

Flood Forecast and dam operation optimization systems

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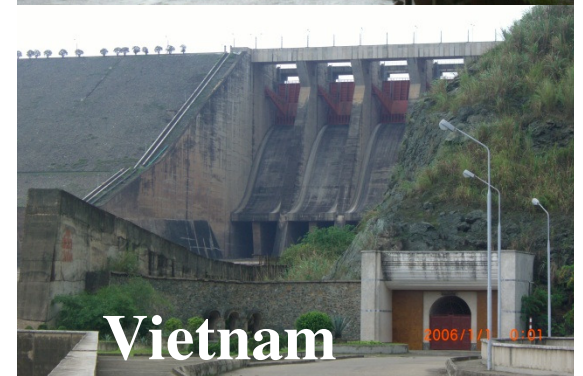
Floods in Asia Pacific Region

- Heavy rainfall brings expected rainfall for agriculture but they might also turn into floods causing damages.

Need 1: Emission of flood warning to perform evacuation timely

- Basins with existing gated dams when operated effectively are able to reduce flood damage.

Need 2: Dam release decision to reduce flood peaks and store volume for water-use



Decision support Systems under heavy rainfall

- Flood Warning Support System (FLOWSS)

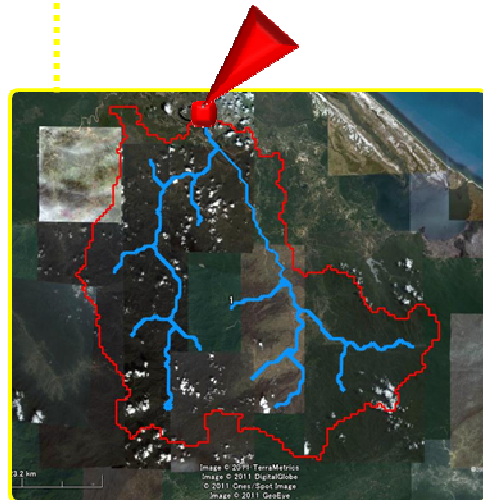
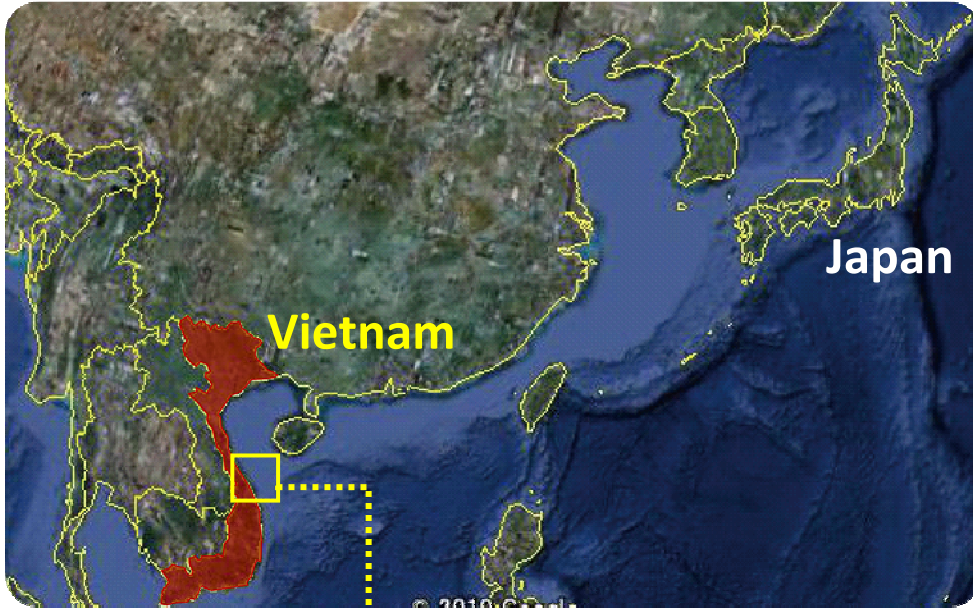
Goal: Emit flood warning to perform evacuation timely

- Dam Release Support System (DRESS)

Goal: Dam release decision support to reduce flood peaks and store volume for water-use

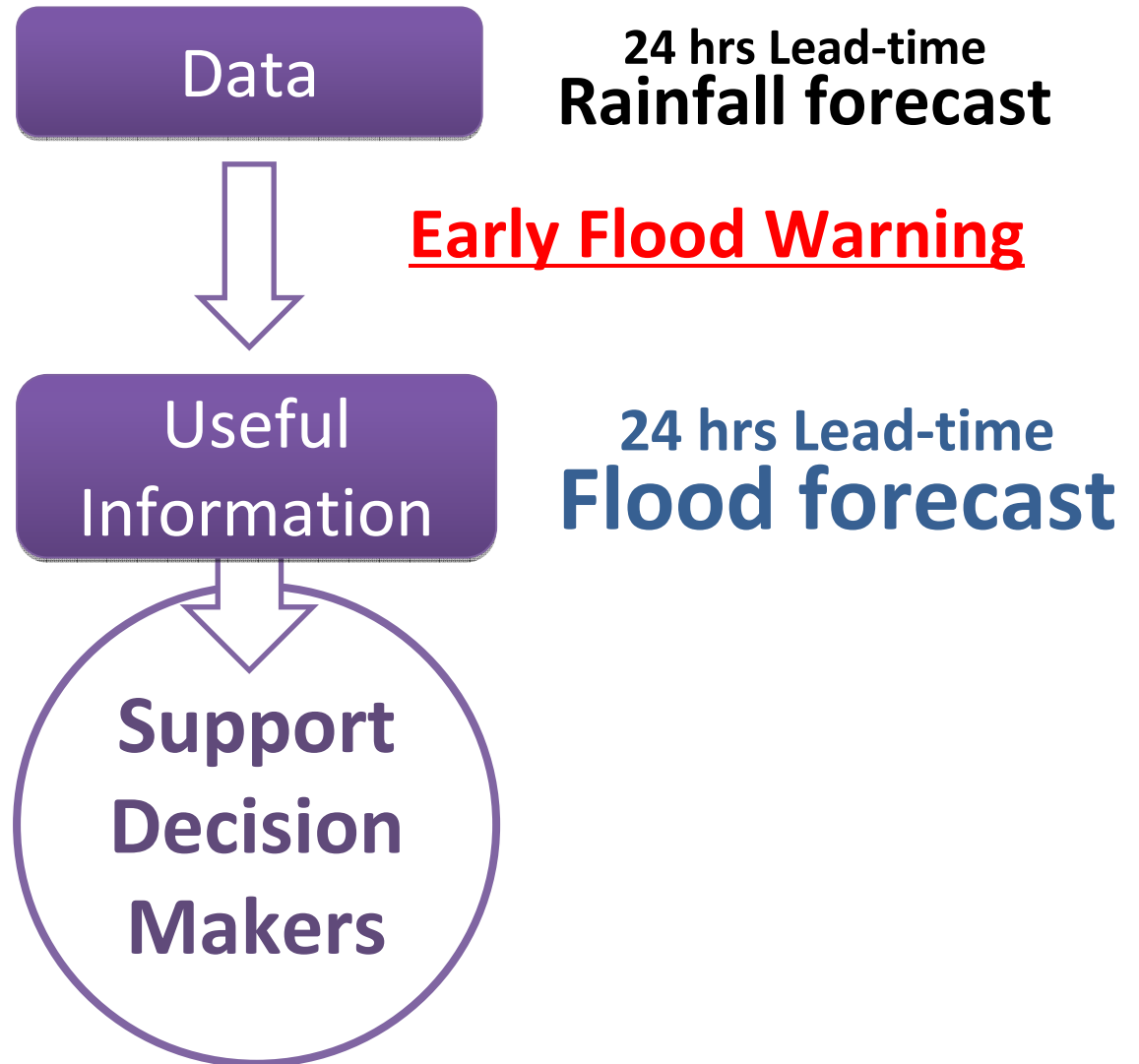
Flood Warning System FLOWSS

- Using **Quantitative Precipitation Forecasts**
- Based on **Ensemble Method**
- Applied in the Huong River, Vietnam

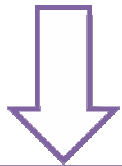


Huong River basin

Objective.



