Started Development of Watershed Flood Control Digital Test Bed

FUKUHAMA Masaya, Director , River Department

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1. Introduction

To address the increasing frequency and severity of water-related disasters caused by climate change, many different stakeholders are collaborating to achieve watershed flood control and minimize these disasters across an entire basin. In implementing watershed flood control and fostering consensus among various stakeholders in a large region, it is crucial to have a clear visualization of flood control effects. Additionally, a robust system capable of promptly verifying and implementing the latest disaster control technologies from private businesses, universities, and research institutions is essential. To achieve this goal, the River Department of the NILIM has started the development of a watershed flood control digital test bed. This platform serves as a demonstration and testing platform, simulating a river basin in a virtual space. Its purpose is to expedite the implementation of watershed flood control measures.[1] We are planning to start its operation in FY 2025. Figure 1 illustrates a conceptual diagram of the digital testbed.

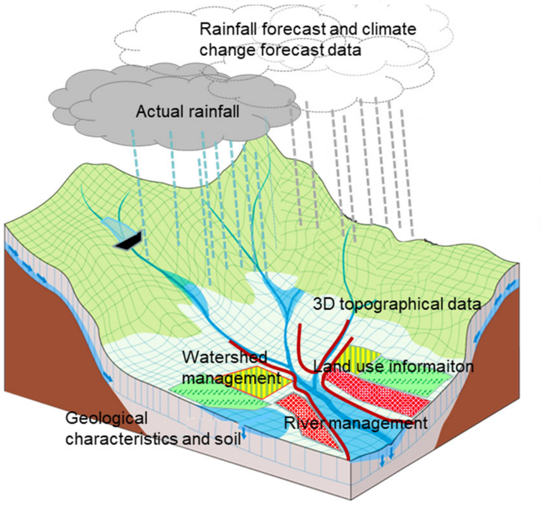

Figure 1. Conceptual diagram of the watershed flood control digital test bed

2. Purpose of developing the watershed flood control test bed

Watershed flood control necessitates several measures, such as utilizing reservoirs in catchment areas, creating rainwater storage and infiltration facilities, strengthening evacuation systems in flood-prone areas, and minimizing economic damage. Thus, it is crucial for stakeholders to establish consensus and develop a robust disaster preparedness structure.

Promoting watershed flood control in a large area like a first-class water system managed by the national government involves a wide range of many stakeholders. However, not all stakeholders have expertise in flood control due to their diverse and numerous backgrounds. To advance watershed flood control initiatives, it is crucial to clearly visualize water-related disaster risks and the benefits of flood control measures in an easily understandable way.

To ensure timely evacuation from flood damage, it is effective to establish a disaster preparedness system as early as possible, utilizing forecast information efficiently. To guarantee effective evacuation, the NILIM is currently developing forecasting technology to visualize flood risks.[2] However, the technology still requires further refinement and sophistication.

Hence, our focus in developing this digital test bed is on creating technology that visualizes the benefits of watershed flood control and the next-generation flood forecasting methods.

3. Utilization as a foundation for promoting public-private partnerships

In Japan's technological development efforts, technologies developed within Japanese institutions and existing seeds, including both technological advancements and data, have been combined. Additionally, in certain cases, collaborations with external R&D schemes, facilitated through programs, such as the Cross-ministerial Strategic Innovation Promotion Program (SIP) and the Public/Private R&D Investment Strategic Expansion Program (PRISM), have been utilized to introduce external technologies.

At the stage when the watershed flood control digital test bed becomes operational, it will be accessible to private businesses, universities, and research institutes. The first goal is to collaborate in developing technologies that enable the visualization of the benefits of watershed flood control measures.

Using this test bed, we will compile a dataset containing openly available topographical and meteorological information specific to individual watersheds. This dataset will be used to present watershed flood control measures and their effects in a clear and easy-to-understand manner. In the future, we anticipate that private businesses, universities, and research institutes will utilize this dataset to develop technologies through demonstration experiments in virtual spaces. These technologies will then be compared and assessed for their practicality and usefulness to achieve their implementation in society (see Figure 2).

