

İSTANBUL 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.

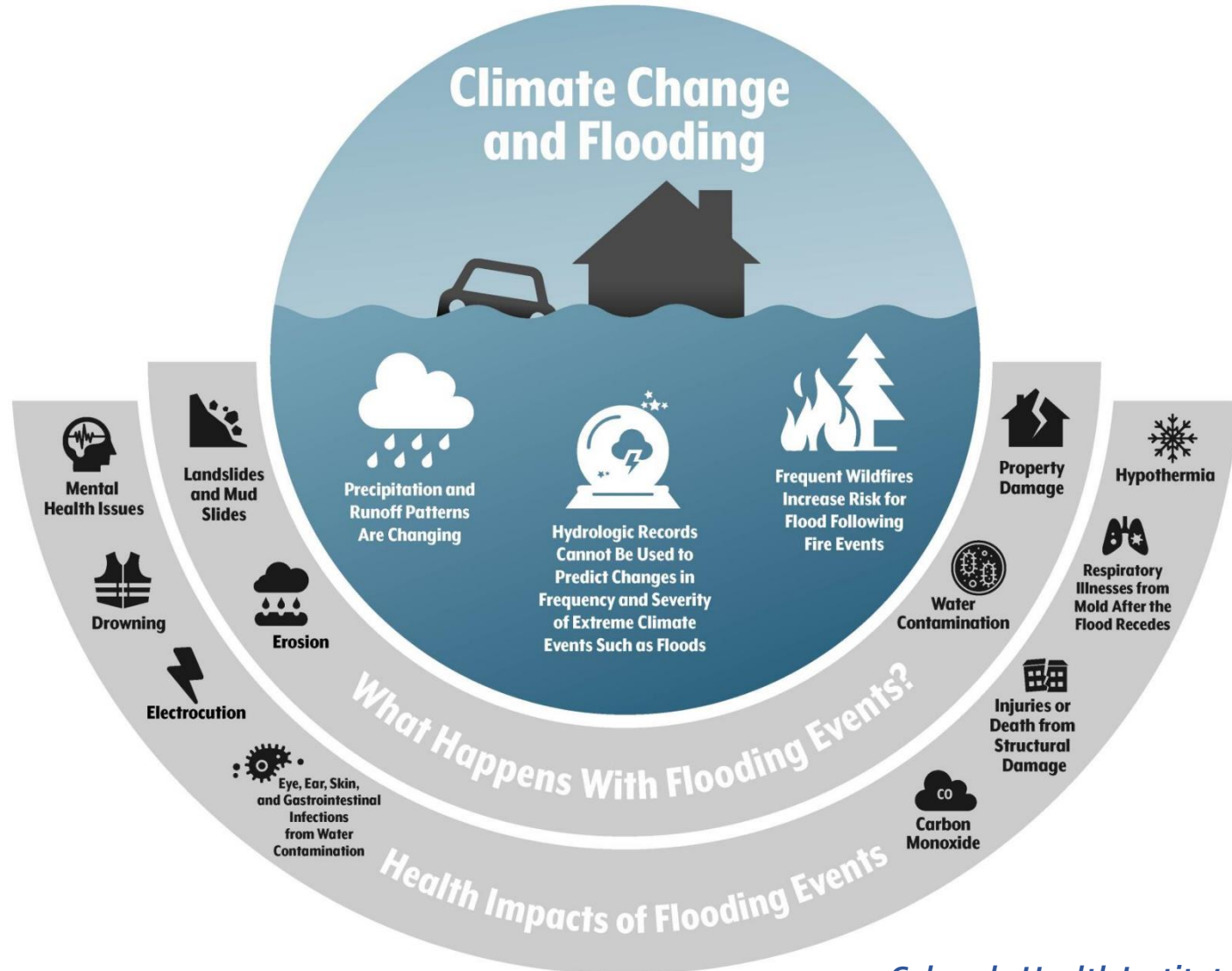
Vegetation:

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.

