ISTANBUL FLOOD EARLY WARNING SYSTEM

Cemre ERBİL

İSKİ Research & Development Branch

What is Flooding?

- Floods are the most frequent type of natural disaster and occur when an overflow of water submerges land that is usually dry.
- Flooding occurs when a river bursts its banks and overflows onto the surrounding land.
- There are many factors which can cause a flood - often the natural landscape can influence flooding and also human interactions can increase the risk.

- Flooding can lead to both ***tangible*** and ***intangible losses.***
- Tangible losses are experiences that are easily seen, like ***death, breakups*** or ***bankruptcy.***
- Intangible losses are experiences that often go unnoticed such as ***loss of trust, safety, security,*** and ***control.***
- Tangible and intangible losses are both painful.

Causes of Flooding

Prolonged Rainfall:

If it rains for a long time, the land around a river can become saturated (it's holding as much water or moisture as can be absorbed).
If there is more rainfall it cannot be soaked up, so it runs along the surface - this is known as surface run-off.

Heavy Rainfall:

If there is heavy rainfall there is less chance of it being soaked up by the soil (infiltration) so it runs off into the river.
The faster the water reaches the river, the more likely it will flood.

Relief:

A steep valley is more likely to flood than a flatter valley because the rainfall will run off into the river more quickly.

Geology:

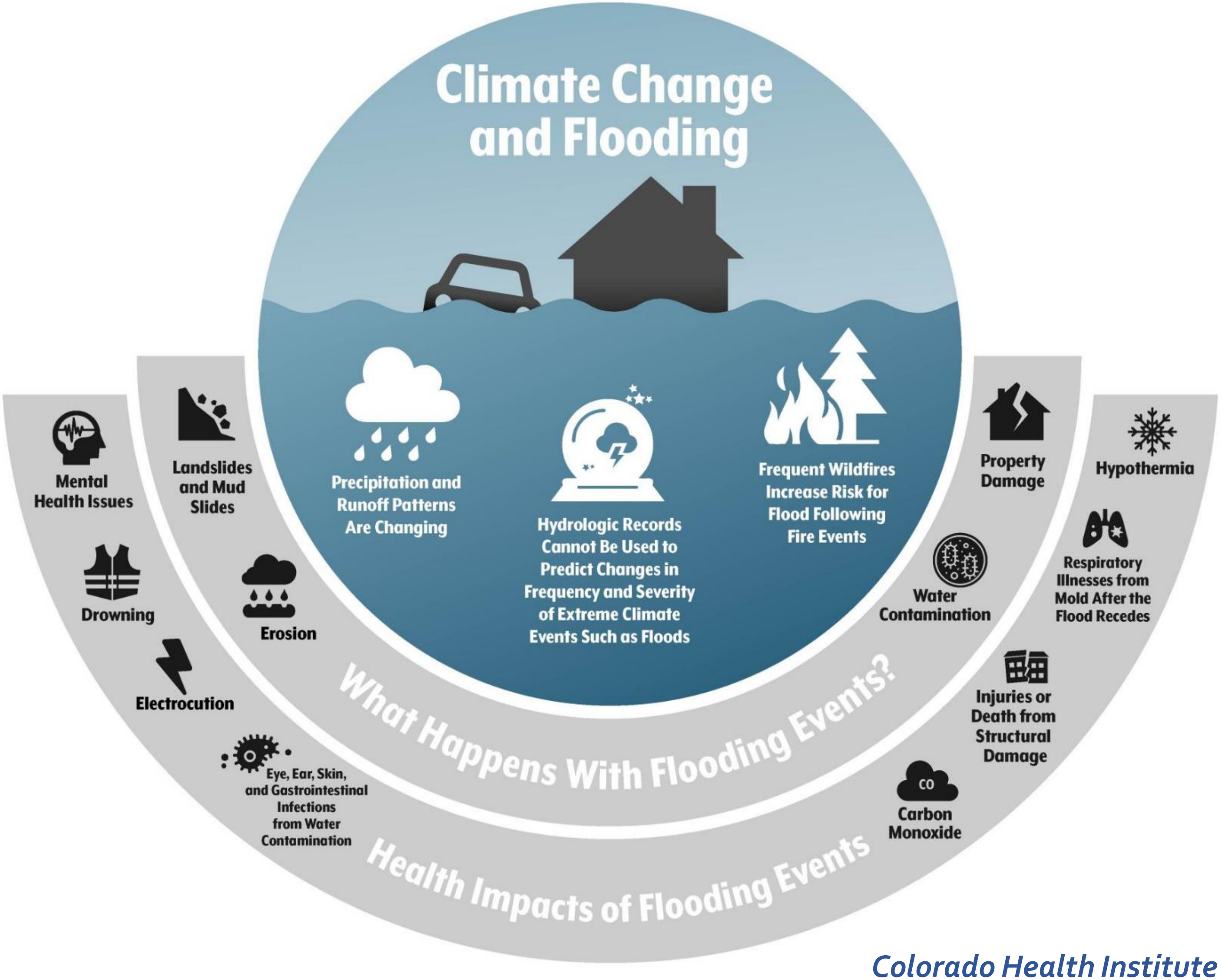
Permeable rocks allow water to pass through pores and cracks, whereas impermeable rocks do not.
If a valley is made up of impermeable rocks, there is a higher chance of flooding as there is an increase in surface run-off.