Rain forecast



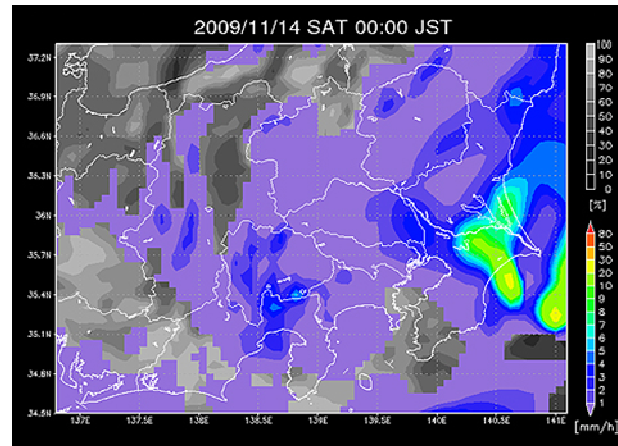
Evaluation



Probabilistic Approach



Simulation

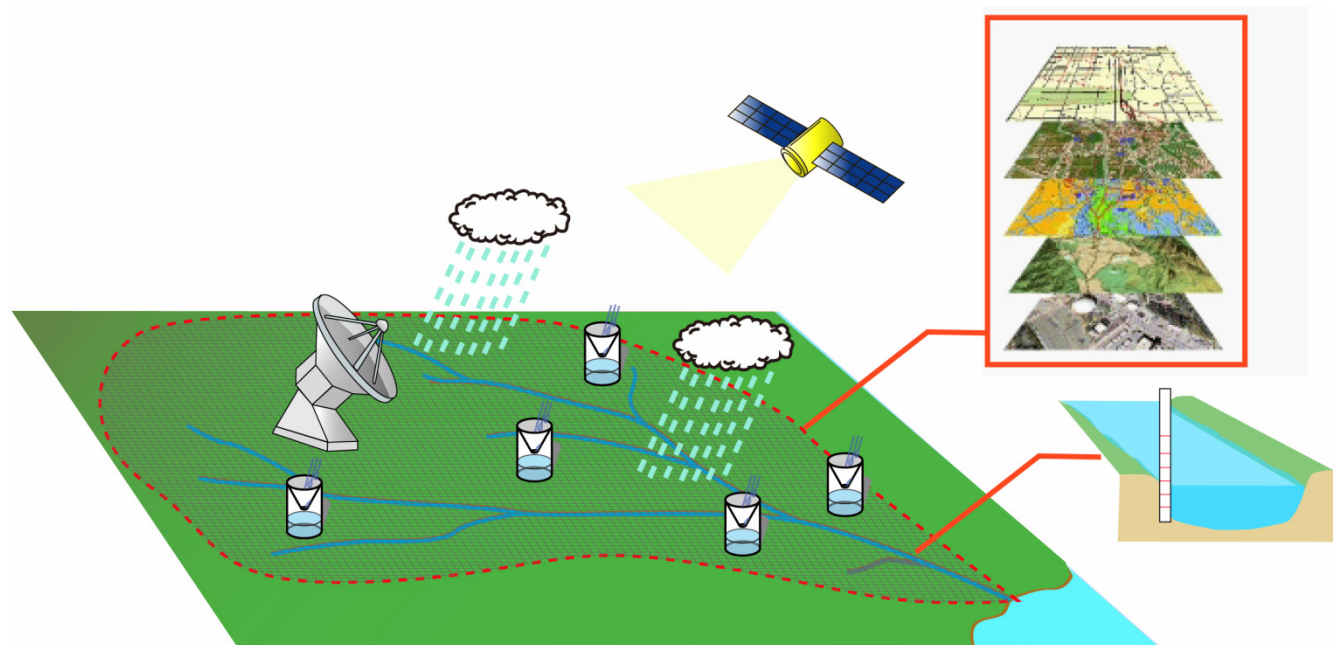


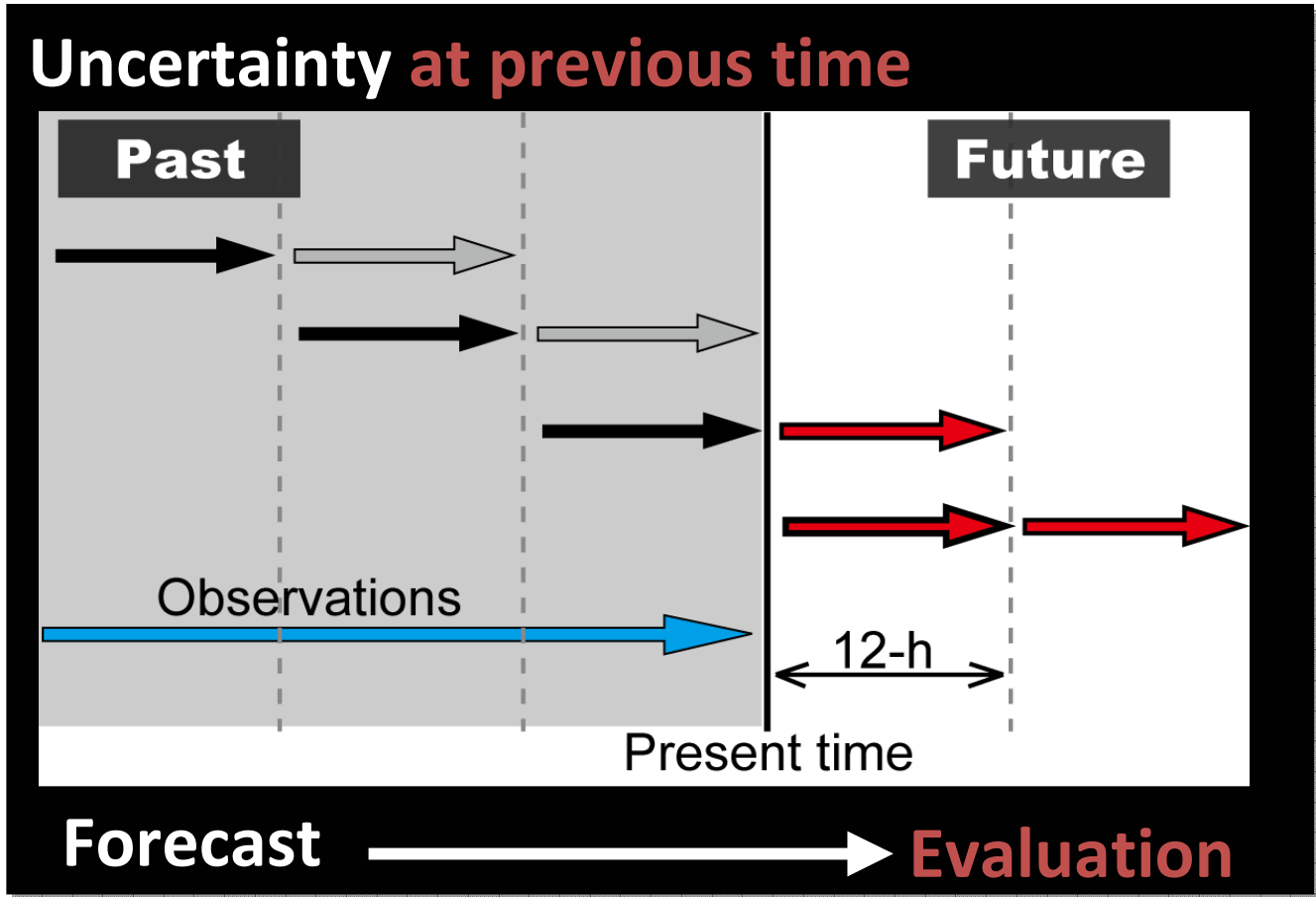
