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CHULA ENGINEERING
Foundation toward Innovation

Water Disaster Management and Smart System Applicability

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Outlines

1. Water Disaster
2. Proactive Management
3. Spearhead Research Program
4. Smart System
5. Applicability
6. Remarks
7. References

Floodings in Bangkok

Pumping during Crisis

Future Thailand under risks

GDP

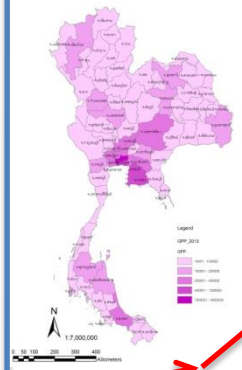
Future Thailand

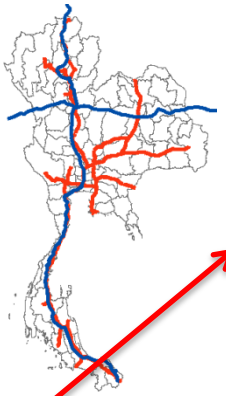
GDP gr 5 - 8 %

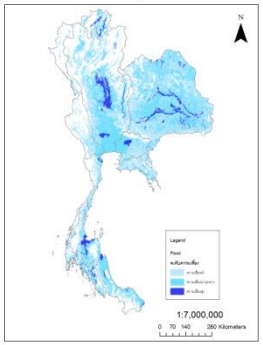
Middle income trap

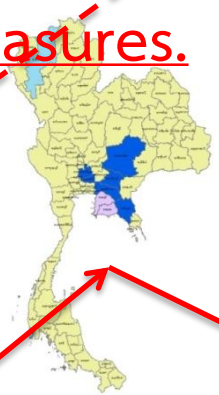
Loss

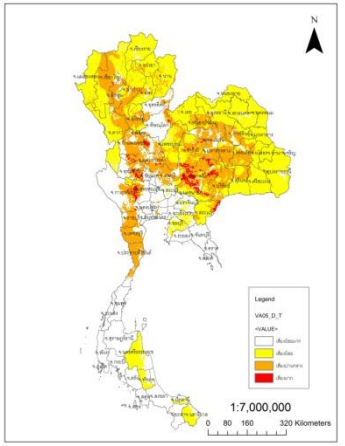
Floods, Drouht, Energy are major issues for development with no major measures.











GDP gr 3%

Development baseline | Mega projects | Flood | Super cluster | Drought

Time

Disaster Prevention Master Plan

Drought Counter Measures in 2014/15 and 2015/16

Year 2014/15	Year 2015/16
Preparation works	M1 Promotion of knowledge, cost down and change to other crops
Inform water situation	M2 Extension of rental fee and/or debt payment
Repair water gates	M3 Job creation or training
maintenance canals	M4 Skill development based on community request
review water allocations	M5 Water saving and improve water efficiency
Measures for farmers	M6 Increase water sources
find local water sources (ponds/wells)	M7 Secure health and security
recommend suitable crops	M8 Promotion of Community enterprise and inform weather information

WB Integrated Drought Management approach

Three Pillars of Drought Preparedness

1. Monitoring and forecasting/early warning

Foundation of a drought plan

Indices/ indicators linked to impacts and action triggers

Feeds into the development/ delivery of information and decision-support tools

2. Vulnerability/ resilience and impact assessment

Identifies who and what is at risk and why

Involves monitoring/ archiving of impacts to improve drought characterization

3. Mitigation and response planning and measures

Pre-drought programs and actions to reduce risks (short and long-term)