Vegetation:

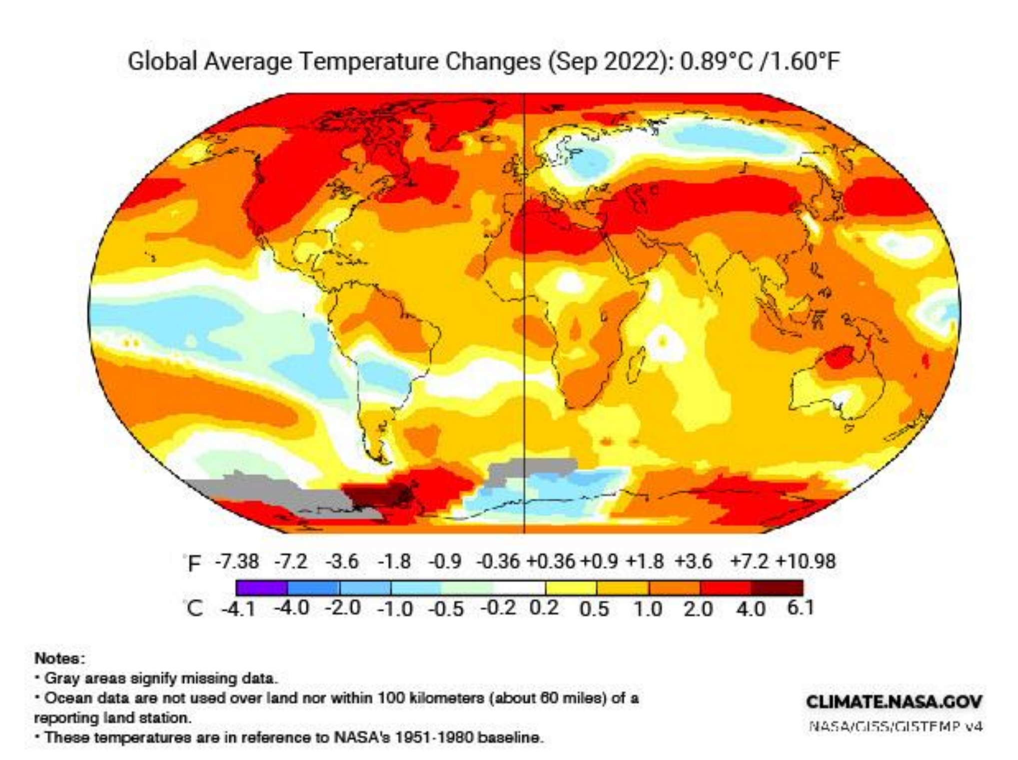
Trees and plants absorb water, this is known as interception.
Lots of vegetation reduces flood risk. Sometimes people cut down trees (deforestation).
This will increase the flood risk, as the water will not be intercepted and flow into the river.

Urban Land Use:

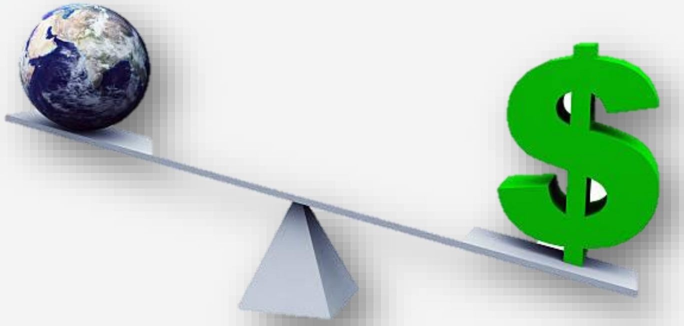
When an area surrounding a river is built on, there is an increase in the amount of tarmac and concrete, which are impermeable surfaces.
Drains and sewers take water directly to the river which increases flood risk.



Colorado Health Institute



Deforestation & Urbanization



Canik, Samsun
July 4, 2012

- According to the Turkey Disaster Management and Natural Disaster Statistics prepared by AFAD, 38 floods occurred in Istanbul from 1950 to 2018.
- In our country, 1235 people lost their lives due to floods between 1955 and 2007.
- The number of houses destroyed or rendered unusable is 61,000.
- There have been 1500 flood disasters in our country in the last 3 years and 113 people lost their lives.
- The bill resulting from floods alone reaches 4 billion dollars.