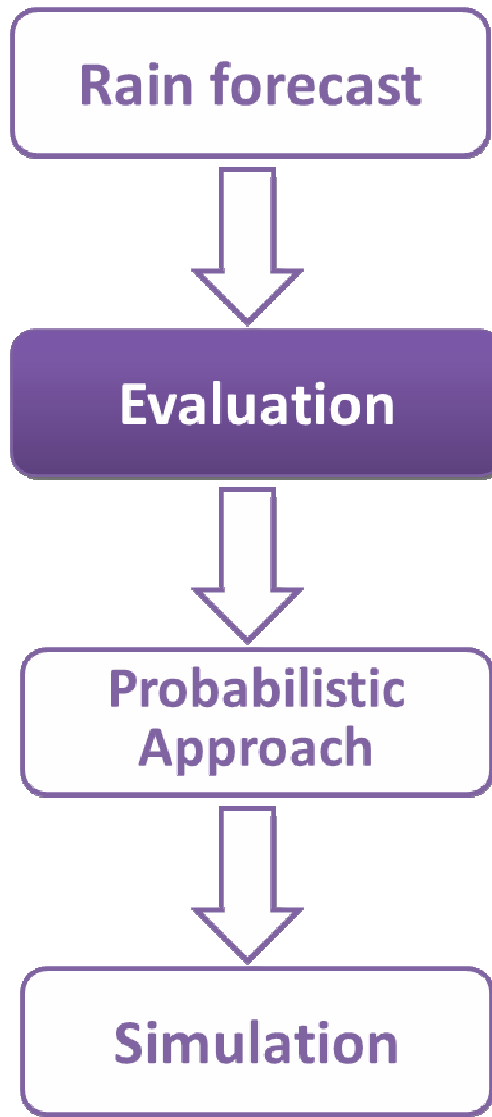
Grid Point Value (GPV)

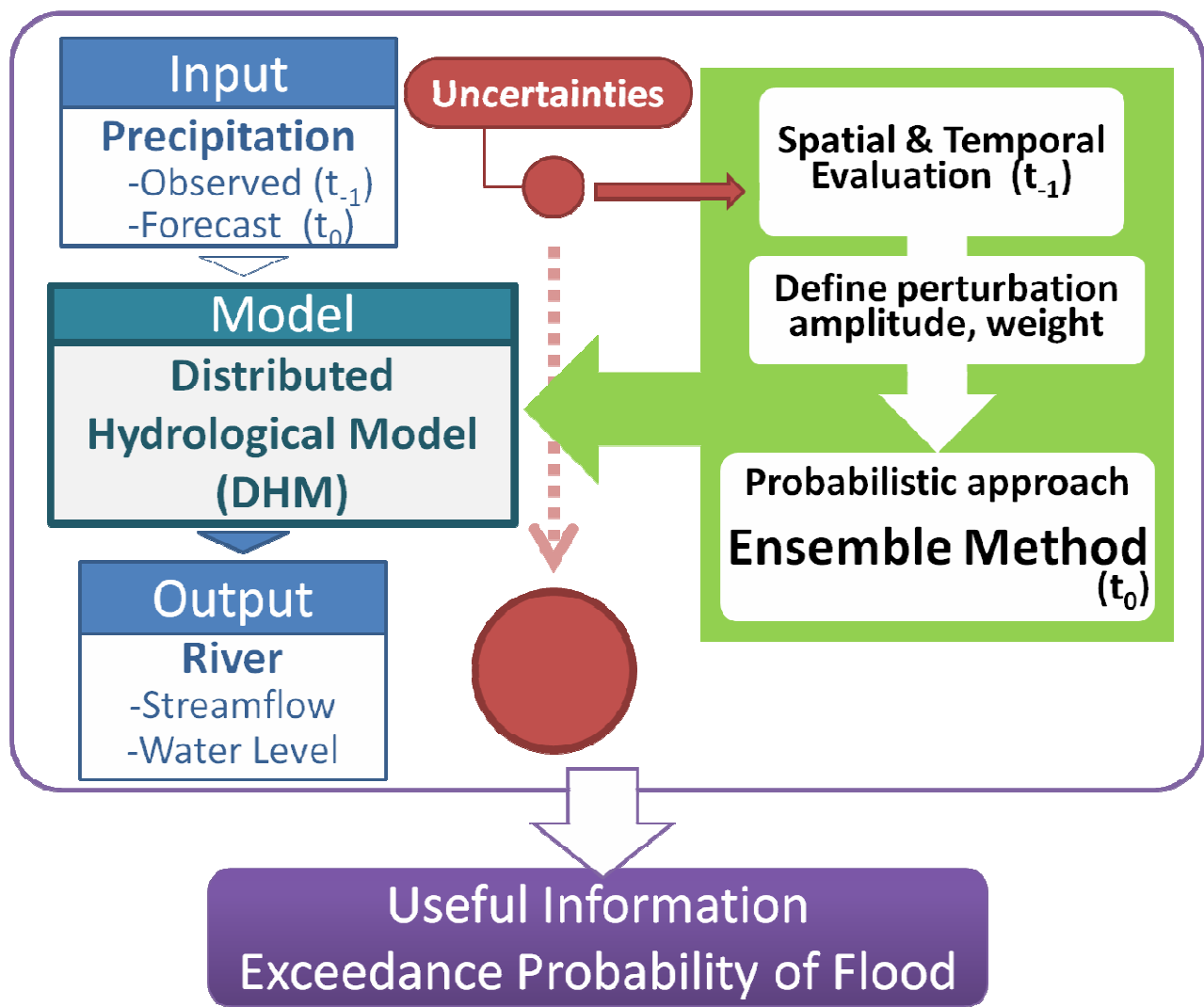
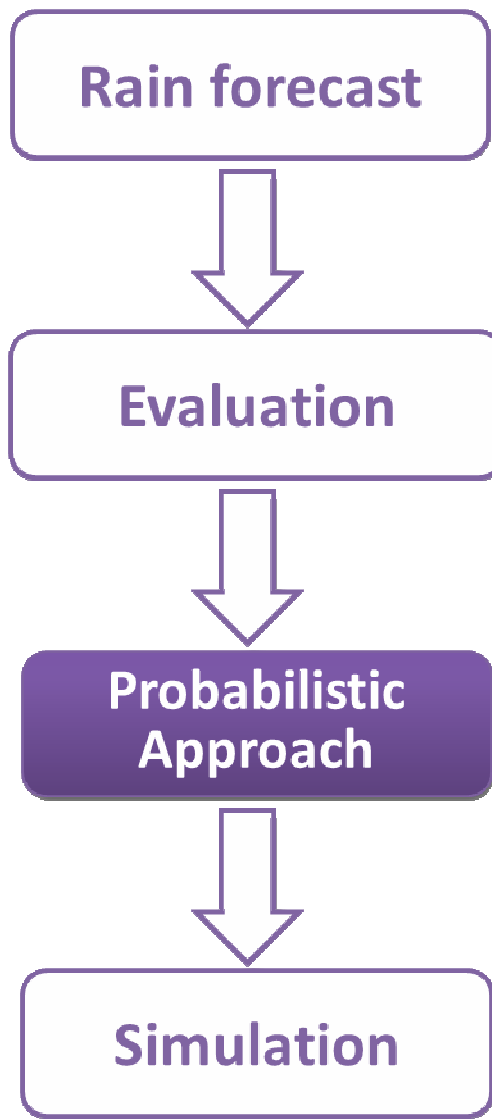
24 hrs lead-time

