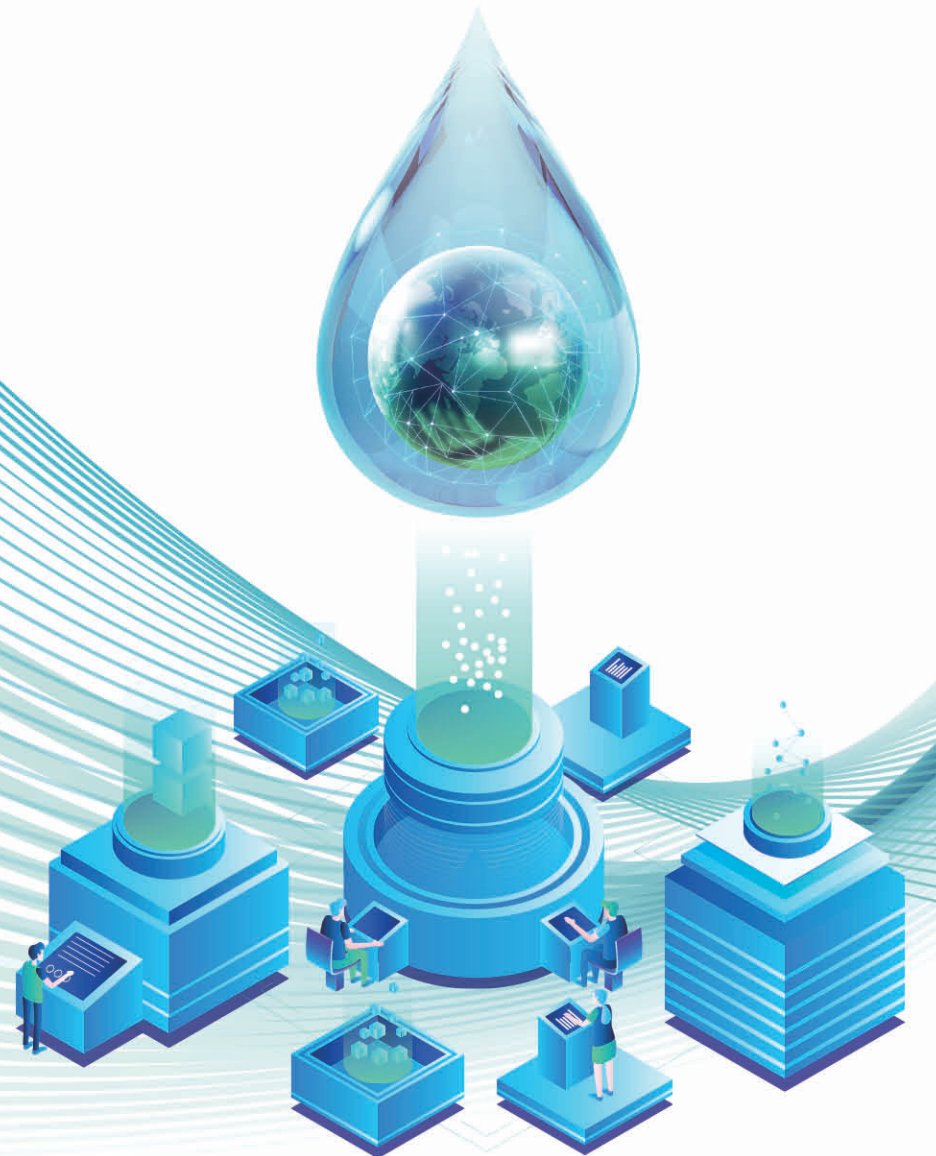


# Digital GARAM+



## Digital GARAM+ Background & Goal

### Background

#### Climate Crisis

- 85% of natural disasters are caused by typhoons and heavy rainfall
  - » Massive flood damages occurred downstream of Sumjin river('20.8) & Geum River('23.7)
- Increasing regional rainfall imbalance due to geomorphological impact
  - » In the same period of 2022, Seoul suffered from urban flood and southern part experienced droughts