Flood Prevention Strategies

HARD ENGINEERING

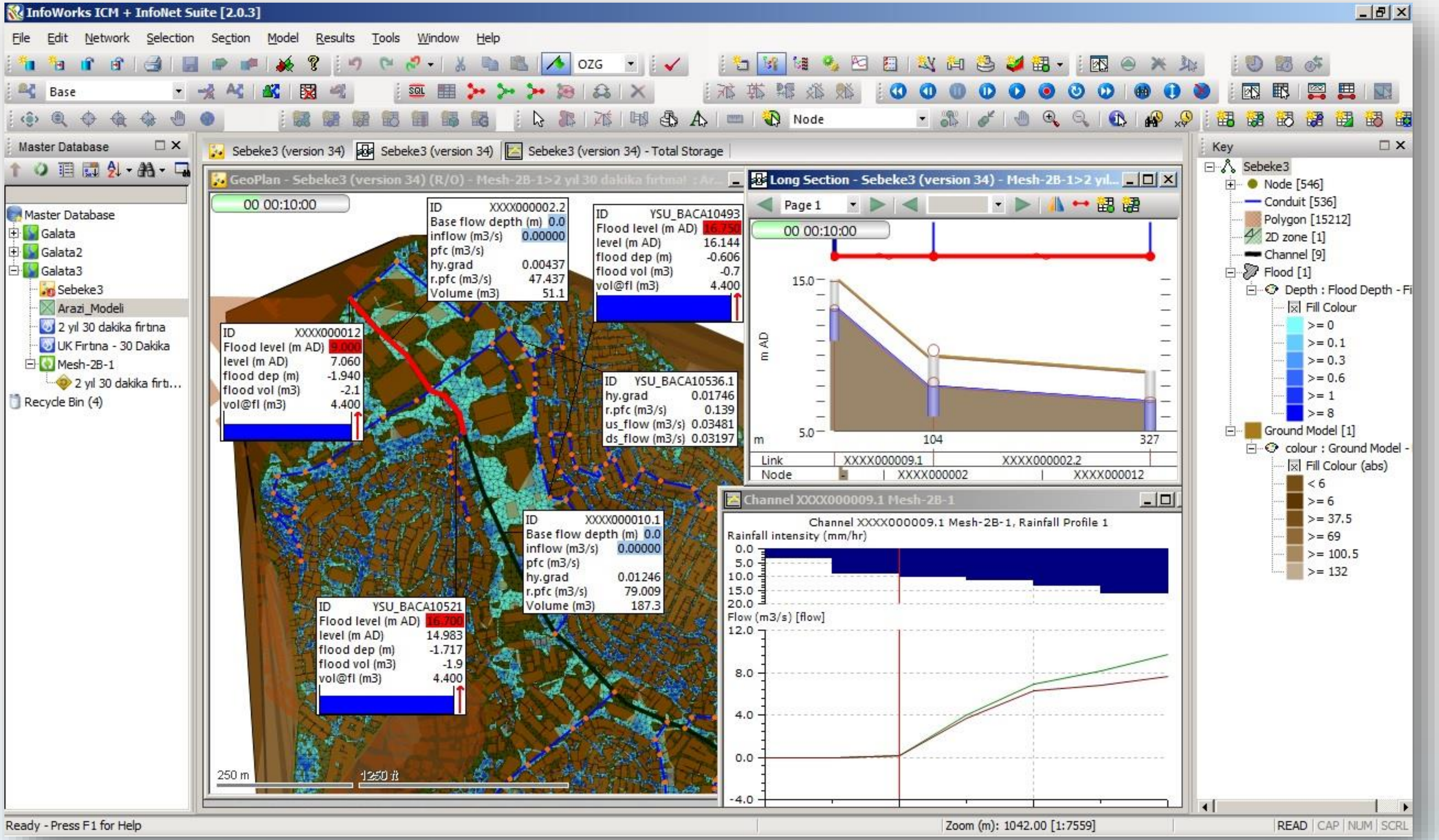
- Dams and reservoirs
- River straightening and dredging
- Flood relief channels

