New trend of floodplains management -Digital twin basin

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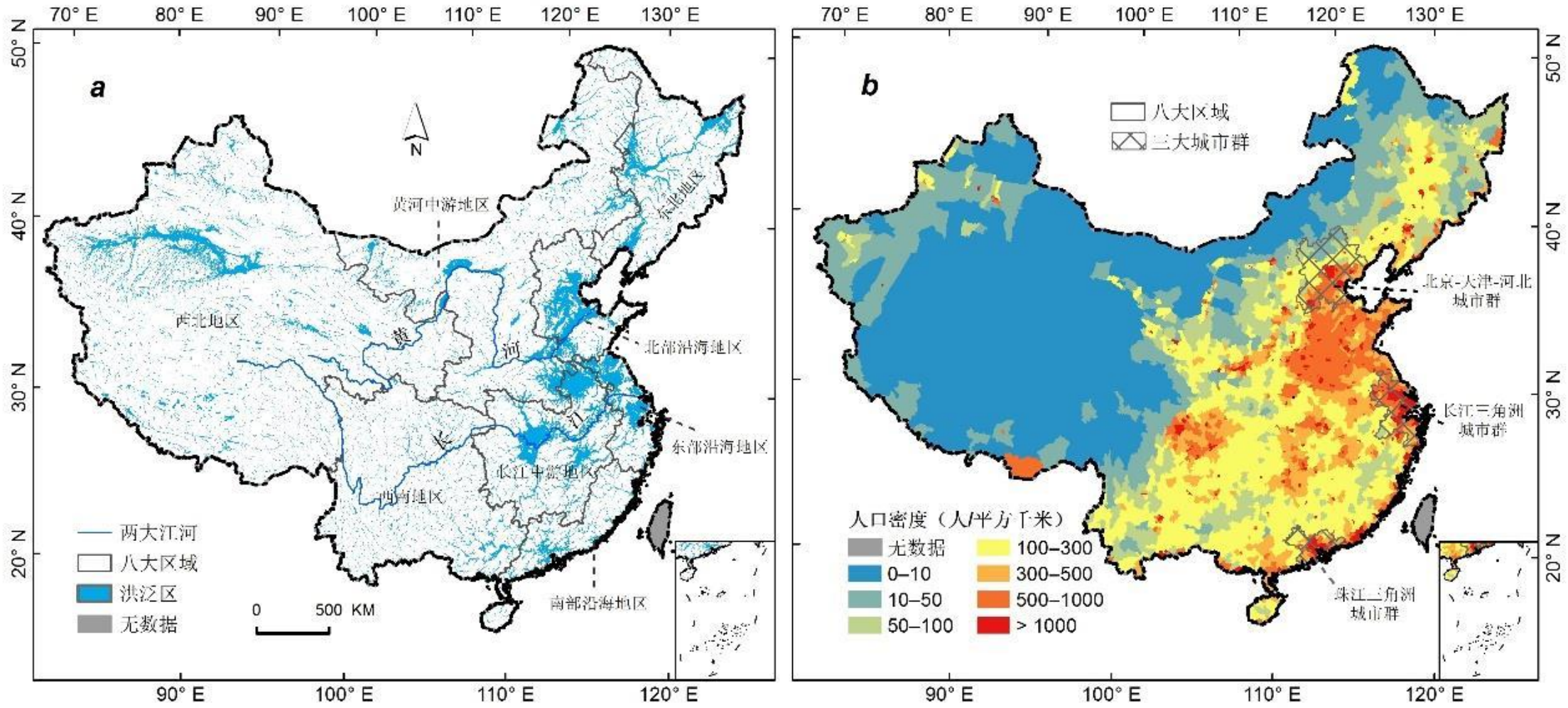
Contents

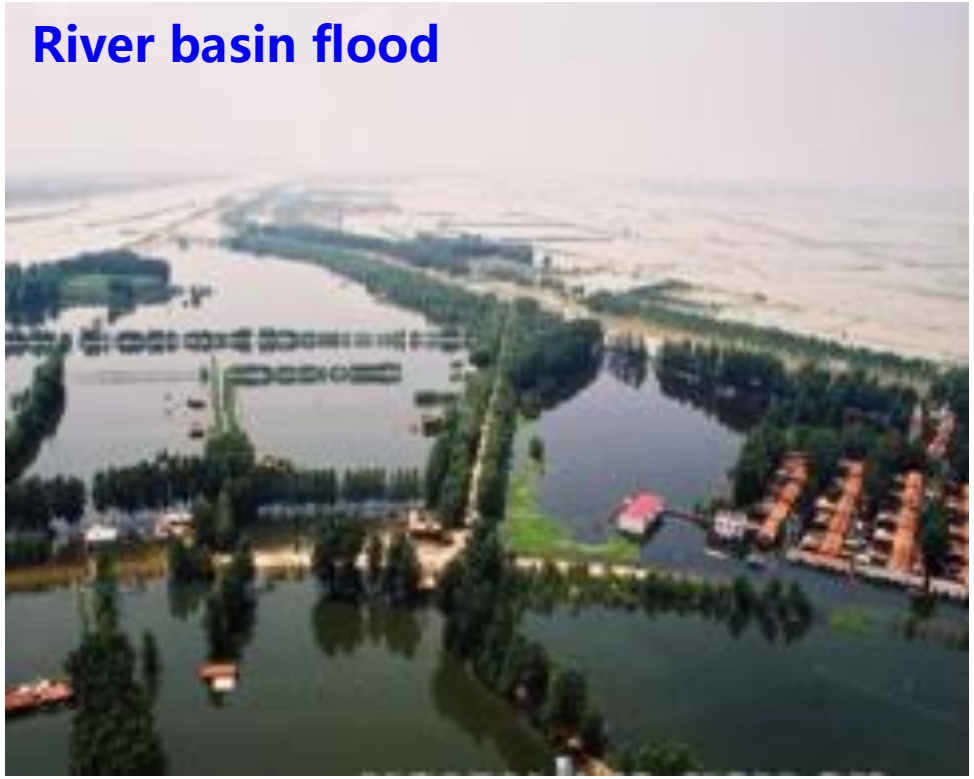
1 Traditional floodplain management



Floodplain area: 1,143,380km^2, 12% of total land area

Population: 453.3*10^6, 33% of total population (2015)

