Fight against climate change: "Environmental Security" to reduce & manage disaster risks

New tools for first responders: how to better prepare for climate-driven disasters

- This project focuses on the Maghreb region—Mauritania, Morocco, Algeria, Tunisia, Libya—and the Middle East, including Egypt, Jordan, Palestine, Israel, and Lebanon. In these areas, natural disasters caused by climate change have led to serious issues such as dam collapses, flooding, and earthquakes. These disasters have resulted in thousands of casualties and have destroyed critical economic infrastructure, forcing many people to migrate and creating humanitarian crises.

Tunisia
Morocco
Mauritania
Algeria
Libya
Lebanon
Palestine
Jordan
Israel
Egypt

Funded by the EU

SDGs

How can new technologies help prevent, prepare and respond to climate-driven disasters?

- Over the past five years, the impacts of climate change on the environment have become increasingly severe, characterized by rising global temperatures and intensified extreme weather events. These changes pose significant threats to human communities and natural ecosystems, leading to disruptions in wildlife and biodiversity. The ongoing melting of polar ice caps contributes to rising sea levels, endangering coastal regions, while ocean acidification jeopardizes marine life, including coral reefs.

- Tackling these urgent environmental challenges requires global teamwork and immediate action. Let's all get involved to fight against climate change and adapt to its impacts. Every small effort makes a difference, and together, technologies can help create a better and more sustainable future for our planet!

Setting up a digital environmental security tool “SAVE” in the climate change frame.

- One of the major activities of ISTC is to help specialists prepare for and deal with natural disasters like fires and floods or earthquakes. ISTC works with government teams to ensure their prevention preparedness for natural disasters.

In this project an innovative digital tool named SAVE(Space Analytics for Visual Environments) has been developed by the ISTC Technology Team. This tool uses information from satellites and smart computer programs to monitor where and how disasters like fires, floods, and earthquakes could occur. It also monitors critical infrastructure, such as dams, bridges and hospitals that might be affected.

SAVE helps people anticipate what might happen, plan for different situations and respond quickly when disaster strikes.

It is designed for emergency responders to help them identify problems early and prepare to keep people safe and reduce damage to the economy.

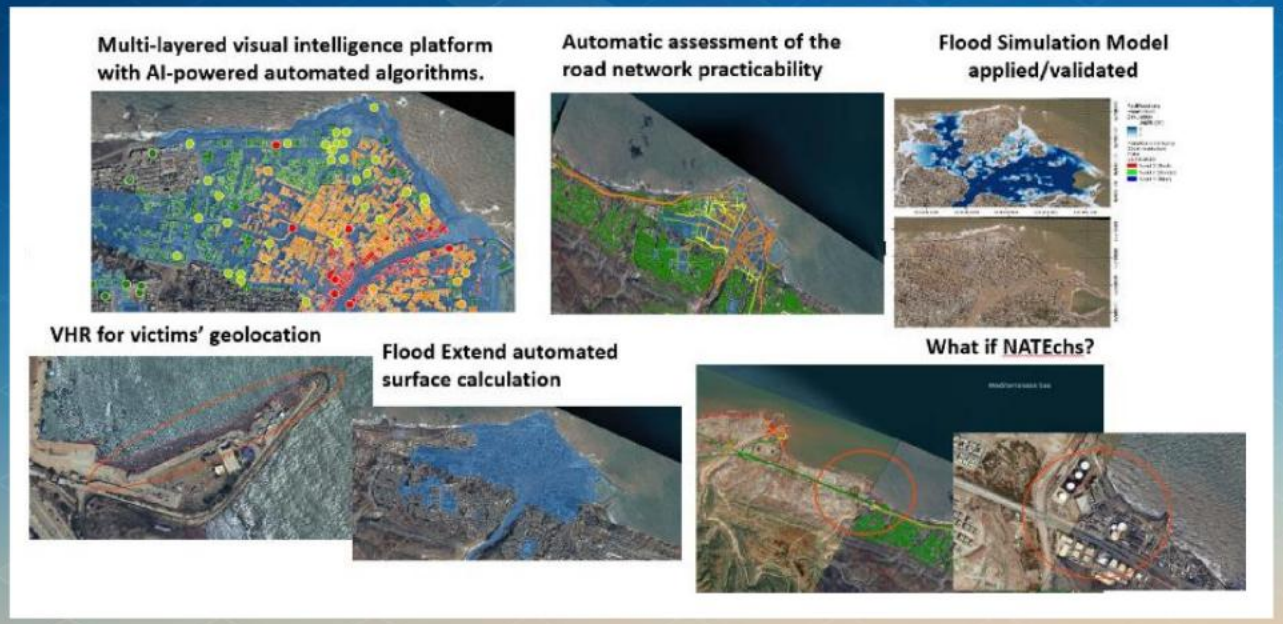
How earth observation data can make our world safer