Climate change has increased the complexity and uncertainty of water management, necessitating a new paradigm to overcome existing limitations in hydrosystems

(2020)	(2022)	(2023)
Longest duration of rainy season in recorded history	Damage reported due to flooding of the Naeng River in Pohang	Overtopping of the bank in the tributary of the Geum River
<p><b>장마 역대 최장기간 기록</b></p> <p>중부지방</p> <p>2020년 (6.24-8.16) <b>54일</b></p> <p>2013년 (6.17-8.5) <b>49일</b></p>	<p>포항생천범람위기</p> <p>[포항시청] 포항시 남구 생천 범람 위기. 생천 인근 오천읍, 청림동, 세월동 주민들에게는 재실동행지침(인덕동 368-45) 등 즉시 안전한 곳으로 대피하십시오.</p>	<p>논산천 범람 위기...대피령 발령 검토</p> <p>Stay away from flood-prone areas such as brooks, streams, and shores</p>

#### Government Policy

Digital Platform Government Initiative	Prompt establishment of Flood Alert System based on AI & DT
<ul style="list-style-type: none"> <li>• The government has been promoting innovation projects under the Digital Platform Government initiative to accelerate digital transformation across entire industrial sectors</li> </ul>	<ul style="list-style-type: none"> <li>• The Ministry of Environment is establishing a Digital Flood Forecasting and Warning System based on AI and Digital Twin technologies by the year 2024.</li> </ul>
<p>국민은 편리하게 정부는 똑똑하게</p> <p>디지털플랫폼정부위원회 출범식</p> <p>2022.9.2.(화)</p>	<p>하천홍수 및 도심침수 관련 대책 회의</p>

### Goal of the project

Developing digital twin water management platform technology to cope with water-related disasters and enhance operational efficiency

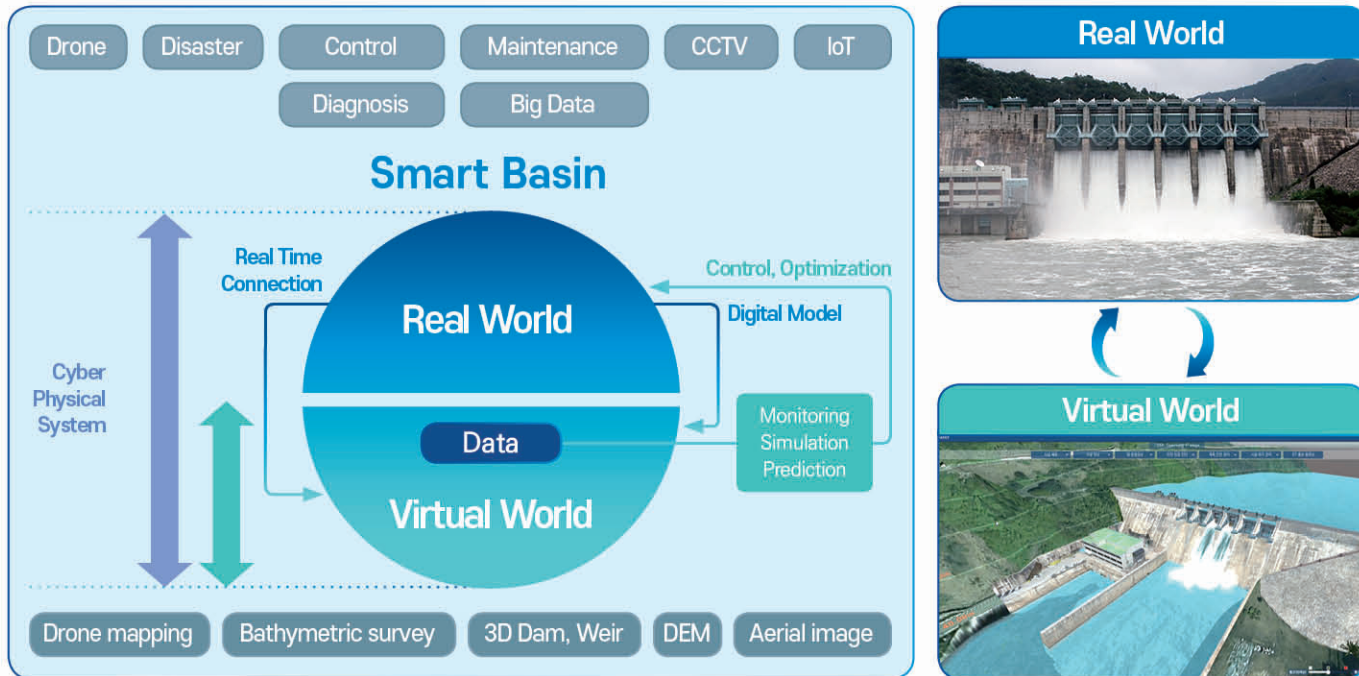
- To improve the accuracy of flood analysis and support optimal decision-making for preventing of water disasters by integrating 50 years of water management experience and expertise with digital technologies
- To lead the digital water management by establishing the world's first digital twin water management platform