SOFT ENGINEERING

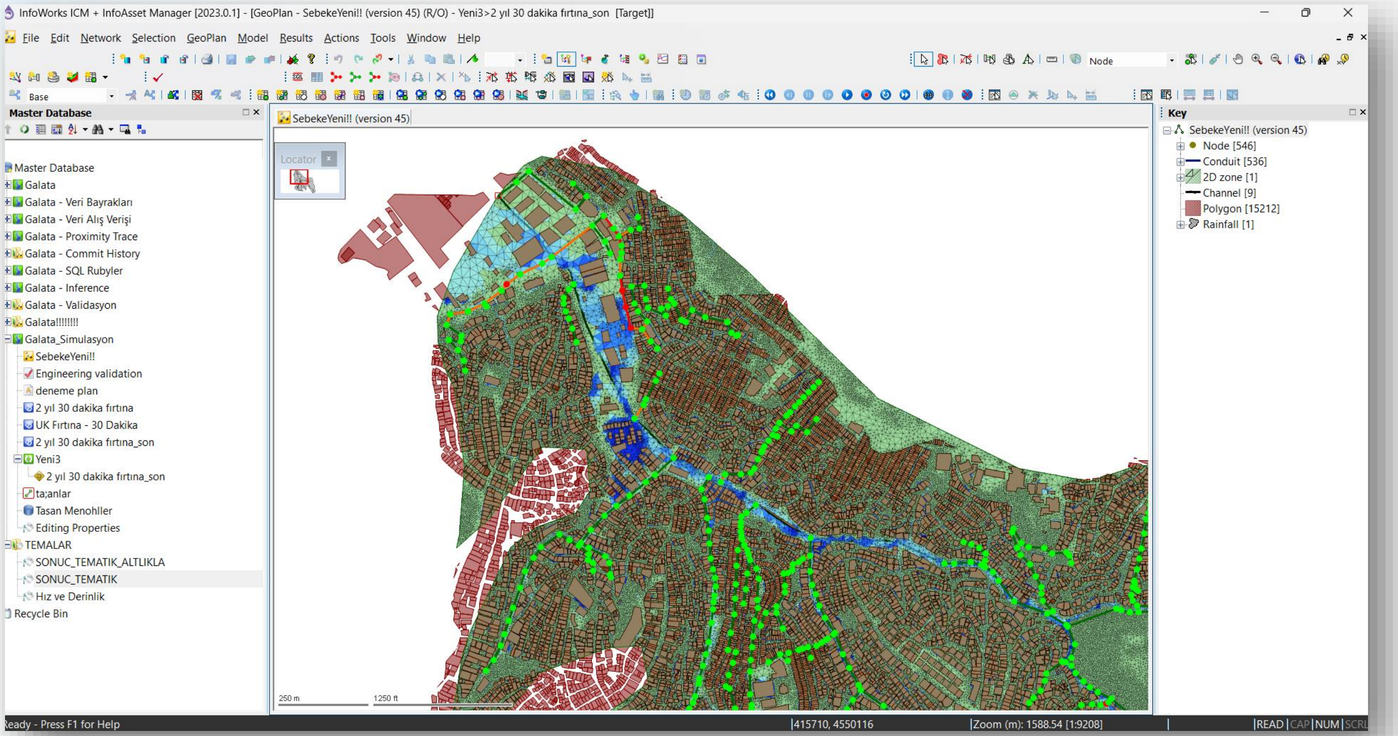
- Flood warnings and preparation
- Floodplain zoning
- Afforestation
- Ecological flooding

Flood Warnings

What is Flood Early Warning System?

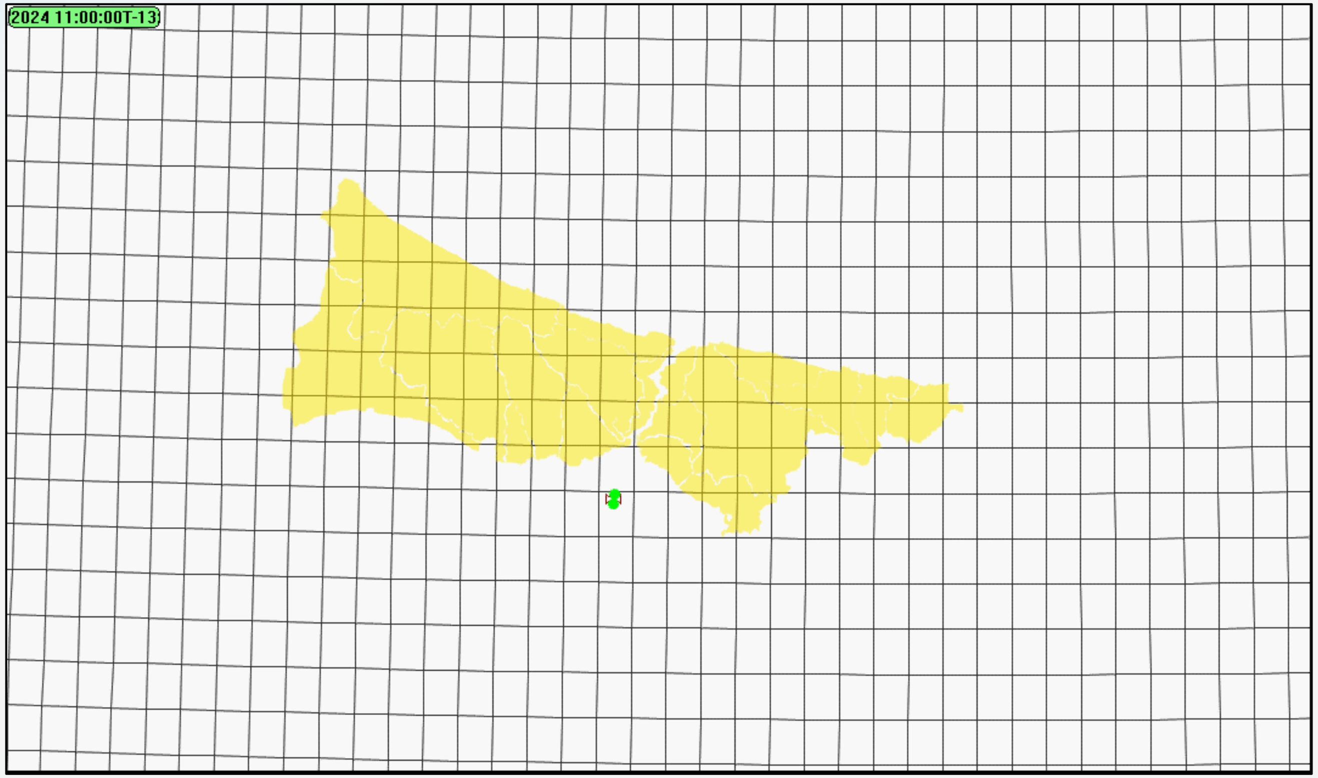


Flood Early Warning System in ISKI?