1 Traditional floodplain management

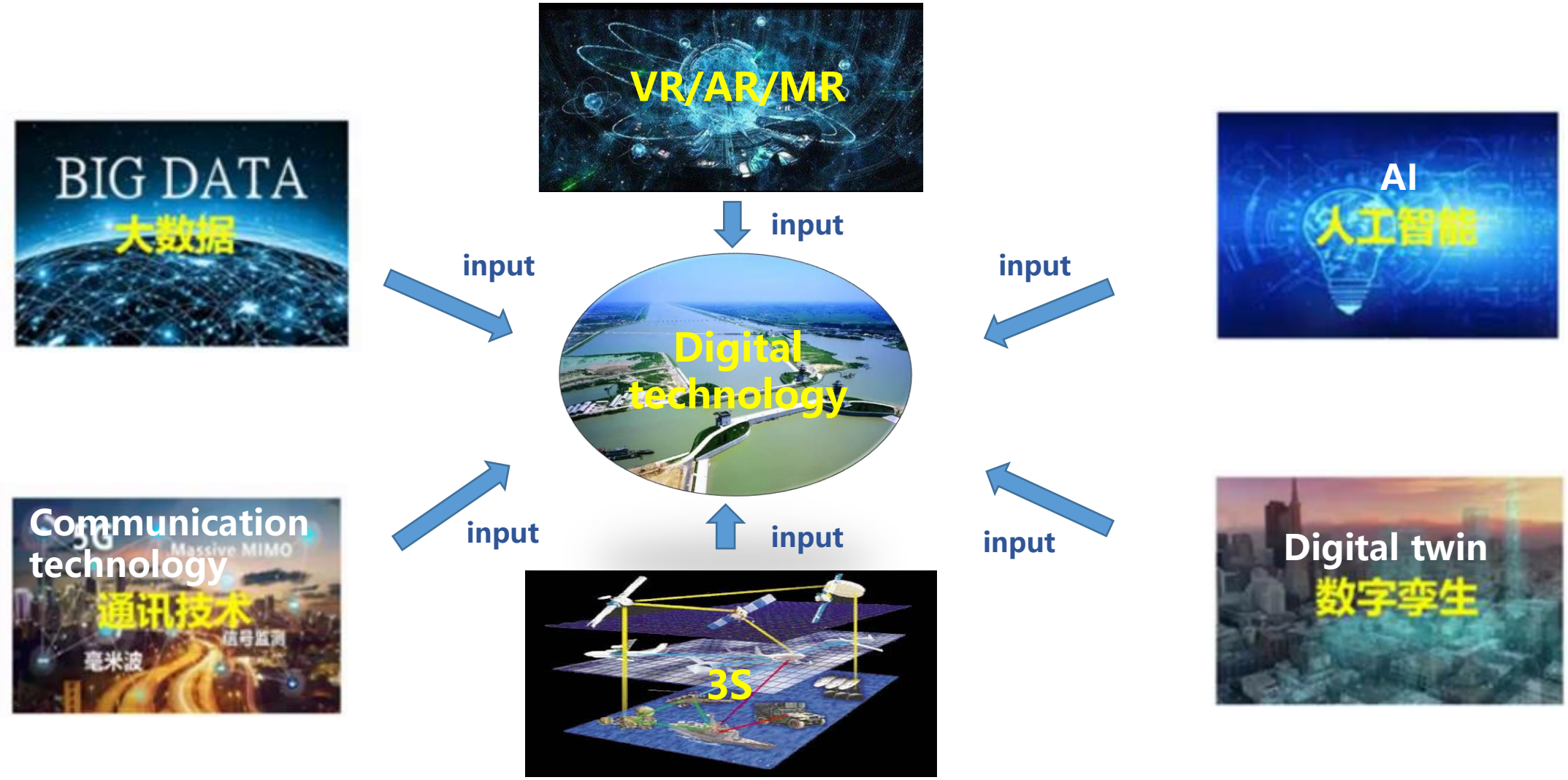


Structural measures

Non-structural measures

1 Traditional floodplain management

2 Digital twinning basin

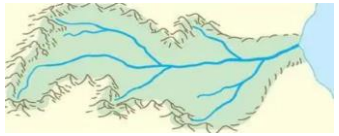


2 Digital twinning basin

Physical domain

Physical unit:
Different scales
Same goal

Plane



Line

Point

Product-ivity

"3A" synergy:
Arithmetic data
is the base
Algorithm
is the core
Algorithmic capability
is the driver