## The Concept of Digital Twin

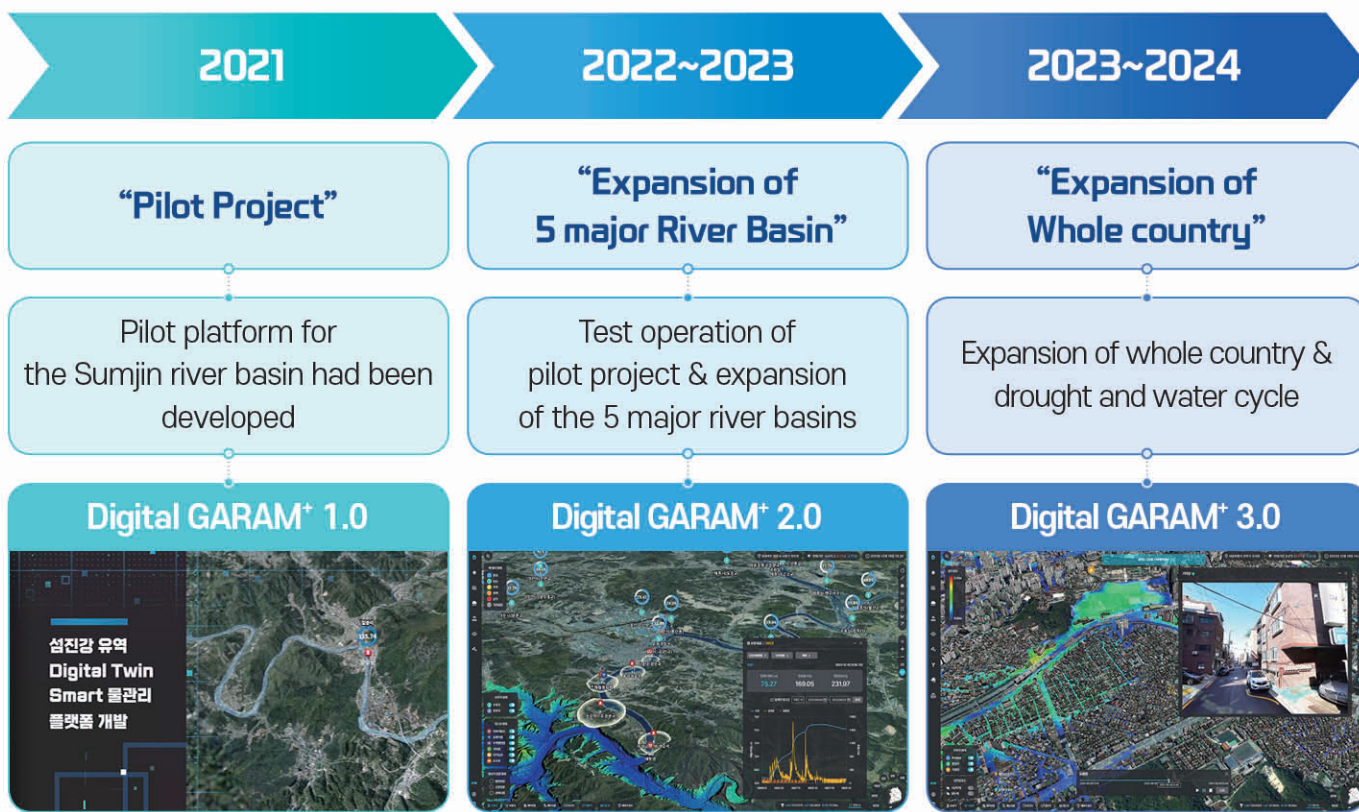
Cyber-physical system that synchronizes the real world with the virtual world, simulating various scenarios and analyzing the results to support optimal decision-making



