Technical session on AI tools – Session 2

Two sessions will take place in parallel. Representatives from the same Member or Participating State are encouraged to cover both sessions between themselves.

13:15 – 16:15, Including coffee break

4) <u>Innovative solutions for DRM developed by EU funded projects and Member States</u>

- **C2IMPRESS** Horizon Europe project, *Serhan Karahan*
- **SAFE-LAND**, Knowledge For Action in Prevention and Preparedness project, *Elisabetta Cattoni, Francesco Pistolesi*
- **French National Fire Officers Academy (ENSOSP)**, *Quentin Brot* and **Entente VALABRE**, *Philippe Meresse*
- **CARMA**, Horizon Europe project, *Alexandre Ahmad, Nicholas Vretos*
- **SYNERGISE**, Horizon Europe project, *Sabina Ziemian*

Co-Creative Improved Understanding and Awareness of Multi-hazard Risks for Disaster Resilient Society

C2IMPRESS Project Introduction & Tools

Serhan Karahan
SAMPAS

16 June 2025

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS C**O**-CREATIVE **IMP**ROVED UNDERSTANDING AND AWARENESS OF MULTI-HAZARD **R**ISKS FOR DISASTER **RES**ILIENT **S**OCIETY

Project Information

Duration:
3 years Oct 22- Sep 25

Consortium:
16 partners

HORIZON-CL3-2021-DRS-01
Disaster-Resilient Society

7 countries

Budget:
Euro 4.17 Million

4 Case study areas

Egaleo-Greece

Ordu-Turkey

Centro Region-Portugal

Balearic Islands-Spain

Main Hazards

Floods

Heat Waves

Wild Fires

Earthquake

Landslides

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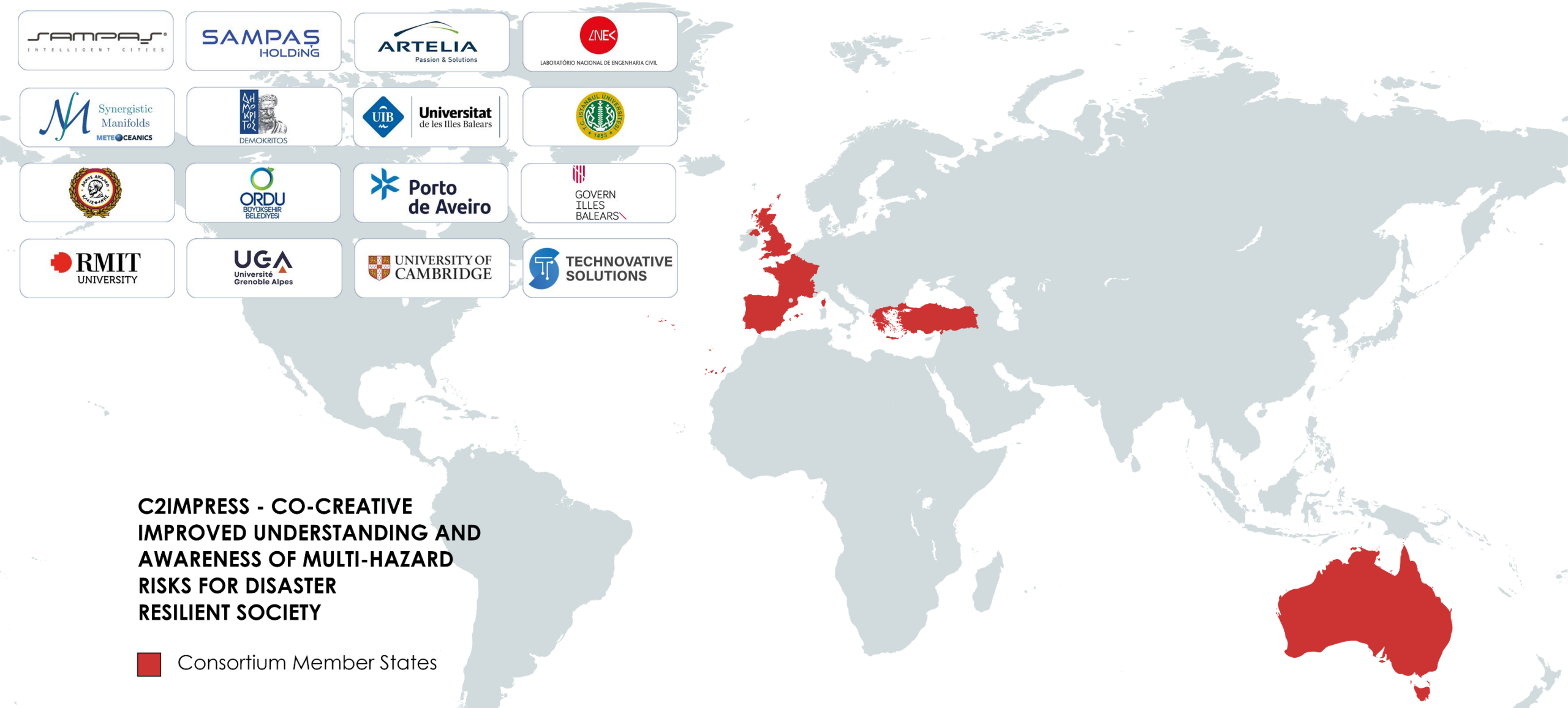
Consortium Members



