Flood Hazard and Disaster Risk Assessment for Bago River Basin

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Basic Information of Study Area

Basin Name: Bago Basin

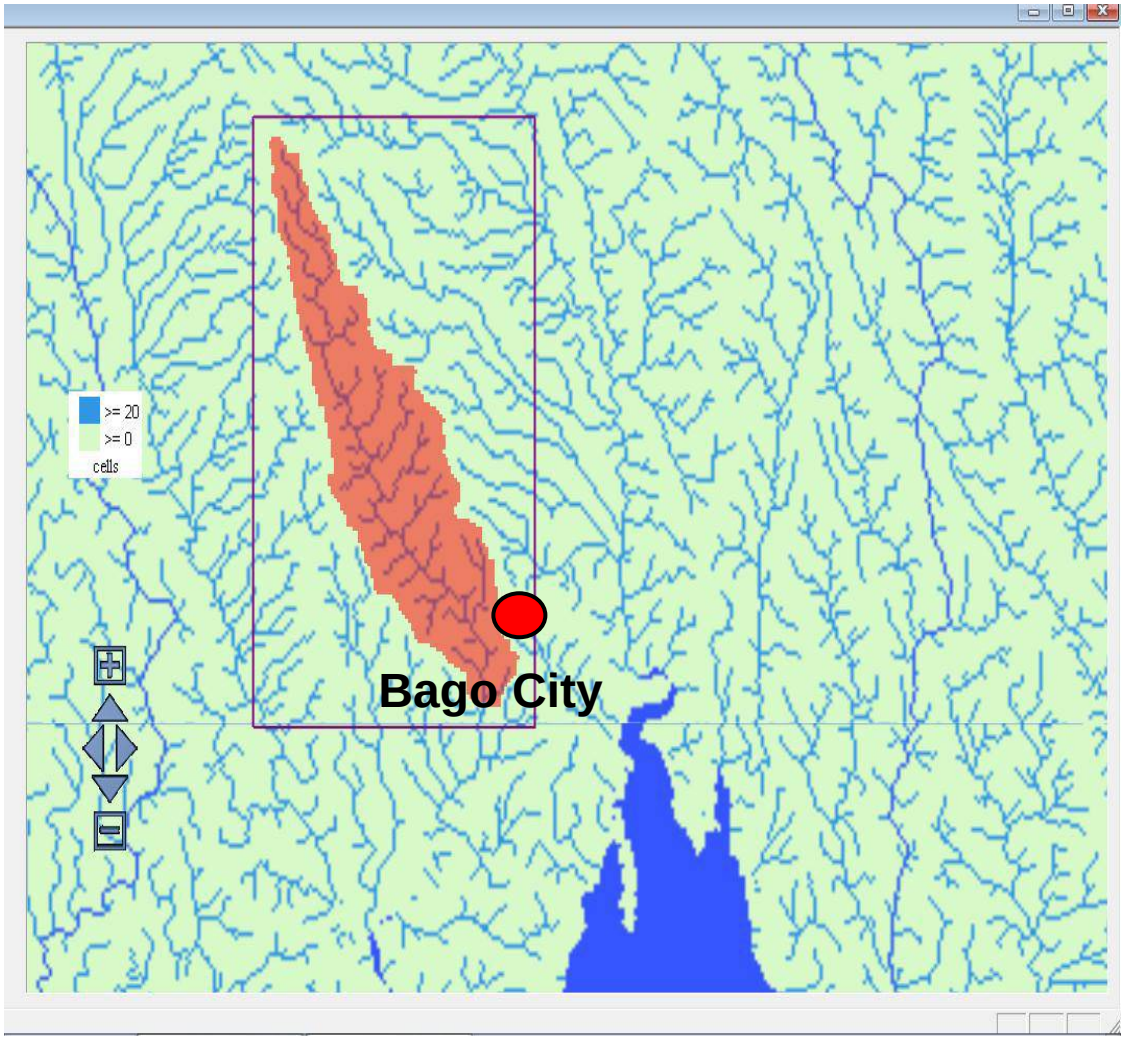
Basin Size: 2,680 km²

Location:

Lat. 16□46’ 00“ - 18□27’ 30" N

Long. 95□53’ 00" - 96□45’ 00" E

Name of River: Bago River



Bago City is flooded during the months of **July and August** in every year due to heavy rainfall and its lowland area

Basic Information of Study Area

River Characteristics and Past Flood Events:

- **Bago river is averagely 60 m wide and 5 m deep.**

- **Maximum Water Level in rainy season is 8.60 m** above MSL.

- **Flood** reaches Bago city's **Danger Water Level of 9.10 m annually**

- **Severe floods occurred in 2011** and its' **Water Level was 9.60 m (Highest record in 47 years)**

- **Approx. 3.2 km of** Yangon-Mandalay **highway and railway** flooded **over 1 m**

- **Some areas** were flooded with a **depth of 1.5 m**. (Htoo Htoo Shwe and Kawasaki, 2014)

