

Smart Control of the Climate Resilience in
European Coastal Cities



The SCORE Digital Twin: Application of smart technologies against climate change

On-line Webinar, 05th April 2024

WP8

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Outline

1. What is a Digital Twin?

2. SCORE DT-EWS System Architecture:

SCORE Digital Twin Structure

The User Scenario Evaluation (USE) module

Ecosystem-Based Adaptation (EBA) solutions

The Early-Warning Support (EWS) module

3. System usage:

The Grafical User Interface (GUI)

Simulations outputs: some examples

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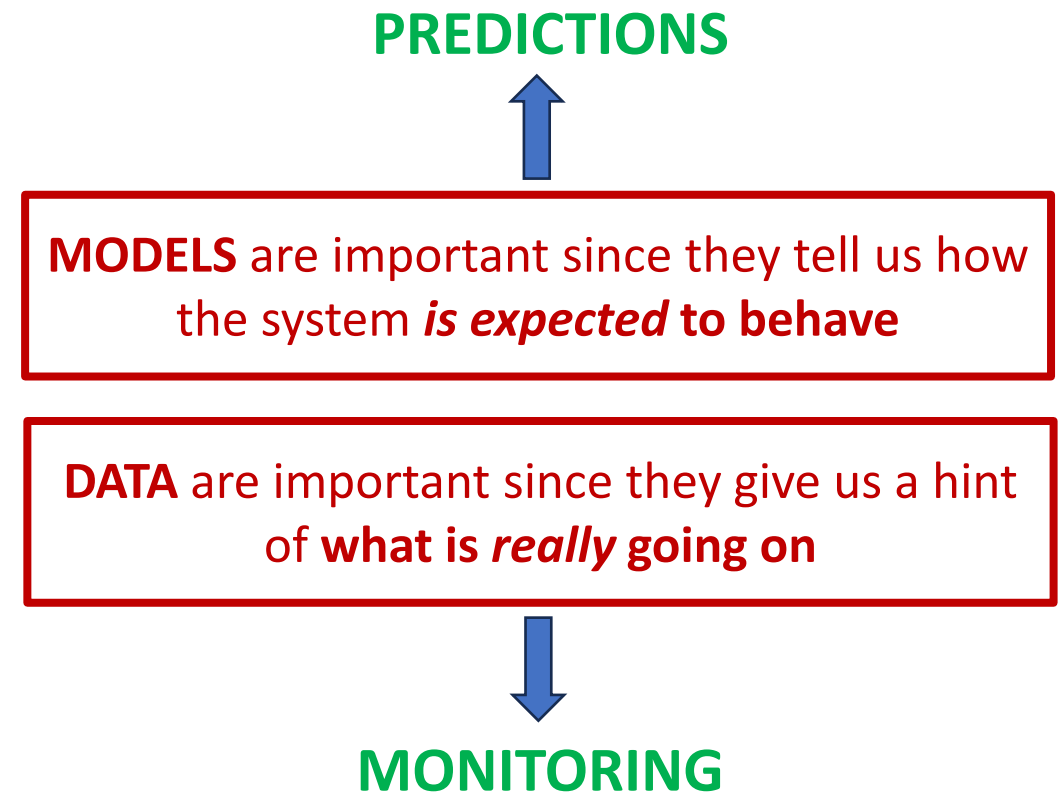
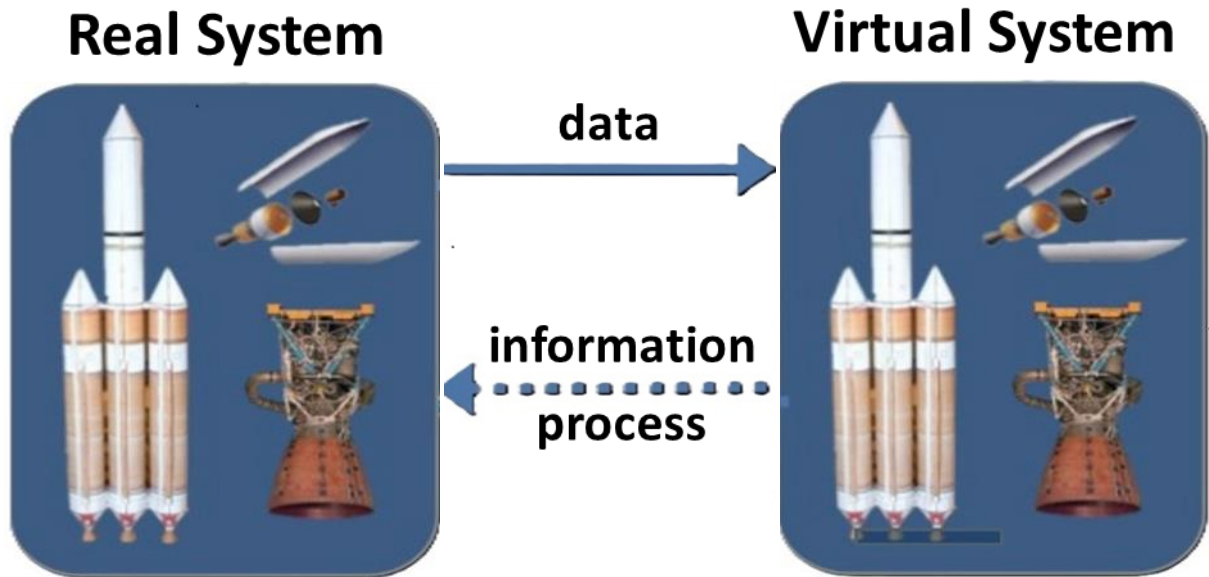
The Early-Warning Support (EWS) module

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What is a Digital Twin?



- The Digital Twin **allows an analysis** of the represented system **without directly interacting** with the real system
- The Digital Twin of a physical entity needs **information on the 'physical twin'**, i.e., a **data exchange** between the digital and physical counterparts, e.g., thanks to **models and sensors**

What is a Digital Twin?