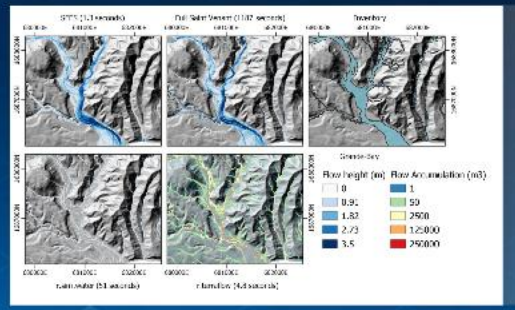
- Satellites, a powerful tool for collecting data from the sky above, are being used in this project. Digital maps can be created from satellite data, which resemble video games but actually represent the real world.
- Ground stations deployed in advanced countries collect this digital data. These stations are the big antennas you might see in some places in Japan.

ISTC is an Associate Partner of the European Spatial Agency (ESA) for the Program “European Resilience from Space” (ERS).

This data can be turned into a digital map of the rivers, using different colors to indicate pollution levels.

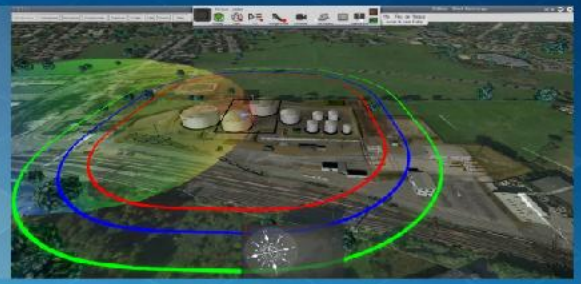
The same information is also used to monitor dam movements and check for possible collapse. All these features will be available on ISTC digital platform, helping specialists make the right decisions.

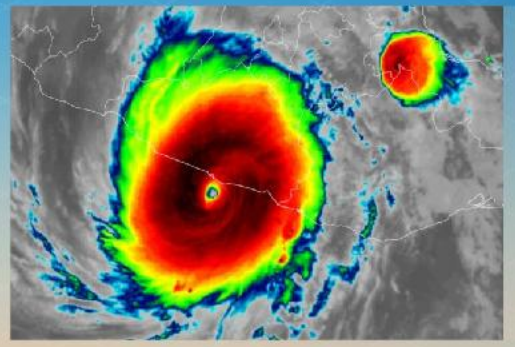




Fast flood algorithm allows flood simulation base on a digital Map. We can change the amount of water to see impacts on the infrastructures, agriculture etc..

Digital Twins allows to simulate explosion, fire and blast effect areas.





Monitoring thunderstorms using meteorological radar enables us to predict the amount of water and simulate the extent of flooding in the area likely to be flooded.

How the digital platform SAVE(Space Analytics for Visual Environments), an ISTC decision-support tool, works for prevention, preparedness, and response.