Basic Information of Study Area

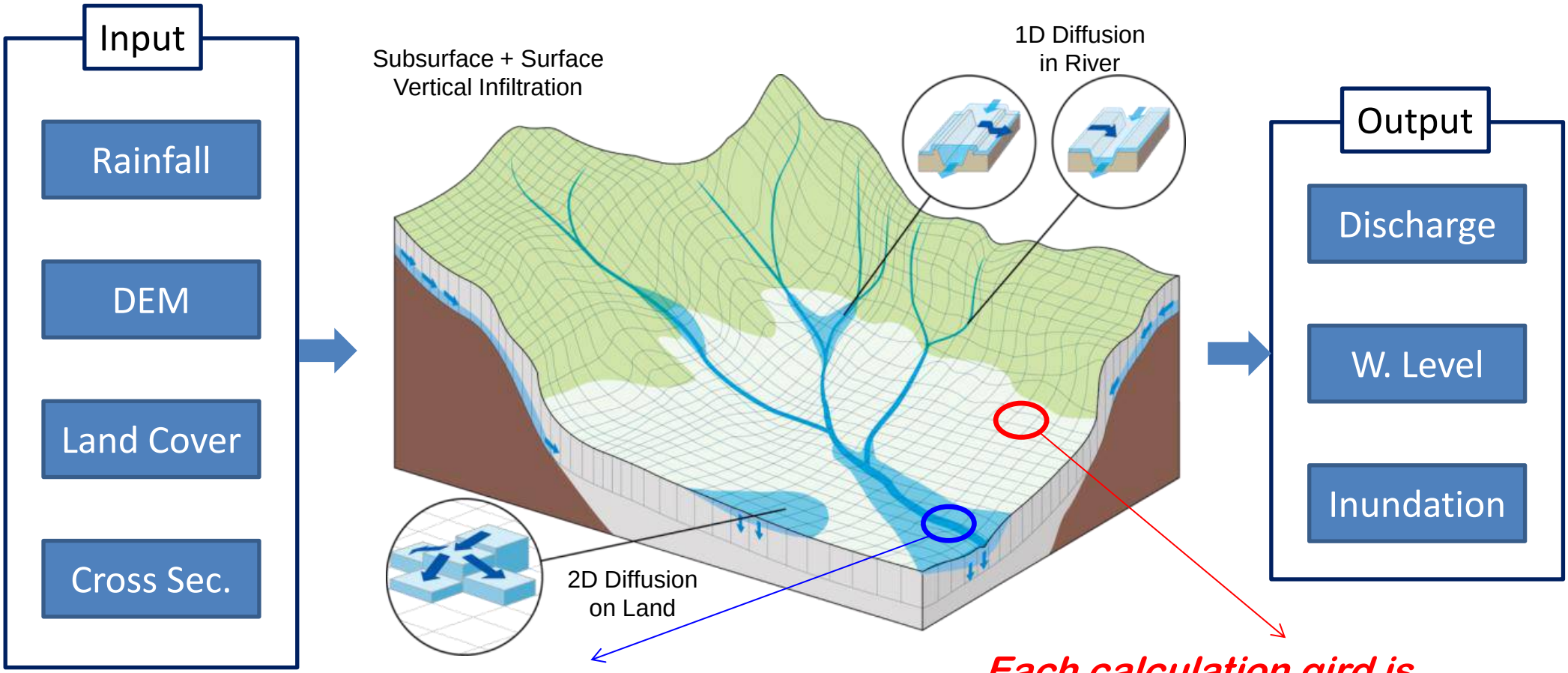
Past Flood Event in 2011

Source: http://www.google.com/mimufloodhazardmap

Introduction of RRI Model

Outline of RRI Model (1/4)

Conceptual diagram of RRI Model is shown in following figure. Basically, RRI Model can simulate river discharge/water level and inundation area



Calculation gird on river courses has not only surface model and groundwater analysis model but also river channel model

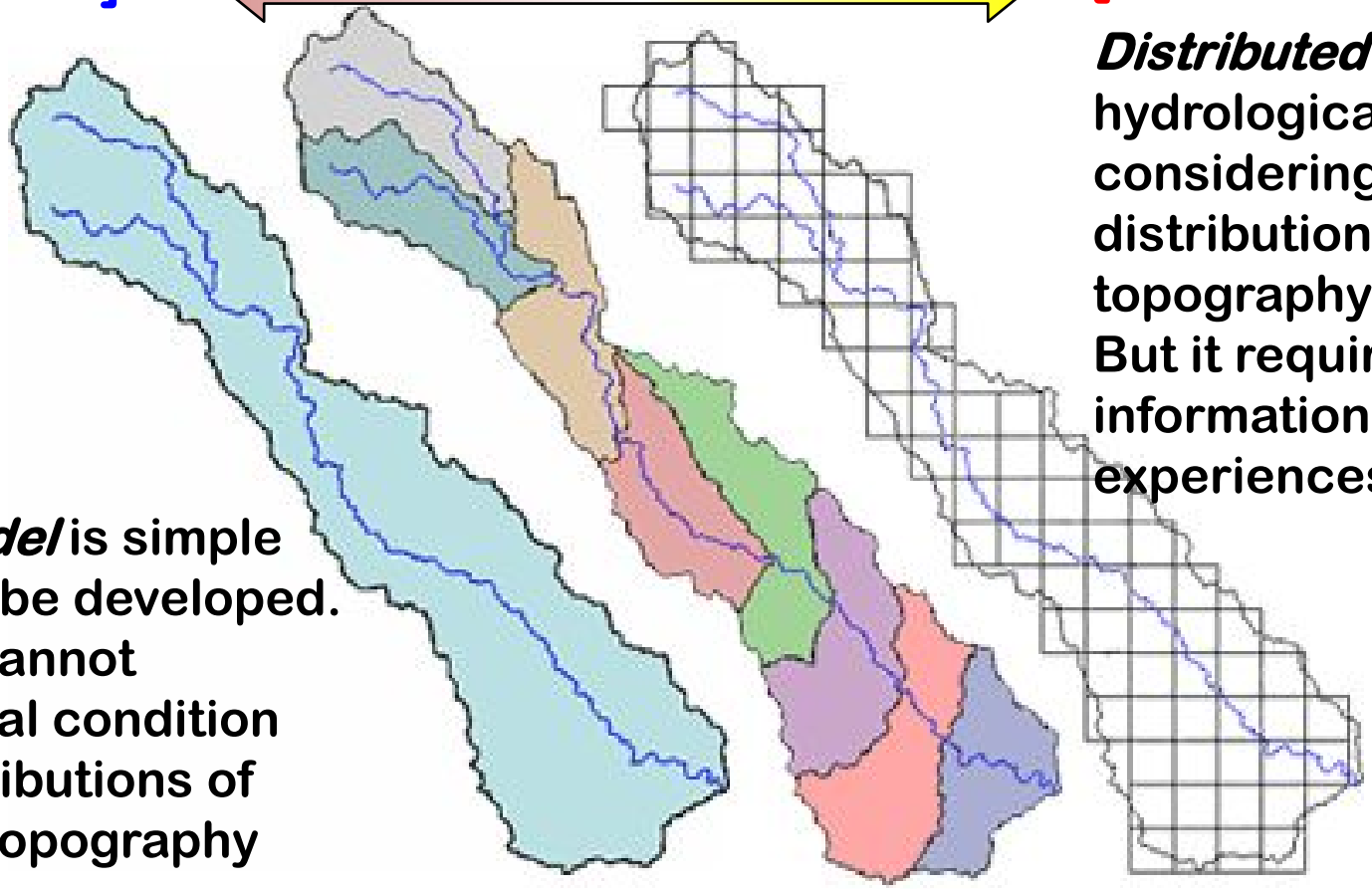
Each calculation gird is equipped with surface analysis and groundwater analysis model.