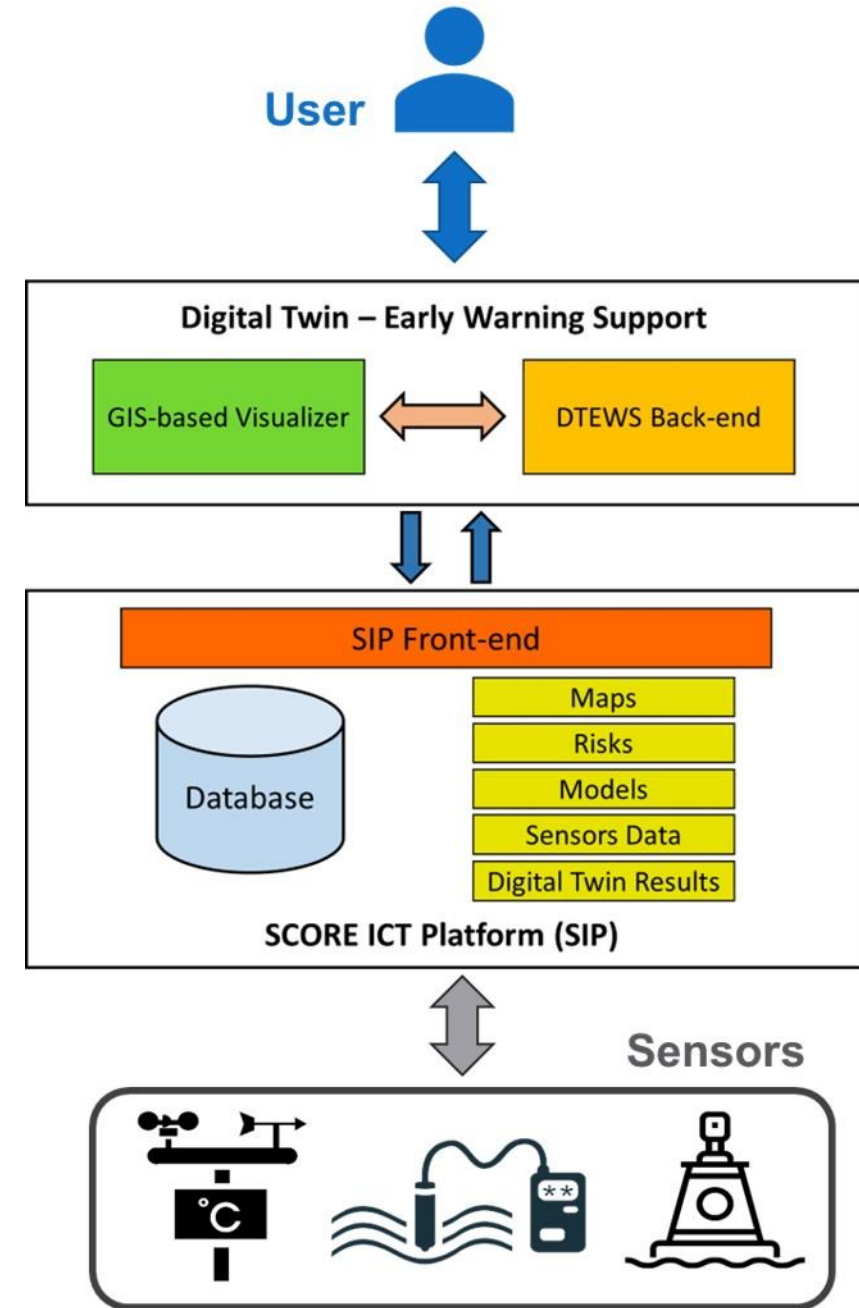
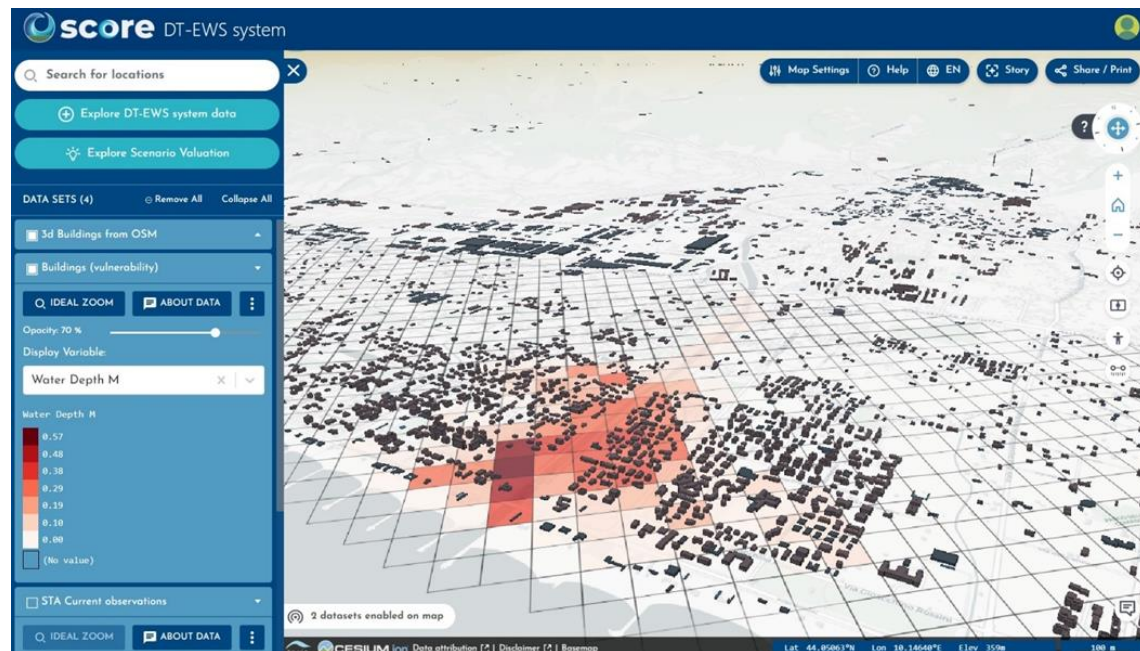
- A **digital representation** of a **real-world physical system** or process (*'physical twin'*) used for **practical purposes**, such as
 - **Simulation,**
 - testing,
 - monitoring,
 - maintenance.

