lead time before inundation and duration of inundation by time-series inundation chart.

<Legend> less than 2ft (<0.3048m) [yellow]; less than 4ft (<1.2192 m) [red]; more than 4ft (>1.2192m) [green]; Inundation depth (m)

Case	Day1		Day2		Day3		Day4		Day5		Day6		Day7		Day8		Day9		Day10		Day11		Day12	
Ordinary flood (10yrs return period)	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.32	0.34	0.32	0.28	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High flood (30yrs return period)	0.00	0.00	0.00	0.00	0.00	0.15	0.33	0.40	0.43	0.45	0.45	0.44	0.43	0.40	0.33	0.25	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Extreme flood (100yrs return period)	0.00	0.00	0.00	0.00	0.00	0.26	0.42	0.58	0.65	0.70	0.74	0.76	0.76	0.73	0.69	0.62	0.52	0.42	0.38	0.33	0.28	0.23	0.15	0.00
2011 Pedring and Quiel	0.00	0.00	0.00	0.00	0.00	0.15	0.32	0.40	0.43	0.44	0.44	0.44	0.43	0.42	0.43	0.44	0.45	0.43	0.42	0.39	0.36	0.30	0.16	0.00

Duration of Inundation:
Ordinary Flood: 2.5 days
High Flood: 6.5 days
Extreme Flood: 8.5 days

This information can be considered for preparation of relief goods, water, etc.

Step 4: Developing Coping Strategy

Identified Problems

Based on Workshop at Barangay Bulusan and Santa Lucia in July 2015 and Jan. 2016

Flood Scale / Component	Ordinary Flood	High Flood	Extreme Flood
Information Communication		-No telephone/mobile phone -Lack of information about inundation /damage situation.	
Evacuation		-Fast speed of rising water during inundation. -Evacuation center doesn't have enough capacity.	
Housing	-Only non-elevated houses get flooded.	-Difficulty in cleaning houses	-Difficulty in cleaning houses -Need of more construction materials for repairing houses.
Water, Food, Relief Goods	-No/less water supply. -No electricity.	-No water supply. -No electricity. -Delay of relief goods -Relief goods get wet. -Need of portable restroom	
Medical Treatment		-Need of medical mission, providing medicines for leptospirosis, fever etc.	
Transportation		-Difficult to go to center area because access road to the elevated road are inundated.	
Others		-Damage of Rice field -Delay in education in school	

What we do/improve?

What we request to Municipality?

Step 4: Developing Coping Strategy

1) Discuss "What we do/improve" and "What we request".

Based on Workshop in Jan. 2016

Flood Scale / Key Component	Before Flood	During Flood	After Flood
Information Communication	➢ Communicate with MDRRMO ➢ Identify which/where to keep, remove or add marker ➢ Update a list of contact persons and phone numbers	➢ Inform water level at "Colors of safety" regularly to MDRRMO ➢ Communicate with MDRRMO ➢ Inform obtained information to Barangay people ➢ Use generator for charging	➢ Identify typical water level, duration, source of flooding
Evacuation	➢ Quantify vulnerable individuals /families ➢ Make residents evacuate quickly to safer place	➢ Make residents evacuate quickly to safer place ➢ Rescue residents ➢ Quantify affected individuals /families	
Housing			➢ Support residents to clean houses for getting back to normal life quickly
Water, Food, Relief Goods		➢ Get/provide relief goods ➢ Keep relief goods dry ➢ Use generator for charging	
Medical Treatment		➢ Save children and elder people	
Transportation		➢ Use Boat (Banka)	
Others			➢ Clean Barangay Hall

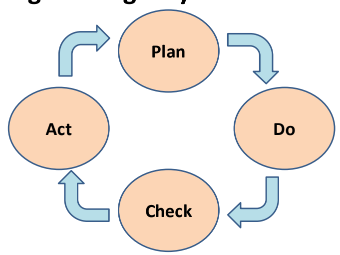
Step 5: Developing Contingency Plan

Ex) Barangay Sta. Lucia

1) Organization Chart
2) Resource map
3) Early Warning System
   Public Storm Warning System
   Location of "Color of safety", person in charge
4) Coping Strategy
5) Sectoral Plan:
   Describe "What we do before/during/after flood".
6) Needs for Future Improvement

Step 6: Sharing and Updating Contingency Plan

1) Share plan with barangay members.
2) Update plan periodically adding new information and experience.