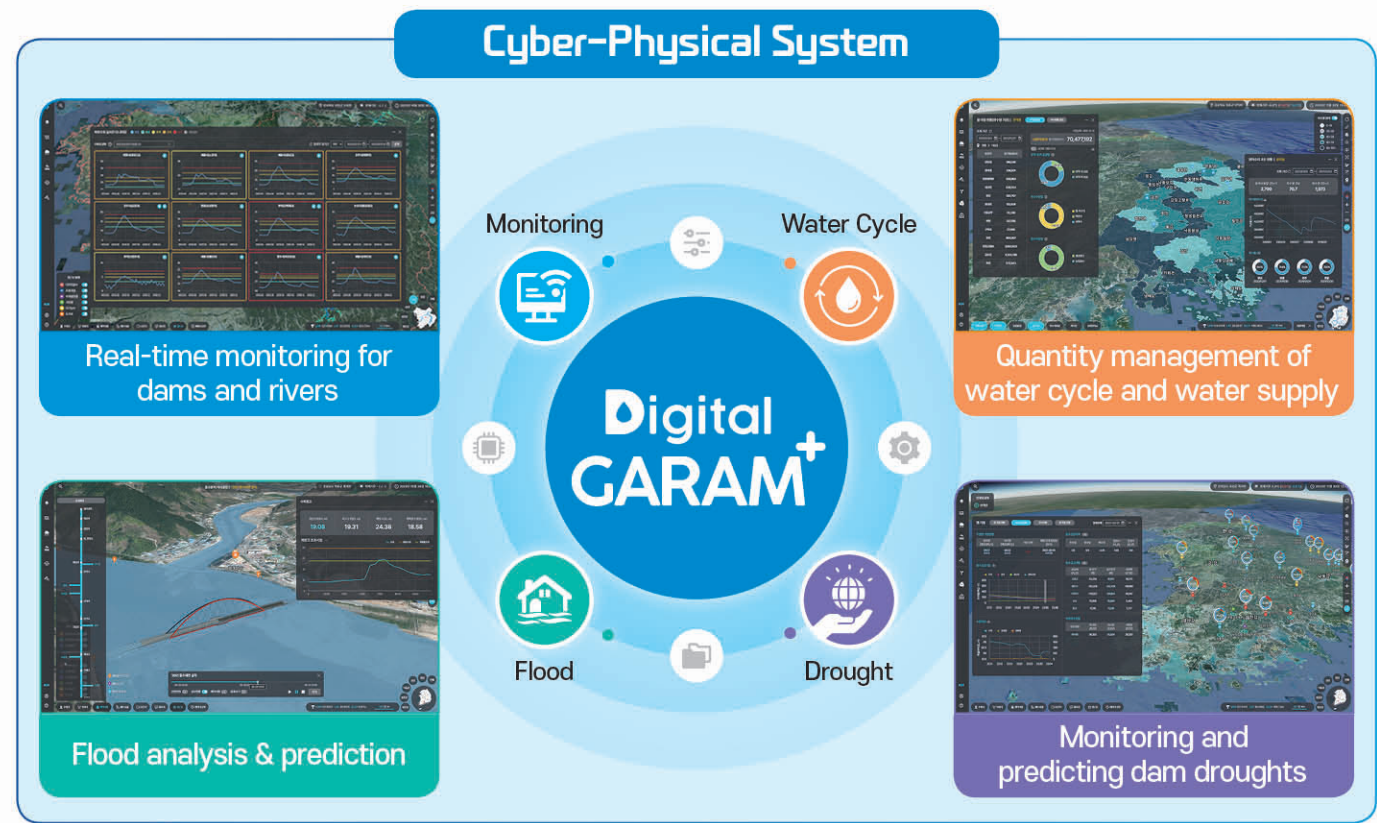
## Development of Web-GIS based digital twin platform considering user convenience