- Virtually, **ANY real-world object or process** can be represented as a digital twin



The aim of the SCORE DT-EWS

- The DT-EWS will assist coastal cities governance in developing collaborative climate resilience management strategies
- It will allow evaluating Ecosystem-based adaptations (EBAs) and support in disaster prevention initiatives
- It will be fed with data from cities and hydrological and sea state models, weather forecasts, data from sensors



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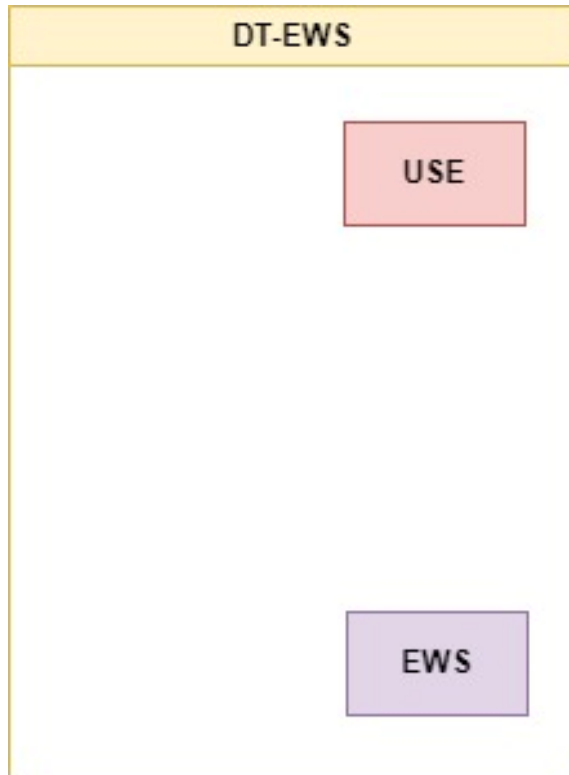
SCORE Digital Twin Structure (1)



User Scenario Evaluation (USE)

- Allows users to simulate **extreme weather and hydraulic** situations
- Assists in the **prediction of their impact** on the study area
- Supports in the **assessment of possible countermeasures**

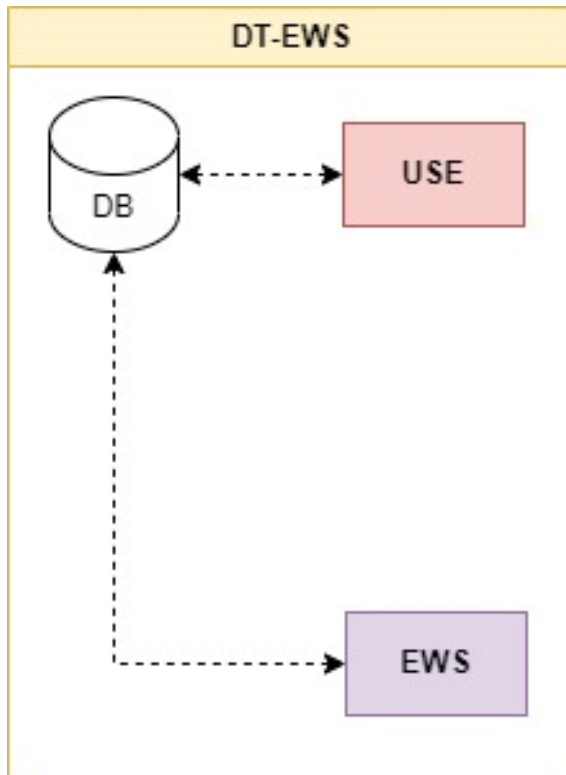
SCORE Digital Twin Structure (2)



Early-Warning Support (EWS)

- Devoted to **continuous, real-time monitoring** of the hydraulic state in the study area
- Simulates in **short time the evolution** of the hydraulic state in the coming hours, **thanks to AI/ML**, by **gathering data** from sensors and weather forecasts
- Can **raise alerts** in case of flood risk

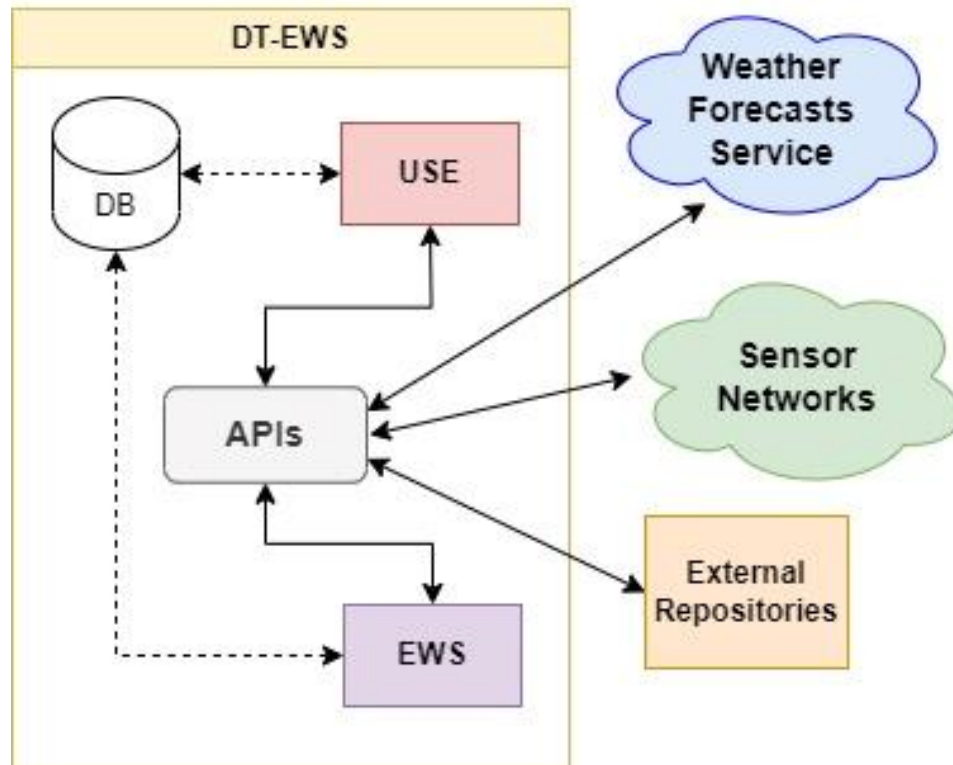
SCORE Digital Twin Structure (3)