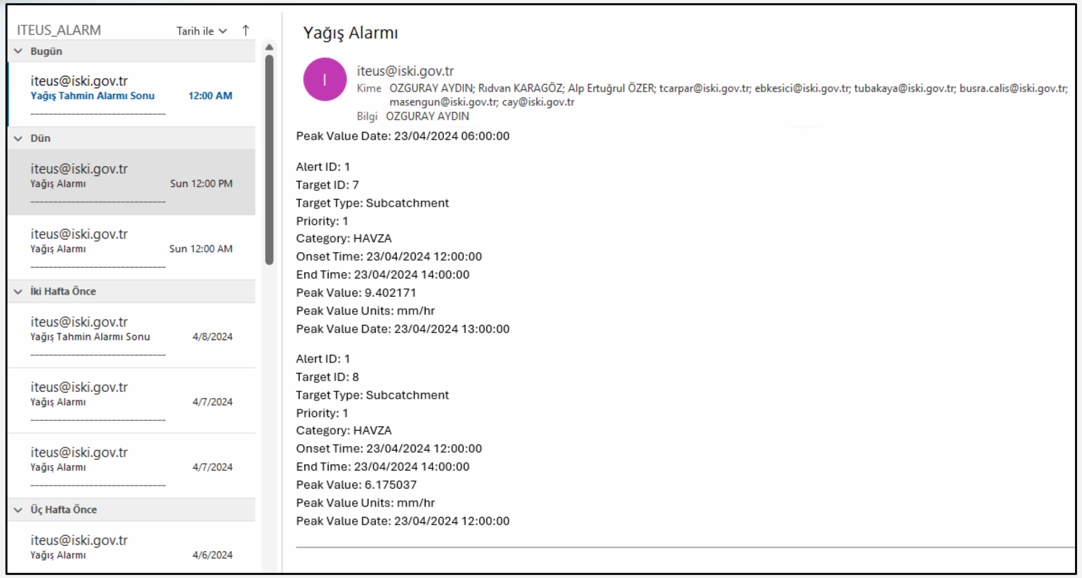
- Hydrodynamic models and have been created in existing Master Plans.
- Infoworks ICM and Infoworks ICMLive software to be used in the Istanbul Flood Forecast and Early Warning System were procured and installed.
- Studies and training on the use of Infoworks ICM program have been completed.
- Innovyze's ICM (Integrated Catchment Modeling) software can simulate all hydraulic and hydrological elements simultaneously in 1 and 2 dimensions.
- Both wastewater and stormwater networks can be simulated in a single environment, including topological flow and hydraulic flow regulation structures in rivers and urban catchments, water chemistry and sediment transport models.

Flood Early Warning System in ISKI?



- Integration infrastructure was created on the software side.
- Integration of live Numerical Weather Forecast (SHT) data from MGM has been completed.
- The installation of hydrological models that will work with SHT data in Infoworks ICM has been completed.
- The established hydrological models began to be run continuously and automatically with Infoworks ICMLive.

Flood Early Warning System in ISKI?