Algorithmic capability

Algorithm

Arithmetic data

Digital domain

Digital Twinning:
Digital mapping
Intelligent simulation

Synchronous simulation

Virtual & reality interaction

Iterative optimization

IWHR

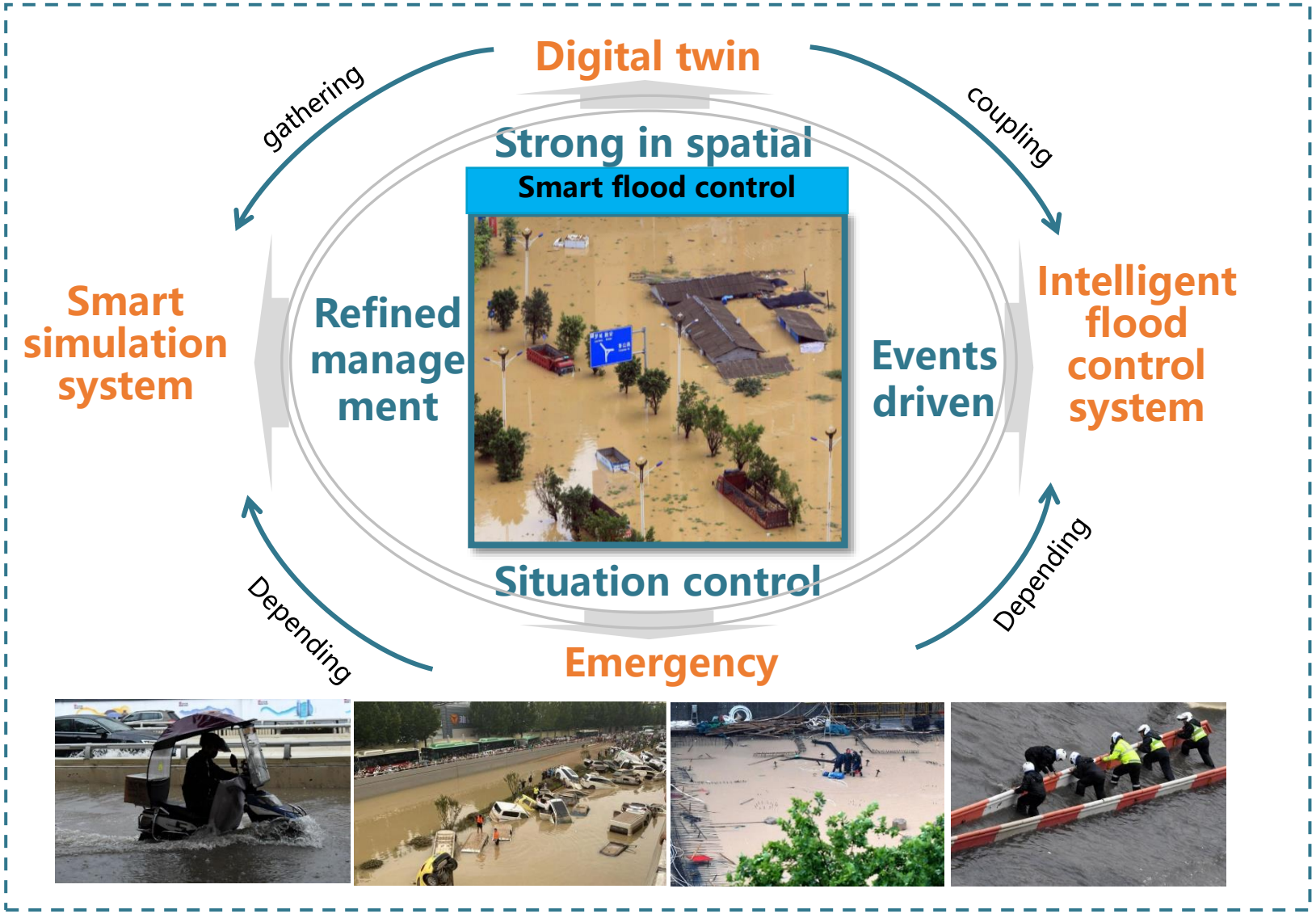
Module interface

New technology empowerment

Integration dominance

Shore up the inadequacies of the traditional digital approach in water sector

2 Digital twinning basin



Forecast — Multi-scenario

Early warning — Precise mapping

Drill — Whole process simulation

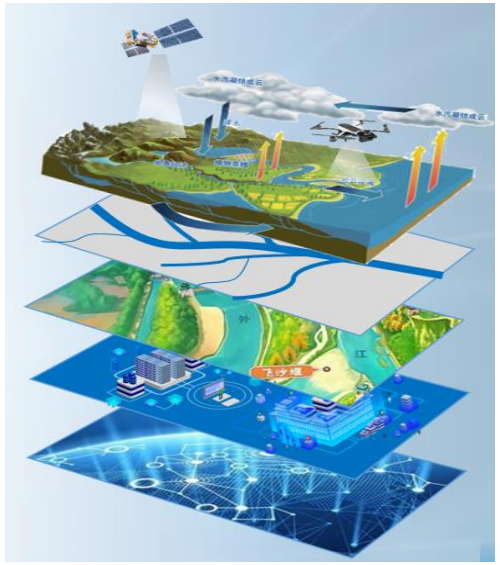
Preplan — Structure visualization dynamic

3 Implement the digital twinning basin

Access to arithmetic data | Optimize the algorithms | Improve the algorithmic capability

Digitalized scenarios | Intelligent simulation | Precise decision-making

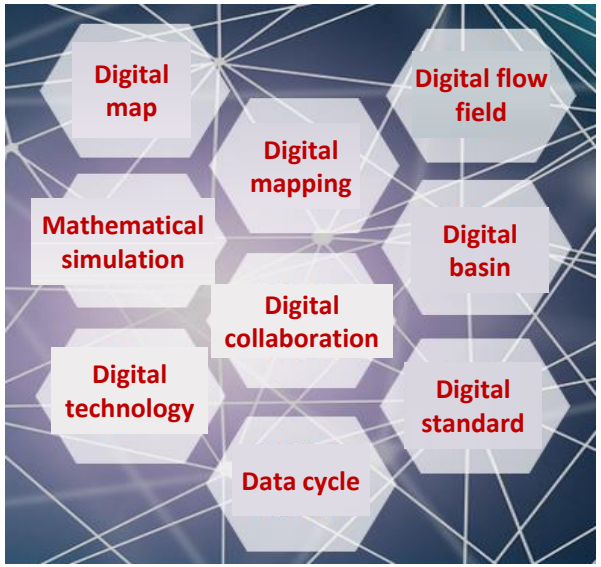
Large system design



Sub-system building

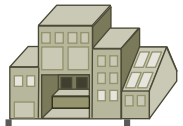
- Sky-air-ground monitoring network
- Basin-wide water system network
- Waterworks defense network
- Human activity distribution network
- Basin-wide water information network

Modular links



Goal：full coverage of "forecasting, early warning, drill and preplanning"

3 Implement the digital twinning basin



Promote the development of data, algorithms & computing power

Hydraulic model as the core

Water conservancy knowledge driven

1

Physical watershed unit

2

Spatial-temporal data based

Realize digital mapping of all elements of physical river basins (physical geography, river systems, water conservancy projects, economic and social information)

Realize dynamic and real-time information interaction and deep integration between physical watershed and digital watershed, and keep the synchronization and twinning of both