Database (DB)

- **Container of all the data** employed by the system in its simulations
- **Temporarily stores the system output data**

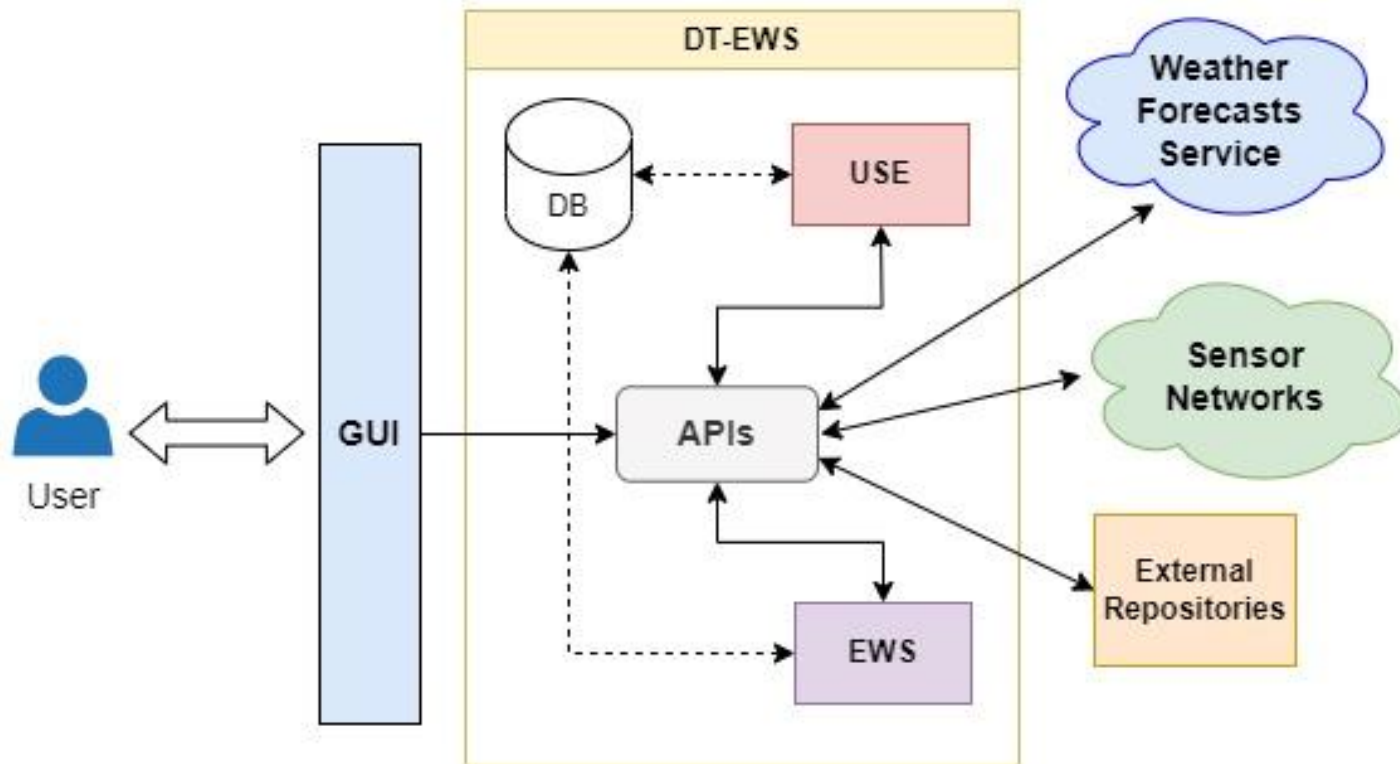
SCORE Digital Twin Structure (4)



Application programming interfaces (APIs)

- **Collect data from the weather forecasts**
- **Interface with the sensor network and obtain the related data stream**
- **Exchange data with external repositories**
- **Connect the system with its front-end**

SCORE Digital Twin Structure (5)



Graphical User Interface (GUI)

- Allows users to operate the system in a **simple and intuitive way**
- Allows **setting up and launching simulations** with the USE module
- Allows the **visualization the output** of USE and EWS