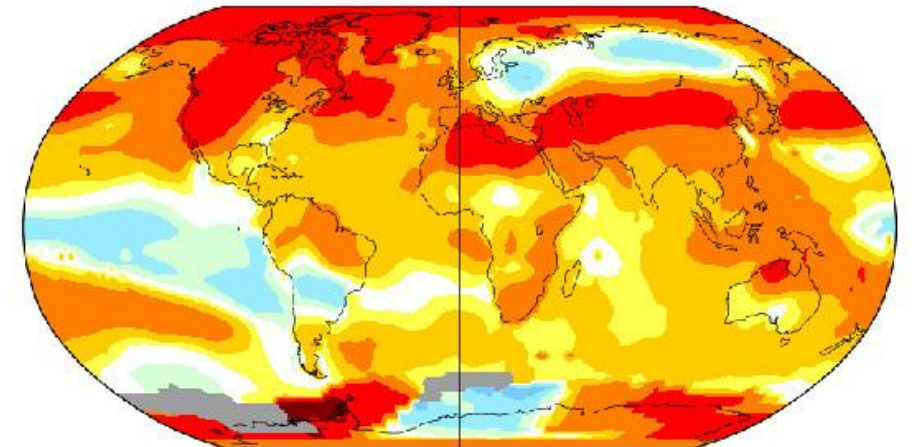
Urban Land Use:

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.

Climate Change and Flooding

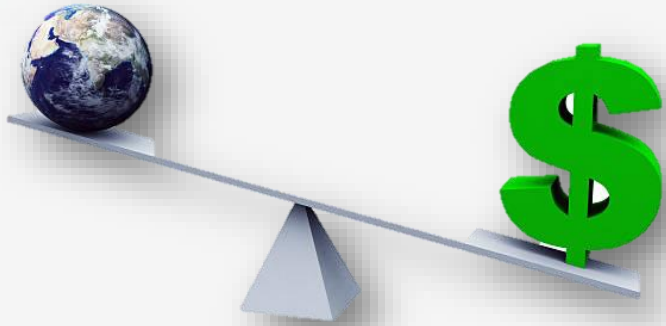


Global Average Temperature Changes (Sep 2022): 0.89°C /1.60°F



- Notes:**
- Gray areas signify missing data.
 - Ocean data are not used over land nor within 100 kilometers (about 60 miles) of a reporting land station.
 - These temperatures are in reference to NASA's 1951-1980 baseline.