C2IMPRESS - CO-CREATIVE IMPROVED UNDERSTANDING AND AWARENESS OF MULTI-HAZARD RISKS FOR DISASTER RESILIENT SOCIETY

Consortium Member States

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

Turkey, France, Portugal, Greece, Spain, United Kingdom, Australia

C2IMPRESS Platform & Integrated Tools

Simulation Models

System-of-Systems for m...

Agent Based Model & Hum...

Risk & Resilience

Risk and Resilience Frame...

Disaster Monitoring and O...

Hazard Monitor App

Guidelines & Methods

Public-Private-Civic Partn...

Citizen Engagement Frame...

ICCA-MHDMF

Polycentric Risk Governan...

C2IMPRESS developed vast number of different "disaster management and monitoring tools" powered by different AI tools for maximizing the policy makers act on the disasters **BEFORE, DURING and AFTER** the incidents. These tools gathered under C2IMPRESS Platform to access all tools at **ONCE.**

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS Platform & Integrated Tools

Risk Management and Decision Support Tools

HazardActionEye

Multi-Criteria Analysis

Spatial Multi-Criteria Decis...

DPSIR and PESTLE

Social Media Data Support ...

Big Data-Powered Decisio...

Map Server

Early Warning and Forecasting System

HIDRALERTA

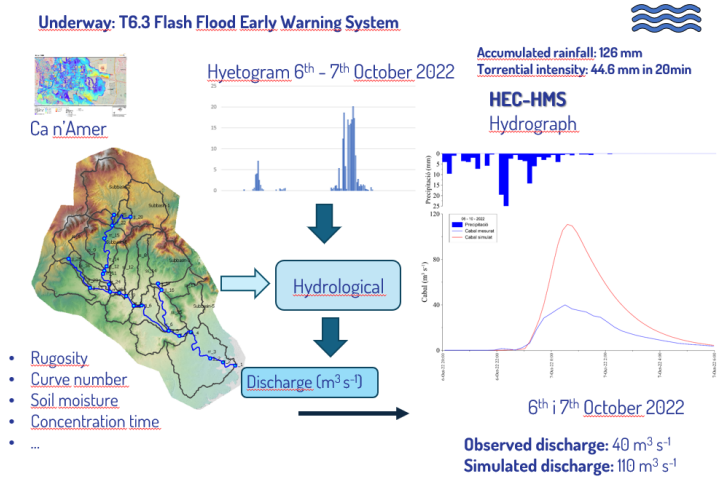
Fluvial Flooding and Landsl...