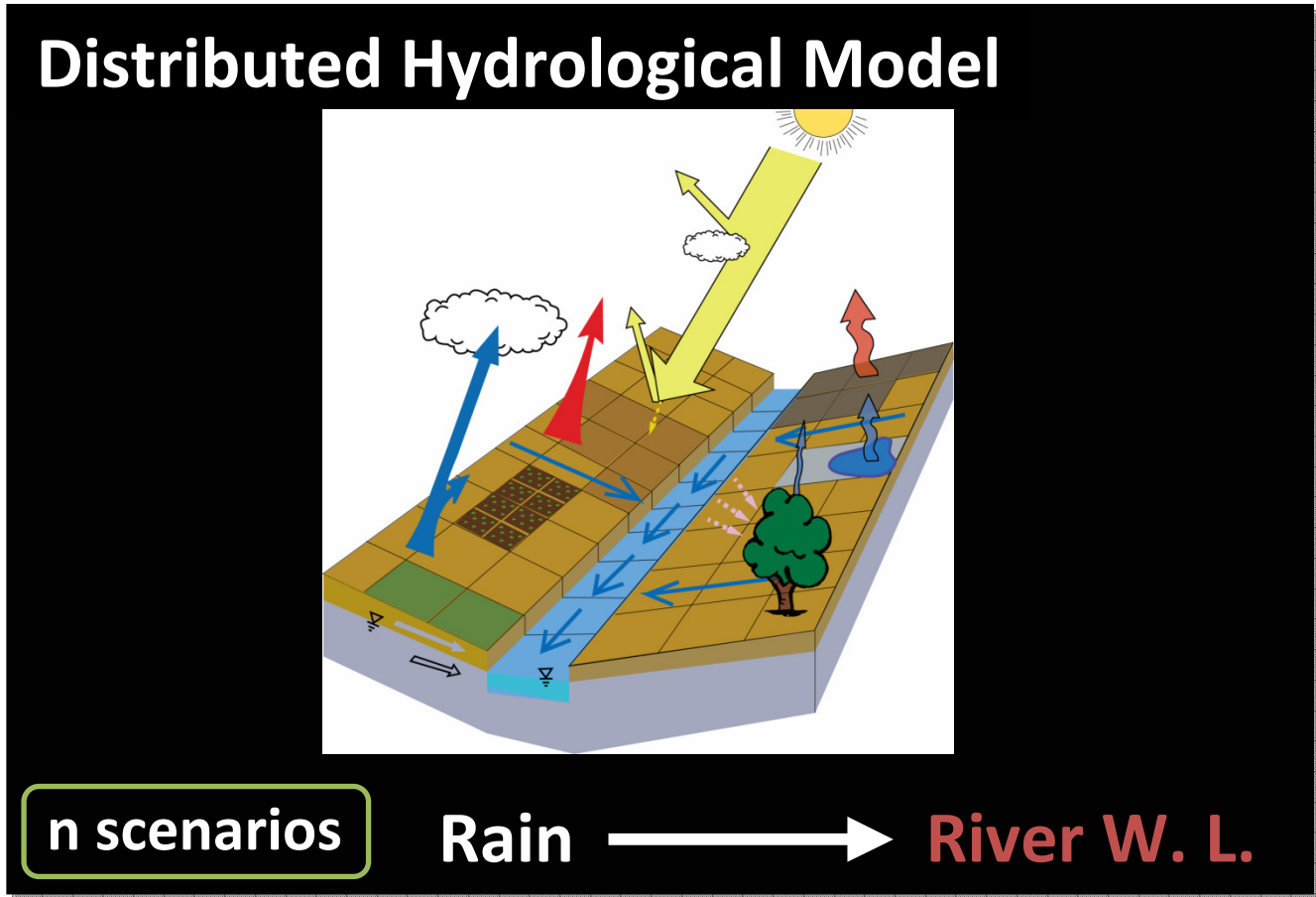
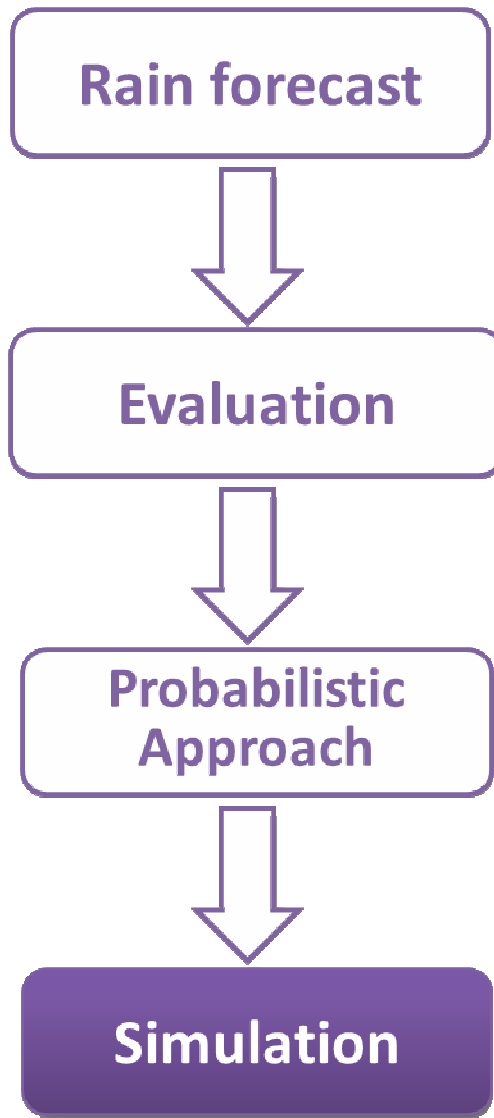
Global scale