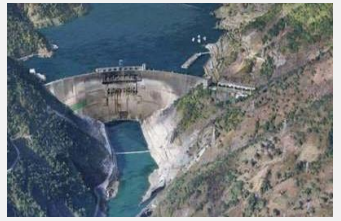
3 Implement the digital twinning basin

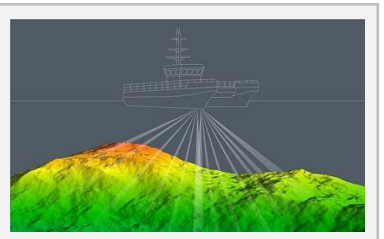
Key water conservancy projects

L3


BIM

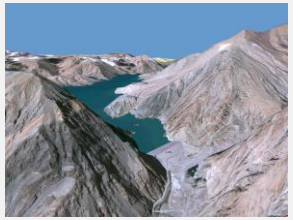

Design draw


UAV DSM

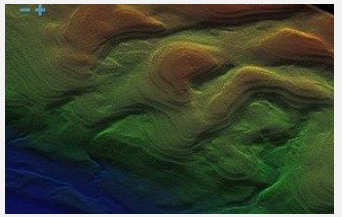

Underwater topography

L2
Key areas

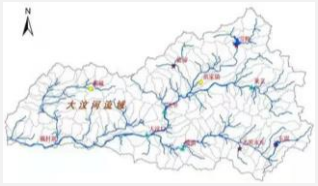

1m DOM


DEM

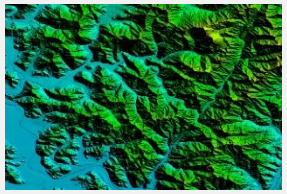

UAV DSM


Underwater topography

L1
River basin

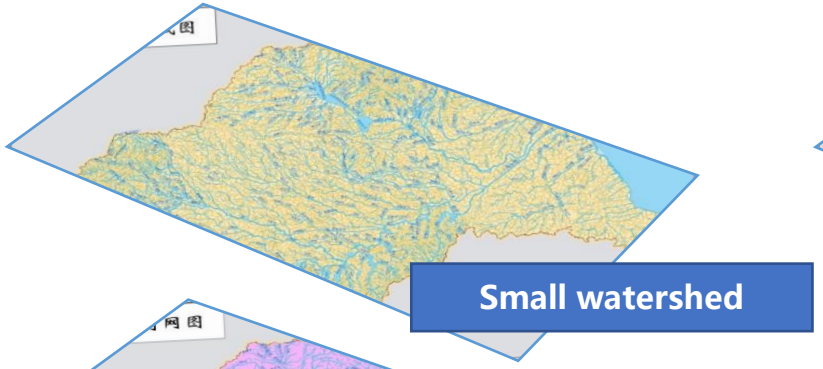

River, lake & hydraulic engineering vector

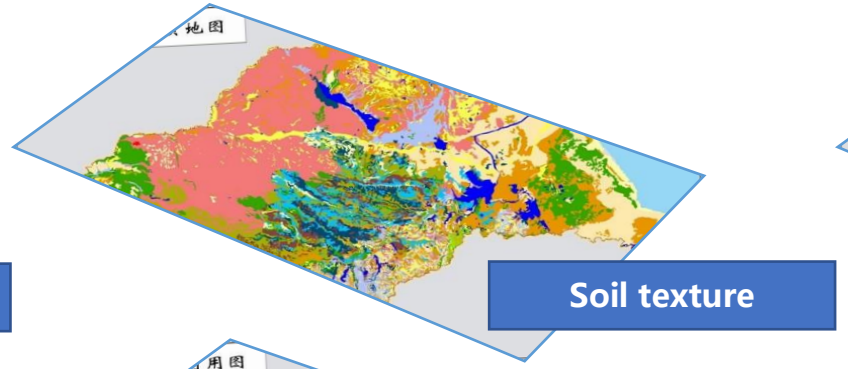

2m DOM

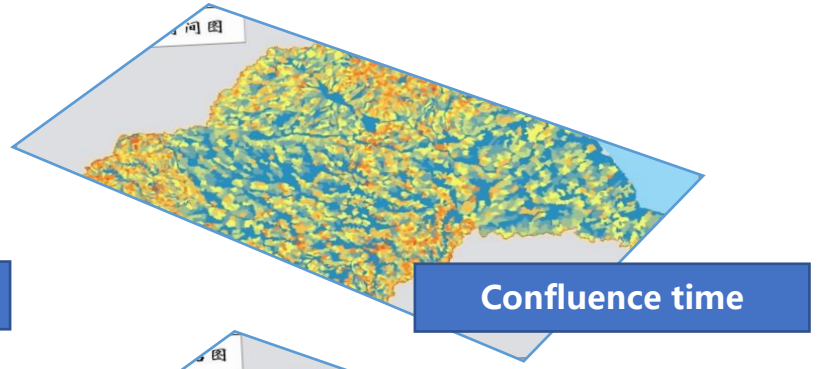

15m DEM

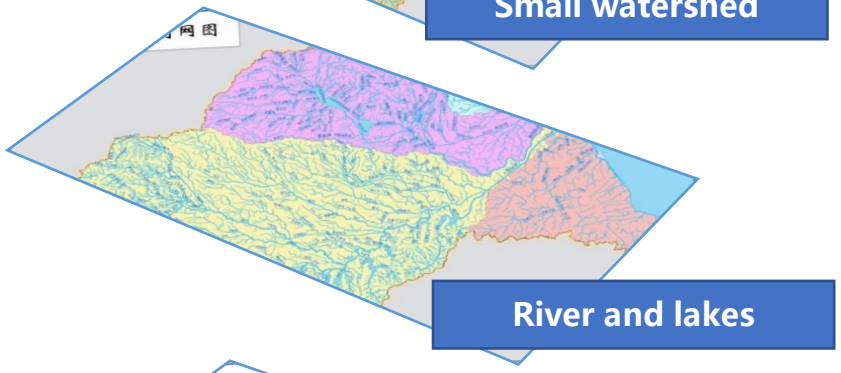