## Progress



## Water management packages : monitoring, flood, drought and water cycle





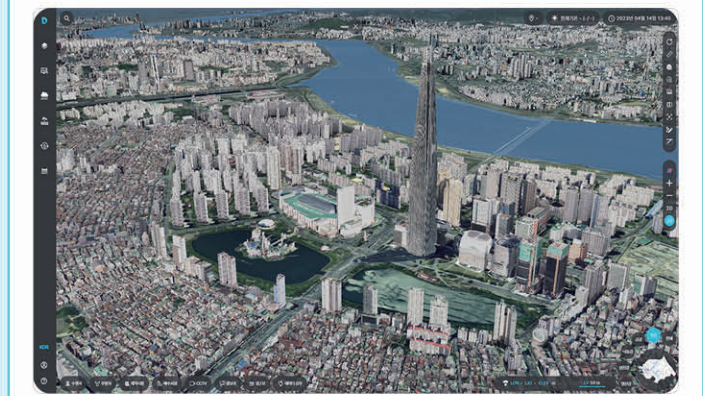
**Digital GARAM<sup>+</sup>**, where 'GARAM' signifies 'river' in Korean, represents a smarter tool for water management achieved by integrating digital technology into the traditional water management process, incorporating real-time monitoring, analysis, and prediction.