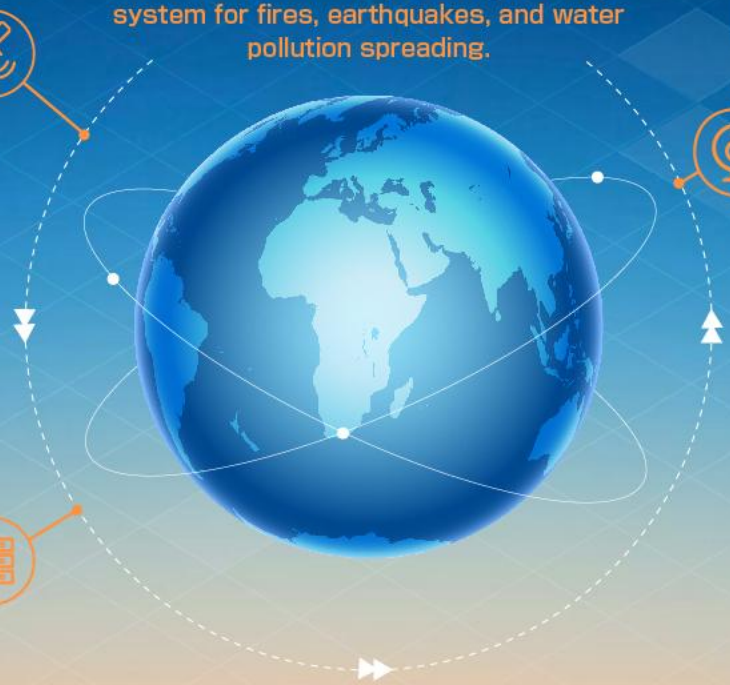
Step 1
Tasking Definition for Satellite Data

Tasking for satellite data is defining what is needed for satellite observations. This involves selecting the area, time, data type (like imagery), and required resolution to best use satellite resources for specific needs, such as environmental monitoring, disaster response, or agricultural assessment.

Step 2
Merging Satellite Data into Database

The data is merged into a database, and land cover is visualized. The Digital Elevation Model provides a 3D view of the terrain, useful for various applications offered by ISTC. We then apply our algorithms to achieve the expected results.

SAVE covers most cases of existing disasters, such as flooding, fire monitoring and fire spreading, earthquake monitoring, and later, an early warning system for fires, earthquakes, and water pollution spreading.



Step 3
Data Merging for Safety Preparedness

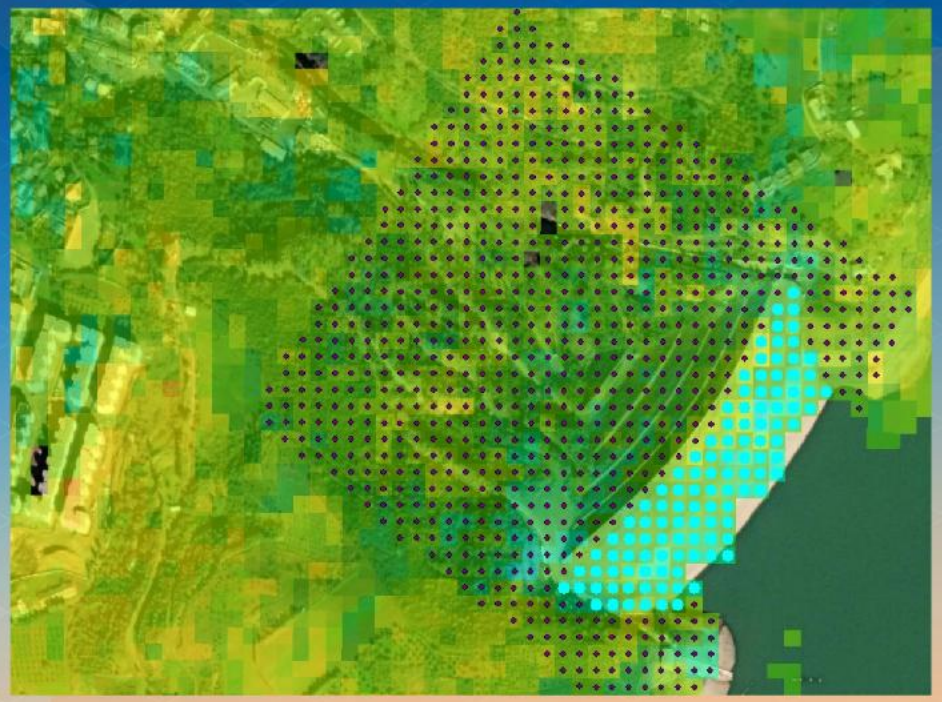
The analysts' work is to combine data and create a digital terrain map. This is done by analysts from different countries' space agencies or the ISTC Tech team, based on available skills. Civil protection specialists share details about critical infrastructure in their countries, such as dams, reservoirs, hospitals, schools, power lines, pipelines, and industrial facilities. Once data is geolocated, civil protection and risk assessment specialists analyze it to create simulations for first responders to develop contingency plans and prepare effectively.

