POSTER BOARD NUMBER:C03

Flood Inundation Simulations and Dataset Suitable for Poorly Gauged Small Rivers in Japan

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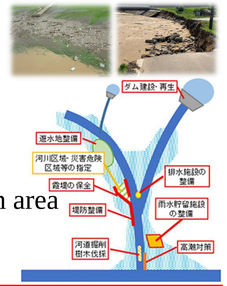
Introduction

- Recently, flood disasters have occurred frequently due to heavy rainfall in small and medium-sized rivers
- Integrated Basin management for flood control is being promoted in Toyama Prefecture, Japan



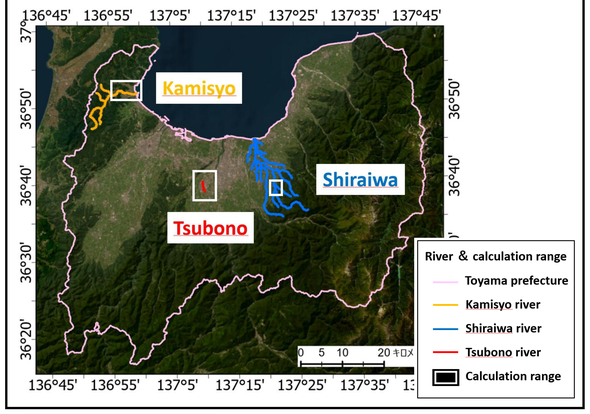
- Limitation in flood inundation model
  - Insufficient river cross-section data in upstream area
  - The embankment breach locations are unclear

objective

To propose a new flood inundation method suitable for small and medium-sized rivers by utilizing the LP data.

Data and Methods

Study location



Study Flow

Calculate Probable maximum precipitation (PMP)

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LP data (1m) is used for the river cross-section
- Accuracy Verification
- Estimation of Embankment breach location

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Flood inundation simulation

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Verify the flood model accuracy with historical flood event
Comparison of LP data for elevation data (1&5m)

Conclusion

- **Probable maximum flowrate is too large for small rivers**
- **LP data (1m) has better accuracy**
- **It is possible to predict Embankment breach location by utilizing LP data (1m)**
  Embankment breach location of the actual disaster could be evaluated in advance
- **Results of flood inundation analysis**
  LP data (1m) has a better performance in representing river cross section
- **The difference of LP data 5m and 1m for floodplain elevation is insignificant.**

Input rainfall Probable maximum discharge 0.4 times

Calculated Probable maximum precipitation (PMP), rainfall-runoff, and peak river discharge

	kamisyo	shiraiwa	tsubono
Peak river discharge (m³/s)	2172.7	917.9	91.6

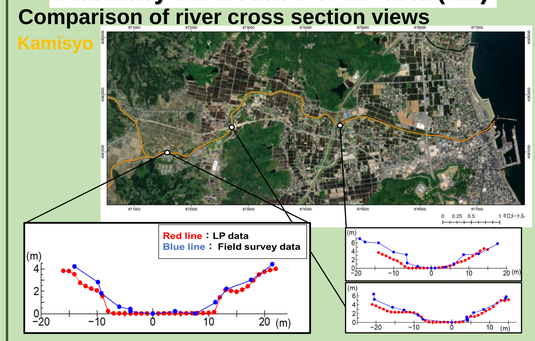
Approx. 0.4 times

Shiraiwa is calculated actual disaster rainfall Peak river discharge : 331 [m³/s]

LP data (1m)

Accuracy Verification of LP data (1m)