Introduction of RRI Model

Outline of RRI Model (2/4)

Surface model can be categorized to 1) lumped model and 2) distributed model. RRI Model is distributed model

[Lumped Model] ⟷ **[Distributed Model]**



NOAA / NWS / The COMET Program

Distributed model **can simulate hydrological condition considering spatial distributions of rainfall and topography etc. But it requires much data/ information and experiences/skills of hydrology**

Lumped model **is simple and easy to be developed. However it cannot consider local condition (spatial distributions of rainfall and topography etc.**

Introduction of RRI Model

Outline of RRI Model (3/4)

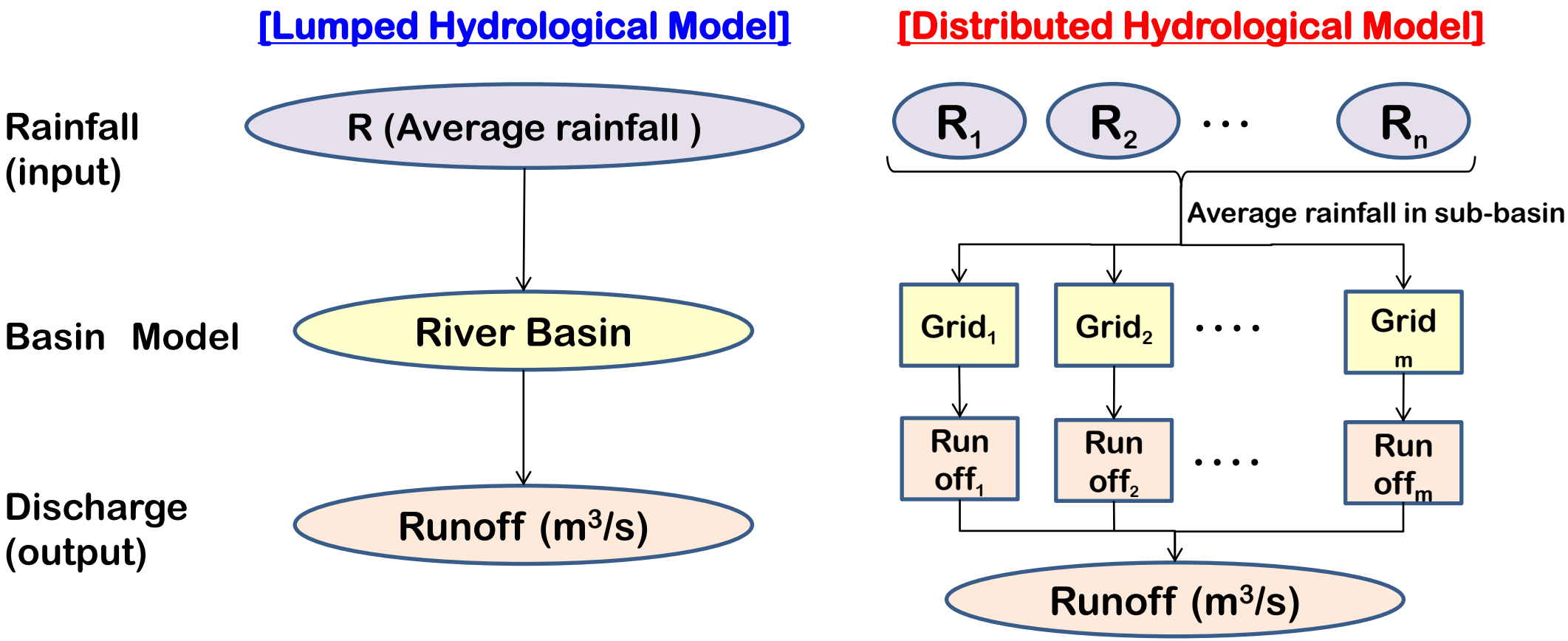
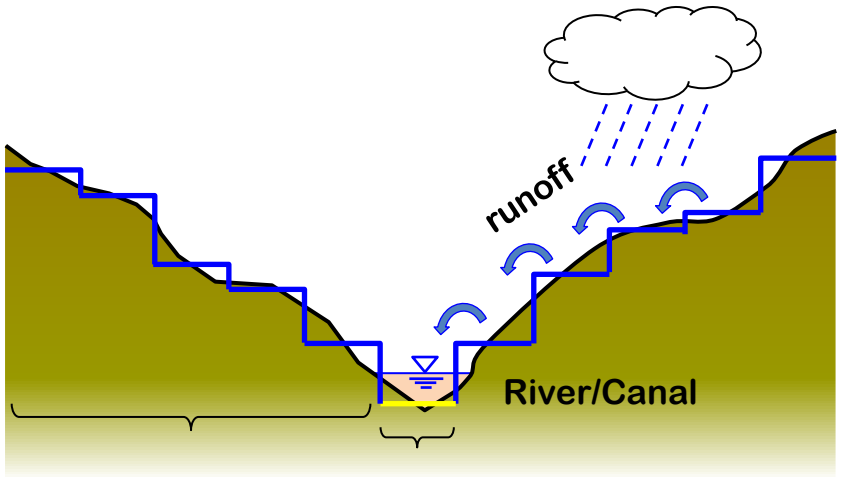