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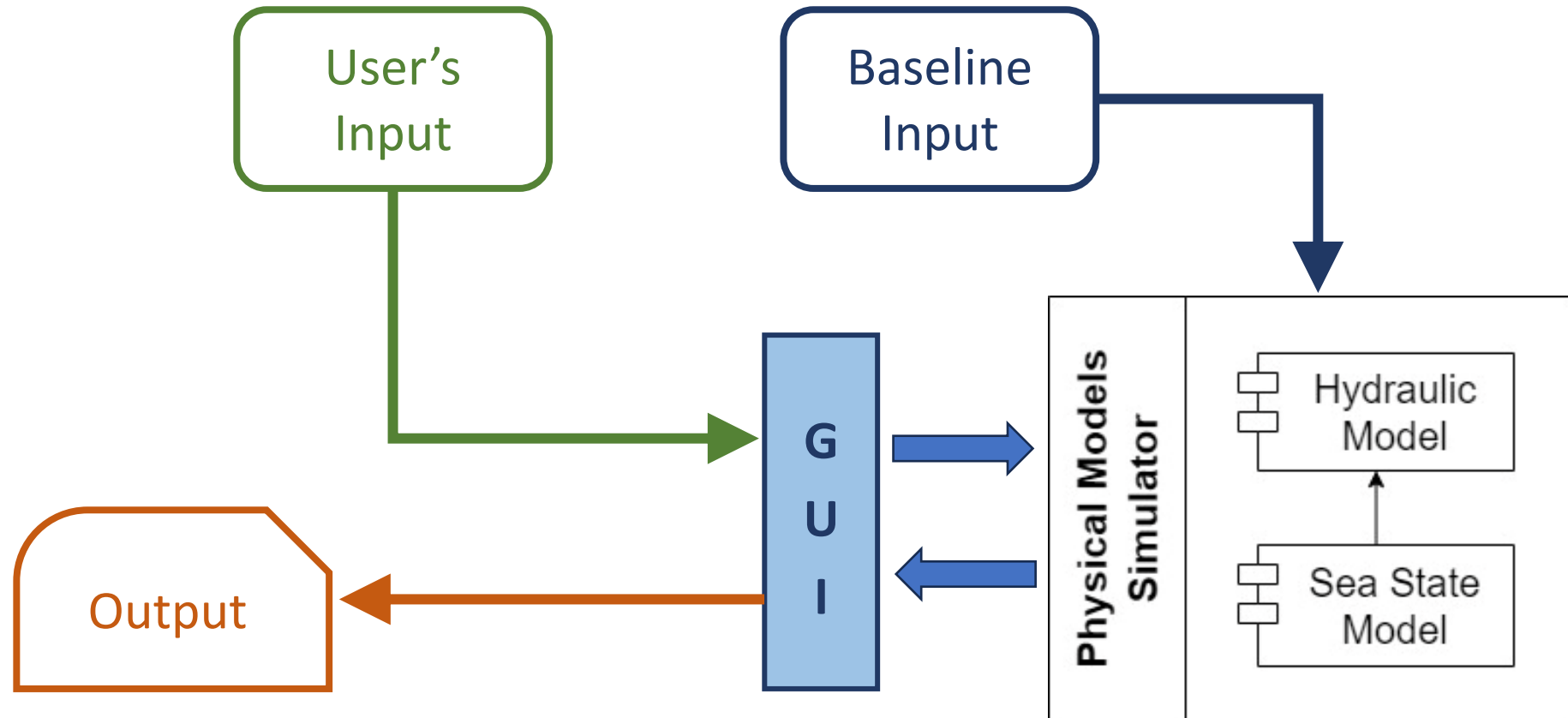
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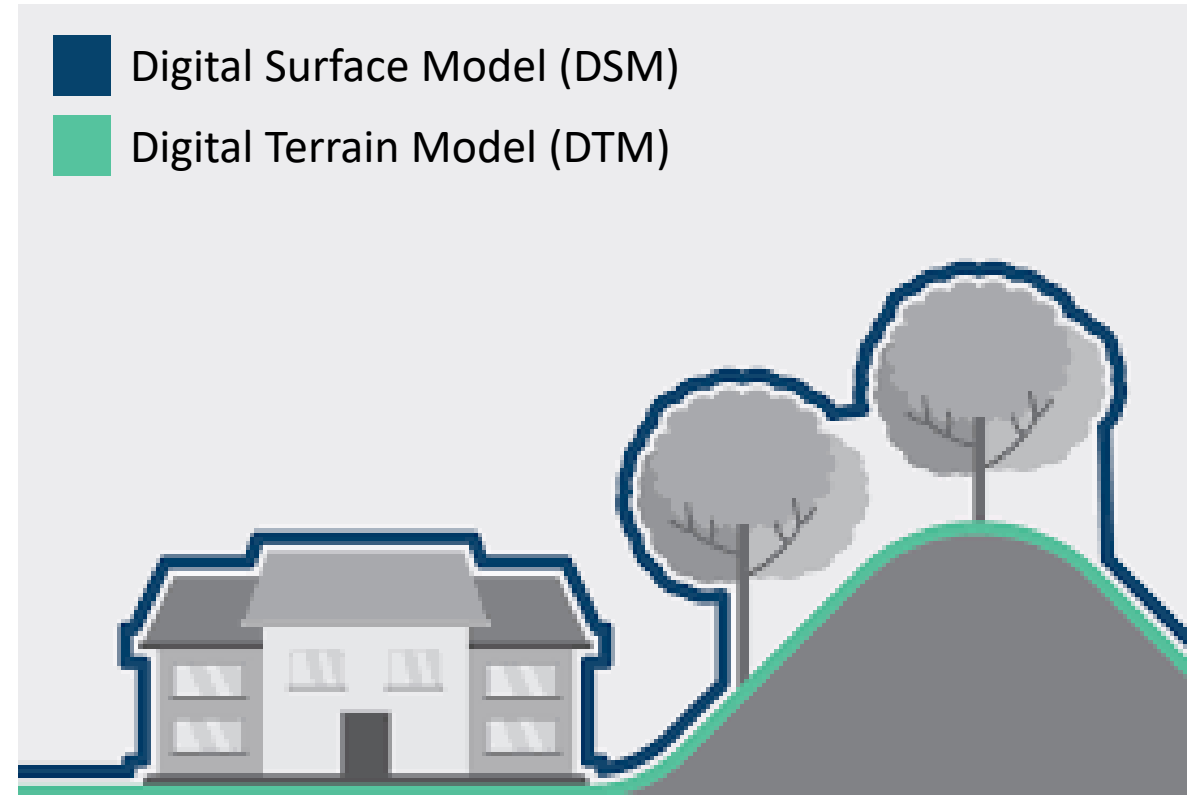
The User Scenario Evaluation Module – Structure

This subsystem simulates user-defined scenarios



The User Scenario Evaluation Module – Baseline Inputs (1)