## Digital Twin Level 1 (Mirroring)

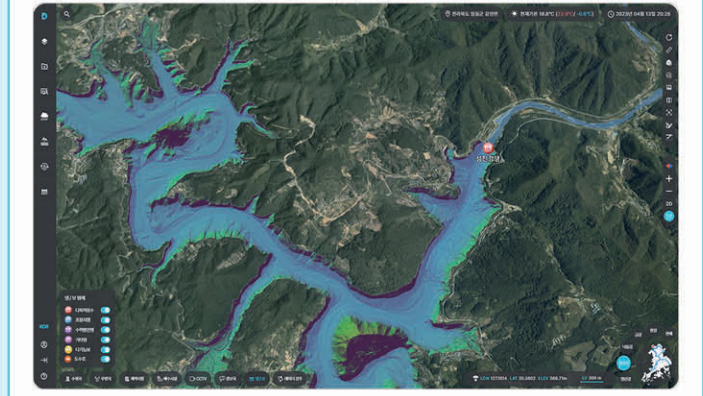


### Construction of 3D terrain in high resolution

- 3D objects like buildings in urban and rural areas



- 3D topography Information of reservoirs and rivers



- 3D object assets modeling by drone mapping

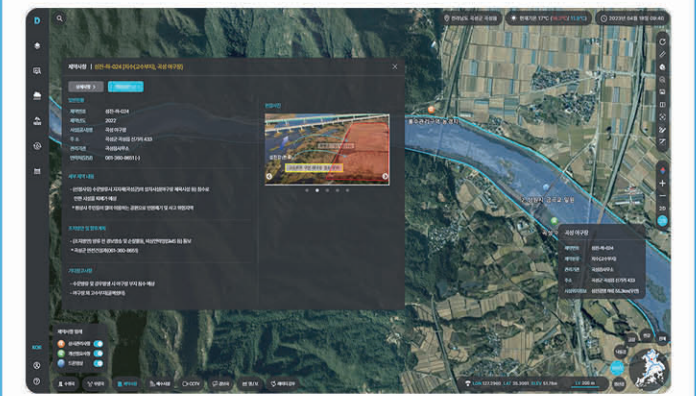


## Digital Twin Level 2 (Monitoring)

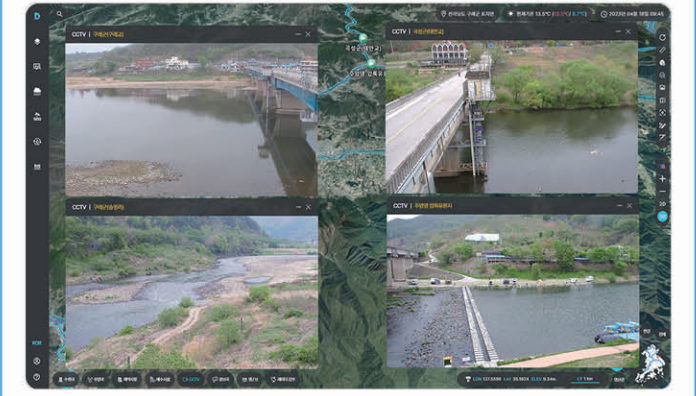
## Digital Twin Level 3 (Simulation)

### Providing water management information

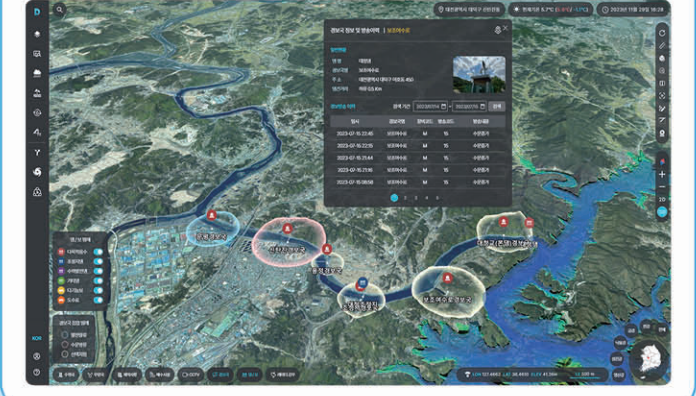
- Constraints info. of dam operation(360° video, etc)