We aim to expedite the implementation of technologies in society by combining and utilizing government-owned technologies with the diverse technological expertise of private businesses, universities, and research institutes.

4. Development and operation of watershed flood control digital test bed

Figure 3 illustrates the three-stage structure of the watershed flood control system's development and operation, encompassing *basic data, analysis*, and *utilization*. It also introduces the concept of areas where these stages operate in collaboration, as well as competitive areas.

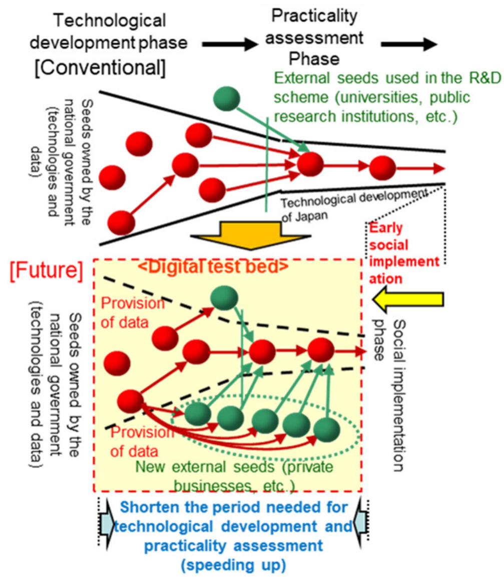

Figure 2. Accelerating technological development through public-private partnerships

In the initial stage, known as *basic data*, coordination is key. This phase primarily involves external data, such as three-dimensional topographical and geographic data, as well as rainfall data. The objective here is to create a watershed dataset for each first-class river system by coordinating and processing data from different open data sources. The national organization NILIM will play a central role in the system's development. The NILIM will conduct studies involving various entities and technologies to achieve *analysis* and facilitate *utilization*, including the visualization of risks and benefits.

In the second stage, *analysis*, private businesses, universities, and research institutes utilize their respective technologies, relying on the *basic data*. They collaborate or compete to develop hydraulic analysis and other technologies in this phase. When developing technology, it is crucial to consider the characteristics of each entity and the shared rights among them, particularly in competitive areas. Concerning public-private partnerships, we will carefully consider the approach needed to ensure that the technology becomes beneficial for social implementation.

In the third stage, *utilization*, we expect that the technology developed in the *analysis* stage will be employed for visualizing risks and the effects of countermeasures in the collaborative and competitive areas. The system is expected to be utilized by various entities, such as local governments responsible for disaster preparedness and community development, land and facility managers in the business sector, and companies aiming to develop business continuity plans or disclose climate change risks.

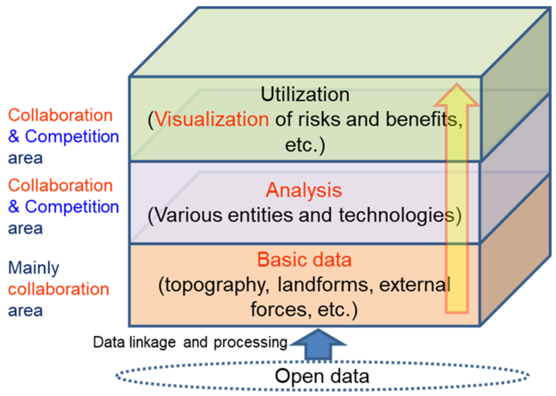

Figure 3. Development and operation of watershed flood control digital test bed

5. Conclusion

The advancement of digital technology will significantly expand the available information. Furthermore, technological advancements, including wide-area and high-frequency monitoring through satellites and artificial intelligence (AI), are progressing rapidly. We strive to fully incorporate these technologies to enhance watershed flood control efforts.

☞For more information:

1) Website of Water Cycle Division, NILIM "Online Seminar on Watershed Flood Control Digital Test Bed Co-Creation"
http://www.nilim.go.jp/lab/feg/index.htm

2) FY 2022 NILIM Lecture Material: Visualizing Flood Risks to Adapt to Climate Change
http://www.nilim.go.jp/lab/bbg/kouenkai/kouenkai2022/koen2022/pdf/siryou/2.pdf