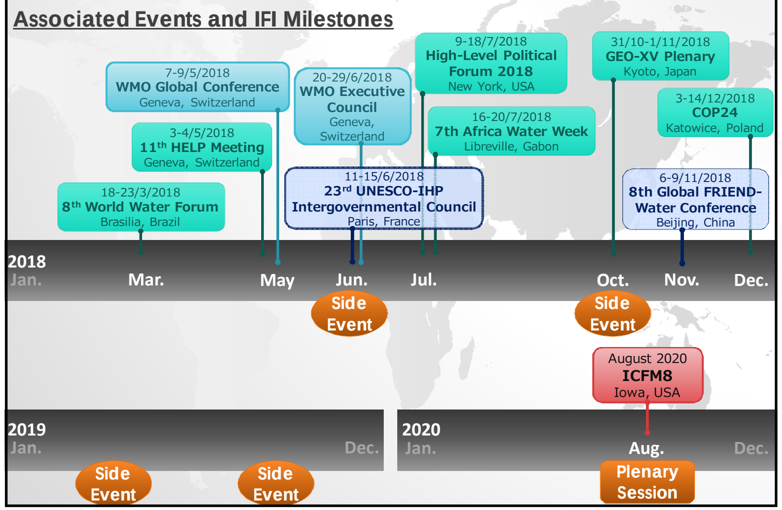


PLATFORM ON WATER RESILIENCE AND DISASTERS

Mamoru Miyamoto

International Centre for Water Hazard and Risk Management (ICHARM)

IFI ROAD MAP FOR 2020



GLOBAL TRENDS

International Flood Initiative (IFI)

International Flood Initiative (IFI) is a joint initiative in collaboration with such international organizations as UNESCO-IHP, WMO, UNISDR, UNU, IAHS and IAHR since 2005. ICHARM is the secretariat of IFI.

IFI partners

Support

Platform on Water Resilience and Disasters

Objective components (6)

- Data integration
- Climate change
- Economic assessment
- Flood forecasting
- Sediment disaster
- Contingency planning

"Platform on Water Resilience and Disasters" is specified in the HLPW outcome document.

Global Agendas

Sendai Framework for Disaster Risk Reduction 2015-2030

Paris Agreement

Sustainable Development Goals (2016-2030)

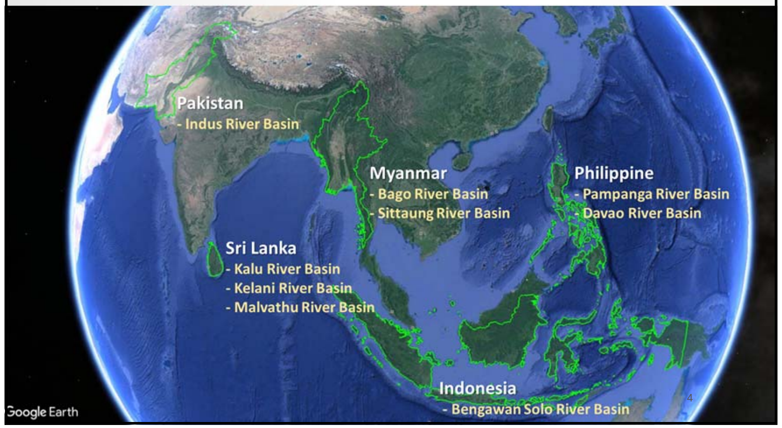
UN International Decade for Action: Water for Sustainable Development (2018-2028)

High Level Panel on Water (UN/WB)

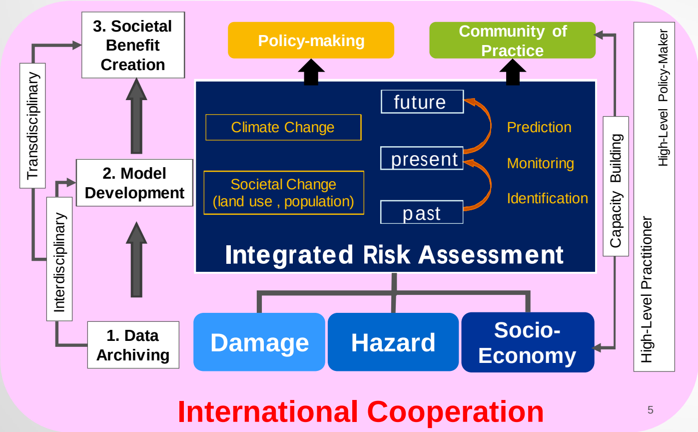
12 world leaders issue clarion call for accelerated action on water