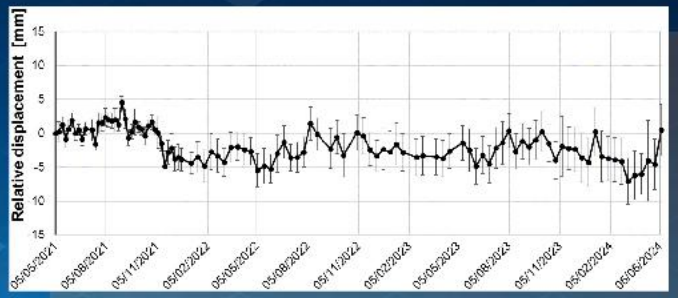
Real case of Algeria Keddara Dam – Dam Movement

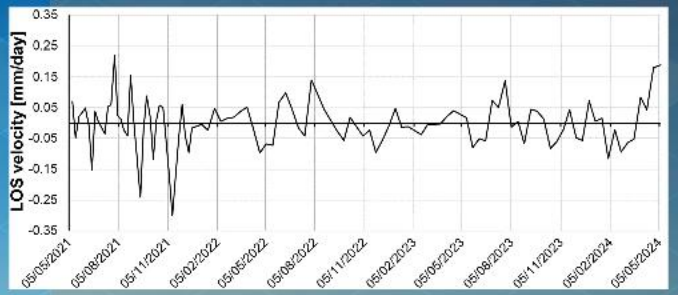
- The following slides will provide an overview of the results derived by Geospatial Insight (GSI) from satellite INSAR analysis of surface and structural movement:

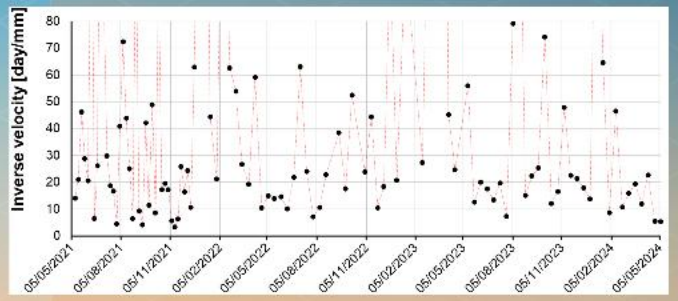
The dam structure as a whole does exhibit some minor cyclical deformation

Overall, there is no obvious sign that the Keddara Dam is approaching brittle failure