- **Terrain Models** of the study area (DTM/DSM) at **high resolution**

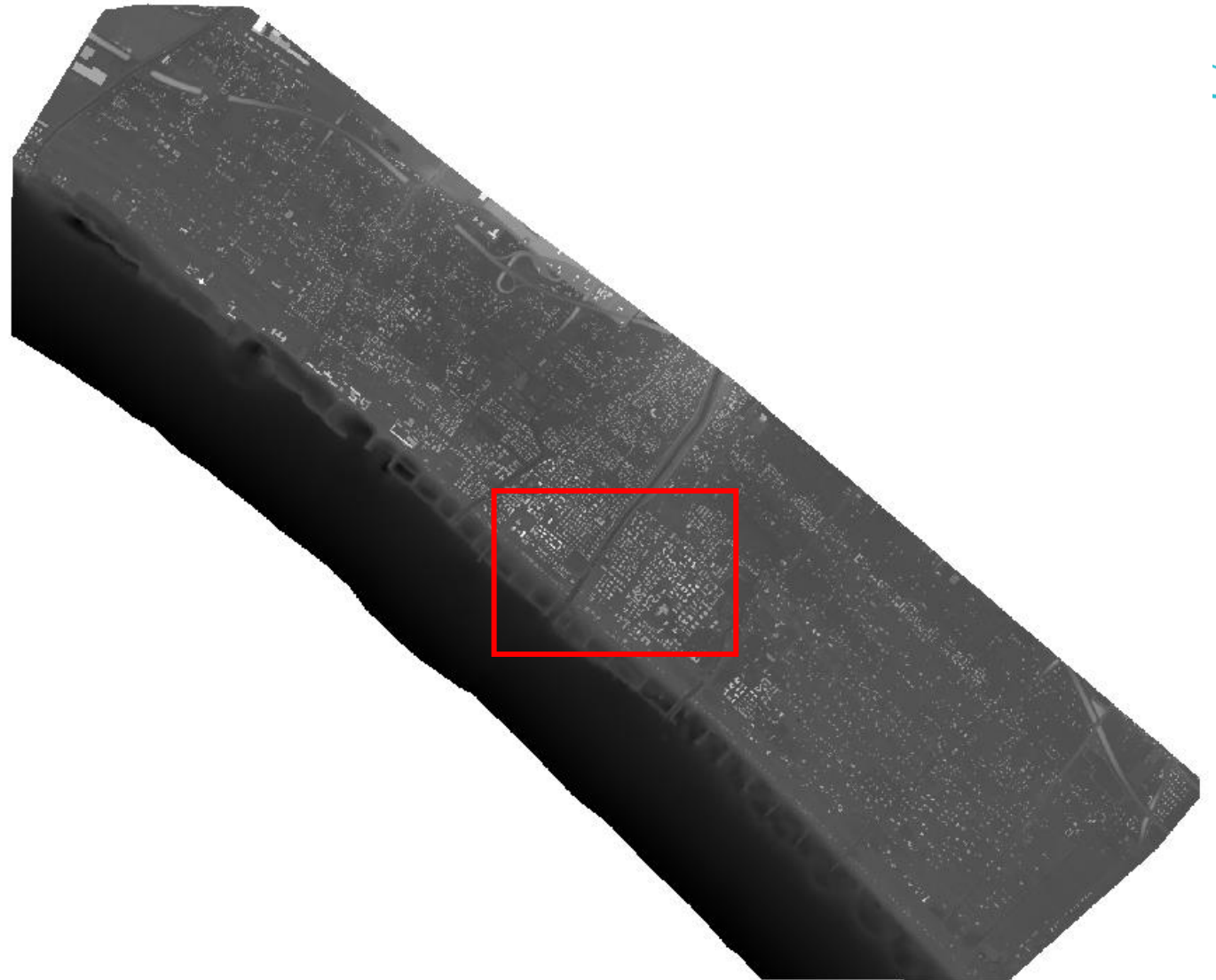


Important to understand how water interacts with the land surface and existing structures

The User Scenario Evaluation Module – Baseline Inputs (2)

How a DSM looks like:

2m x 2m spatial resolution



The User Scenario Evaluation Module – Baseline Inputs (2)