Deforestation & Urbanization





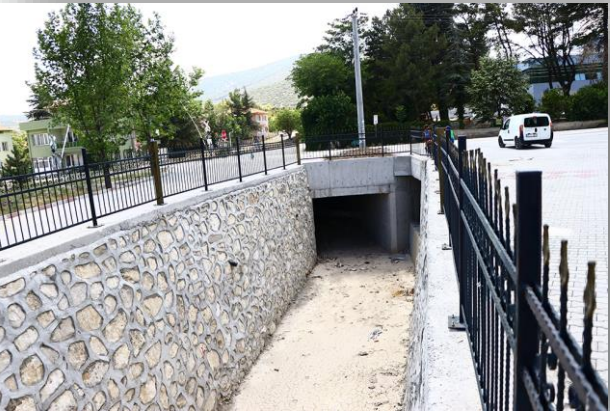
*Canik, Samsun
July 4, 2012*

- 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



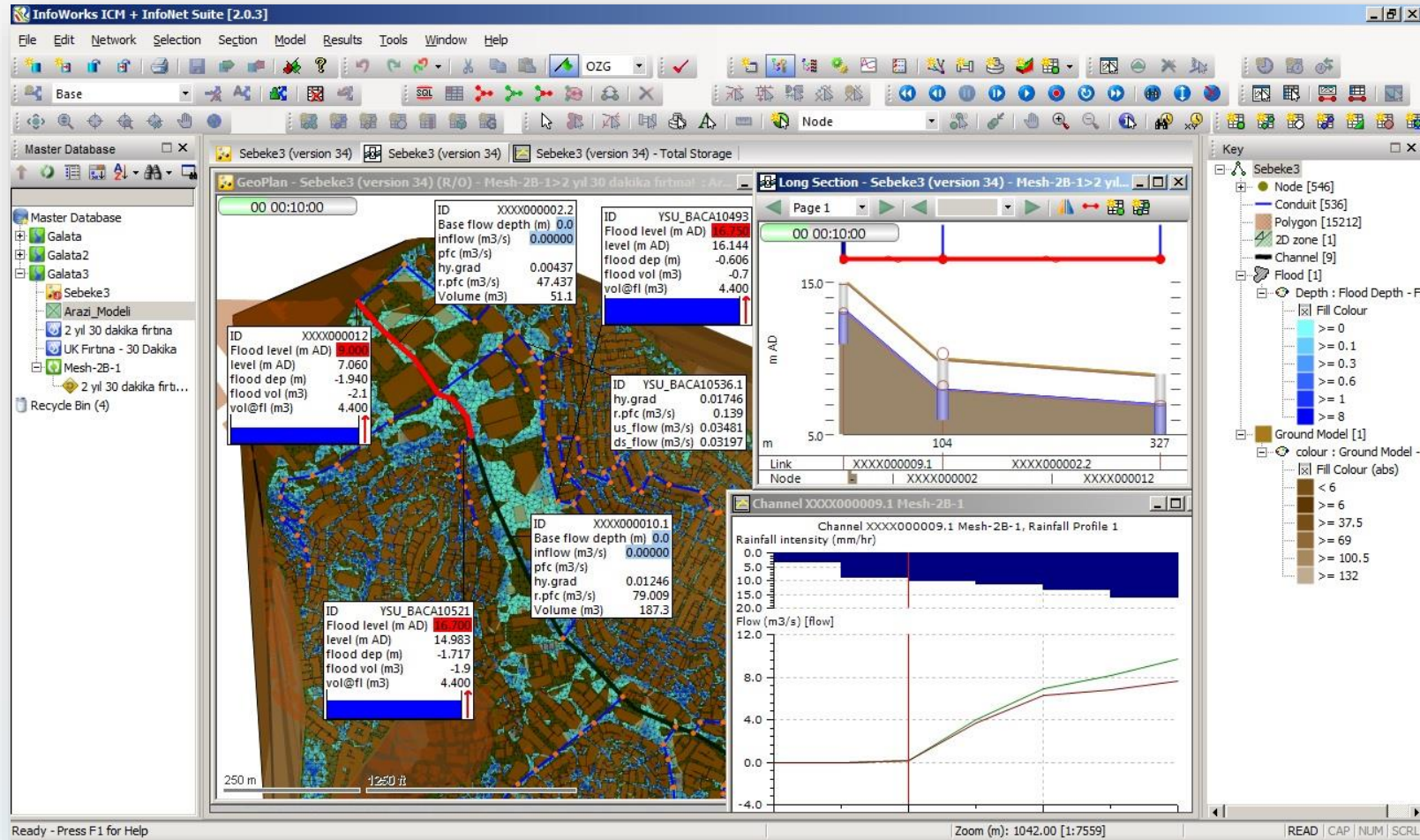
SOFT ENGINEERING