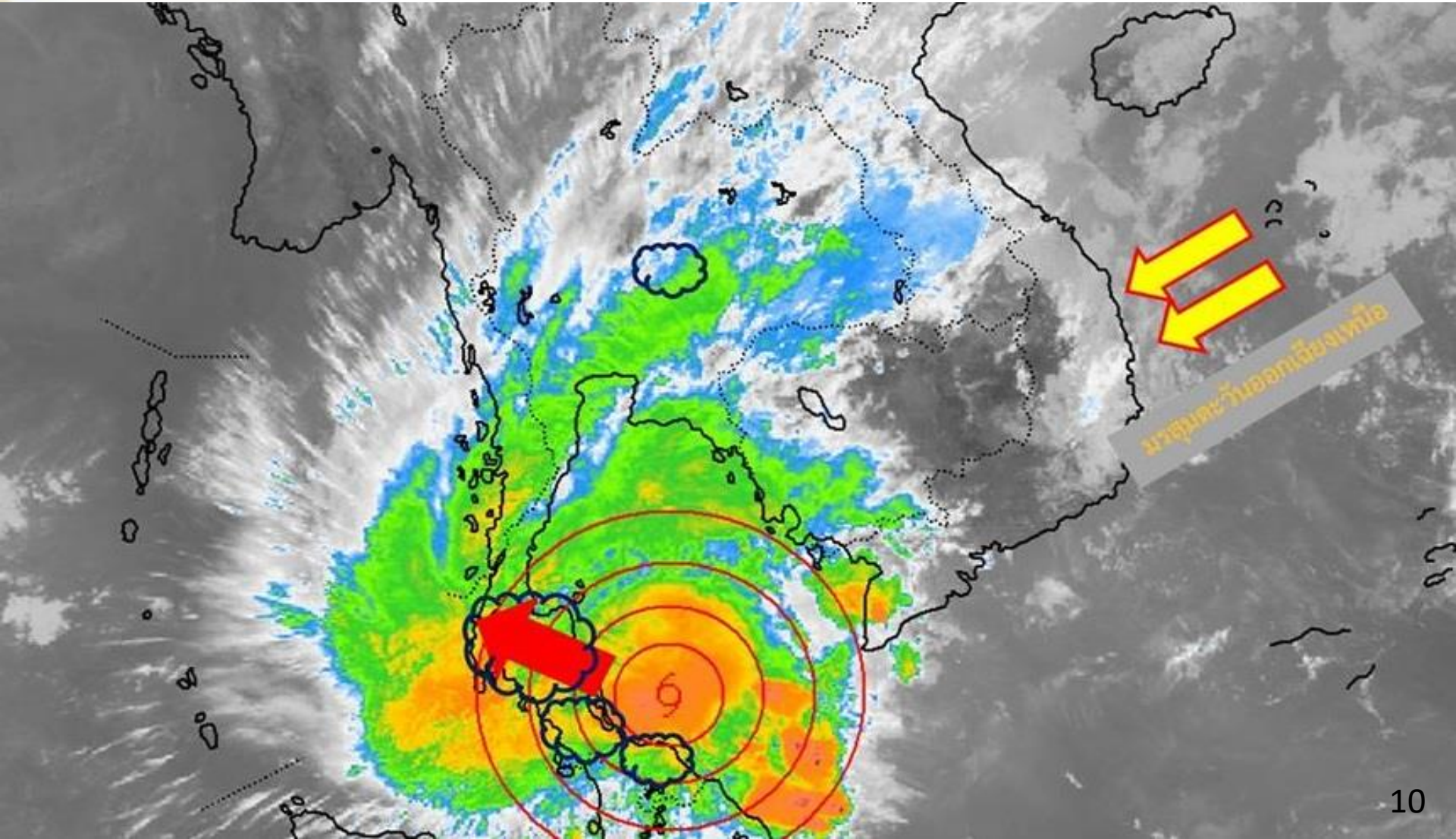
Well-defined and negotiated operational response plan for when a drought hits

Safety net and social programs, research and extension

World Bank Additional Guides

- Need of a Systematic **Proactive Approach** in addition to Reactive Approach
- Socio-economic losses must be considered, but also global water security and ecological resilience, not only economic analysis
- Drought monitoring activities need improvement and coordination
- **Need for more capacity building, knowledge transfer, data sharing and more access to information → community involvement**

Pabuk Tropical Storm (March 2019)



Strategic Goals:

- Reduce average water consumption by 15%
- The amount of water used to benefit from water budget is 85%.