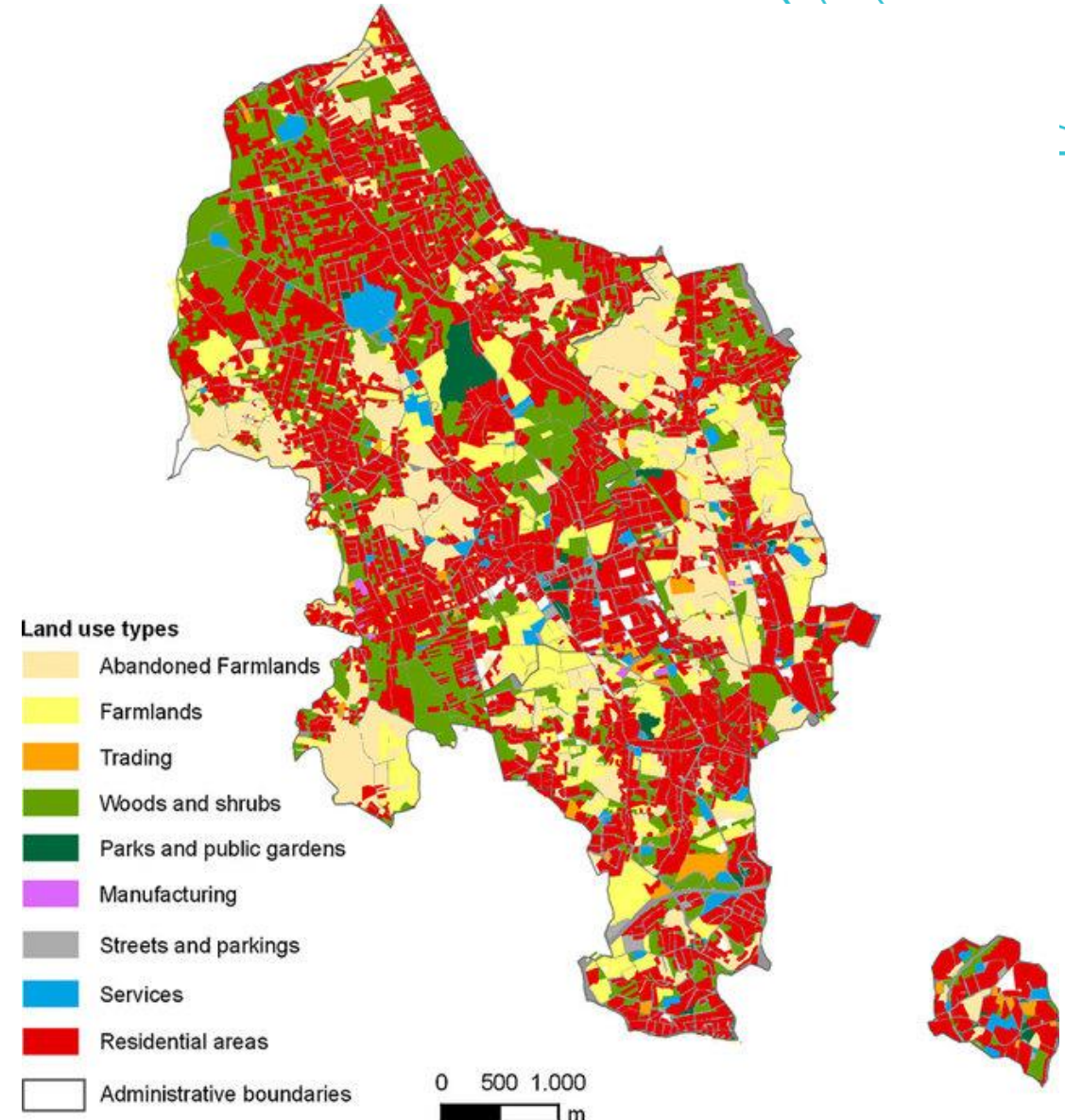


2m x 2m spatial resolution

The User Scenario Evaluation Module – Baseline Inputs (3)

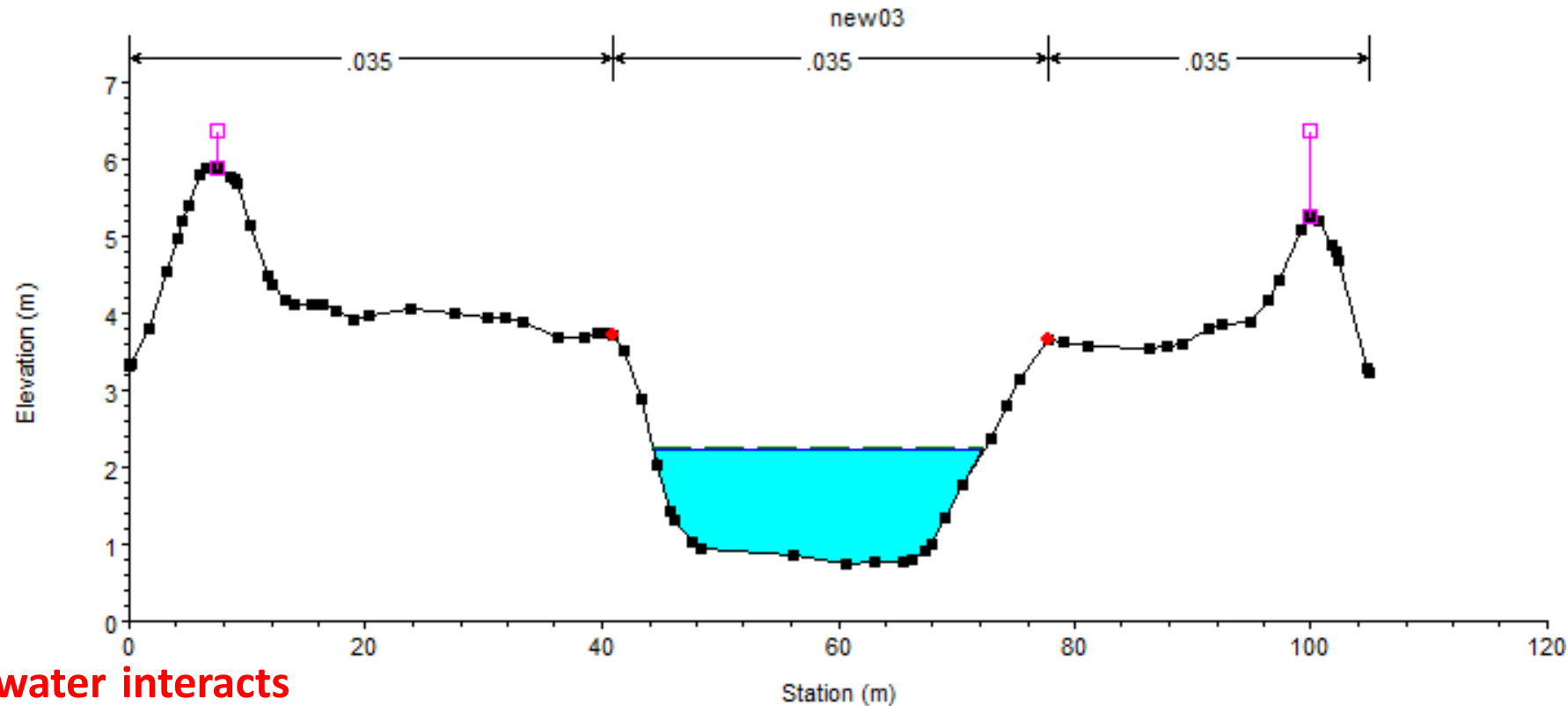
- **Land use maps**, reporting the land cover

Important to understand how water interacts with the land surface and existing structures



The User Scenario Evaluation Module – Baseline Inputs (4)