Zoning vector

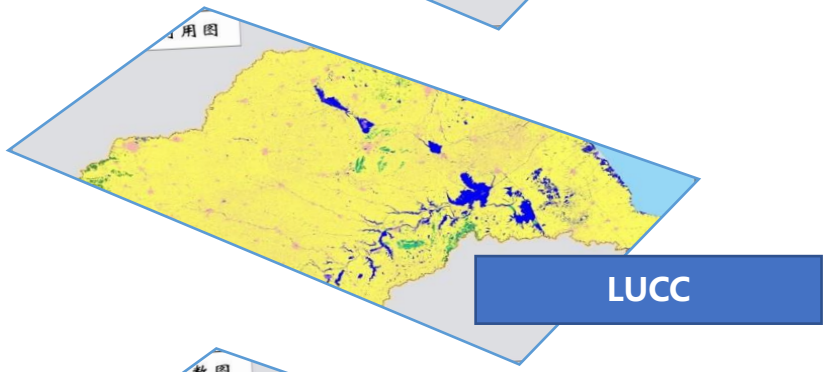
3 Implement the digital twinning basin

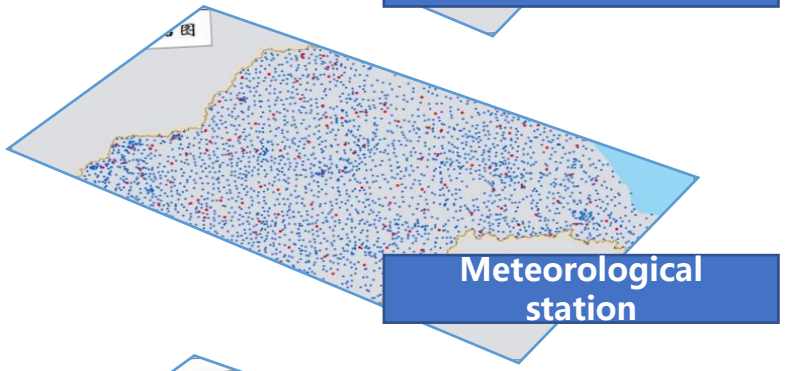

Small watershed

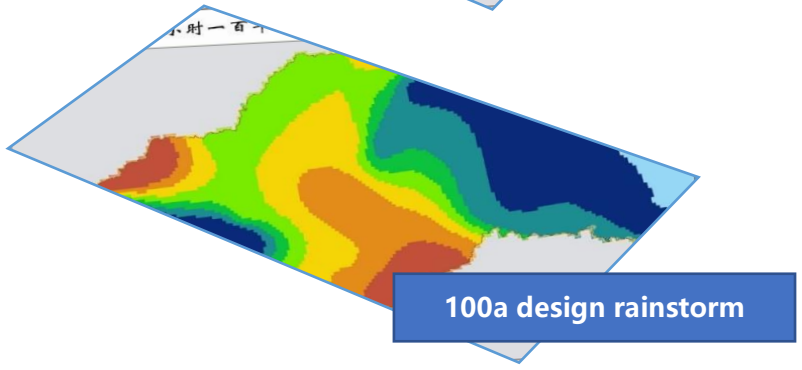

Soil texture

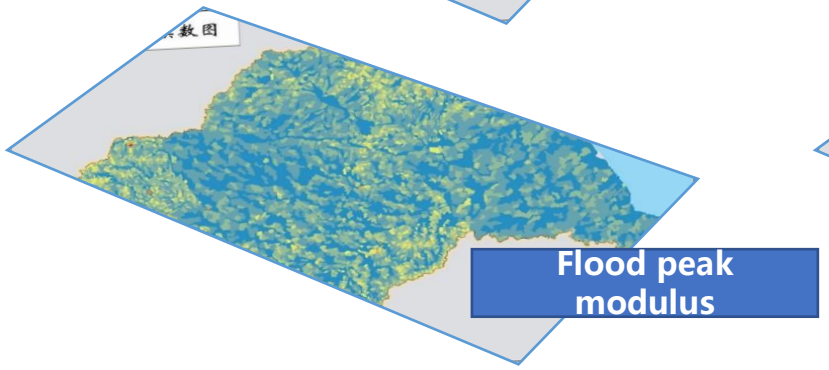

Confluence time


River and lakes


LUCC

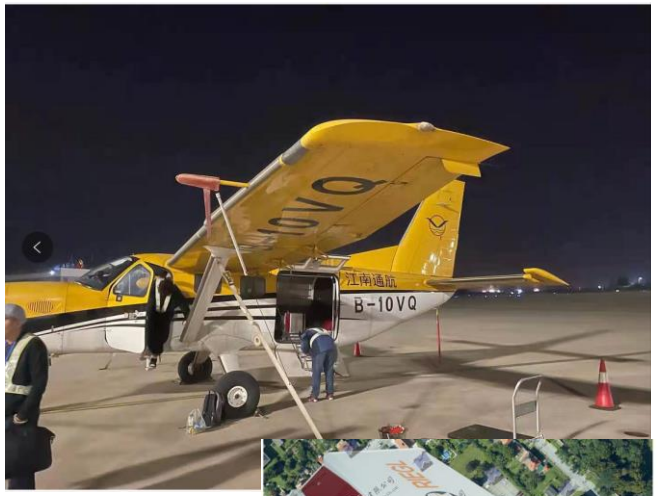

Meteorological station


100a design rainstorm

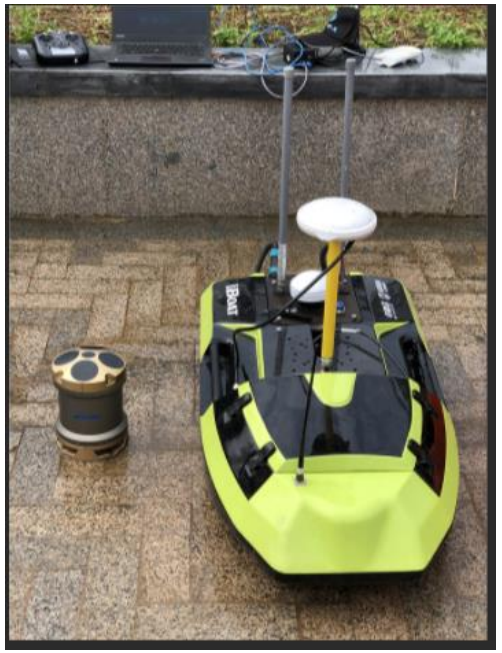

Flood peak modulus


Flood control works

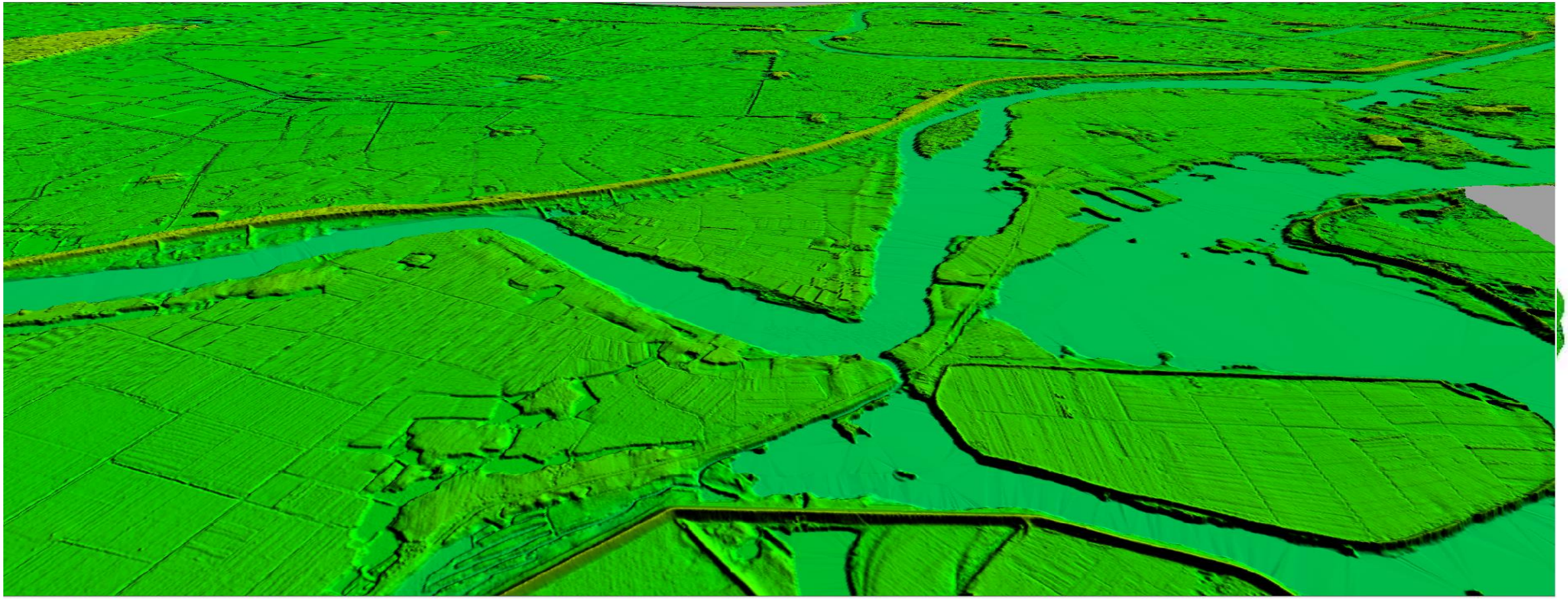
3 Implement the digital twinning basin



- high-precision terrain data obtained by liDAR loaded by helicopter
- River section data by using doppler sounding and ADCP measuring ship