Spearhead Research Program

Program Promoting Committee

Program Chair

ODU (Outcome Deliver Unit) ⟷ PC Office (Drive, Link, Develop)

	1	2	3
	Develop water management in the EEC area	Increase water management efficiency in the upper central irrigation area	New Water Management technology development
Outcome	Reduce water consumption by 15% in EEC	Save 15% of water usage, effective storage is 85%	Strengthen technology, sensor AI and water saving
Output	Spatial water management model has been accepted by all sectors	Decision support system for water management and agricultural area management at the irrigation project level	Water-saving technology
Drivers	There are prototypes and techniques for managing various water sectors.	Water management techniques from developed systems	Technology and research data

Framework of 3.2 Data transmission and data analytic for intelligence dam water management system

Rules/
Knowledge

Weather forecast
- Rainfall
- Temp 1-7-14

(Satellite/WRF model)

Rainfall/
Temperature

Water Management

Release/allocation
(Operation, Plan)

Previous model

New AI

Data

Receive/Storage/Transfer

Water Demand
- Agriculture
- Industry
- Domestic
- Envi.

(Field checking/
Satellite/Sensors)

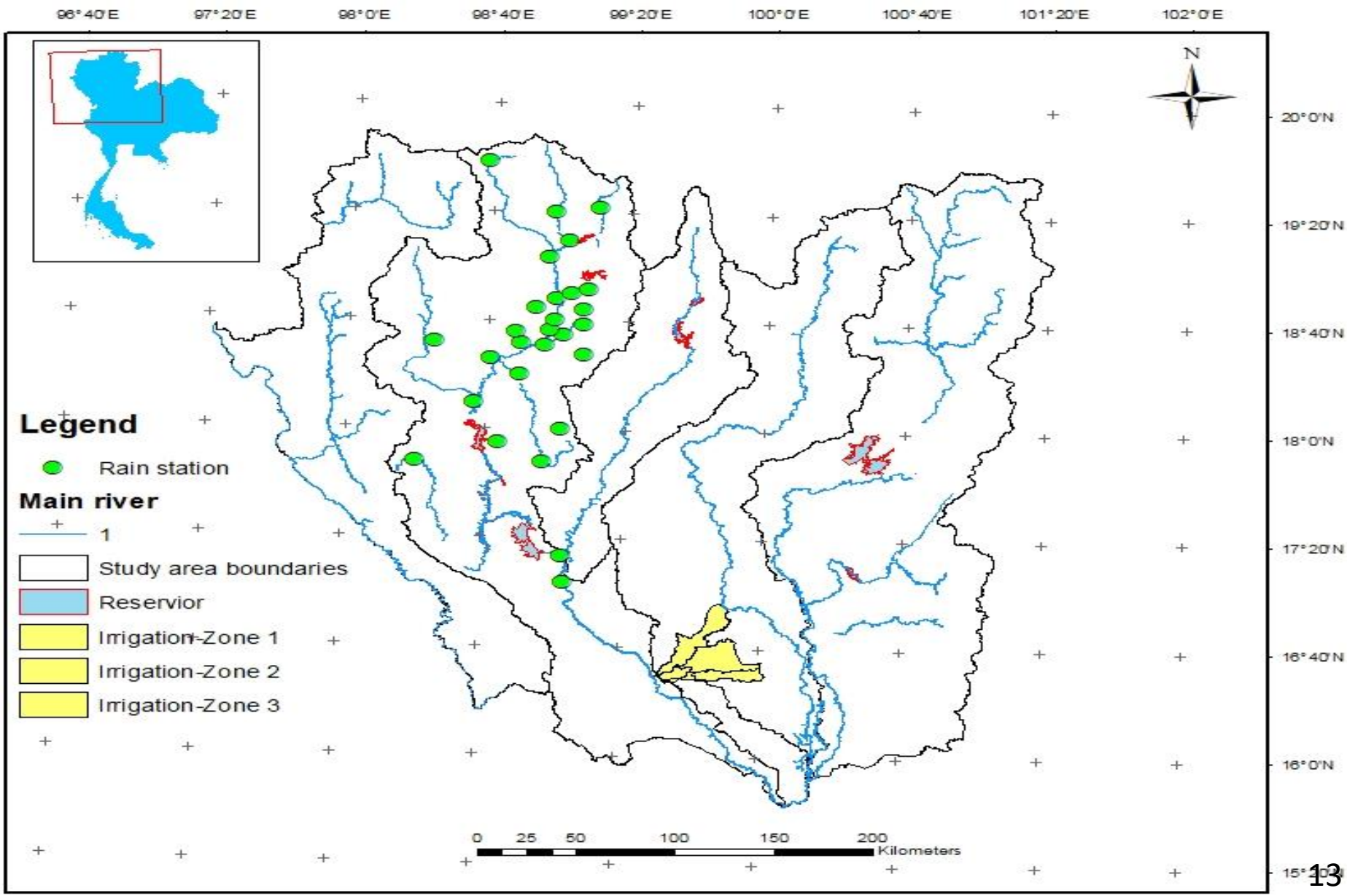
Water Supply
- Dam
- Groundwater
- Other