Twice per day

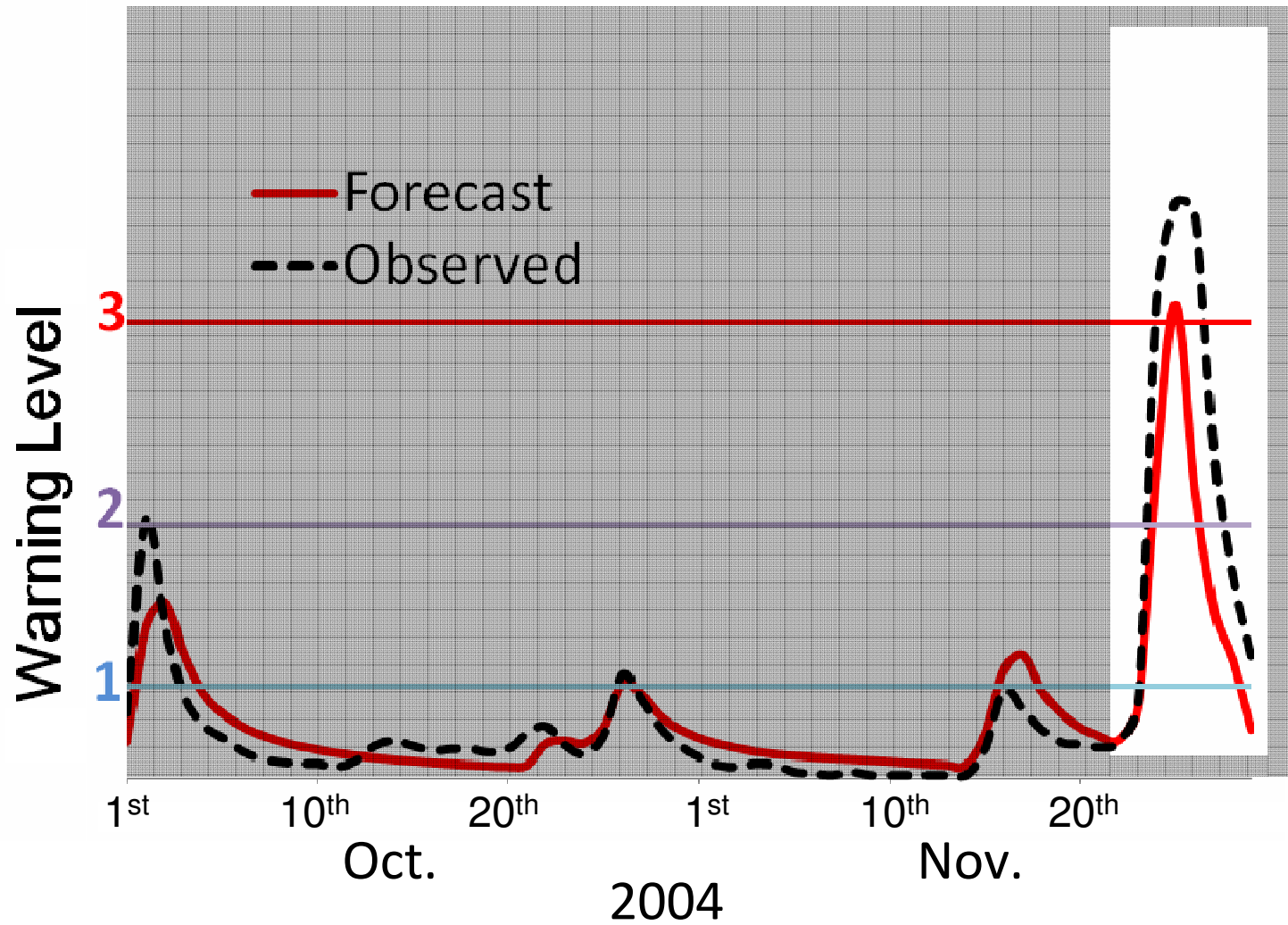


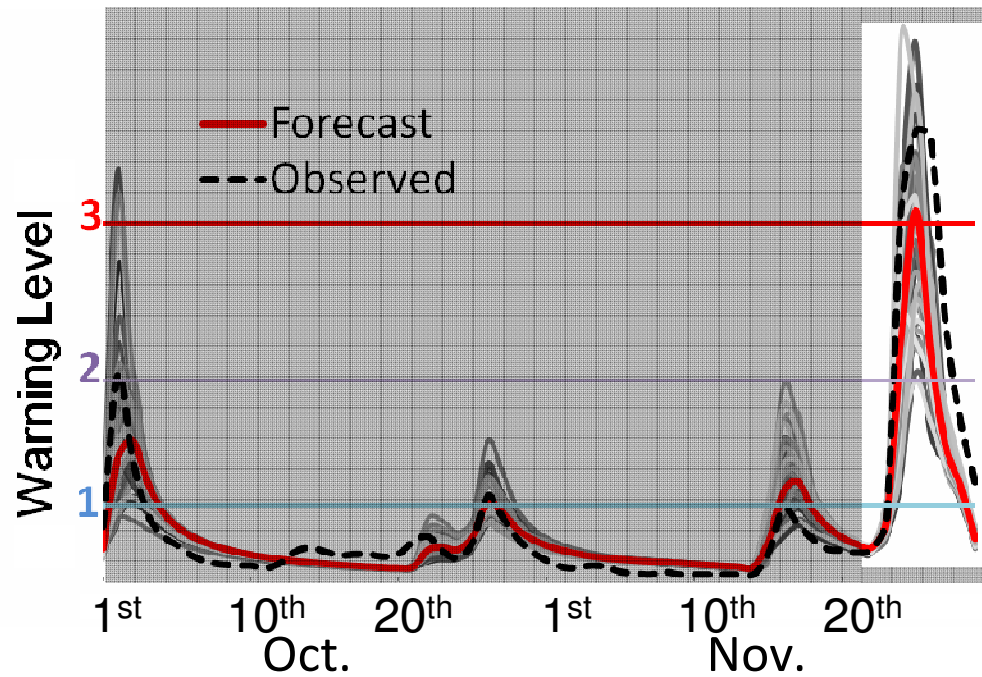






Result.





2004

Date		Nov.					
		24	25	26	27	28	29
Predicted exceedance probability (%)	W.L.3		8	52			
	W.L.2		74	96	72		
	W.L.1	6	96	96	96	96	96
Observed	W.L.	0.9	3.1	3.5	3.5	2.4	1.7

So far...