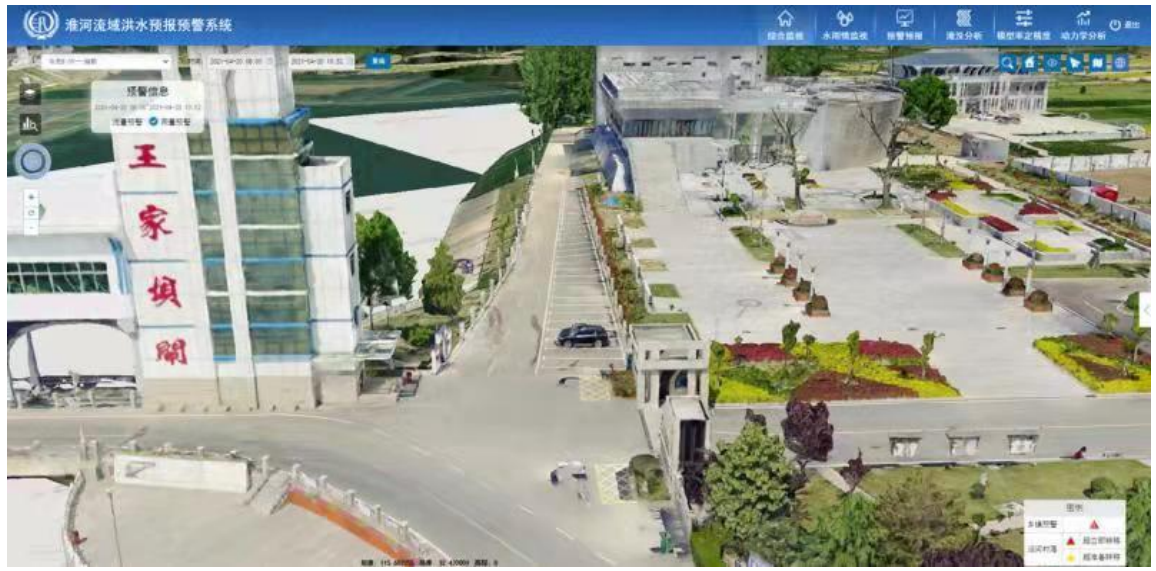


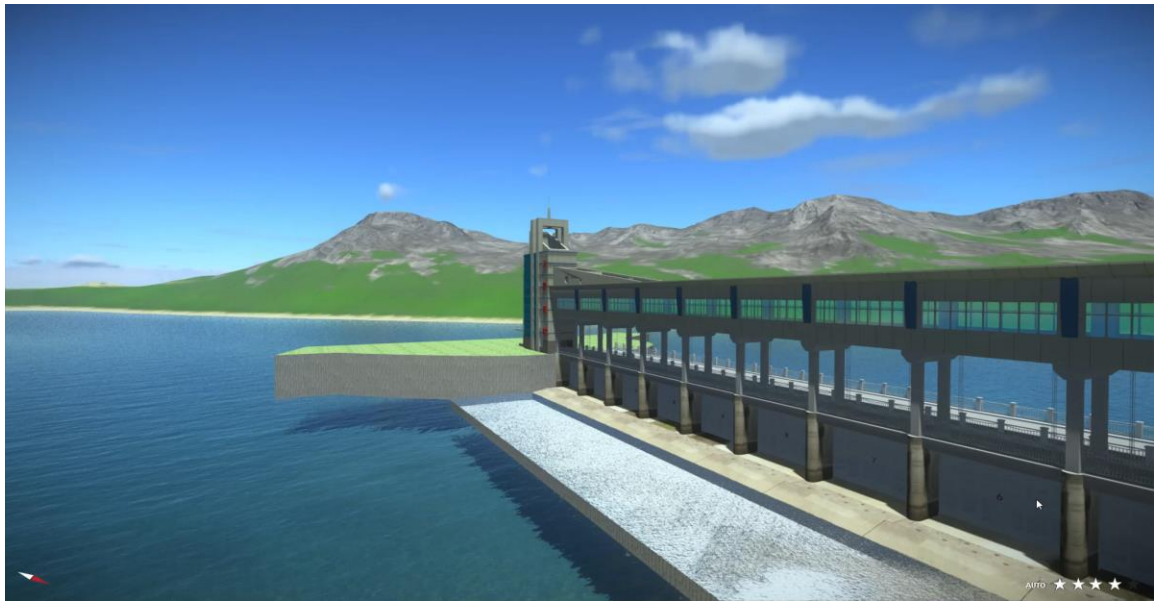
3 Implement the digital twinning basin

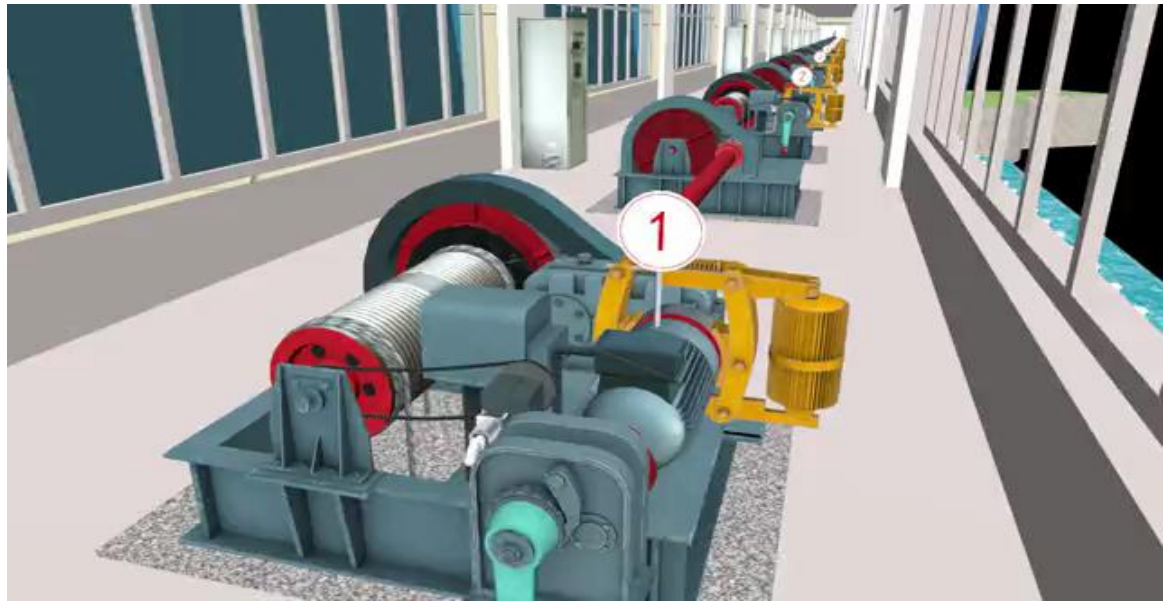


Fine DEM

3 Implement the digital twinning basin

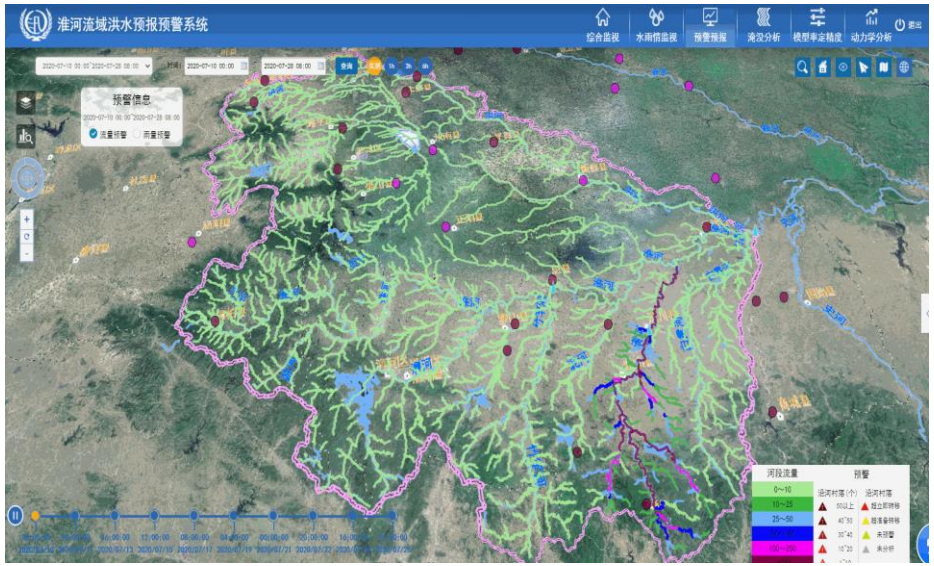


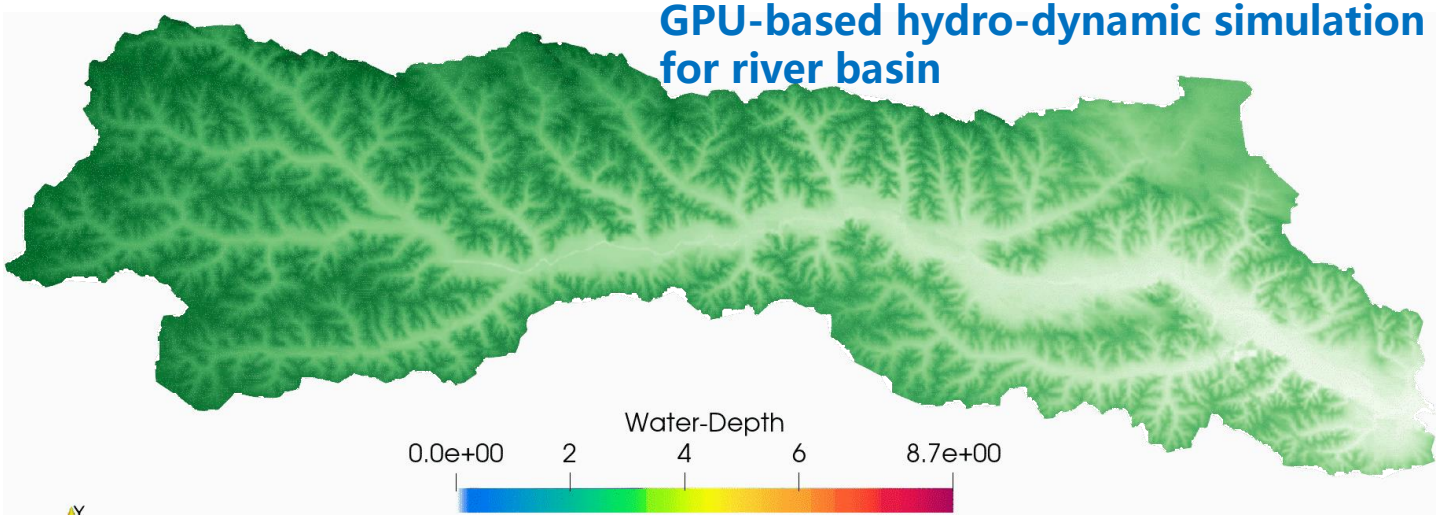




3 Implement the digital twinning basin

- Spatial-temporal distribution feature recognition of rainfall based on AI
- Early identification of rainstorm risk based on ML technology