- Real-time CCTV information of dams and rivers

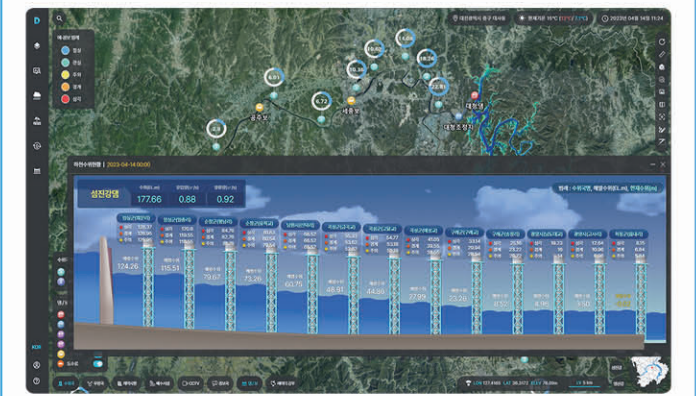


- Warning stations information of dams

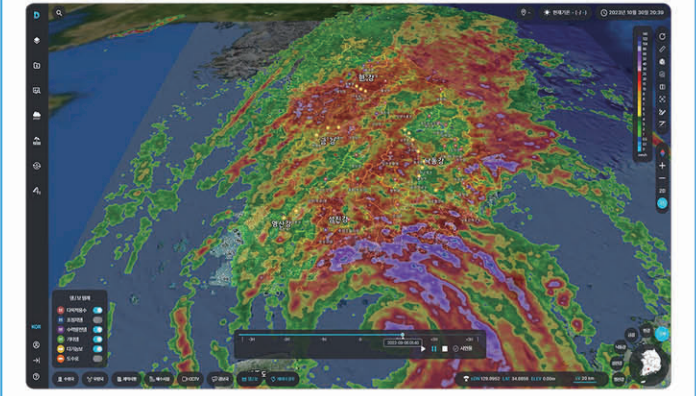


### Monitoring of real-time hydrological and weather information

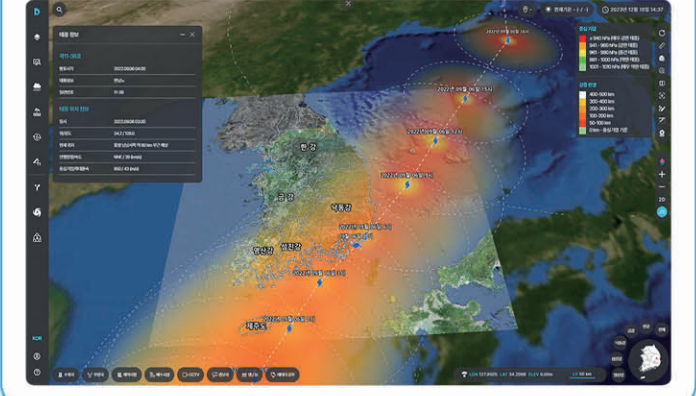
- Real-time water level monitoring for dams and rivers



- Real-time rainfall radar images



- Real-time typhoon route information

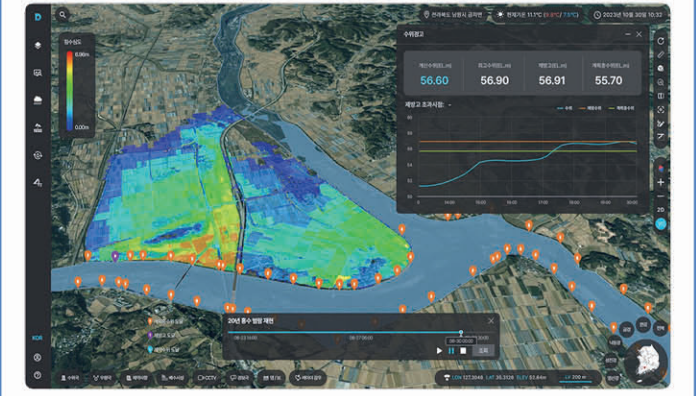


### Analysis and prediction for water management decision making

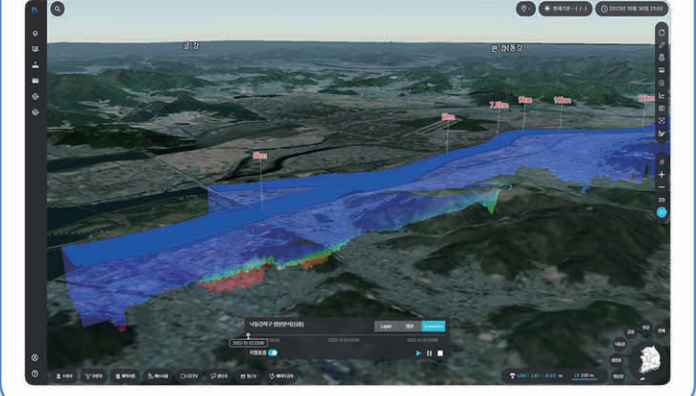
- Real-time flood prediction by hydrological & hydraulic models