Disaster Assessment

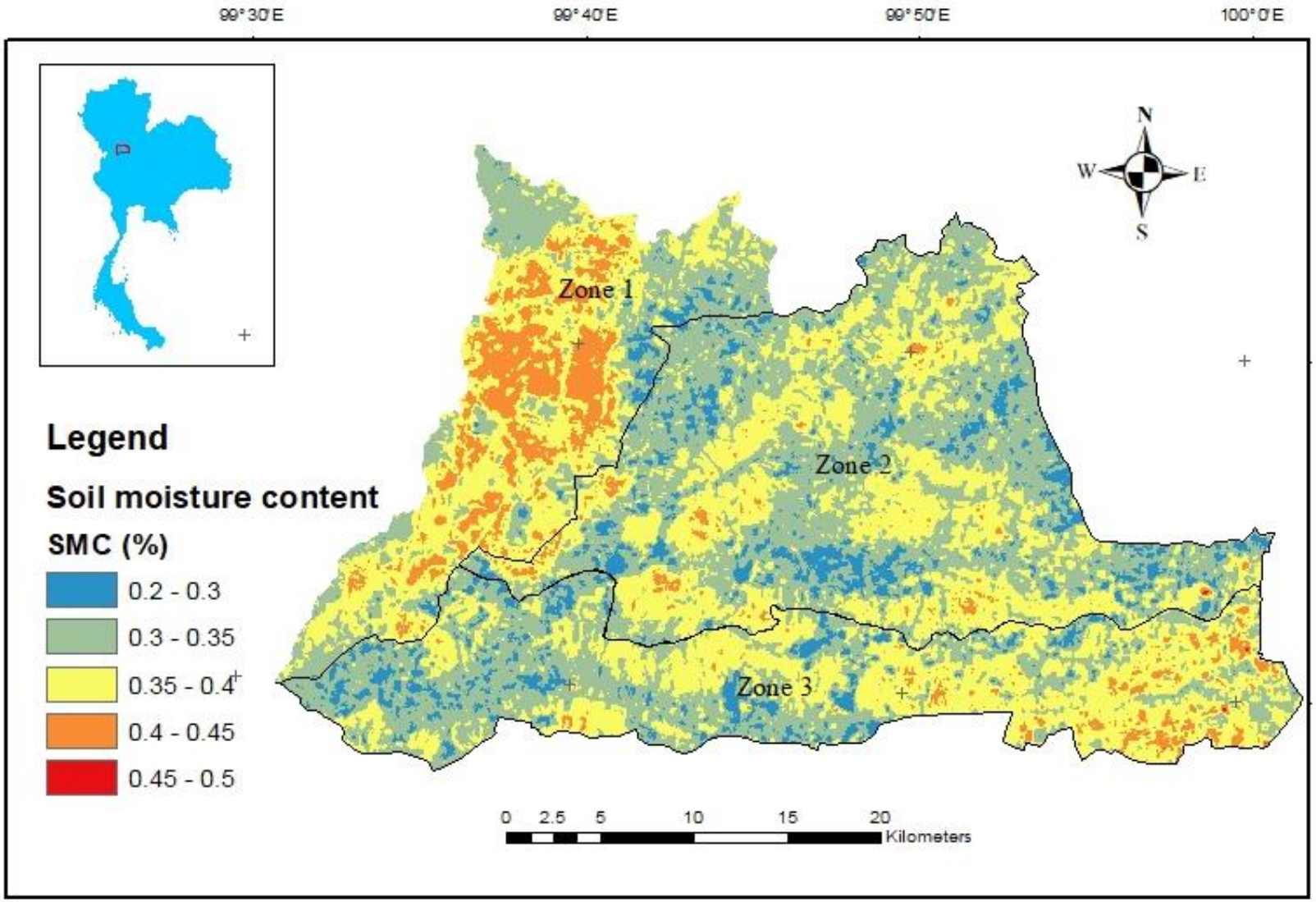
Flood

(extreme model,
extreme damage)