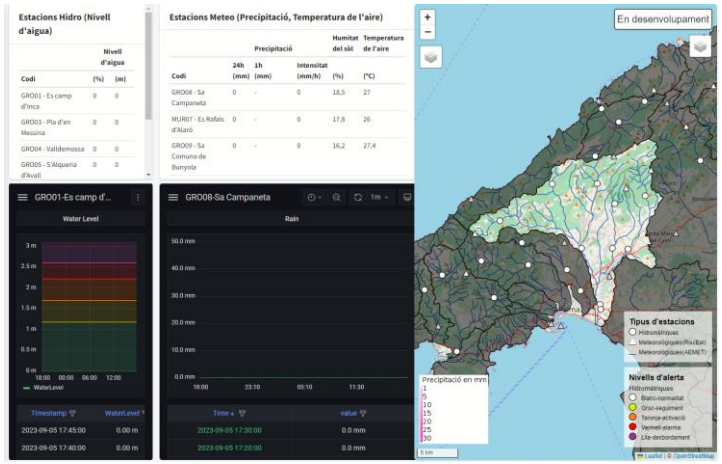
Multi Hazards in the Baleari...

Weather Forecasting Egaleo

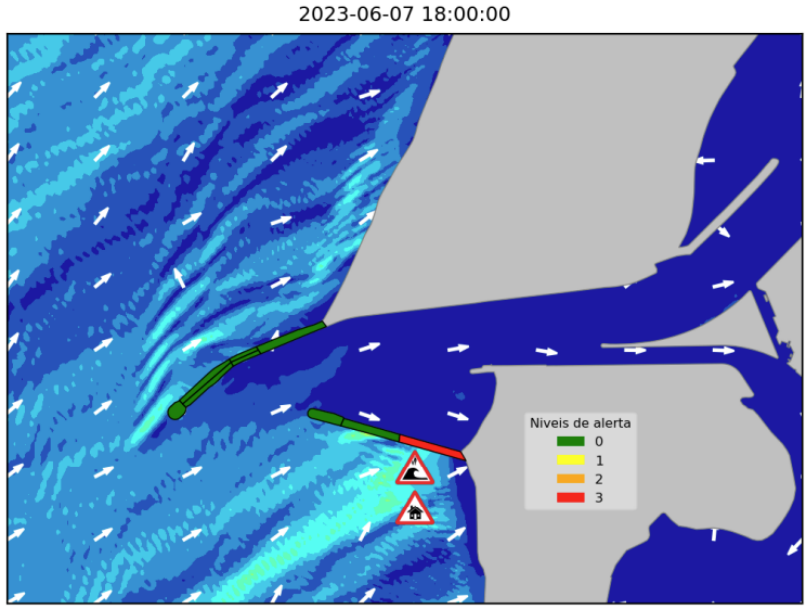
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

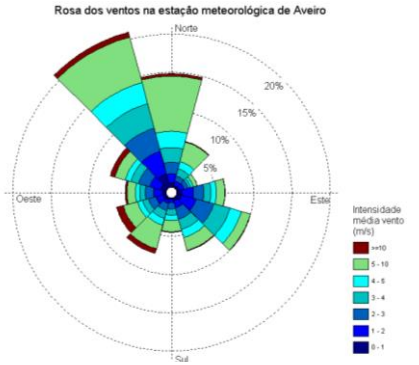
C2IMPRESS Early Warning Systems Developed in Spain & Portugal

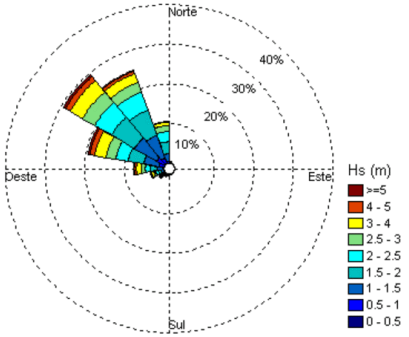




Flash Flood & Wildfire Early Warning System in Mallorca







Numerical Modelling: Ship Behaviour

Flooding Early Warning System in Portugal

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS System-of-Systems ESDI platform and holistic Multi-Hazard Risk intelligence network – Synthetic IPAI-ESDI Experiments of Coevolutionary Multi-Hazards

Developed New Augmented Information Physical Systems Intelligence (AIPSI) for enhanced spatiotemporal early detection, attribution, prediction and decision support on multi-hazards. Deployed to simulate disasters arising from single and coevolutionary multi-hazards across a sample of synthetic settings representing realistically inspired circumstances. This has been achieved through IPAIESDI.