Outcome document (14 March 2018)

IFI PLATFORM ACTIVITIES IN ASIA



CONCEPTUAL FRAMEWORK OF PLATFORM



DATA LIST

An example of data list

Hazard

Data	Source of information
DEM	
Rainfall	
Meteorological data	
Water level	
River flow	
River cross section	
Tidal level	
Inundation depth	
Dam operation	

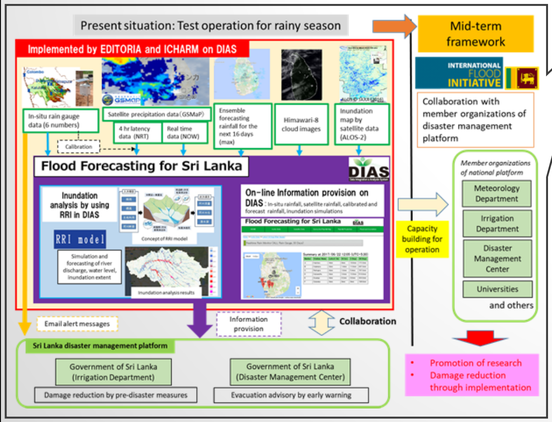
Damage

Data	Source of information
Casualties & missing person	
Affected people	
Agricultural damage	
Housing damage	
Critical infrastructure damage	
Economic damage	

Socio-economy

Data	Source of information
Population	
Land use	
Agriculture	
Infrastructure	
Industry	
Commerce	
Drainage facility	
Information	

PLATFORM IN SRI LANKA



Objective components

- Data Integration
- Flood Forecasting
- Climate Change
- Sediment Disaster
- Economic Assessment
- Contingency Planning

INSTITUTIONAL STRUCTURE

- Chair
- Leading organization
- Participating organization

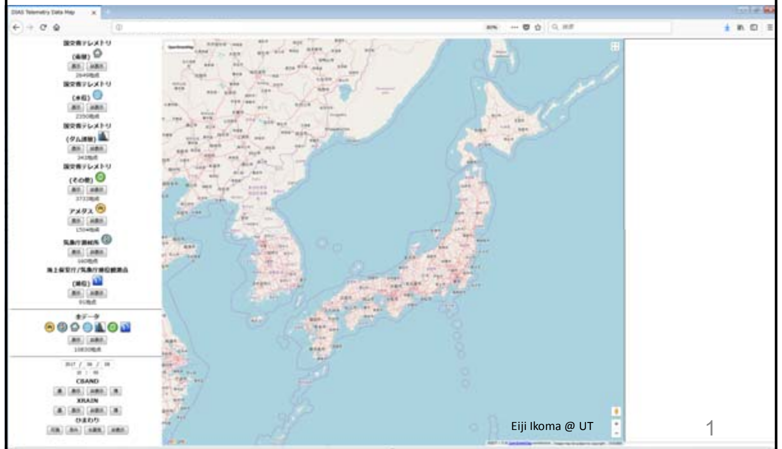
- Irrigation Department
- Disaster Management Center (DMC)
- National Building Research Organization (NBRO)
- Meteorological Department
- Survey Department
- Ministry of Megapolis and Western Development
- Ministry of Mahaweli Development & Environment
- Sri Lanka Land Reclamation and Development Corporation (SLLRDC)