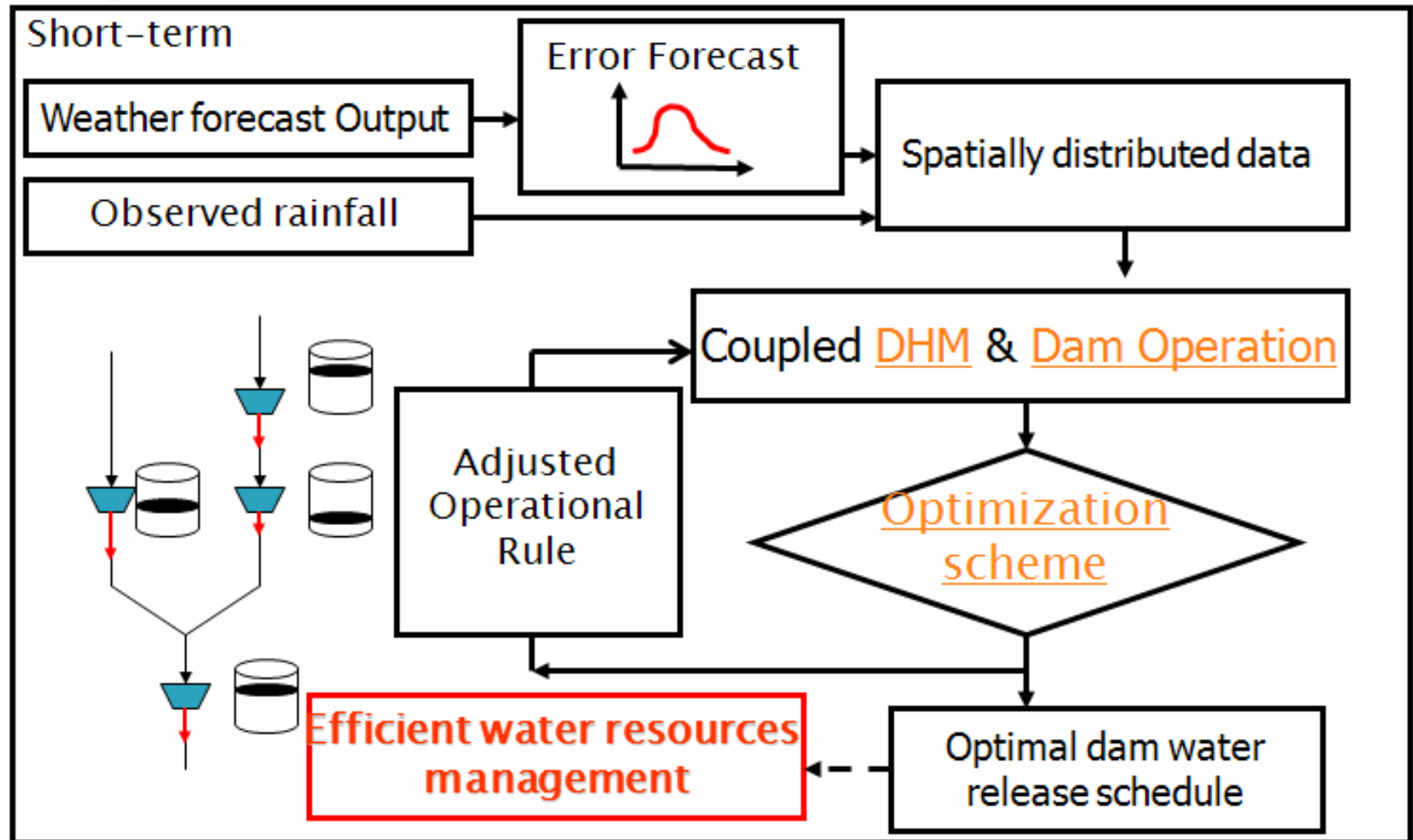
Extended Lead-time

6hrs → 24hrs

with

**Successful performance, but
more events are needed
and include two new dams**

DRESS system



Ensemble member generation of QPF

$$GP(x, y)_k = \text{Max}\{QPF(x, y) \times (1 + A \varepsilon N(0,1) \times wi_{sub} + B \varepsilon N(0,1) \times wi_{tot}), 0\}$$

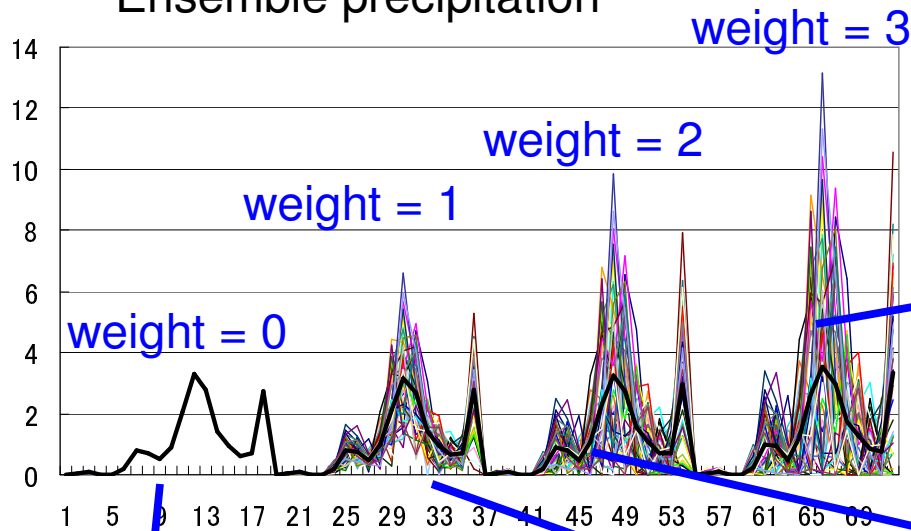
Saavedra, Koike et al., 2010

$N(0,1)$: Gaussian normal distribution

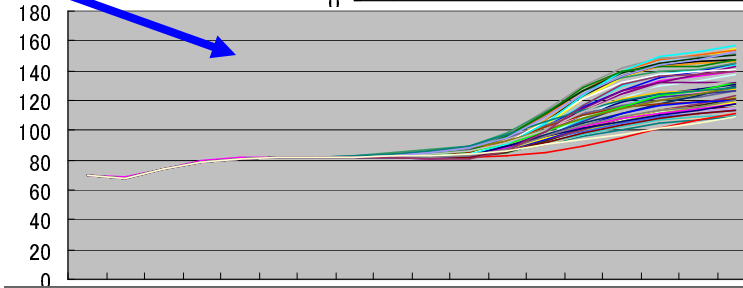
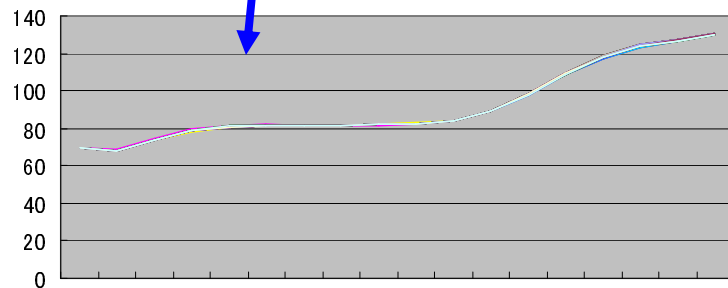
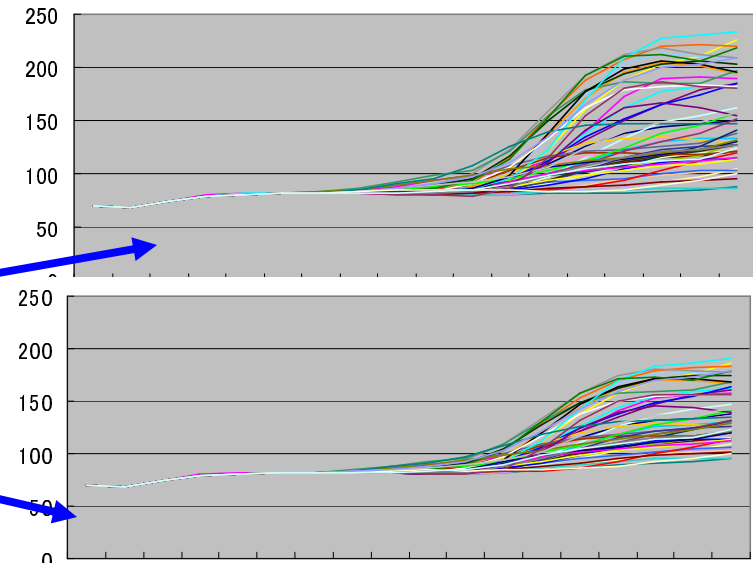
wi_{sub} : weight per sub basin; wi_{tot} : weight per sub basin