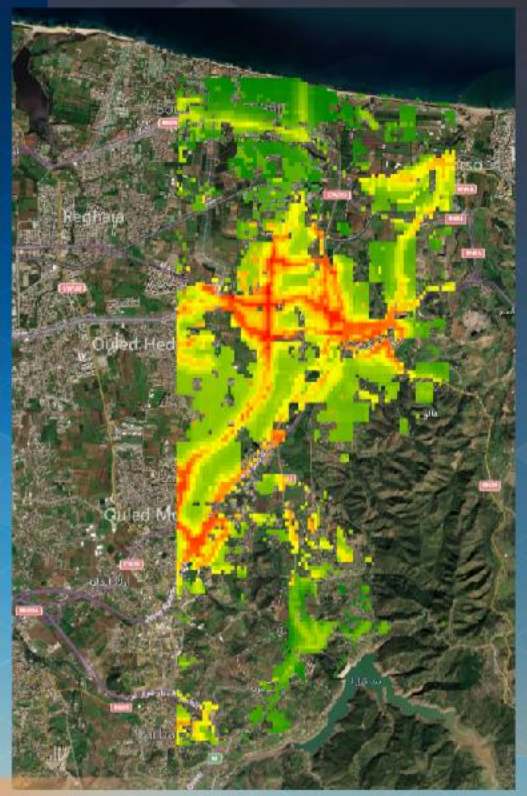




Flood and population density

Higher FastFlood Model

Median FastFlood Model

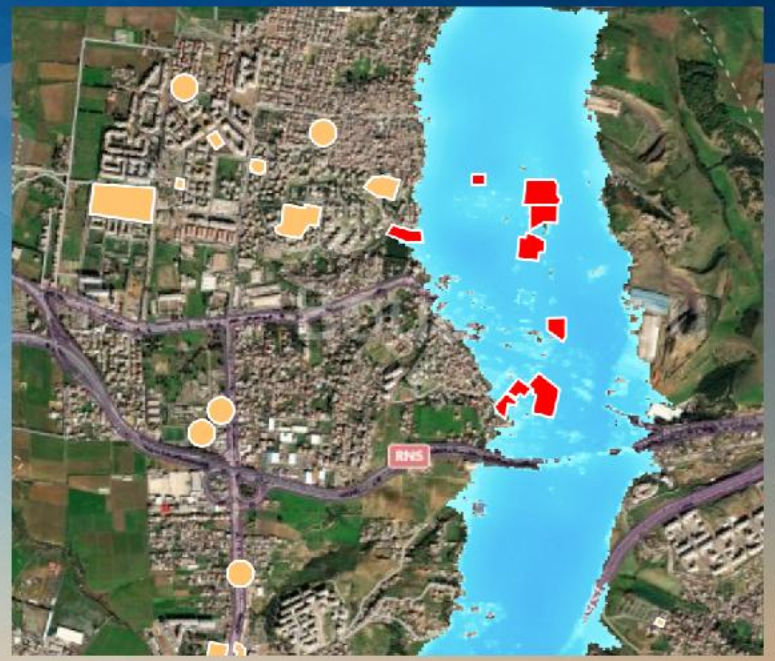


Population Density

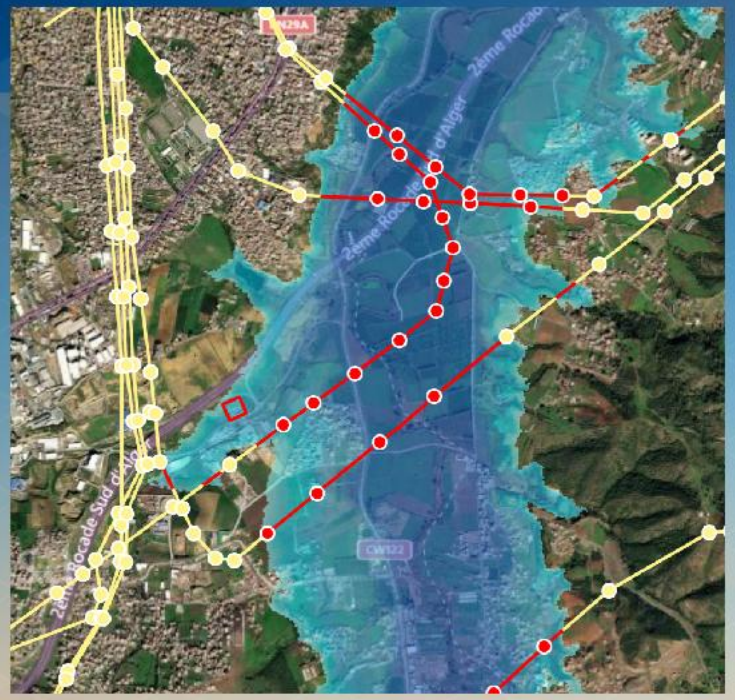
The comparison of the flood model results with the population density map indicates that extensive areas within densely populated regions of the catchment would be significantly impacted in the event of a dam collapse.

Critical infrastructure analysis – education infrastucture

Two images that show different regions of the catchment which contain schools within the predicted median flood model.