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

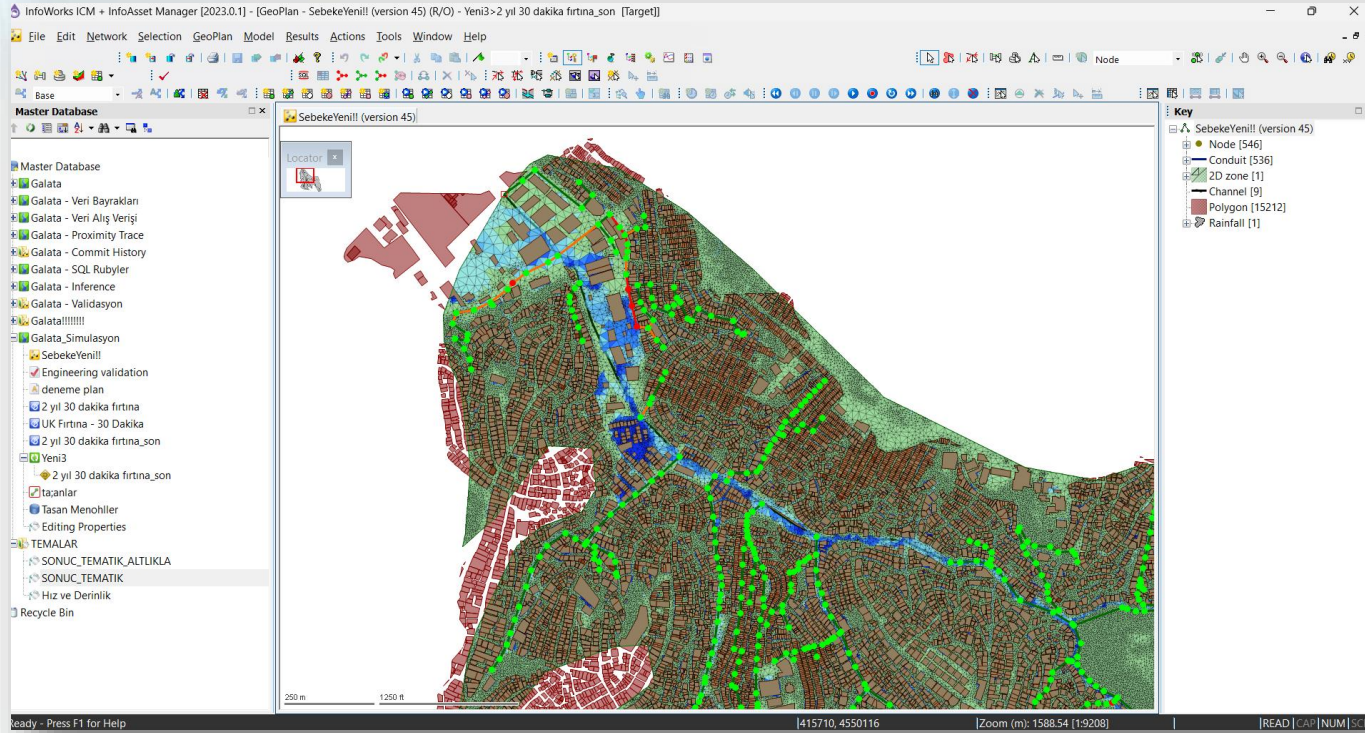


Flood Warnings

What is Flood Early Warning System?



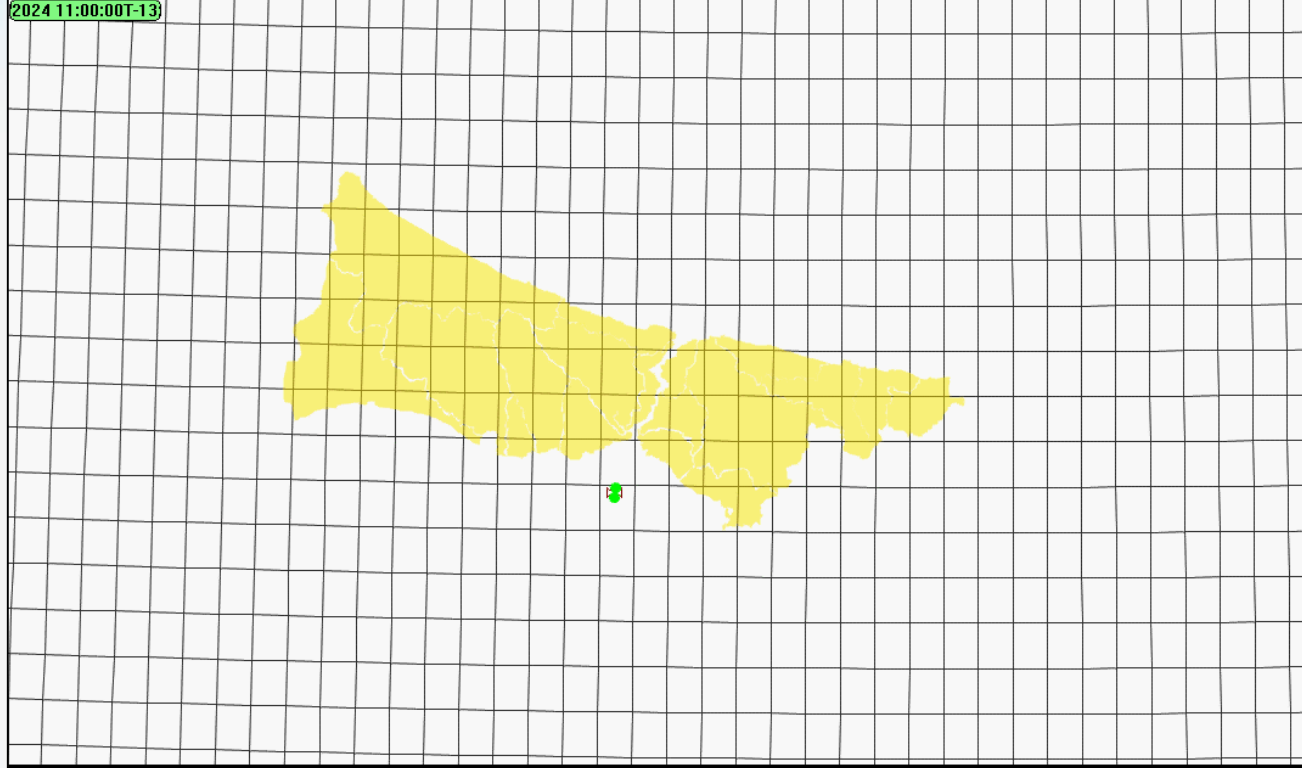
Flood Early Warning System in ISKI?