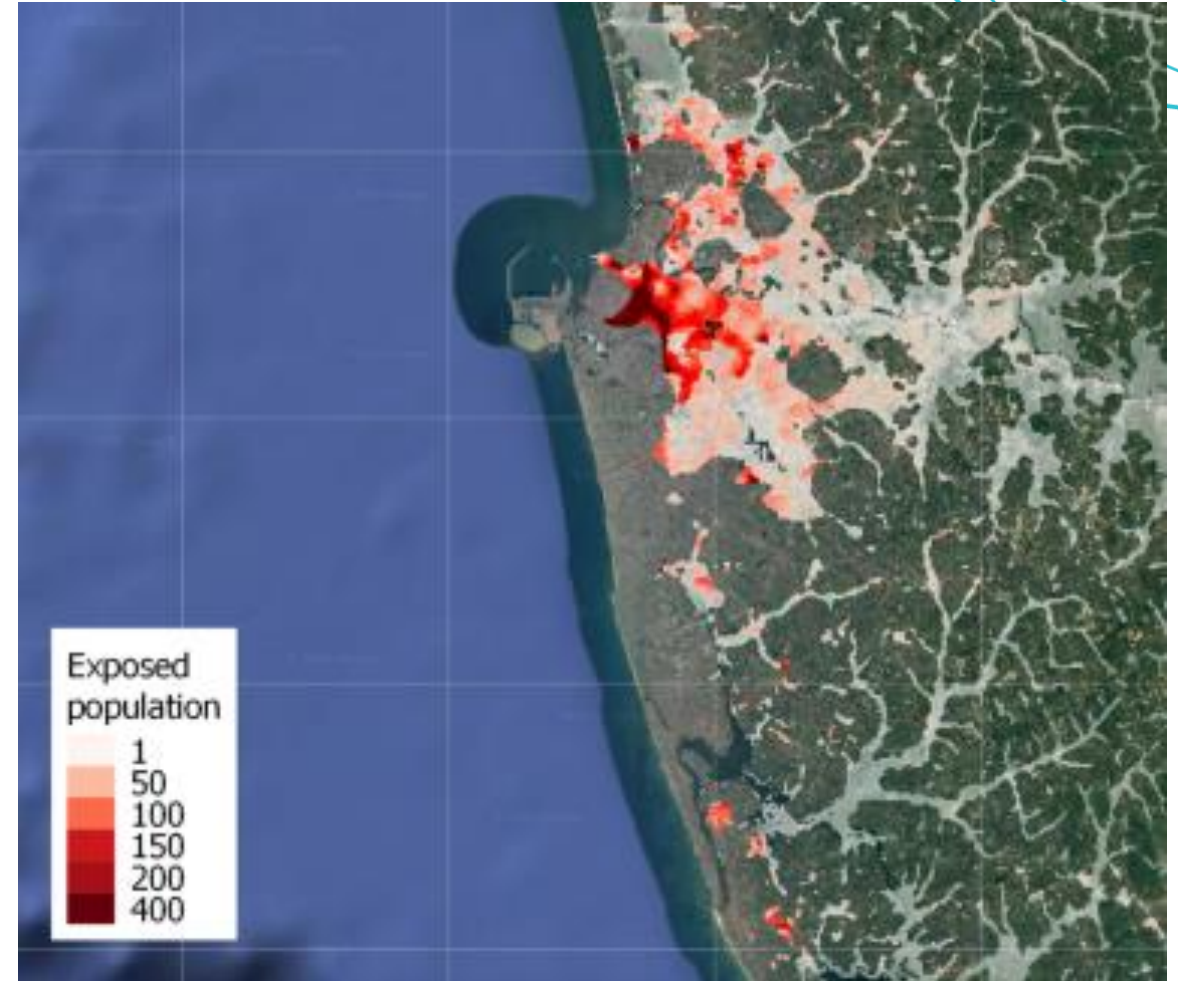
- Rivers bed geometry



Important to understand how water interacts with the land surface and existing structures

The User Scenario Evaluation Module – Baseline Inputs (5)

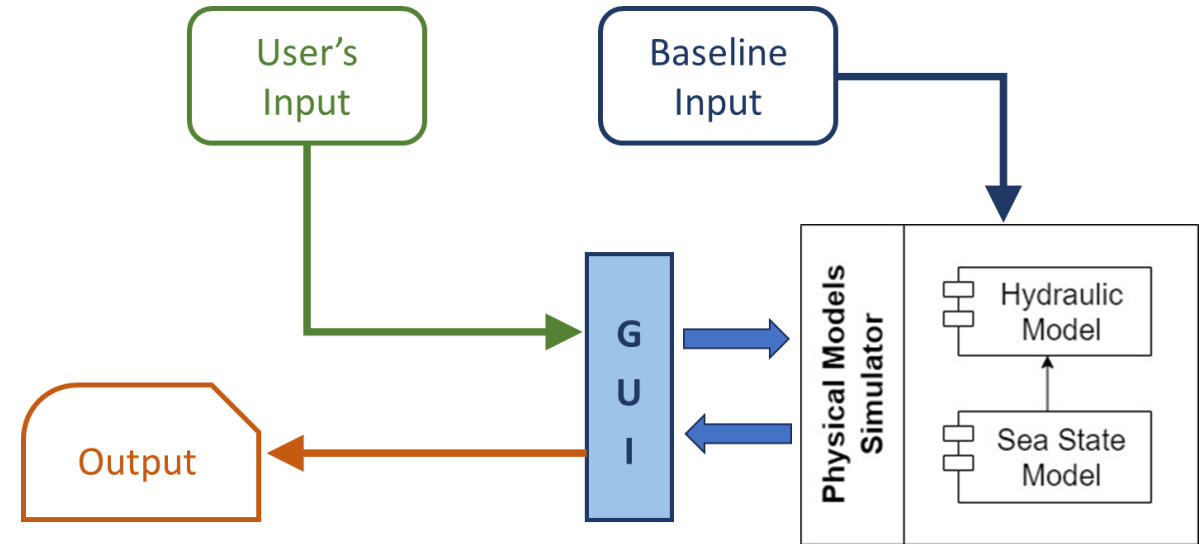
- Human and financial **exposure** and **vulnerability** maps



The User Scenario Evaluation Module – User's Inputs

User's Inputs

- **Weather events** to be simulated
 - Rain rate
 - Sea state
 - Rivers discharge
- **Ecosystem-based Adaptation solutions (EBAs)**



The User Scenario Evaluation Module – Outputs

- **Flooding maps**
- **Human/financial** risk maps on the study area