Critical infrastructure analysis – energy network

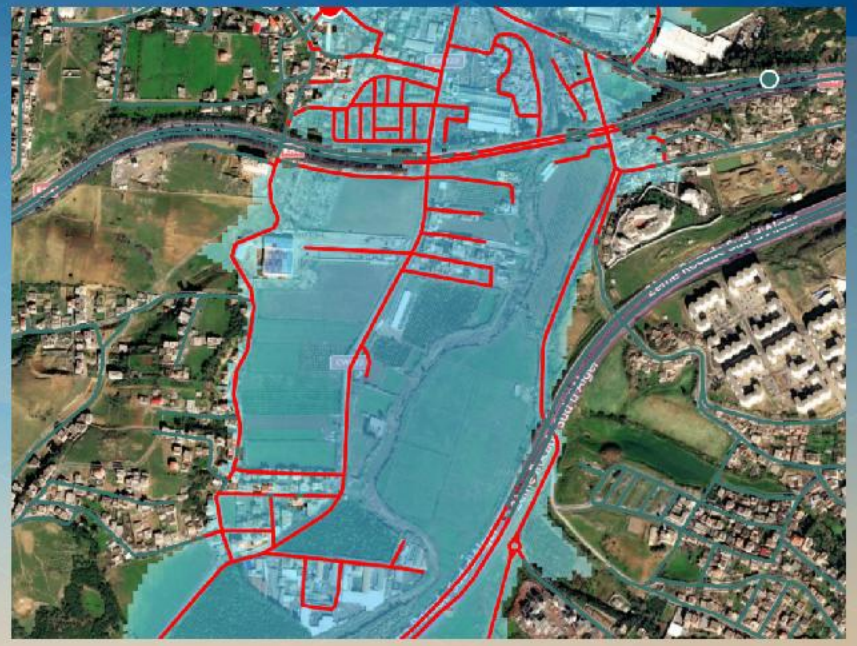


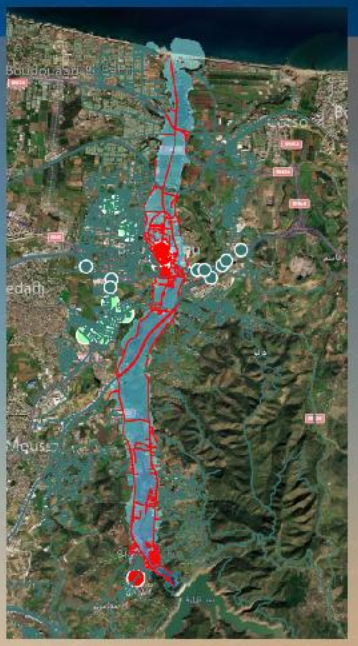
Based on the q85 flood model, a greater proportion of power lines and towers will be severely affected by any flooding event.

Resulting in significant power loss across the area

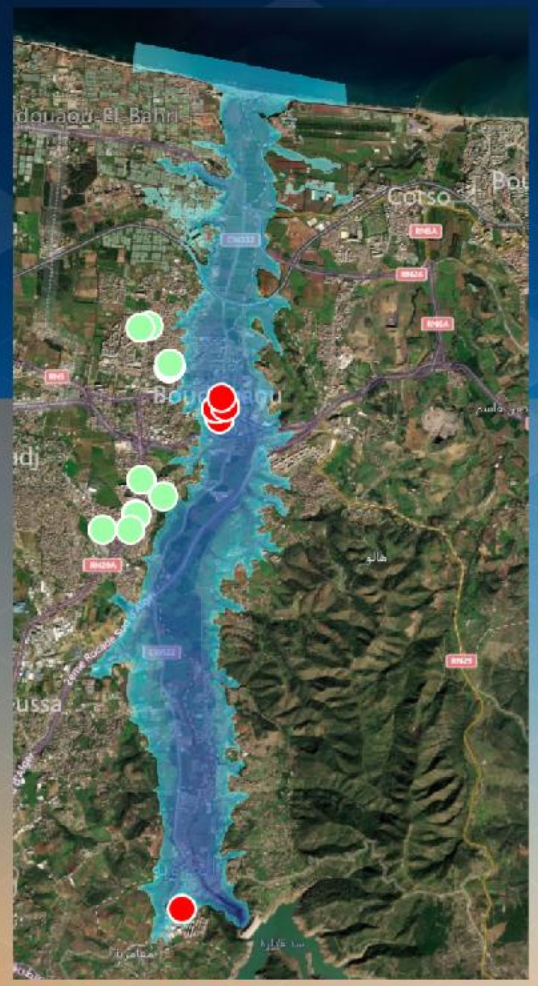
Critical infrastructure analysis – transportation network

Assessing the road networks compared to the results from the median flood model, many of the main roads connecting Algiers to the East Coast would be affected, creating logistical issues for emergency responders and aid providers





Critical infrastructure analysis -health infrastructures



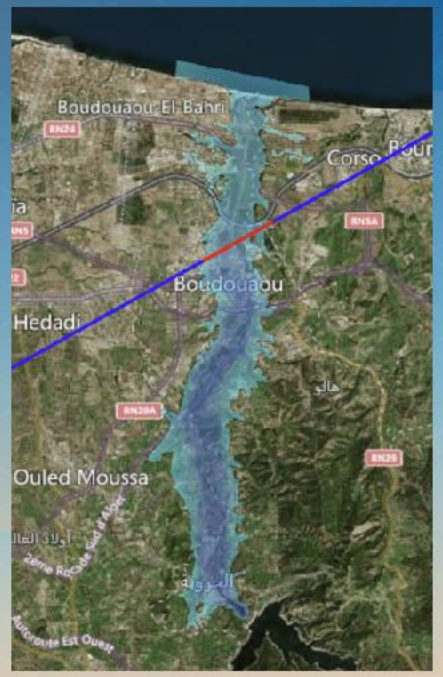
Based on the q85 flood model, more pharmacies and hospitals would be at risk.