Simulated flash flooding and consequent village damage in a synthetic tight valley of Alpine inspiration.

Simulated surge overtopping and flooding on a synthetic coastal town of Southern European inspiration.

Simulated wildfire on a synthetic rural environment of Southern European inspiration.

Simulated Triadic Disaster (synergy among Earthquake, Urban Fire from gas leak, Flood from dam break).

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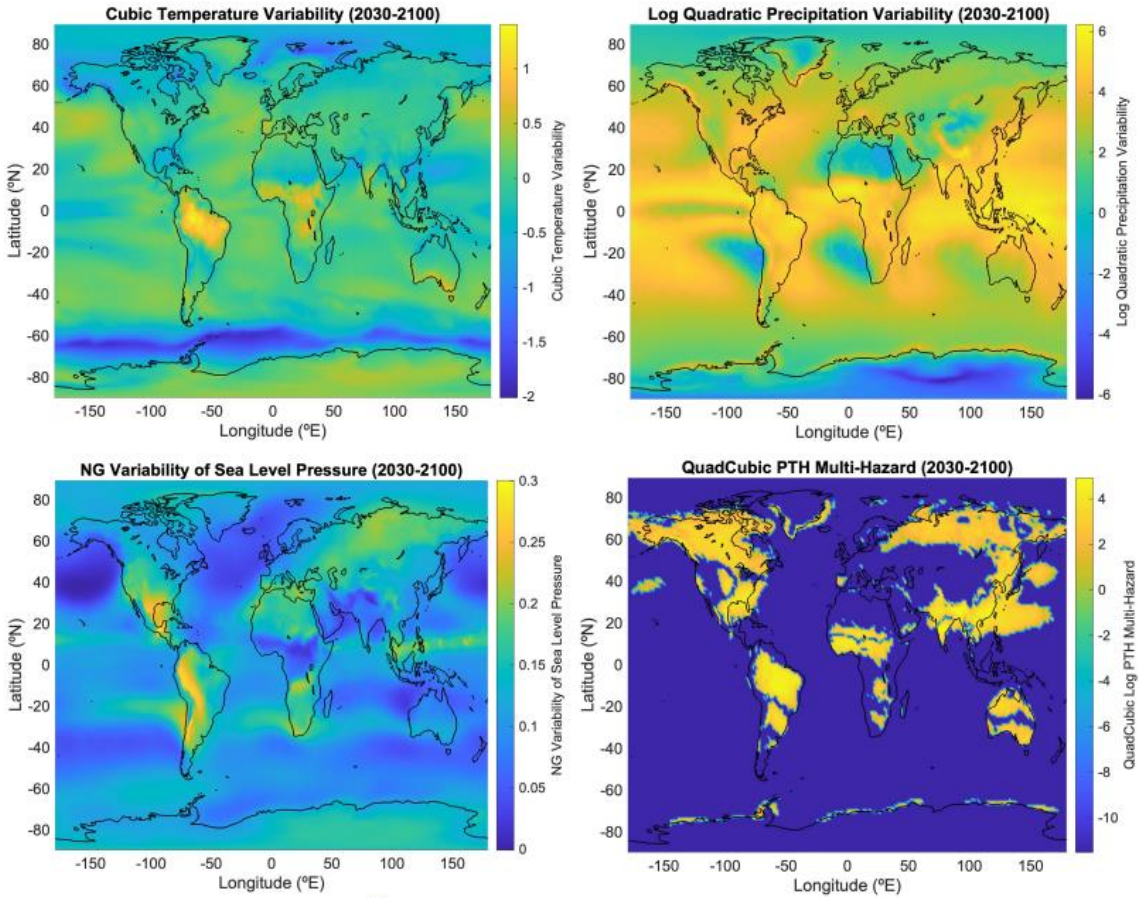
C2IMPRESS