(8) Data management and archiving

Katsunori Tamakawa , Project researcher

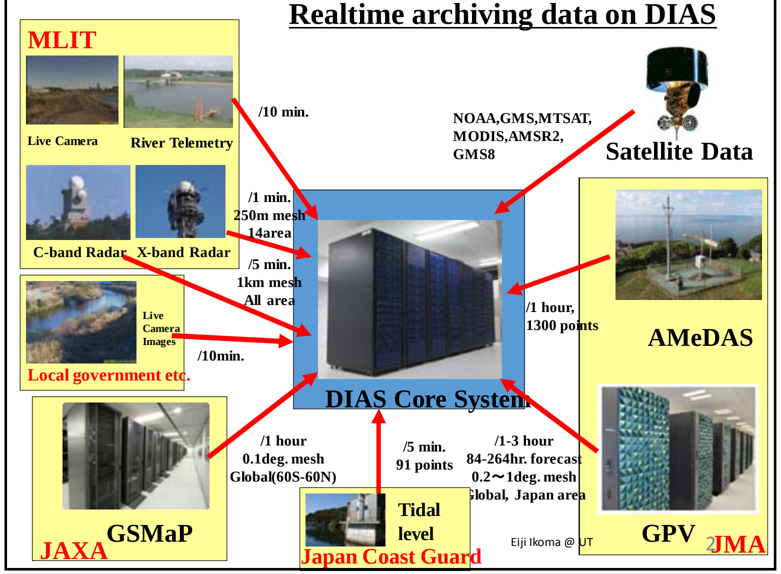
International Centre for Water Hazard and Risk Management (ICHARM), Public Works Research Institute (PWRI), Japan

DIAS: Real-time data archiving, visualizing, and downloading interface.



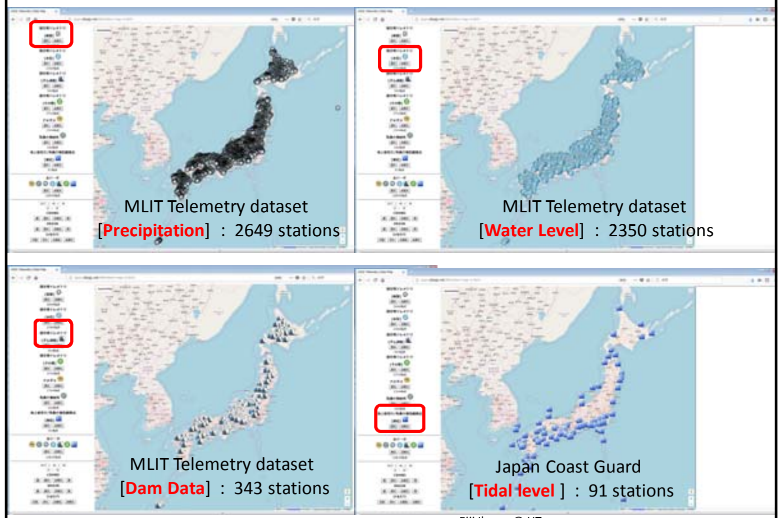
Eiji Ikoma @ UT

Realtime archiving data on DIAS



Eiji Ikoma @ UT

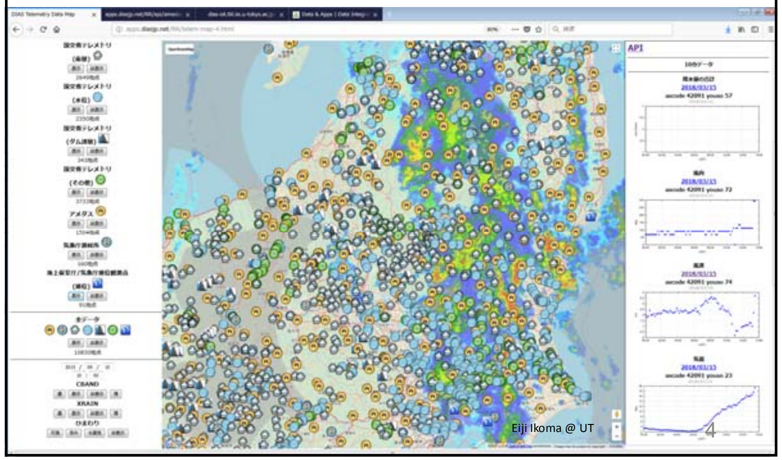
DIAS: Real-time data archiving, visualizing, and downloading interface.