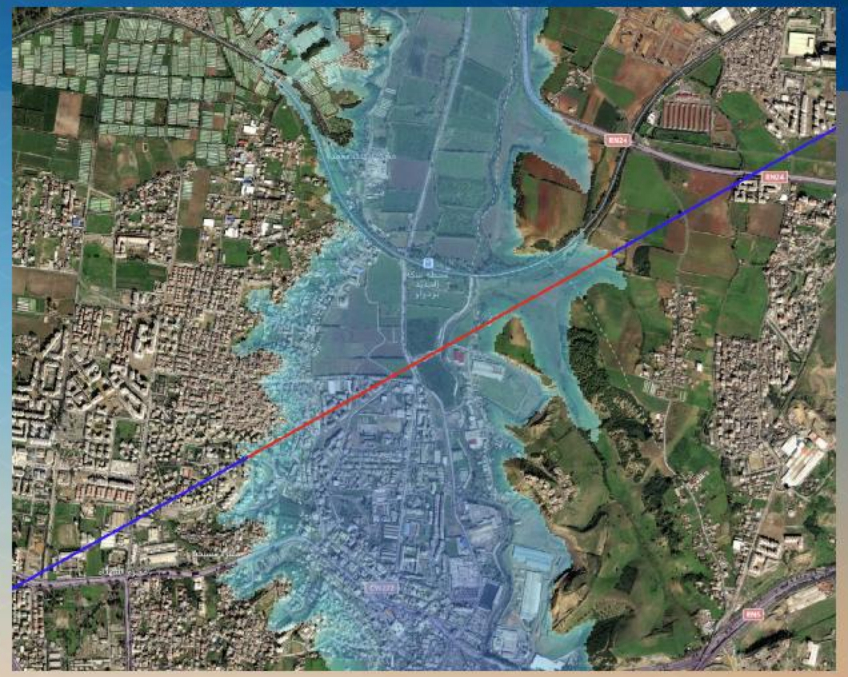
Resulting in fewer locations being suitable to provide aid relief.

Critical infrastructure analysis – oil and gas

The images show the main oil and gas pipeline that runs through the area of interest for the q85 flood model.

Based on the model a larger section of pipeline will be affected. Increasing the risk of damage to the pipe, causing energy supply issues and pollution to the flooded area.





Technologies that contribute to building disaster resilient communities

Better Preparedness: Countries will be more ready to handle natural disasters like floods and earthquakes with improved tools and resources.

Stronger Responses: Emergency response systems will become more efficient, helping teams work together quickly during a crisis.

Early Warning Systems: New alert systems will provide timely warnings about potential disasters, keeping people safe.

Smart Risk Assessment: Communities will learn more about their risks and vulnerabilities, which will help them plan better and use resources wisely.

Easier Information Sharing: Tools will be created to help share important information quickly, making it easier to make good decisions during emergencies.

Partnerships: Collaboration with the ESA (European Space Agency) Civil Security from Space (CSS) program will bring advanced technology and Earth data to support disaster response efforts.

Focus on Safety Risks: There will be a greater emphasis on understanding and preparing for chemical and nuclear risks, making communities safer.

Digital Observatory: A new digital observatory will help monitor environmental risks and improve teamwork between countries.

Community Involvement: Local people, especially youth and volunteers, will be more engaged in disaster planning and response, building stronger communities.

Continuous Learning: Training programs will help local responders and community members build skills for long-term disaster preparedness.

- In conclusion, this project represents a significant step towards fostering resilience and cooperation in the Mediterranean region. The project aspires to create a safer and more secure environment for the diverse populations of the Mediterranean countries, while strengthening their collective ability to respond to and recover from various crises.