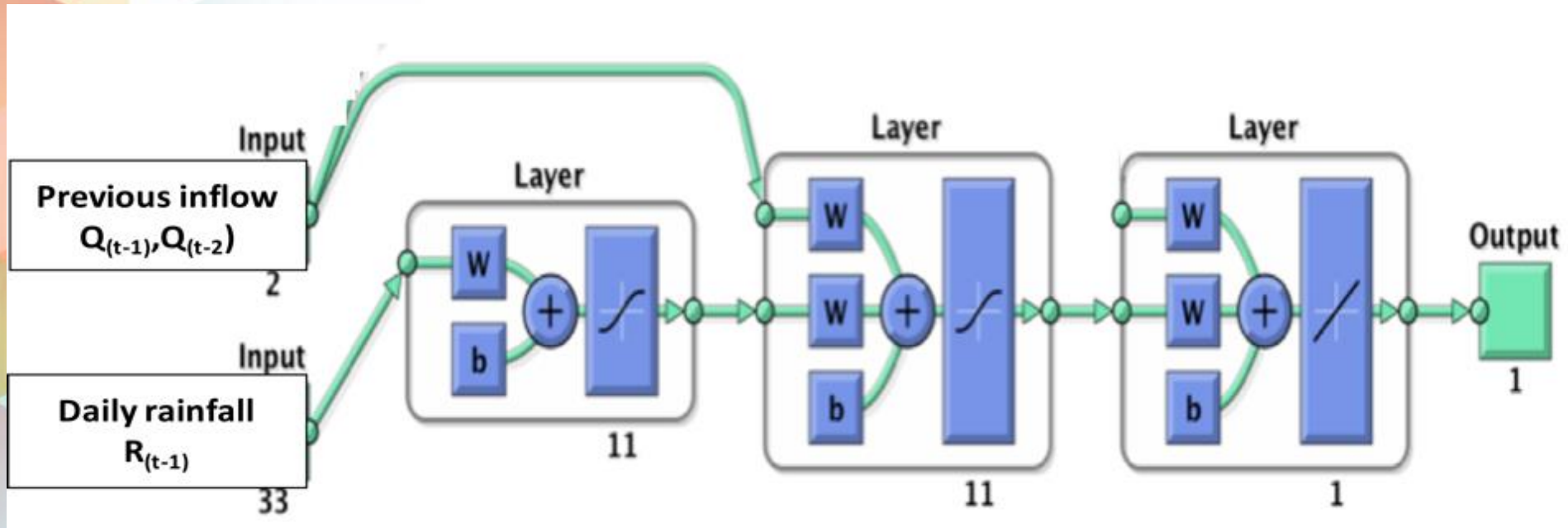
Sample of ANN: Study area



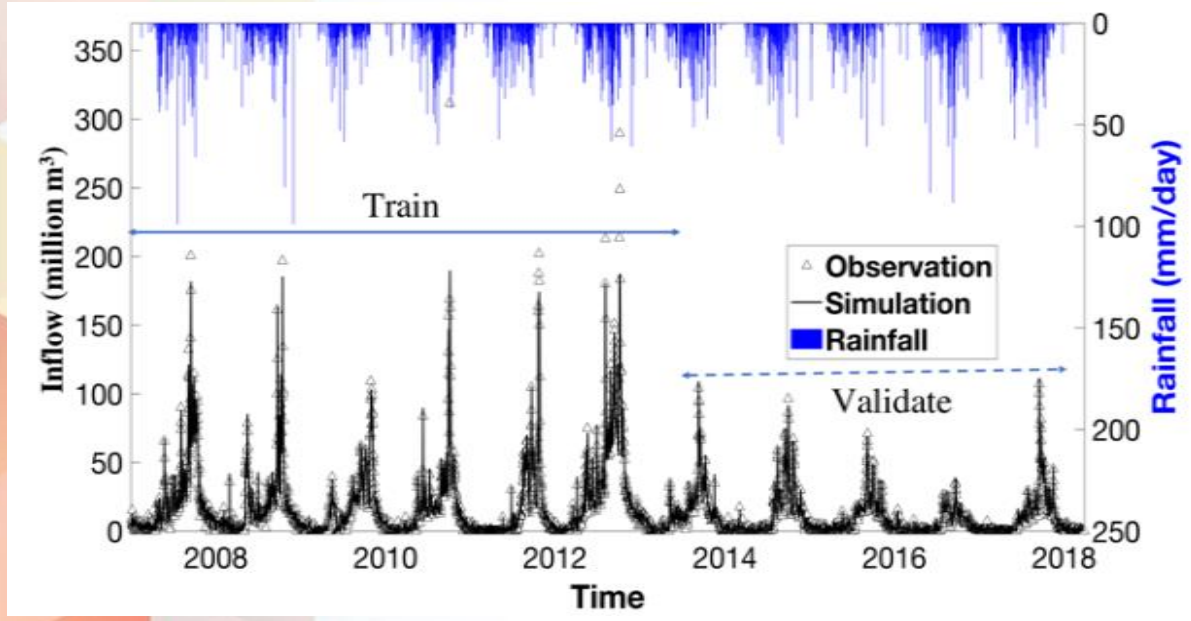
Spatial distribution