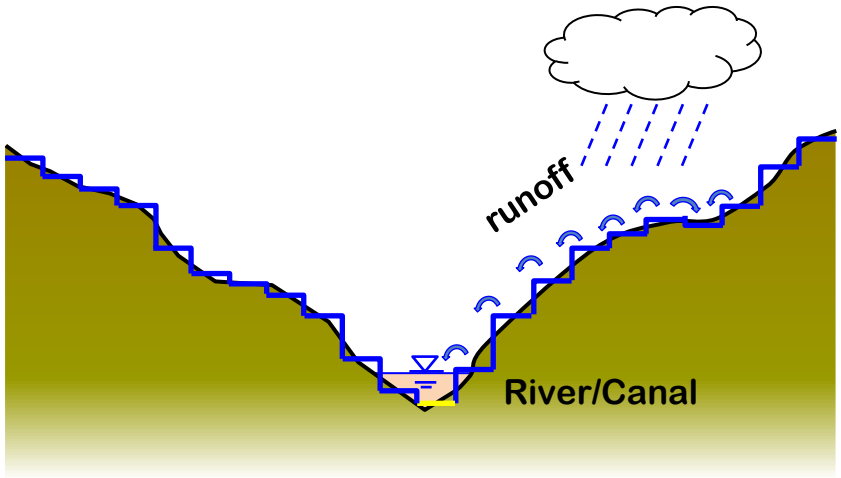
Fig- Schematic Diagram of Lumped/Distributed model

Introduction of RRI Model

Outline of RRI Model (4/4)

RRI Model describes land form with elevation grid (DEM)





Calculation grid for river basin equipped
1) Surface model
2) Groundwater model

Calculation grid for river/canal has river channel model (for calculation of discharge)

If calculation grid is divided into finer grids, the model can express the land form more precisely.
However, it takes much time to analysis due to increase of calculation grids.

Distributed hydrological model is able to reflect the basin characteristic and describe detailed runoff characteristic.

Input Data and Initial Setting for Flood Hazard Assessment

Input Data

(1) Daily Rainfall Data of 6 stations
- Bago, Zaungtu Stations of DMH,
- Kodukwe, Wakadoke Dams, Shangaing and Paingkyone Sluices of ID

(2) Daily Water Level Data of Bago Gauge Station (Hydrology Branch, Irrigation Dept. (ID))

(3) Discharge Data of Zaung Tu Dam (DHP), at Zaungtu Station (DMH) and at U/S of Bago City Bridge (ID)

Data period : 1 – 31 August 2014

(4) Topography data: DEM data (HYDROSHED)
30 sec= approx. 900 m-resolution

Location of Raingauge Stations

Input Data and Initial Setting for Flood Hazard Assessment

RRI Modeling

(1) Bago River Basin area is extracted from HYDROSHED Data (DEM)

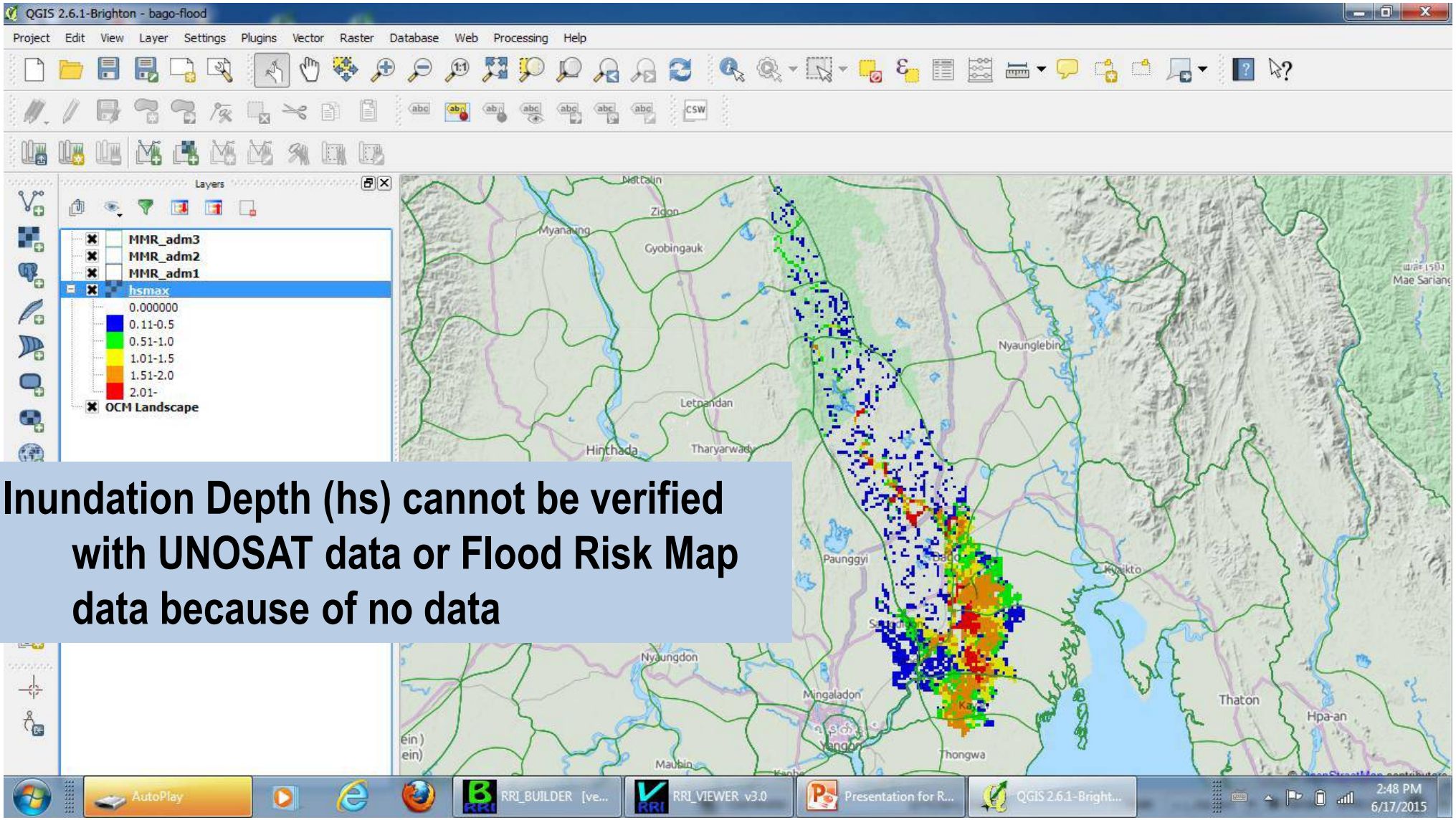
(2) Discharge data of Zaung Tu Dam, Zaung Tu Station and Bago Station are used for setting boundary conditions