- Flood inundation simulation by 2D-hydraulic models



- Salinity monitoring & prediction in the estuary of river

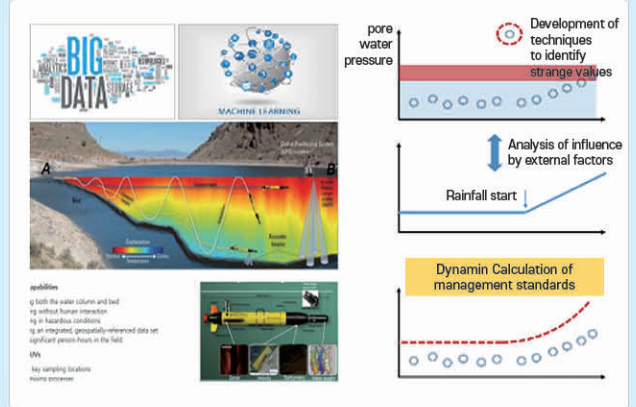
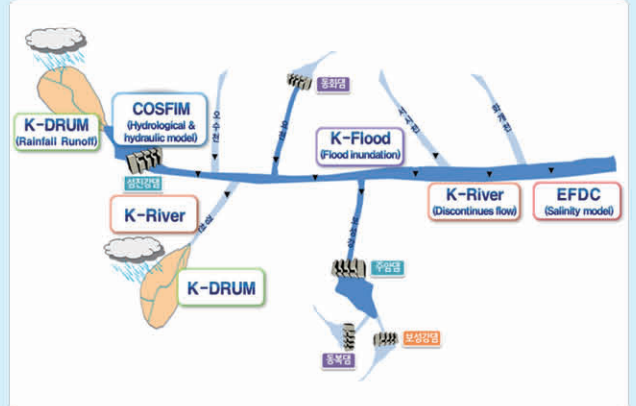




**Improving the water management model and developing advanced technologies**

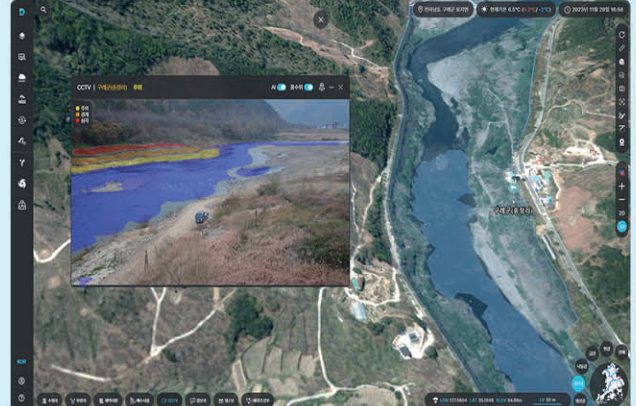
**Improvement of analysis model**

- Improving accuracy and reducing calculation time
- Incorporating 4<sup>th</sup> industrial revolution technology



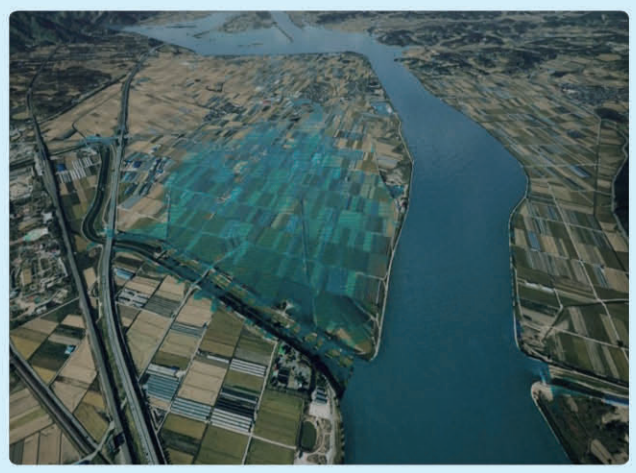
**Development of AI application**

- Developing AI-CCTV for detecting potential dangers (Ex. river water level, river pedestrian)



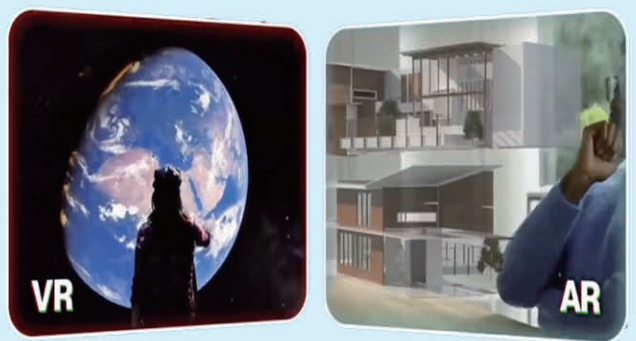
**Advanced 3D visualization technology**

- Developing 3D reality description technology based on Game Engine



**Enhancing the use of 3D visualization devices**

- Diversification of tools such as AR / VR for using digital twin platform



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