of soil moisture



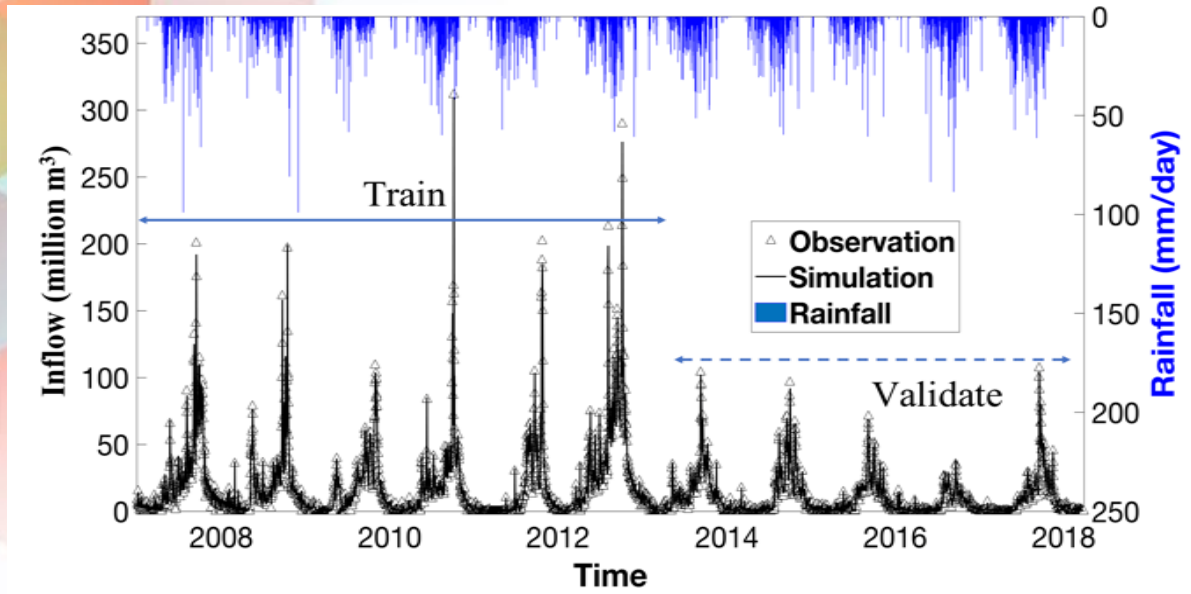
Structure of ANN with conveniently input layer for rainfall-runoff