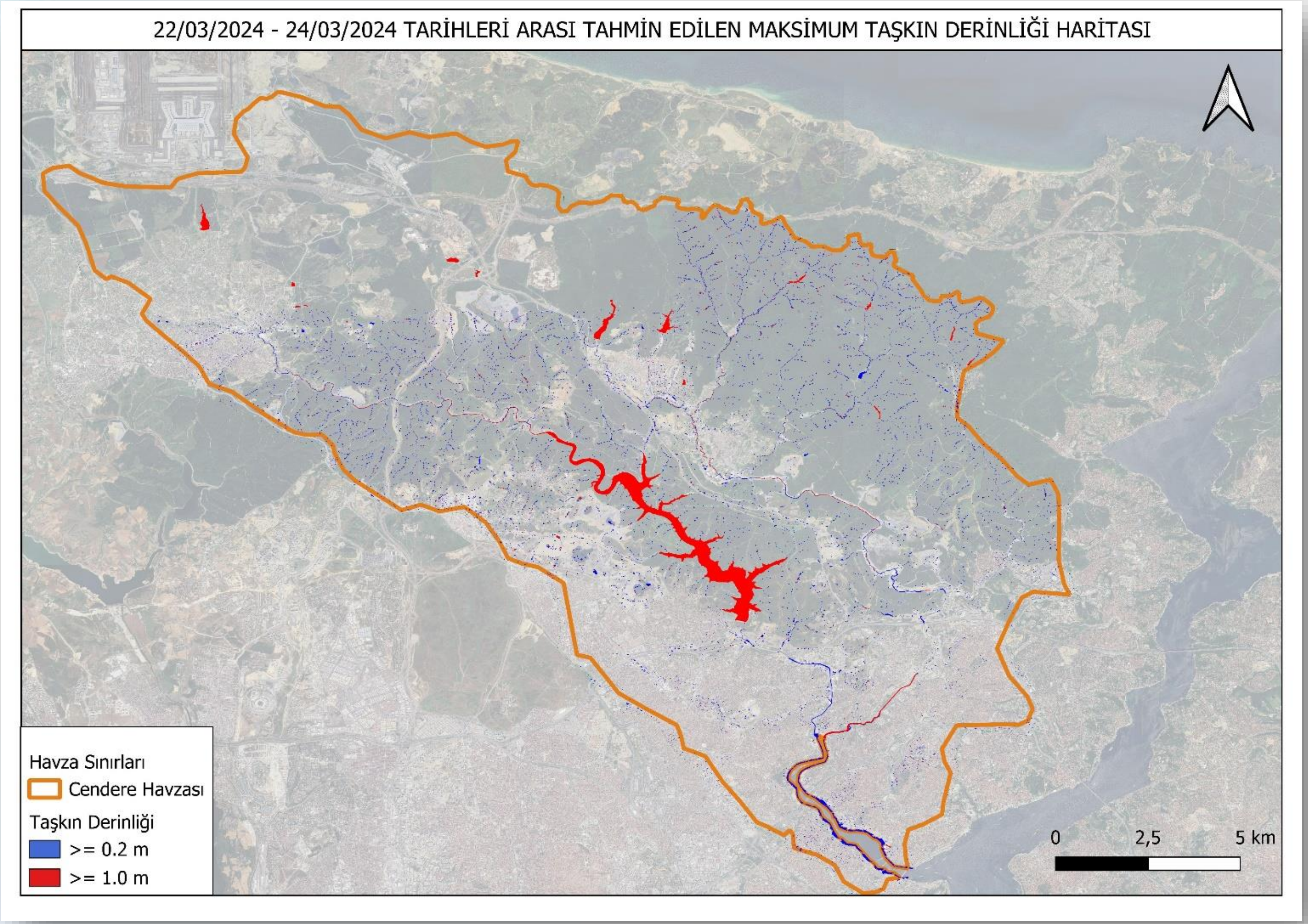


- Through Infoworks ICMLive, an alarm mechanism that generates warnings based on hydrological model results was established, and rainfall alarms began to be given and sent to authorized employees by e-mail.

ECMWF_IST

Alert definition ID	Target ID	Target type	Priority	Category	Onset time	End time	Peak value	(Units)	Peak time
1	1	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	7.467901	mm/hr	20-04-2024 12:00
1	1	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	6.547529	mm/hr	21-04-2024 08:00
1	10	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	6.012171	mm/hr	20-04-2024 12:00
1	11	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	8.305645	mm/hr	20-04-2024 14:00
1	11	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.234800	mm/hr	21-04-2024 06:00
1	12	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	5.535607	mm/hr	20-04-2024 14:00
1	16	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	6.200166	mm/hr	20-04-2024 14:00
1	17	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	5.021736	mm/hr	20-04-2024 14:00
1	18	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	7.040774	mm/hr	20-04-2024 12:00
1	2	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	8.128537	mm/hr	20-04-2024 14:00
1	2	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	7.593211	mm/hr	21-04-2024 07:00
1	3	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	8.861831	mm/hr	20-04-2024 14:00
1	3	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	7.929601	mm/hr	21-04-2024 07:00
1	4	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	9.777466	mm/hr	20-04-2024 12:00
1	4	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	7.681191	mm/hr	21-04-2024 06:00
1	5	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	7.571700	mm/hr	20-04-2024 14:00
1	5	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.990492	mm/hr	21-04-2024 06:00
1	6	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	7.161272	mm/hr	20-04-2024 12:00
1	6	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.865820	mm/hr	21-04-2024 06:00
1	7	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	6.082229	mm/hr	20-04-2024 12:00
1	8	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	5.820075	mm/hr	20-04-2024 14:00
1	9	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	7.339053	mm/hr	20-04-2024 14:00
1	9	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.105993	mm/hr	21-04-2024 07:00