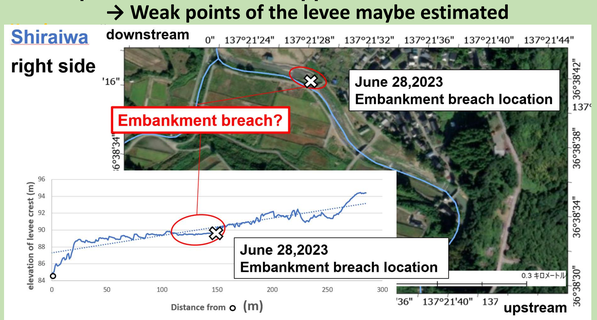
Comparison of river cross section views



LP data (1m) has accuracy

Calculation of Embankment breach location

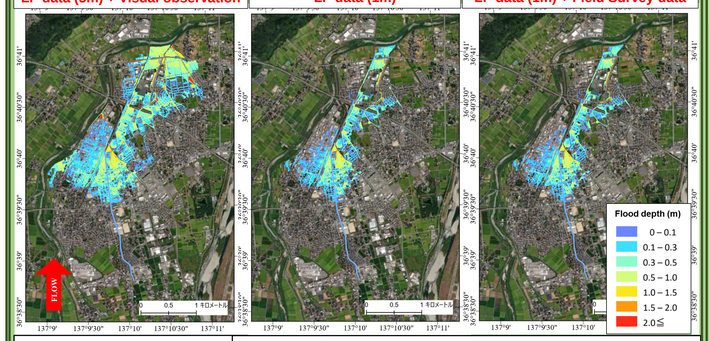
Create a graph of the levee crest elevation from LP data (1m) find the point lower than the approximate curve
→ Weak points of the levee maybe estimated



Results and Accuracy verification

Results of Flood inundation analysis

Case1 (Low accuracy)	Case2 (high accuracy)	Case3 (best)
LP data (5m) + Visual observation	LP data (1m)	LP data (1m) + Field Survey data



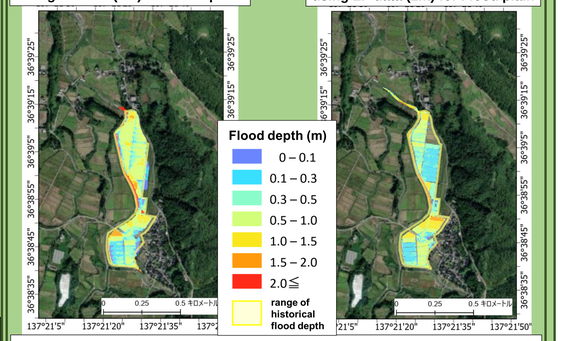
Case1 is the most flooded area

Case2 and Case3 approximately match flooded area depth of flooding

Comparison of LP data for elevation data (1 & 5m)

Case2 using LP data (5m) for Flood plain

Case4 using LP data (1m) for Flood plain



Elevation data of floodplain is sufficient to use LPdata(5m)

Next step

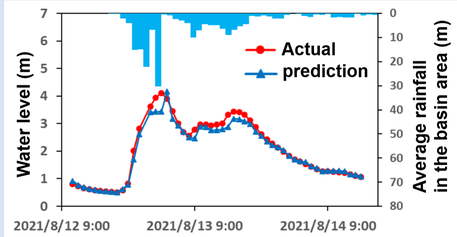
This study will allow the two studies below to be applied to small and medium-sized rivers.

Water level prediction

Water level was predicted by deep learning using MEPS in small river

※GRU is based on Long Short Term Memory and consists of only reset and update gates

◆ The accuracy of the model using GRU was verified



Results of water level prediction one hour ahead by deep learning

Now, First class river…

Quantitatively evaluate of Adaptation countermeasures at future discharge in first class river in Toyama Prefecture, Japan

Calculation of future peak river discharge

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Flood inundation analysis for 4℃ rise in 150 and 350-year probability events

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Flood inundation analysis considering Adaptation countermeasure

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Calculation of Damage costs reduction rate

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Cost-benefit analysis

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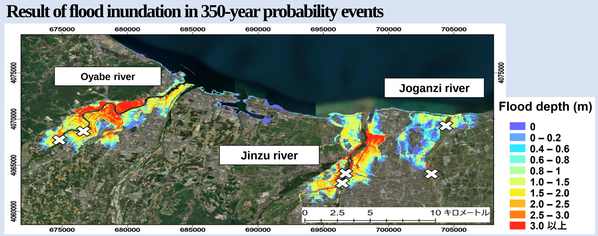
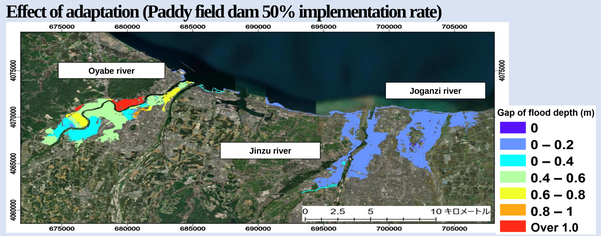
Quantitative adaptation measures can be evaluated

Result of flood inundation in 350-year probability events



Effect of adaptation (Paddy field dam 50% implementation rate)



Results of Cost-benefit (Paddy field dam)

		Oyabe	Joganji	Jinzu
Paddy field dam	50% implementation rate	12.6	0.87	8.56
	100% implementation rate	14.9	1.73	6.01