System-of-Systems ESDI platform and holistic Multi-Hazard Risk intelligence network – Forecasting of Climate Behaviour

SoS4MHRIN in action

- Long-term Earth system dynamics beyond SoA;
  - 1.296 billion timeseries all over the world
  - 4x finer resolution than SoA GCM and ESM
  - Nonlinear Predictive Lead increased 10-fold
- System dynamic intelligence beyond GA:
  - Full dynamics with daily series for whole planet
  - Unveiled new spatiotemporal multi-hazards
  - Not just data-driven. We see beyond the data
- Quality and benchmarking tests beyond data science:
  - Optimized structural-dynamic spatiotemporal robustness, uncertainty and predictability
  - Ensuring mathematical, statistical, dynamic, bio-geo-socio-physical robustness amidst chaos
  - Powered by MET's pioneering ESDI, AIPSI, IPQuTI



Synergistic Manifolds METEOCEANICS C2IMPRESS

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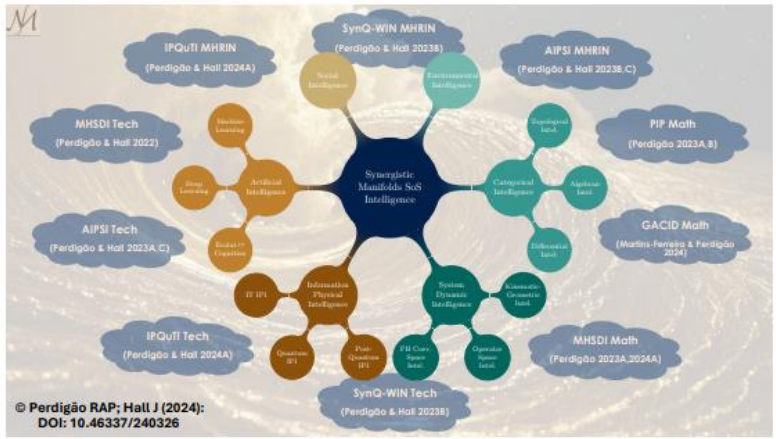
C2IMPRESS

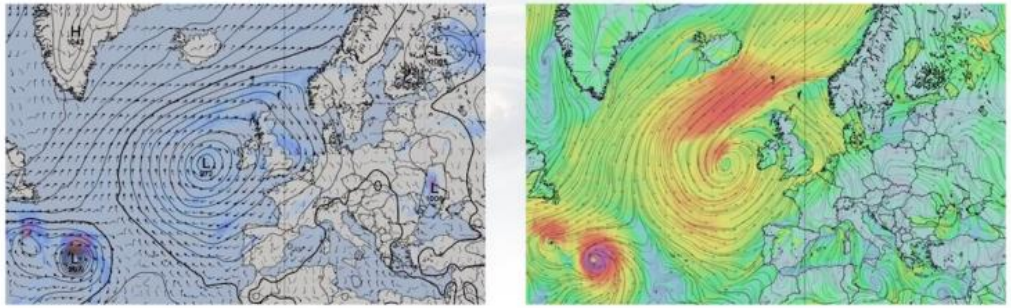
System-of-Systems ESDI platform and holistic Multi-Hazard Risk intelligence network – Forecasting of Climate Behaviour