(3) Calculated Discharge (Q) are validated with the Observed Q Data

(4) Flood Inundation Map is developed

Results of RRI Model Simulation: Inundation Map

Simulated Inundation Map of Bago Basin

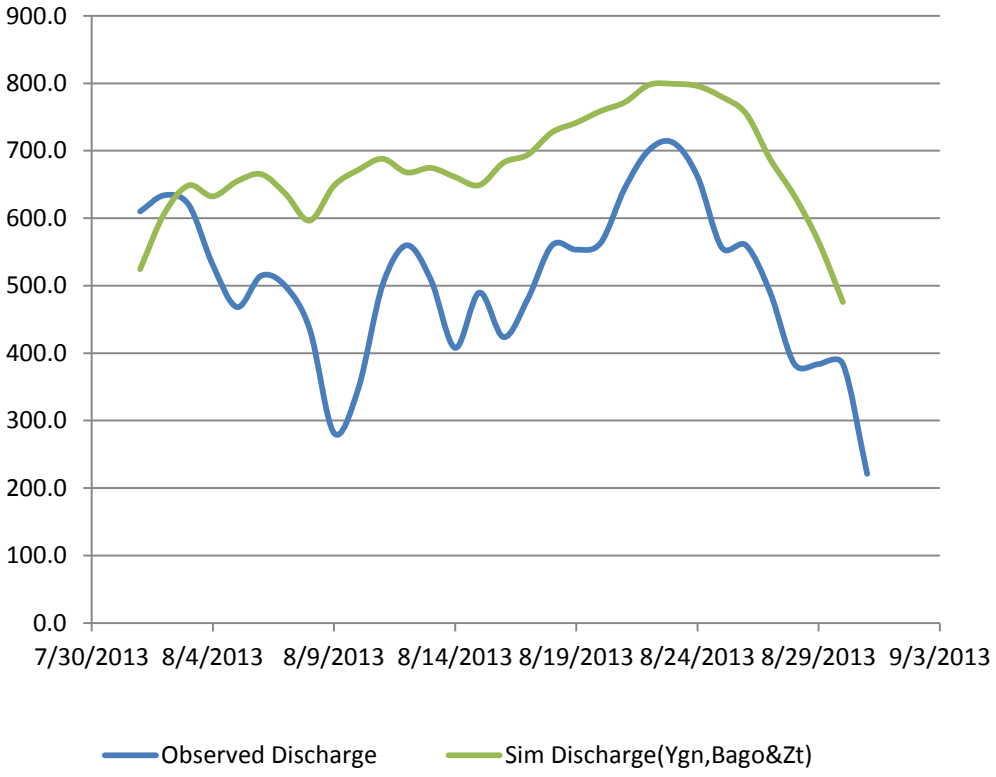


Inundation Depth (hs) cannot be verified with UNOSAT data or Flood Risk Map data because of no data

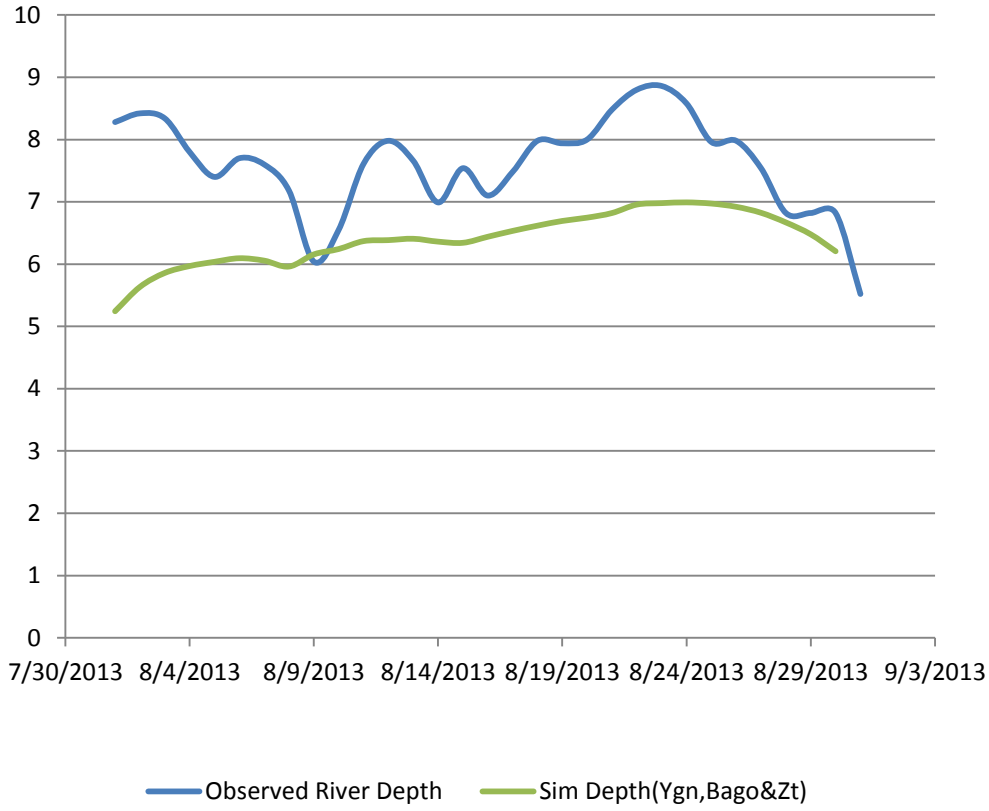
Results of RRI Model Simulation: Discharge and Water Depth