Eiji Ikoma @ UT

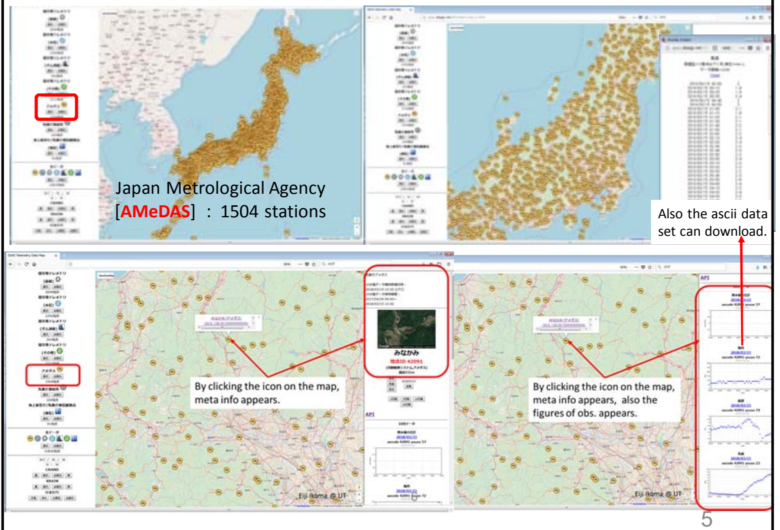
DIAS: Real-time data archiving, visualizing, and downloading interface.

Overlay visualization all real-time data observation points, Cband and XRAIN data



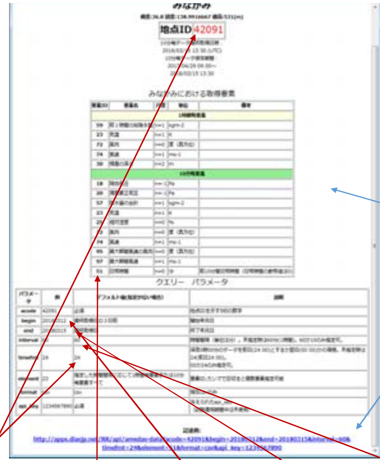
Eiji Ikoma @ UT

DIAS: Real-time data archiving, visualizing, and downloading interface.



Eiji Ikoma @ UT

DIAS: Real-time data downloading using API

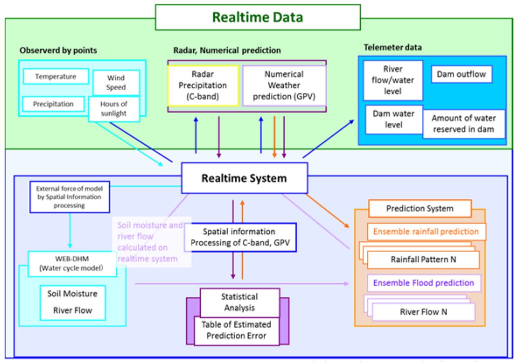


Meta info and "sample" download command using API is appeared.

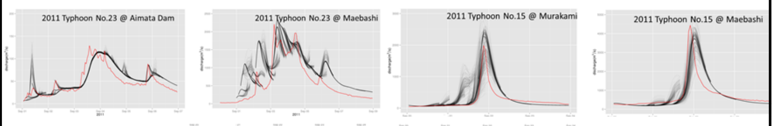
http://apps.diasjp.net/RR/api/amedas-data?acode=42091&element=51&begin=20180312&end=20180315&interval=60&timefmt=24&api_key=1234567890

Eiji Ikoma @ UT

Application : Real-time data for Ensemble Flood Prediction.



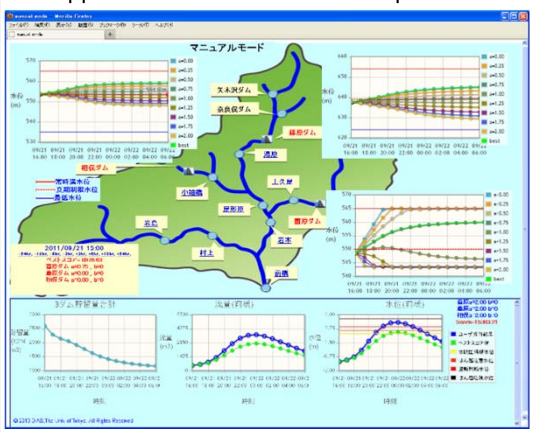
Shibuo, Ikoma, Koike (2014)



• Calculate Soil Moisture and River flood on river basin by WEB-DHM and output one by one
• Estimate prediction error and prepare 50 patterns of GPV rainfall data, and start to calculate every 3hours

Shibuo, Ikoma, Koike (2014)

Application : Simulator of Dam Operation for Decision Making



Aimata dam

Fujiwara dam

Sonohara dam

Ikoma, Shibuo, Koike (2014)

http://www.ktr.mlit.go.jp/tonedamu/tonedamu_index003.html