SoS4MHRIN in brief

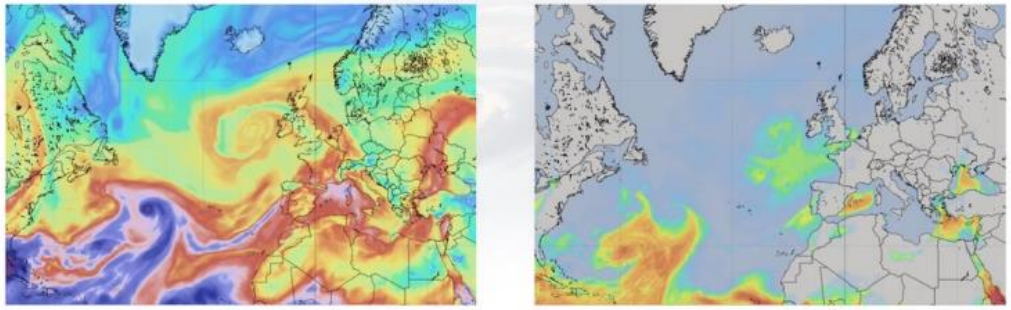
- SoS4MHRIN is not just a model. It is system-of-systems
  - Multiscale multidomain multimodel structures
- Dynamic interplay among nature, technology, society
  - Not mere forcings. All is mathematically coupled.
- Beyond physics and beyond AI, leveraging MET SoS Intel
  - New mathematics, new methods, new technology



Operational Earth System Dynamic forecasting leveraging SoS4MHRIN



Multi-hazardous HyMetOc thermodynamic potentials as early warning signs to extreme events



SoS4MHRIN ESDI sensing, analytics and modelling are not bound to a specific area.
We are portable, from local to global, from event scale to long-term climatic scale.

Synergistic Manifolds METEOCEANICS C2IMPRESS

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C2IMPRESS

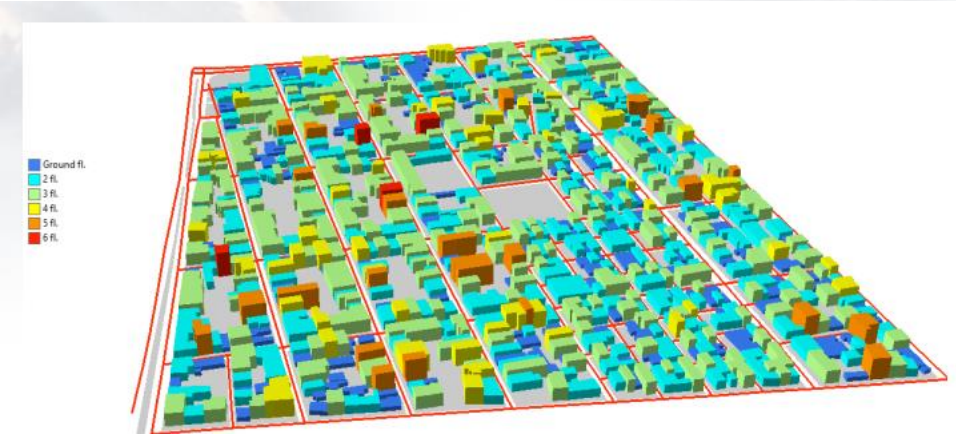
C2IMPRESS Simulation of the effect of people's attitude towards multihazard risk exposure and awareness scenarios using ABM and Integration with SOS4MHRIN – "Agent Based Human Behaviour Modelling"

Population Data

- Initial census and demographic data collected.
- Currently processing information to obtain synthetic population.

Infrastructure Data

- GIS data collected
- Relevant information available
- Commercial / Residential use
- Building information (e.g. floors)



Movement Behaviour Simulation developed within C2IMPRESS showing the evacuation routes of the public during a disaster