Comparison of Observed and Simulated Discharge and Water Depth at Bago Gauge Station

Discharge (Cumec)

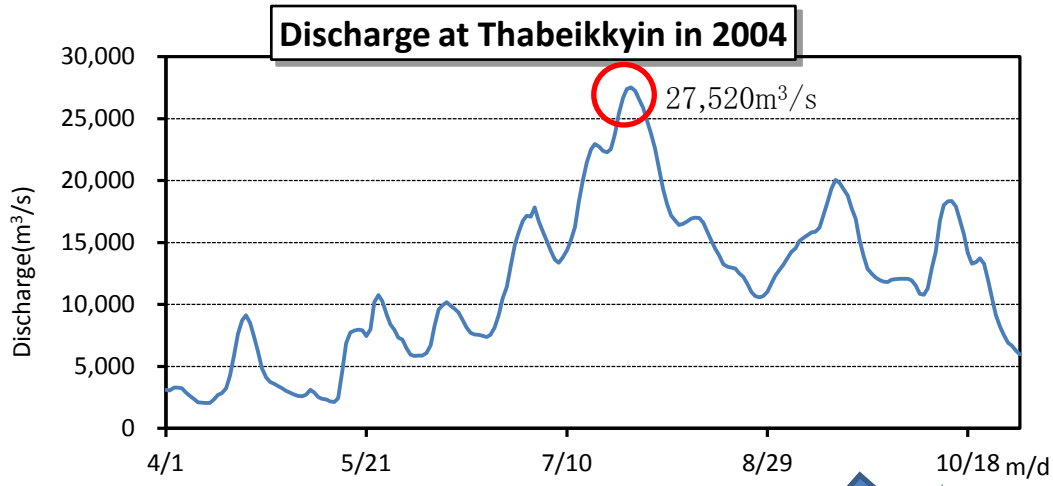


Water Depth (m)



Agricultural Damage Assessment

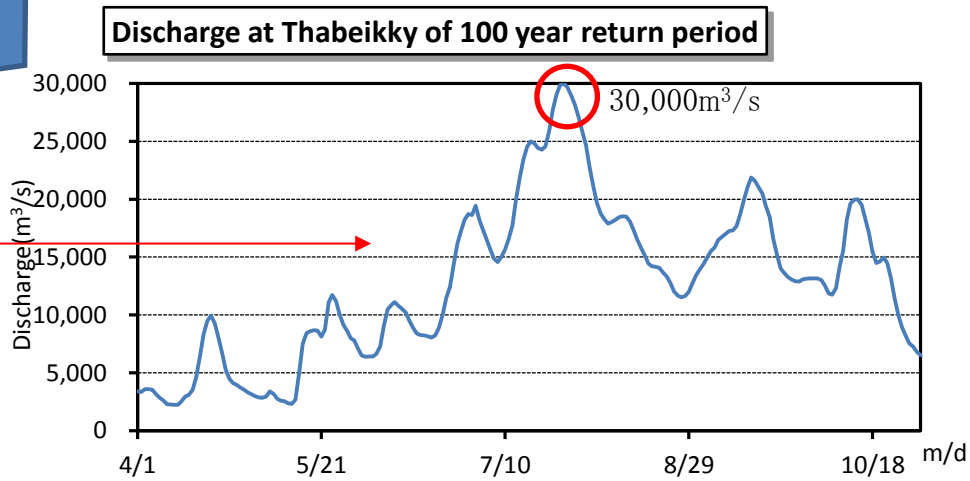
Selecting Target Flood



To simulate 100 year flood, the whole discharge hydrograph at Thabeikkyin is stretched to the maximum discharge of the 100 year return period discharge.

**Rainfall is not stretched in this case.*

By inputting this hydrograph as the boundary condition to RRI Model, an inundation induced by 100 year return period flood is to be calculated.