- 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 İSKİ?

2024 11:00:00T-13



- 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?

ITEUS_ALARM Tarih ile ↑

▼ Bugün

iteus@iski.gov.tr
Yağış Tahmin Alarmı Sonu 12:00 AM

▼ Dün

iteus@iski.gov.tr
Yağış Alarmı Sun 12:00 PM

iteus@iski.gov.tr
Yağış Alarmı Sun 12:00 AM

▼ İki Hafta Önce

iteus@iski.gov.tr
Yağış Tahmin Alarmı Sonu 4/8/2024

iteus@iski.gov.tr
Yağış Alarmı 4/7/2024

iteus@iski.gov.tr
Yağış Alarmı 4/7/2024

▼ Üç Hafta Önce

iteus@iski.gov.tr
Yağış Alarmı 4/6/2024

Yağış Alarmı

iteus@iski.gov.tr
Kime: OZGURAY AYDIN, Ridvan KARAGÖZ, Alp Ertuğrul ÖZER, tcarpar@iski.gov.tr, ebkesici@iski.gov.tr, tubakaya@iski.gov.tr, busra.calis@iski.gov.tr, masengun@iski.gov.tr, cay@iski.gov.tr
Bilgi: OZGURAY AYDIN

Peak Value Date: 23/04/2024 06:00:00

Alert ID: 1
Target ID: 7
Target Type: Subcatchment
Priority: 1
Category: HAVZA
Onset Time: 23/04/2024 12:00:00
End Time: 23/04/2024 14:00:00
Peak Value: 9.402171
Peak Value Units: mm/hr
Peak Value Date: 23/04/2024 13:00:00

Alert ID: 1
Target ID: 8
Target Type: Subcatchment
Priority: 1
Category: HAVZA
Onset Time: 23/04/2024 12:00:00
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Peak Value: 6.175037
Peak Value Units: mm/hr
Peak Value Date: 23/04/2024 12:00:00