Results

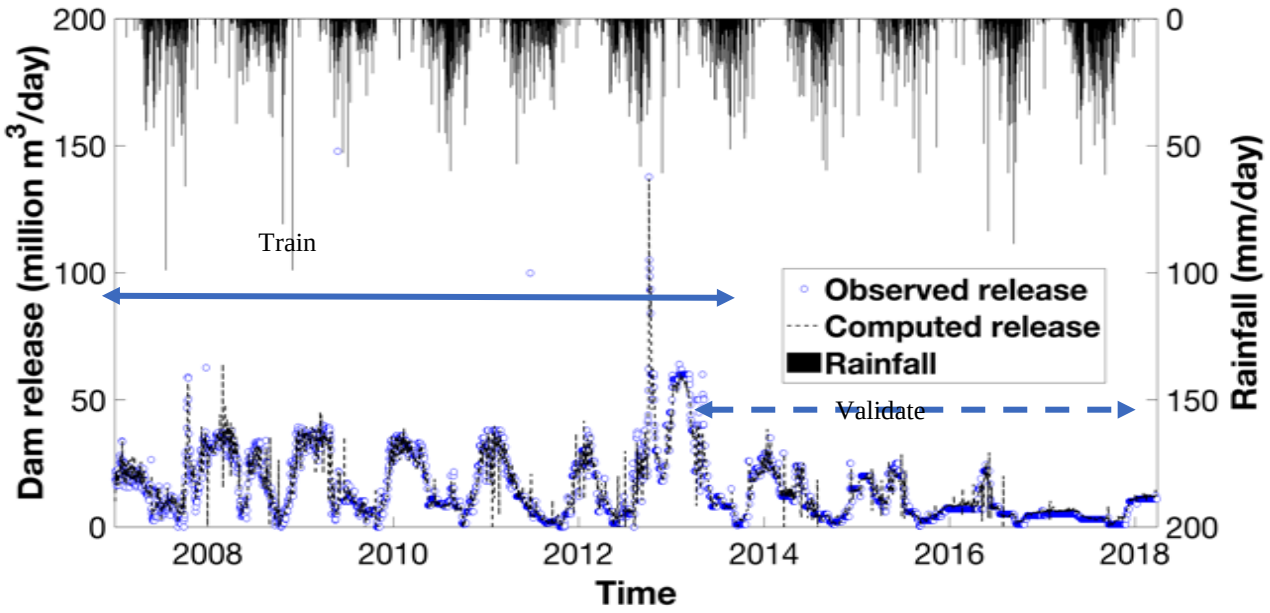


a) Without conveniently input layer (normal)