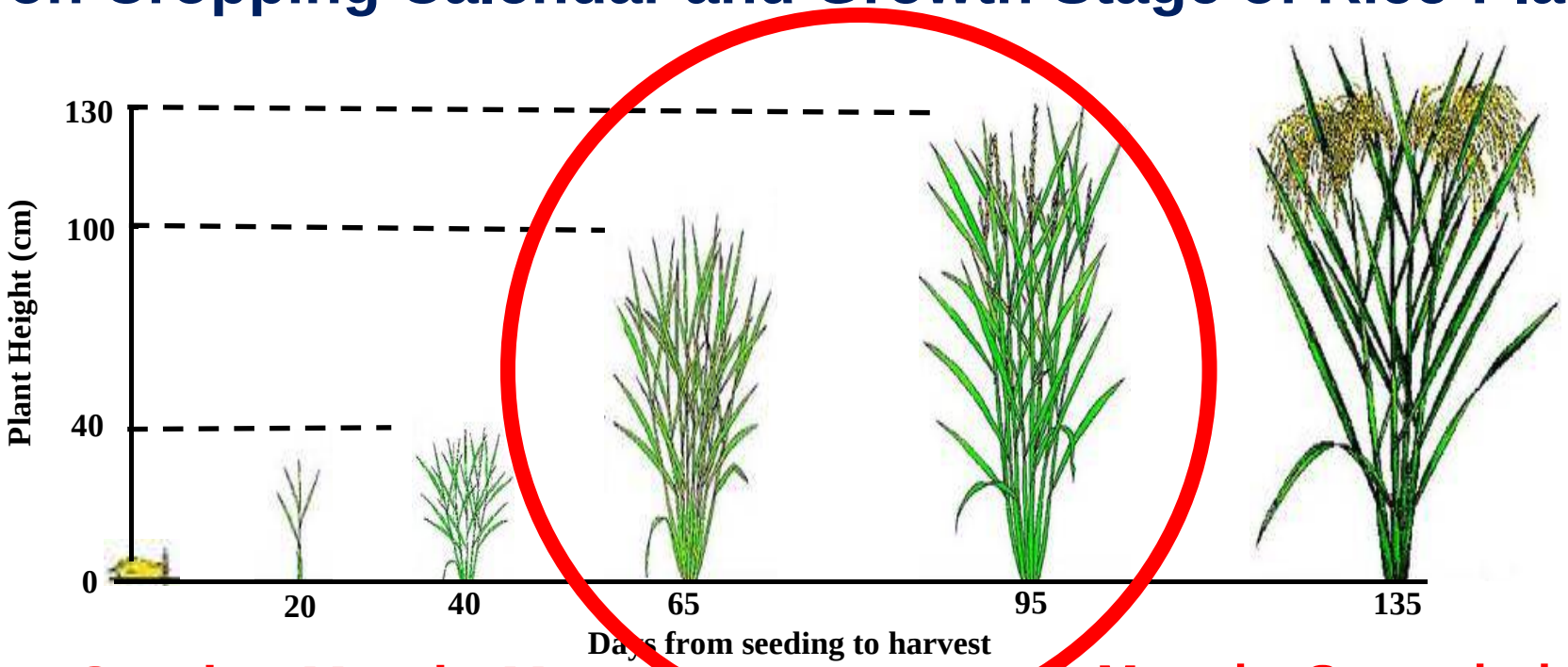
Summary of Simulation

Source: ICHARM

Agricultural Damage Assessment

Growth Stage of Rice Plants

Based on Cropping Calendar and Growth Stage of Rice-Plant



Cultivation Starting Month: May (in case of Myanmar)

Maturity Stage during end of July and August

	Seeding		Maximum tillering and panicle formation		Flowering	Harvest
Duration (days)	20	20	25	30	40	
Growth Stage	Seedbed / Seedling	Newly Planted	Vegetative Stage	Reproductive Stage	Maturity Stage	