- Flood prediction model based on AI
- Intelligent flood control scheduling for water engineering
- Intelligent recognition algorithm of satellite RS image



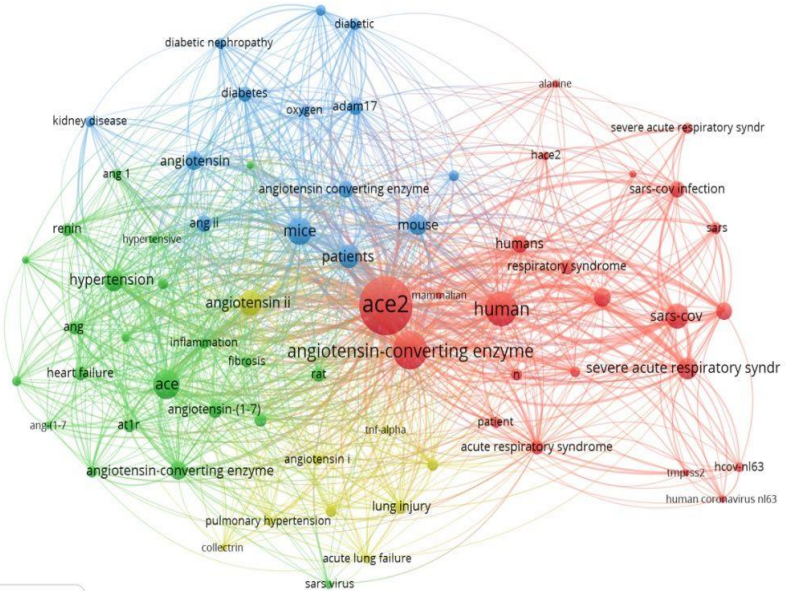


3 Implement the digital twinning basin

Knowledge of water conservancy

- Pre-plan DB
- Knowledge Graph DB
- Historical scene pattern DB
- Industry rule DB
- Expert experience DB

- Riverine flood
- Urban waterlogging
- Flash flood
- Typhoon rainstorm
- Other interdisciplinary