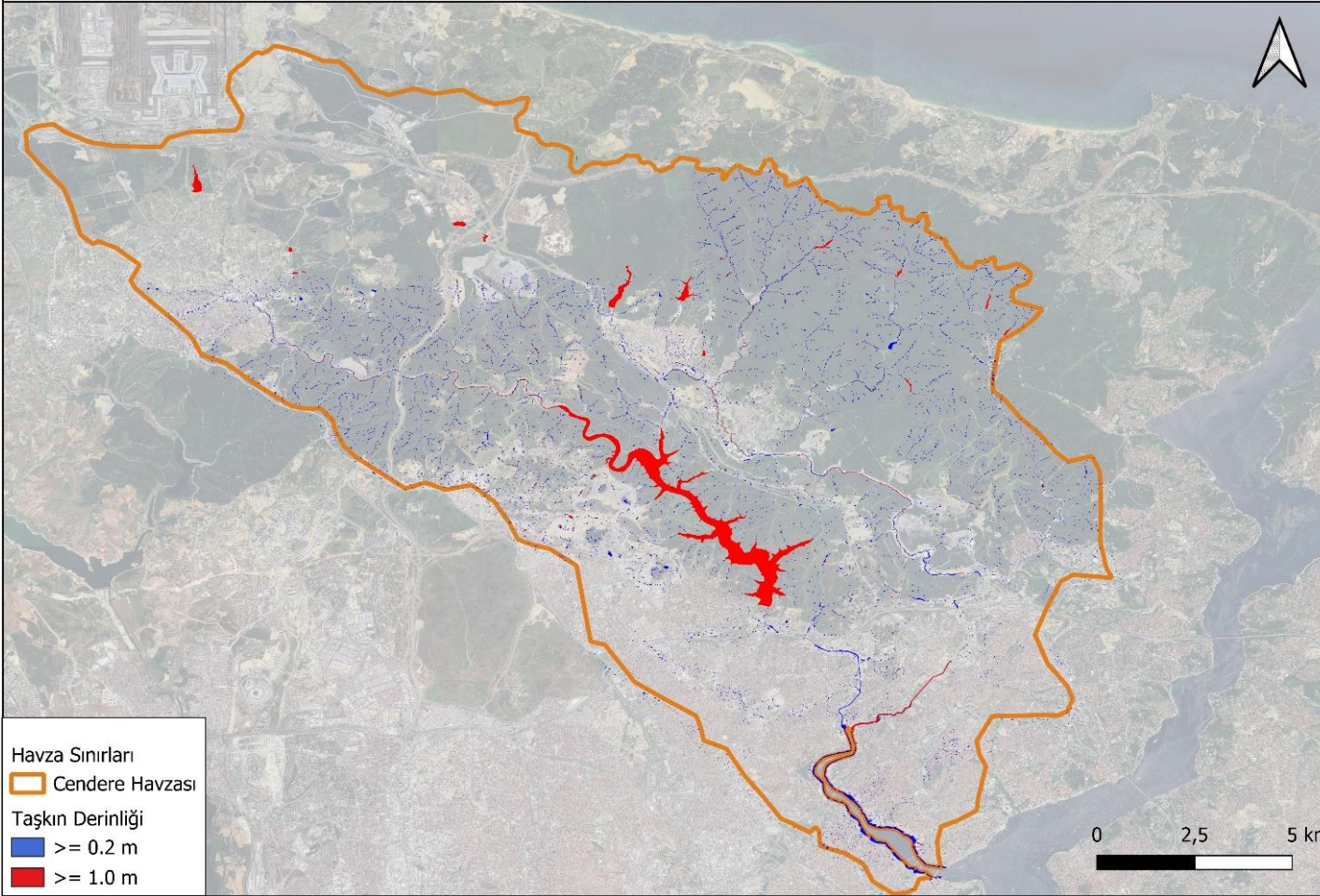
- Through Infoworks ICMLive, an alarm mechanism that generates warnings based on hydrological model results was established, and rainfall alarms began to be given and sent to authorized employees by e-mail.

⚠️ ECMWF_JST

	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
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	1	5	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.990492	mm/hr	21-04-2024 06:00
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	1	7	Subcatchment	1	HAVZA	20-04-2024 12:00	20-04-2024 14:00	6.082229	mm/hr	20-04-2024 12:00
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	1	9	Subcatchment	1	HAVZA	21-04-2024 06:00	21-04-2024 08:00	5.105993	mm/hr	21-04-2024 07:00

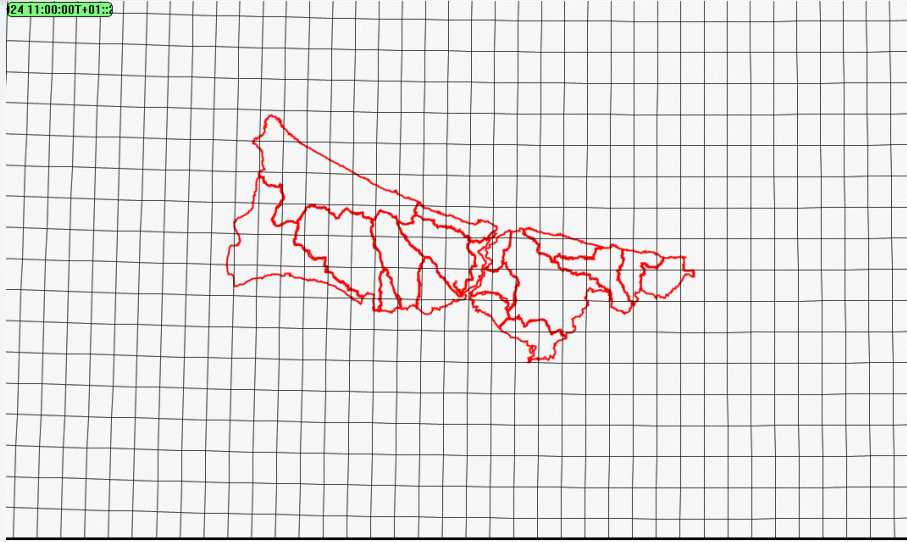
Flood Early Warning System in ISKI?