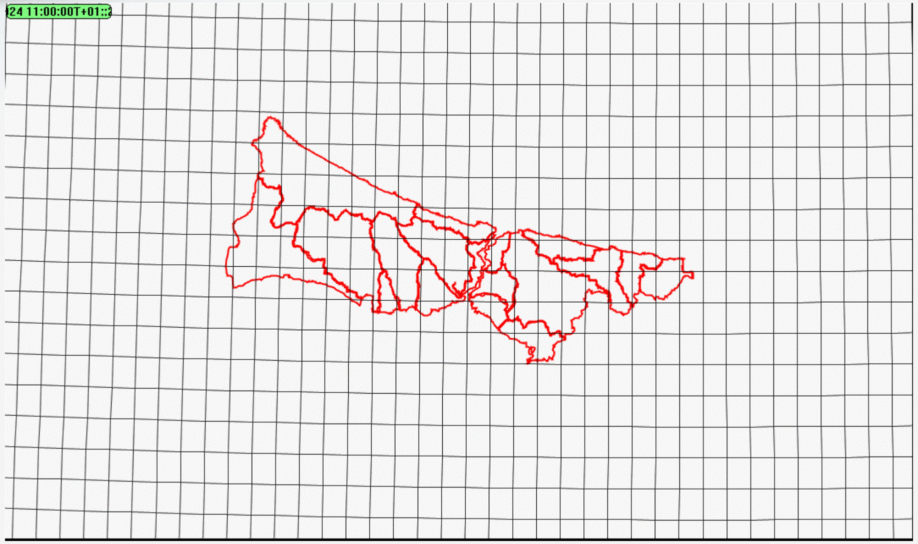
Flood Early Warning System in ISKI?



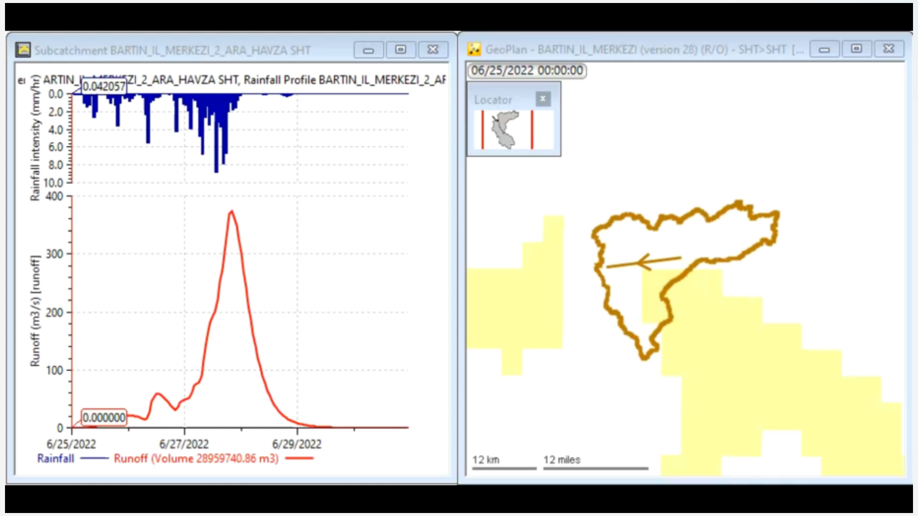
- In a selected sample basin (Cendere), the model was enabled to work hydrodynamically and produce output (distribution area/flood map) every day.

İSTANBUL BÜYÜKŞEHİR BELEDİYESİ
İSKİ

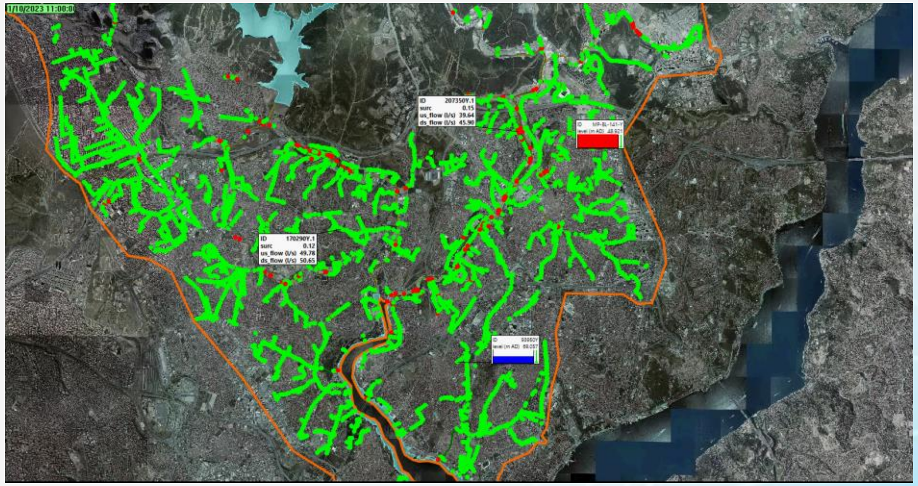
Rainfall Forecast



Hydrological Modelling



Hydrodynamic Modelling



Flow Measurements

Stream Gaging Station

Flow Meter

Dome Camera

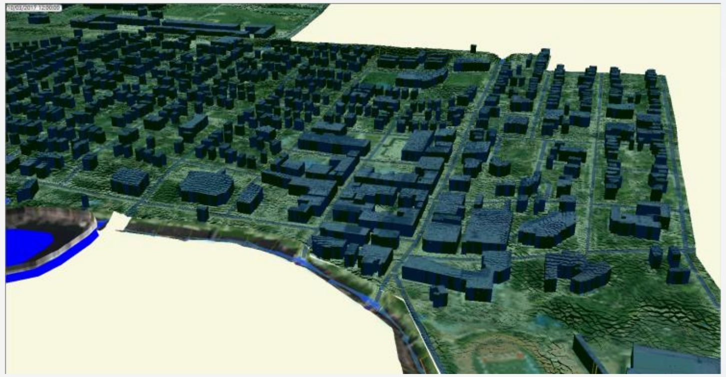
Disaster Management

Before Disaster (BeD)

The real-time presentation of localized forecast data offers opportunities for pre-disaster planning, preparation, and informed decision-making. This high-resolution data aims to inform individuals and locations at risk and prioritize limited resources.