3 Implement the digital twinning basin

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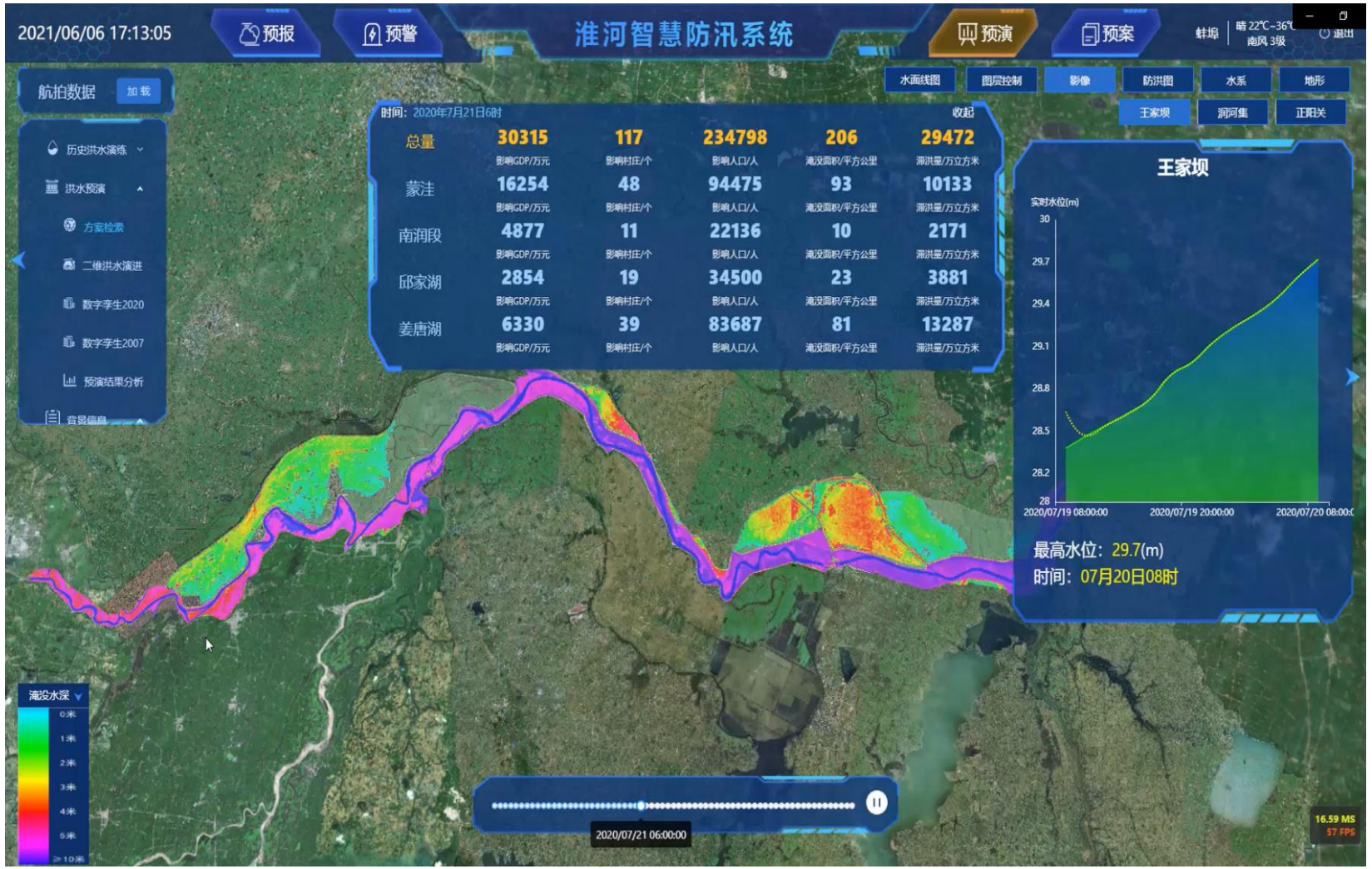
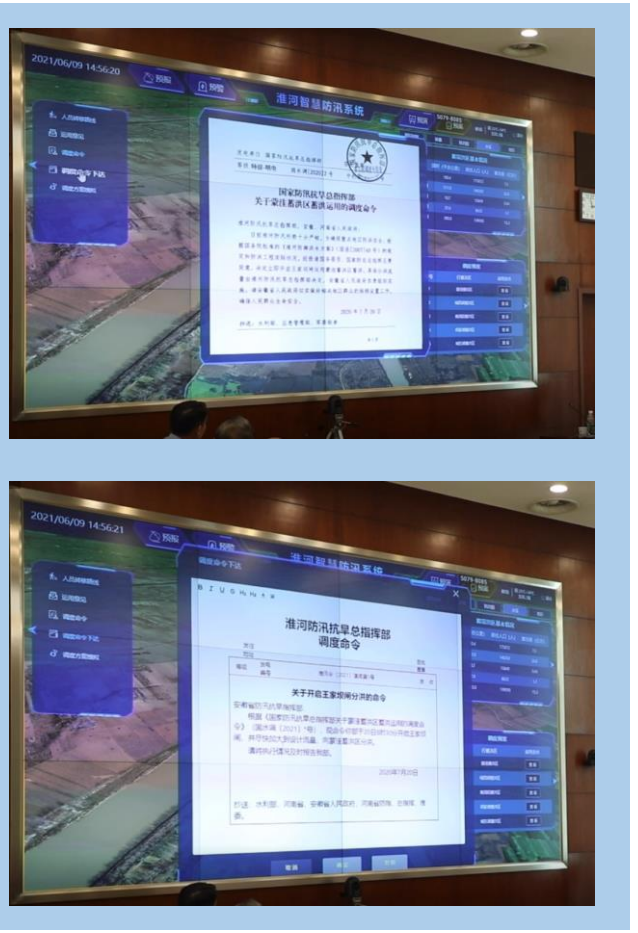
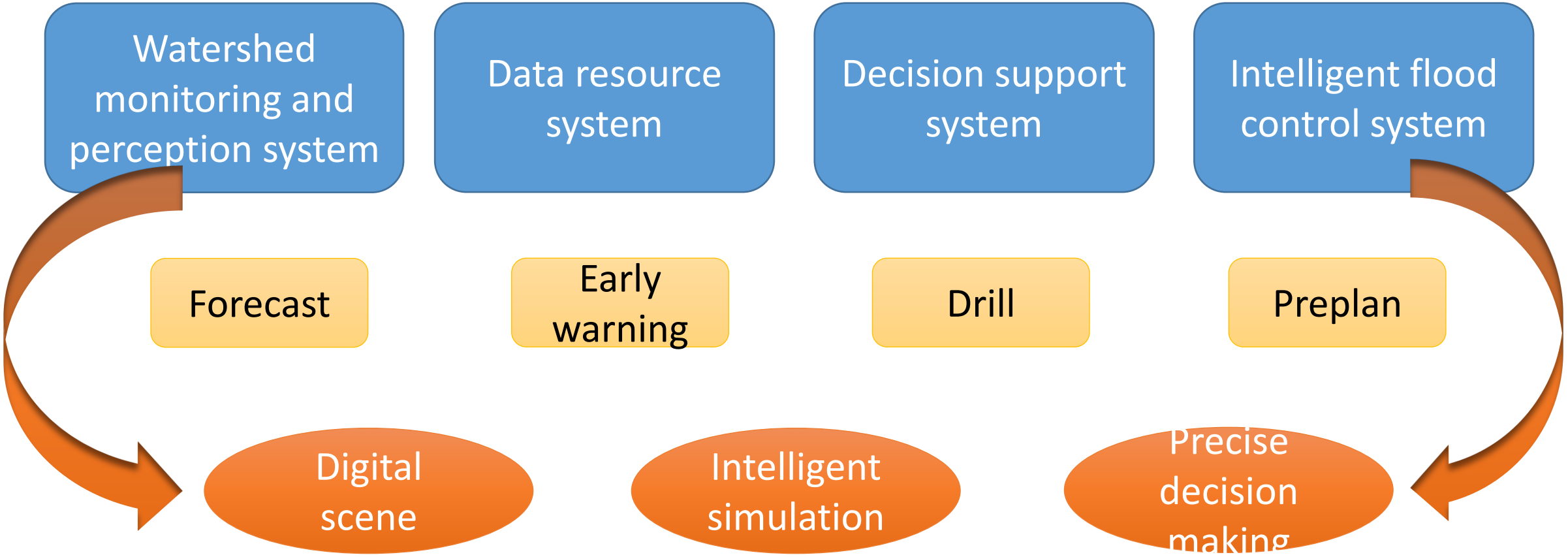




3 Implement the digital twinning basin

Digital twinning basin is an irresistible trend of floodplain management.



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