22/03/2024 - 24/03/2024 TARİHLERİ ARASI TAHMİN EDİLEN MAKSİMUM TAŞKIN DERİNLİĞİ HARİTASI

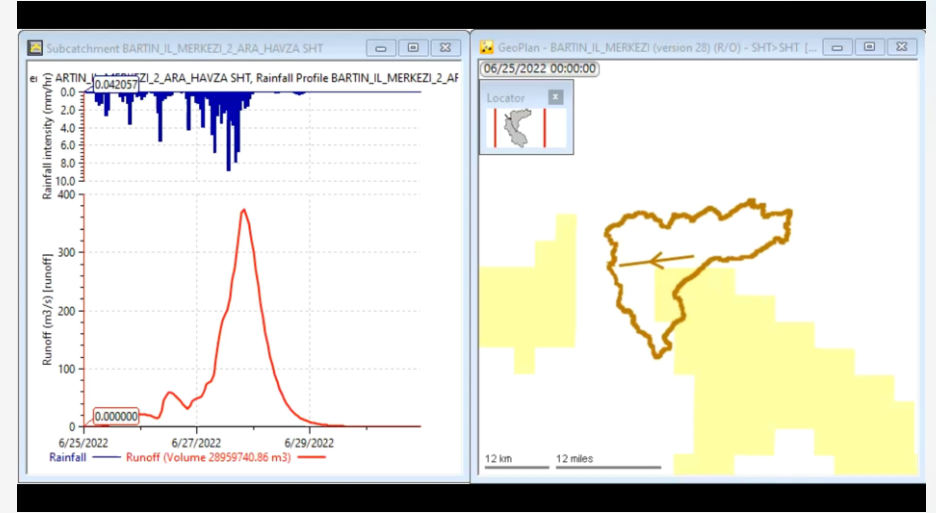


- In a selected sample basin (Cendere), the model was enabled to work hydrodynamically and produce output (distribution area/flood map) every day.