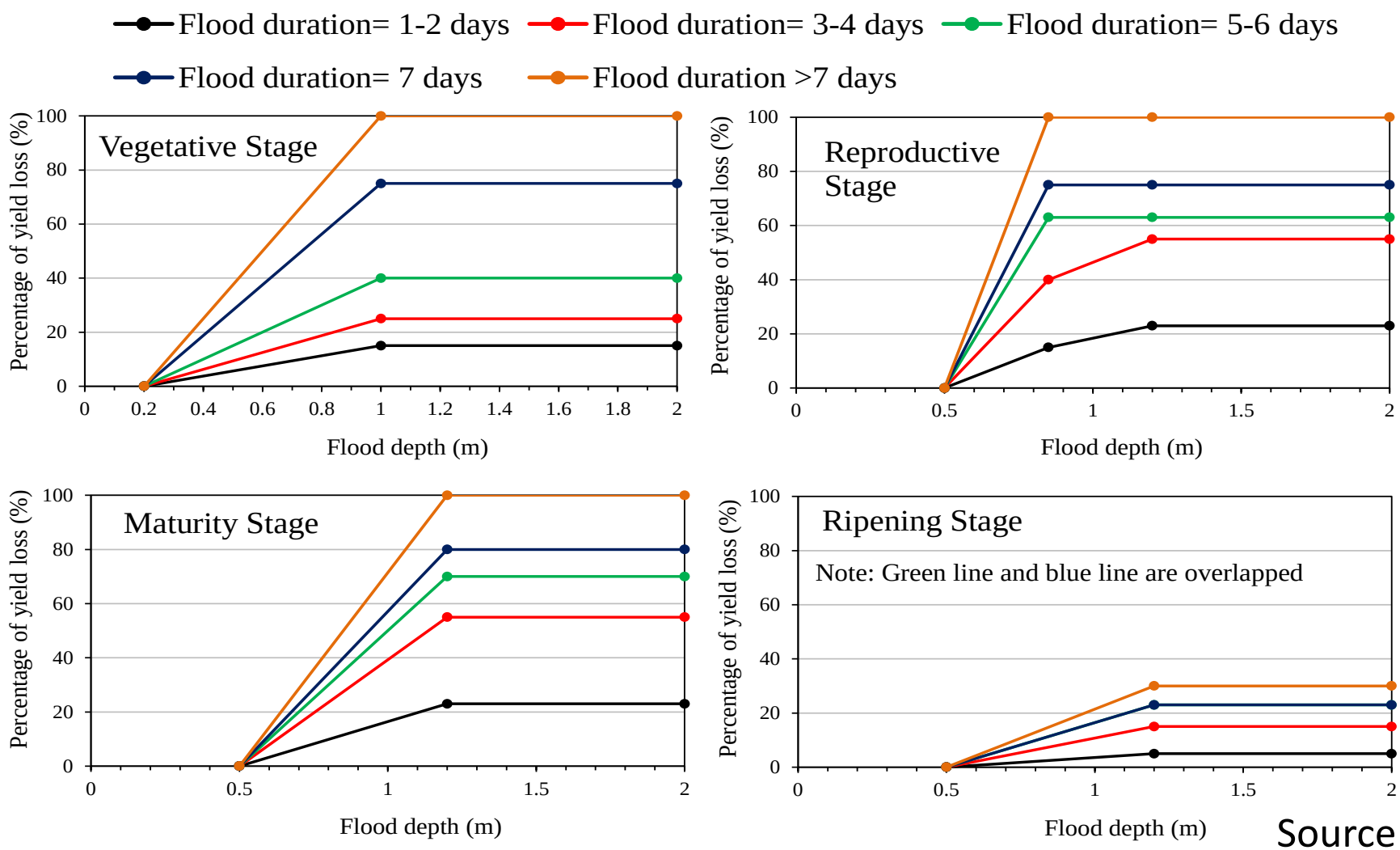
Source: ICHARM

Agricultural Damage Assessment

Development of Damage Function

By using past flood damage data/information, damage function can be developed.

Damage Curve Developed by using the data of the Philippines



Source: ICHARM

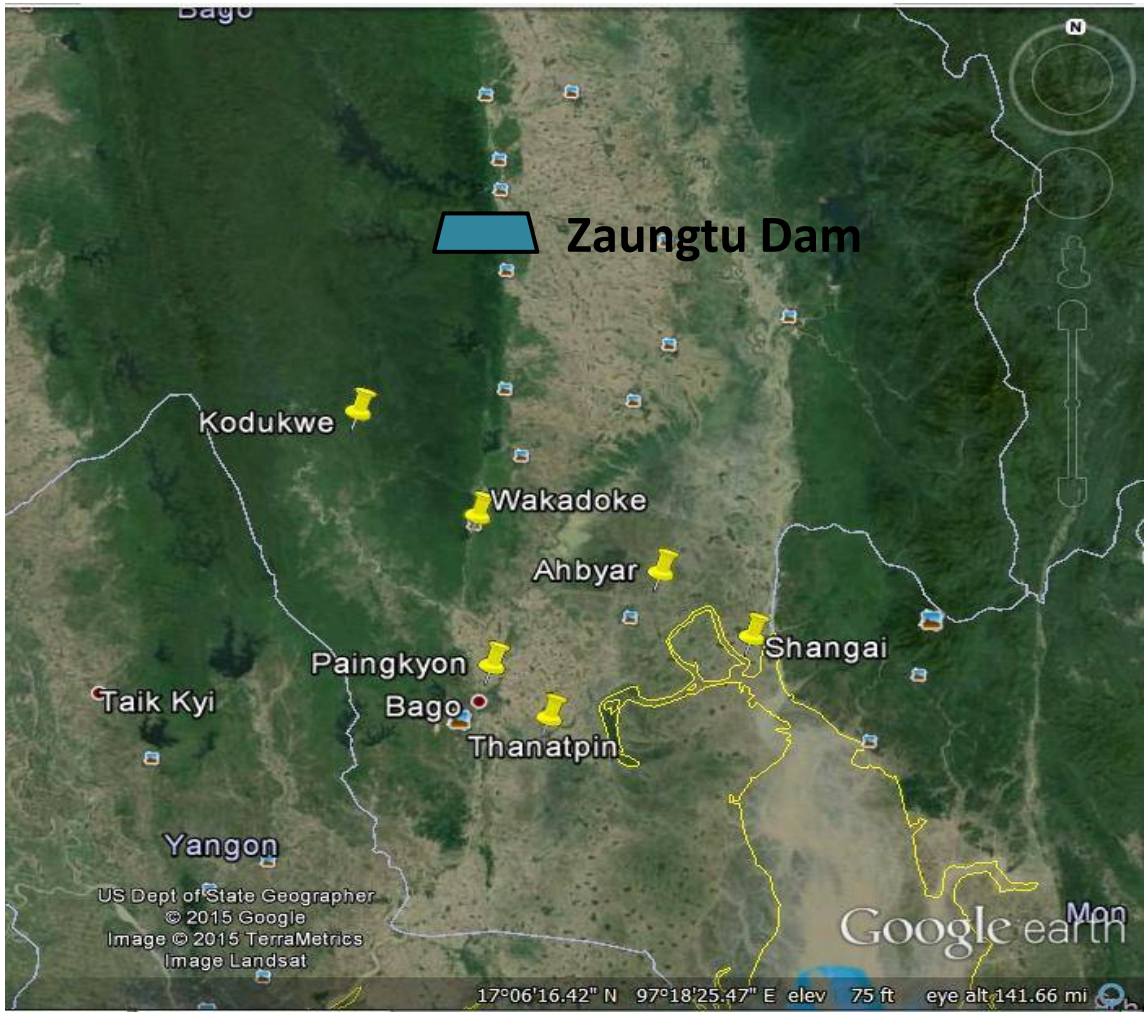
Summary and Way Forward

Inundation map of Bago River Basin is developed applying RRI Model.

Summary and Way Forward

A plan of continuing work on RRI model

- More rainfall station data (Six Auto Raingauge Stations) can be added in future modeling.



Summary and Way Forward

- Catchment rainfall data are not available for analyzing accurate runoff because of difficulties in establishing raingauge stations

- Installation of Auto Raingauge Stations is necessary to be expanded

- Dam outflow data of Kodukwe, Salu and Shwelaung in the catchment area will be used for U/S boundary conditions of Bago Basin to improve the model.

- Embankment heights are to be input

- Tides effect water levels at Bago gauge station and it makes the observed water levels (WLs) higher than the simulated water level (WLs)

- Need to review the reservoir operations, to improve cooperation and sharing data information among Institutions for flood management

Thank you very much