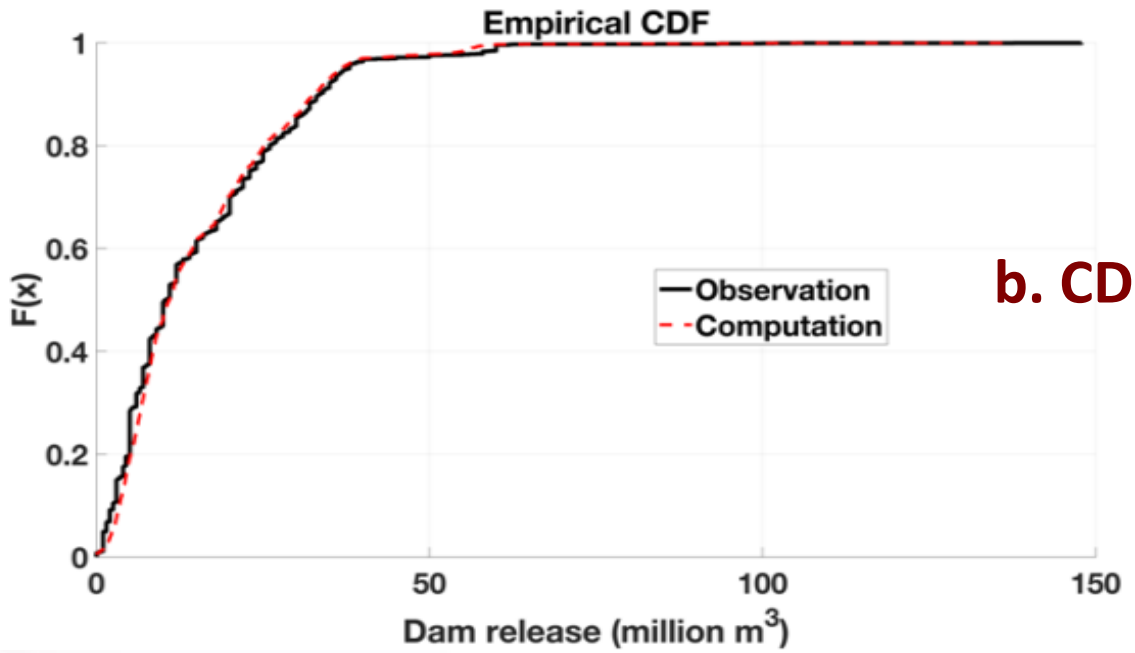


b) with conveniently input layer (cover extreme)

Performance dam release simulation



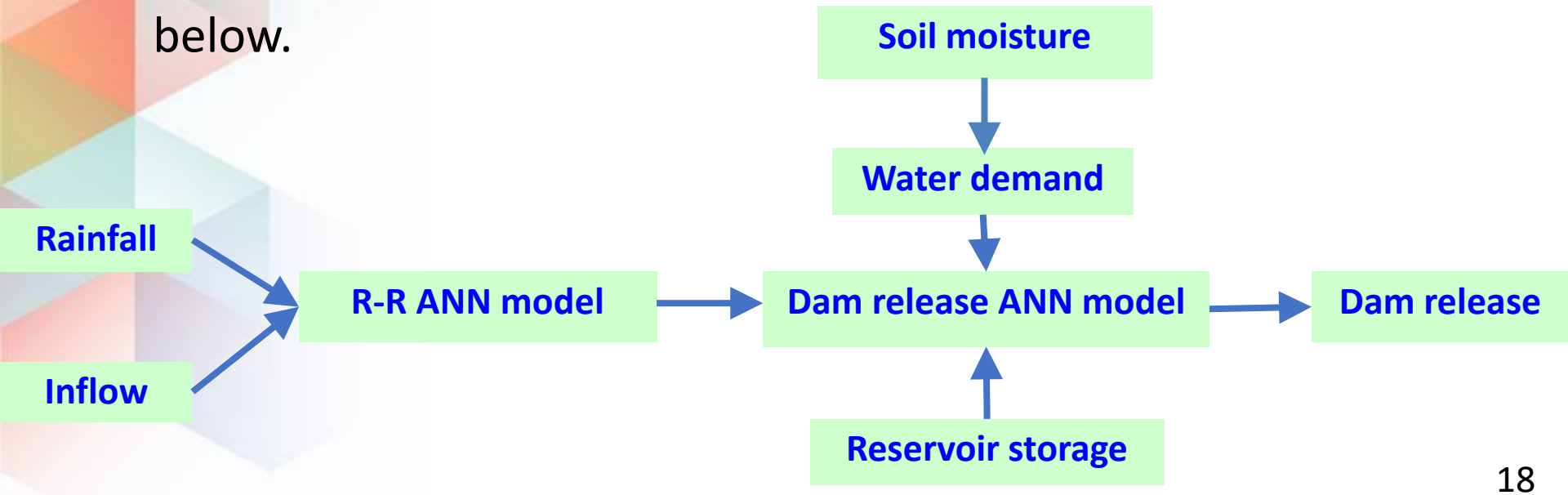
a. dam release in time series



b. CDF curve of dam release

Future works

- Previously, the dam operation is set by demand estimate from the past average record and controlled by upper and lower rule curve. With the developed rainfall-inflow-release data from ANN and soil moisture based irrigation demand, the dam release can be re-optimized with the more real time information to get up-to-dated inflow and demand as shown below.



Remarks

- Water Disaster Management needs more proactive approach to reduce loss risks.
- Water Management System is complicated, based on past records and varied with many natural and man made factors which needs time for computation.
- Smart system can enhance the computing simulation time and use near present data which make more accuracy and more time for decision making.
- More research needed to understand complicated natural phenomena and upgrade learning capacity of AI algorithm.
- High potential for smart system applications in water disaster management area.

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