DioVISTA webinar July 29, 2020



Utilization of Dam Dashboard in the Dam Field



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time	course	substance
10:00 -	1	Utilization of DioVISTA in the field of construction consulting
11:00 -	2	Utilization of Dam Dashboard in the Dam Sector We will introduce Dam Dashboard, a dam operation support tool that realizes AI-based inflow prediction and discharge optimization, and how to use it for dam management and operation support.
13:00 -	3	Utilization of DioVISTA in the field of non-life insurance
14:00 -	4	Utilization of DioVISTA in the field of disaster prevention administration
15:00 -	5	Proposal of BCP support for flood countermeasures for corporate disaster prevention
16:00 -	6	DioVISTA Flood Simulator- technology & use case

Today's materials will be uploaded at a later date. Participants will be notified of the link by email.

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Mokuji

1. Introduction

- 2. Voices from the field
- 3. Proposal 1: Prediction of inflow
- 4. Proposal 2: Automatic calculation of discharge operation plan
- 5. Conclusion

Purpose of the seminar

- Major changes in society
 - With Corona, a changing way of working
 - Telework, computerization, cloud computing
 - Standardization of operations (depersonalization)
 - Intensification of climate change and flood damage
 - "Watershed flood control": It is necessary for governments, private companies, and citizens to consider disaster prevention and mitigation in their awareness, actions, and mechanisms.
 - Dam field: Advanced dam operation based on forecasting (pre-discharge, etc.)

Proposal for the dam field

- Function 1: Support operations with dam inflow forecasting
 - Hybrid AI and simulation
 - Can be used for both flat water and flood water
- Function 2: Support operations by automatically calculating discharge operation plans
 - Based on the dam inflow
 forecast, the optimal discharge
 plan is automatically calculated.

Dam Dashboard (screen exampleDam Dashboard) (The screen is under development)



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Voices from the field

- When you become a chief technician, you have virtually no days off
 - Climate change increases heavy rains and floods
 - Tensions persist, especially during flood seasons
 - You can't go far from your area of responsibility
- The chief technician has left the company
 - No new talent
 - Vacancies increase the risk of the organization going down

Voices from the field



- At least on a normal day without rainfall,
 - I want to be able to make judgments even for operators who do not have that much experience.
 - It is unclear what the veteran is making decisions based on
 - Maybe veterans decide based on experience and intuition?
 - I want a support system that allows me to make decisions like veterans.
 - Isn't AI going to do it these days ?
- But I don't know how to make it
 - I don't know which company to talk to

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Suggestion :



A Prediction by hybrid and simulation



- Flat water (a large number of cases) has an advantage Al
- Simulation is advantageous for floods (rare cases)
- Hybrid the two

Examples of Al predictions HITACHI Inspire the Next



Prediction of dam inflow by AI

- Input: Rainfall, upstream water level
- Output: Dam inflow
- Water systems with dams upstream
 Highly accurate prediction of frequently
 occurring events can be expected.
 - Al is good at normal water when a lot of data is available.
 - Al is more advantageous than simulation modeling because the flow rate of flat water is small and various factors such as groundwater, evapotranspiration, and agricultural water significantly affect it.

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The limitations of AI and the use of simulation

- Al is difficult in principle to learn floods
 - Al needs to learn observation data
 - When flood control measures are taken, the flood flow trend changes, and the previous data becomes unusable.
 - No flooding exceeding the maximum flood ever recorded has been observed.
- Simulation excels at flooding
 - Since floods have a large flow rate and are dominated by runoff phenomena, they can be accurately simulated by runoff models.

Simulation with DioVISTA

- Integrated simulation of phenomena from rainfall to flooding
- Automatically build the models you need from map data



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Example of reproducing water level (Yodo Rivering water level (Yodo Riveri (Yodo Rivering water level



, Japan Society of Civil Engineers, 2017.

Yamaguchi · Kusuda,

Faster flood analysis with cloud computing

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Reproduction water level of Hirakata



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Patent pending (Japanese Patent Application No. 2020-93257)

Experiment: X River Upstream 3 Dans



X^{Upstream}3Dam modeling



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When there is no linkage operation or pre-discharge



- 6 hours long , peak 1 flood
- Each dam cuts its peak in a quantitative manner...



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Dam

Dam

Water Storage Rate

When there is no linkage operation or pre-discharge



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Operation plan automatically calculated by Hitaching the Next

Automatically adjusts discharge timing

- Rices dia character of dama Browitibe may improve the preferrentially ater storage rate
- Reduce the discharge of Dam B in accordance with the discharge of Dam A from 8 p.m.



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When there is no linkage operation or pre-discharge

Emergency discharge causes downstream flow to exceed planned flow

When emergency discharge begins, the downstream flow increases sharply



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Operation plan automatically calculated by Hitaching the Next



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How to use the Hitachi method (draft)

- Hitachi has a short calculation time
 - 36 hours of optimization calculation time:
 - 3 minutes 30 seconds on desktop PC
- Rainfall forecasts may be off.
 - Taking advantage of the short calculation time of the Hitachi method, it is possible to automatically formulate the optimal discharge plan for each rainfall pattern.
 - You can input the ensemble rainfall forecast, etc., and think about the actual operation to be taken based on the operation plan obtained.

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Summary



- Dam Dashboard supports operations with inflow forecasting
 - Hybrid AI and simulation
 - Can be used for both flat water and flood water
- Support operations by automatically calculating discharge operation plans
 - Based on the dam inflow forecast, the optimal discharge plan is automatically calculated.

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END