A, B : preference

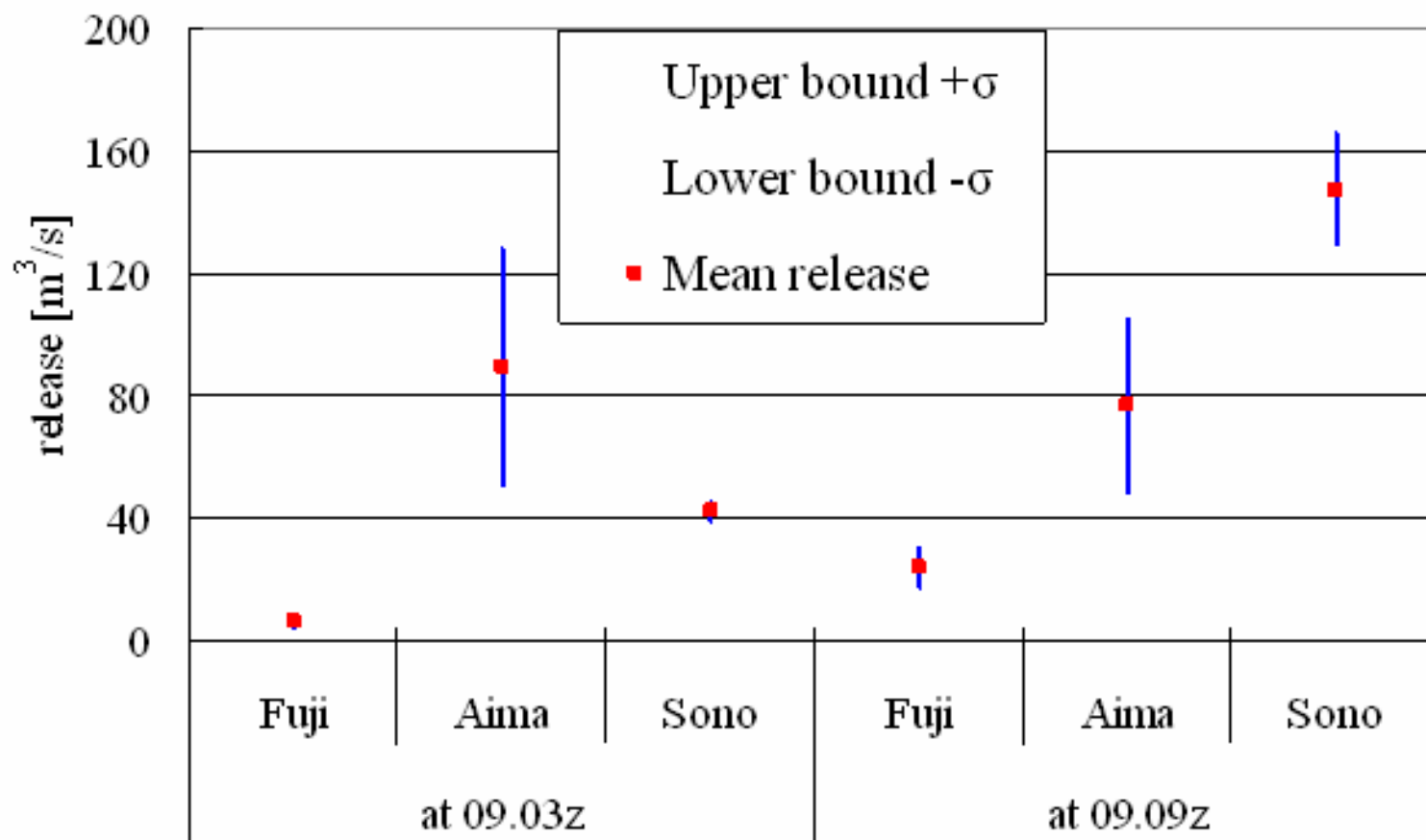
Ensemble precipitation



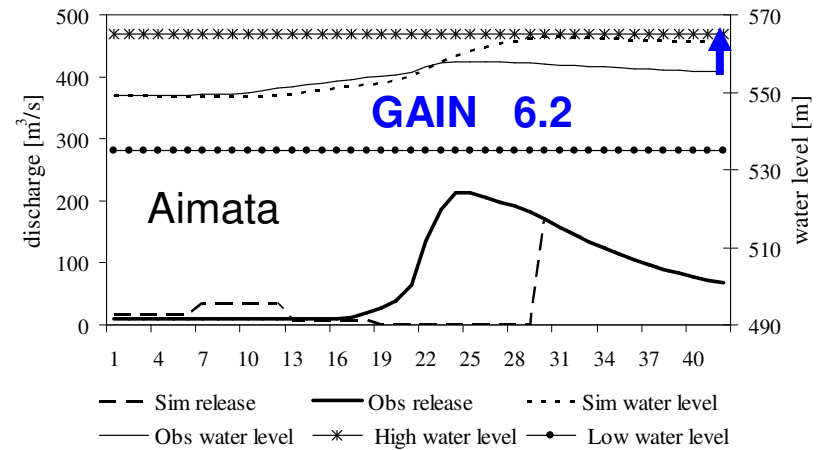
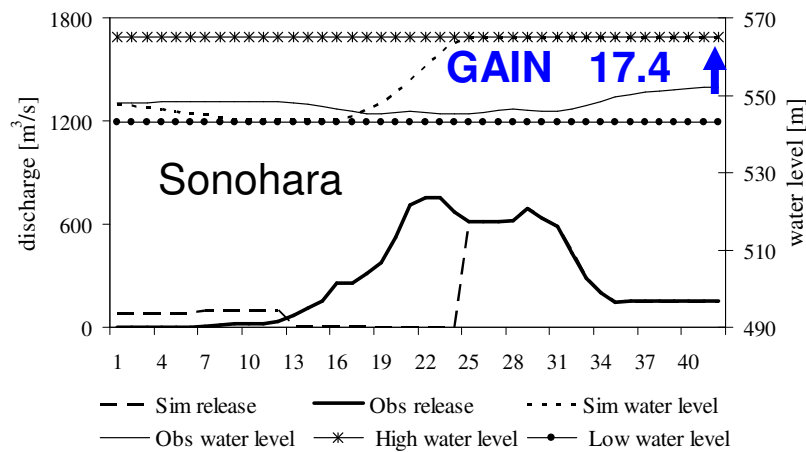
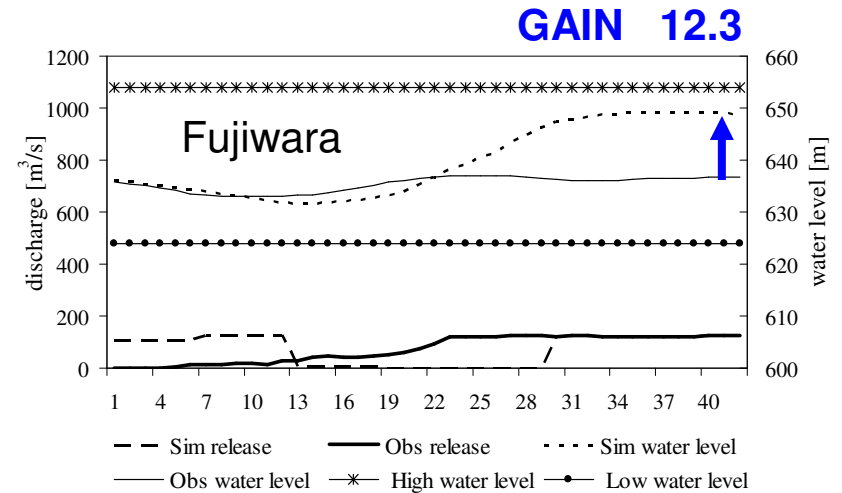
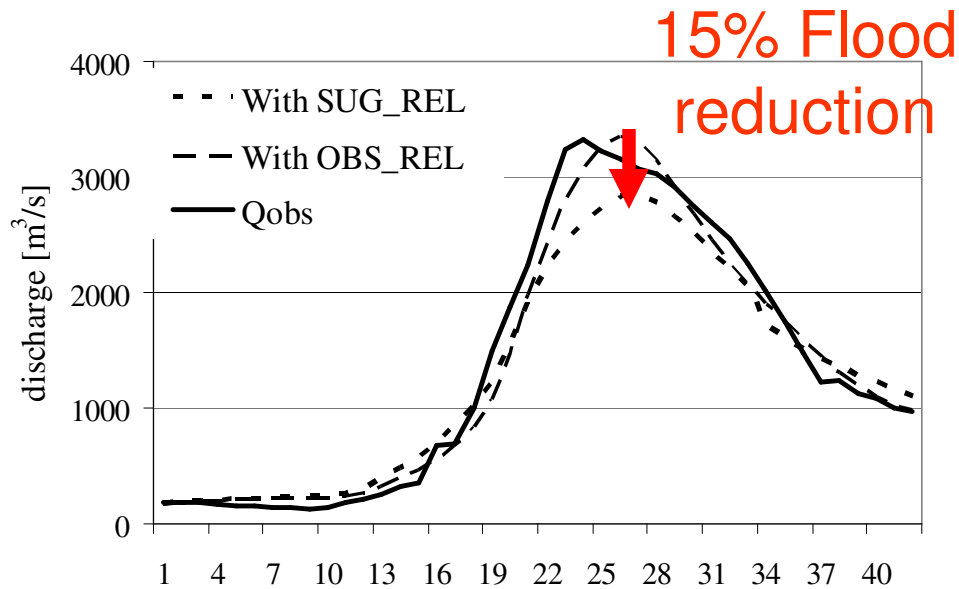
Ensemble discharge



Dam release uncertainties event 9-10 Jul 2002



Results: event 2002 Jul 9~11



TOTAL GAIN 35.9

Input data: Real-time observations and forecast precipitation

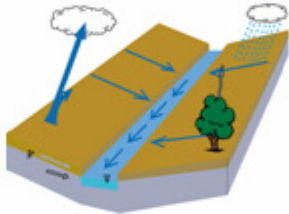


Reservoir Information