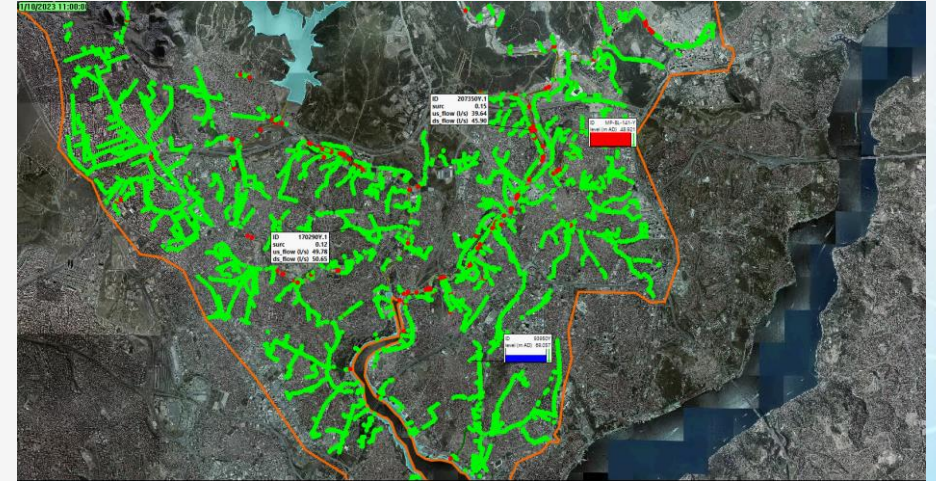
Rainfall Forecast



Hydrological Modelling



Hydrodynamic Modelling



Flow Measurements



Stream Gaging Station



Flow Meter



Dome Camera

Disaster Management



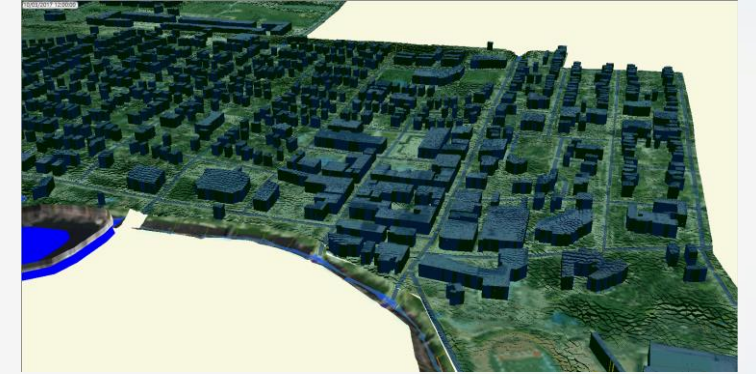
Before Disaster (BeD)

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)

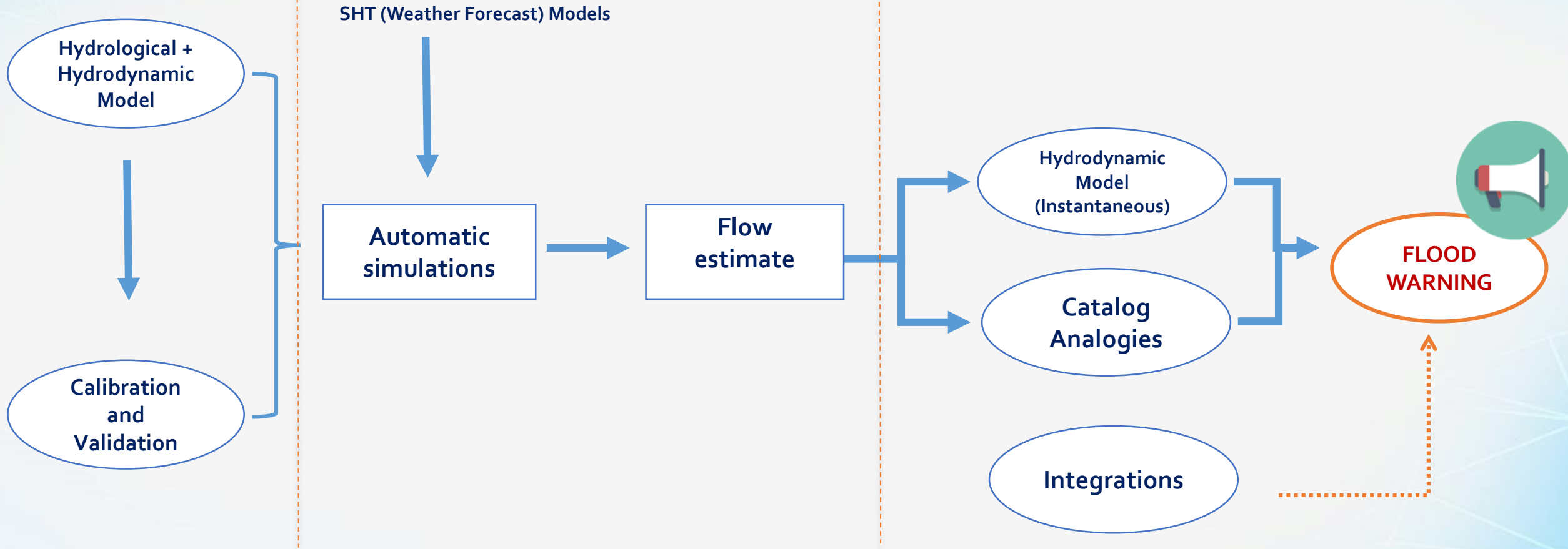
As the situation unfolds, the nowcast serves as a common operational platform, aiding in maintaining situational awareness. It enriches decision-making processes by providing live intelligence on affected individuals, properties, and critical infrastructure, facilitating targeted assistance during critical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