In Disaster (InD)

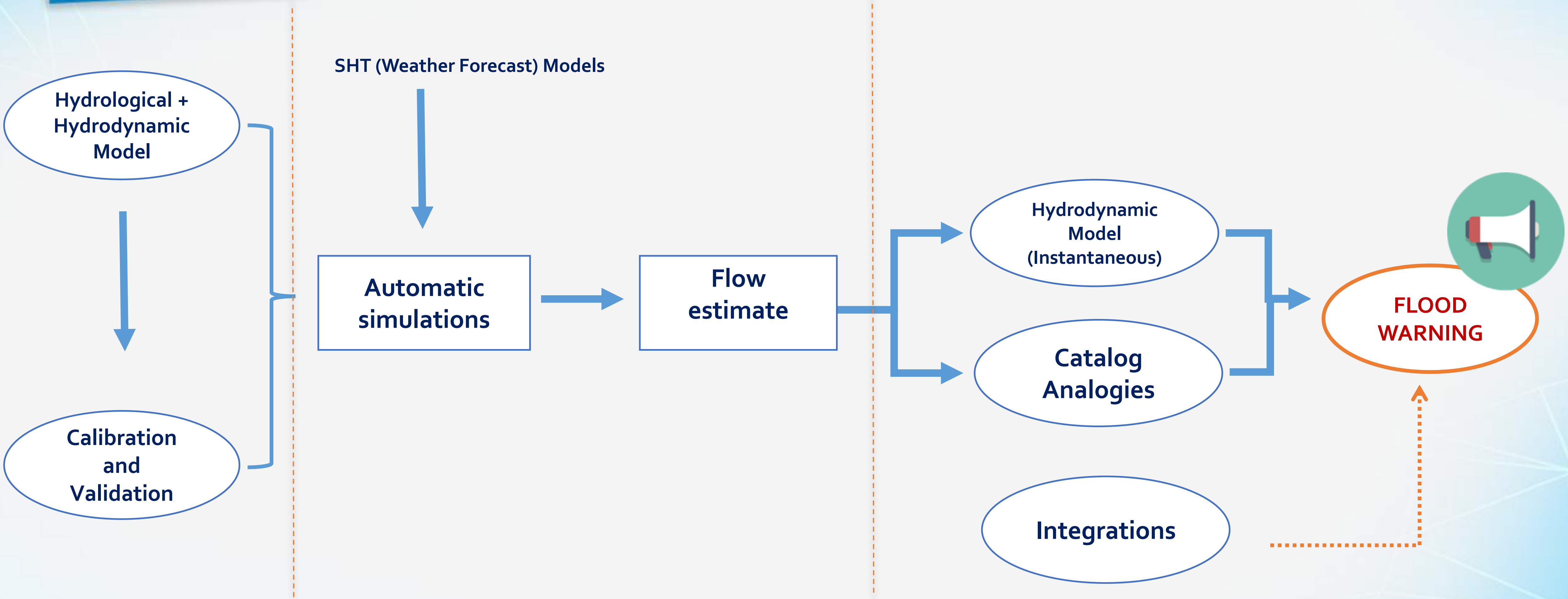
As the situation unfolds, the nowcast serves as a common operational platform, aiding in maintaining situational awareness. It enriches decision-making processes by providing live intelligence on affected individuals, properties, and critical infrastructure, facilitating targeted assistance during critical moments.



After Disaster (AfD)

Performing rapid assessments of impacts across a wide area post-disaster is vital for repair endeavors and the distribution of emergency aid. Additionally, conducting a detailed evaluation of the post-disaster process and leveraging all data to enhance pre-disaster and in-disaster actions is essential.

ITEUS Disaster Management System



Planned Activities

- Bringing the models prepared in the Master Plan up to date and revising them to comply with the flood forecast methodology.
- Pre-running and cataloging statistical simulation precipitation with hydrodynamic models (creating a disaster library).
- Converting the Infoworks ICM Viewer licenses held by İSKİ (delivered by Yüksel Proje) for online hydrodynamic model studies and tests into a full-scope and cloud function-defined Infoworks ICM license subscription and Maintenance/Update of the existing ICM+ICMLive Perpetual Licenses.
- Completing the integrations and developing the location-based İTEUS Disaster Management System.
- Employing/assigning high-level experts to ensure the continuity of the models and system.

The Cost of ITEUS

- **Stage 1**

Perpetual Licence: 145.000$. (This license type is no longer available. Annual fee is charged.)

- **Stage 2**

The pricing is not yet determined in accordance with the Public Procurement Law

Thanks for your interest!