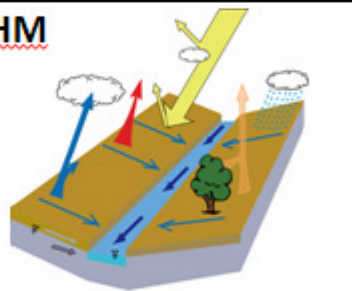


Distributed Hydrological Model

GBHM



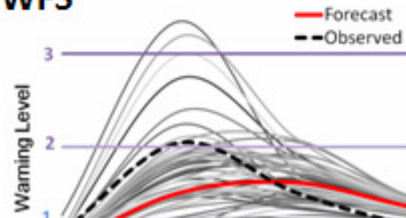
DBiHM



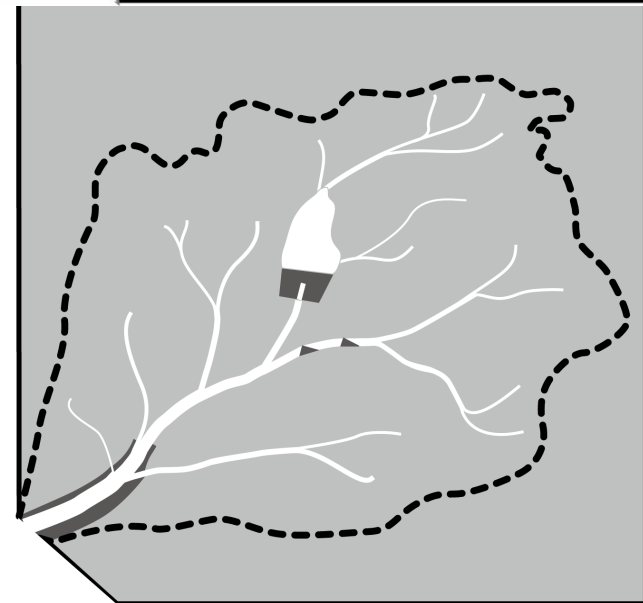
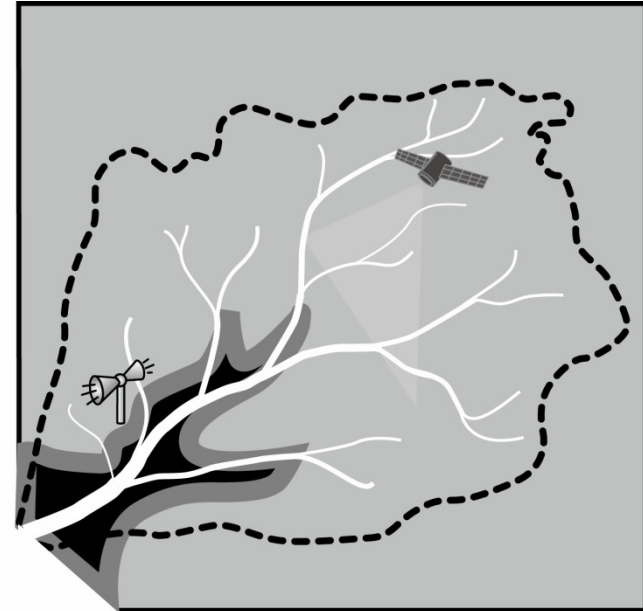
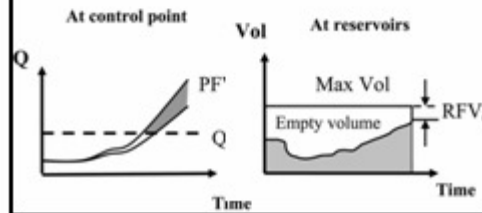
Ensemble method
Based on hindcast evaluation



EWFS



DRESS



Contributing to IWRM

- FLOWSS and DRESS need to be run continuously as in real-time operation
- They can also be used for Climate change impact assessment