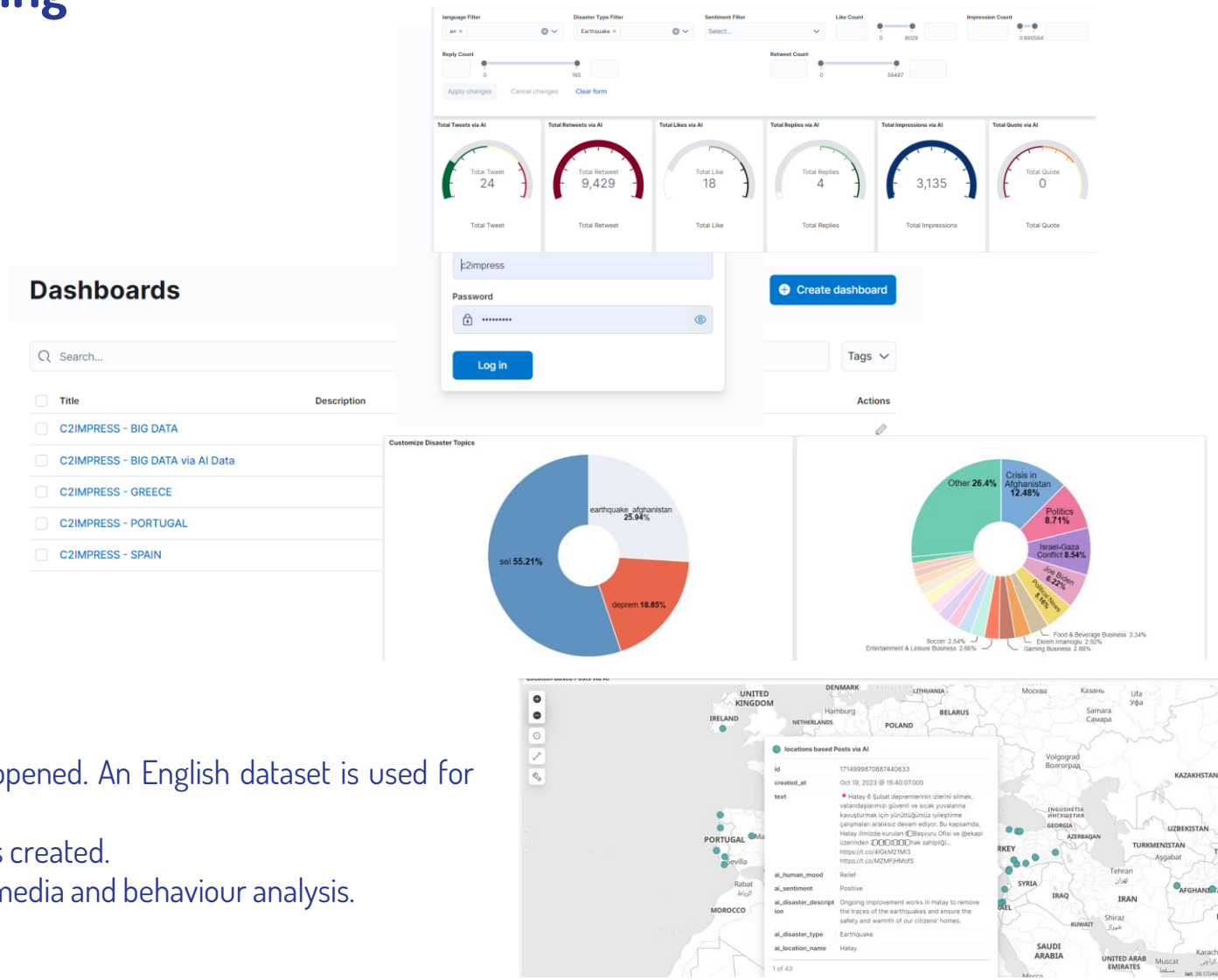
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS

“C2IMPRESS Social Media Data Platform” for simulation, modeling and citizen behaviour analysis and understanding

Data Flow Pipeline

- Real-time API collection from Twitter, Instagram, YouTube, TikTok
- Language detection & translation via Flask-based Model API
- Parallel analysis: Sentiment, Disaster Detection, Topic Classification
- MongoDB storage + Elasticsearch indexing for real-time search
- Kibana dashboards + Alert generation via RESTful APIs



- Social media analysis and visualization platform has been opened. An English dataset is used for testing, visualization and analysis.
- The general framework of the social media data analysis was created.
- 1 to 1 meetings with partners to define their needs for social media and behaviour analysis.

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS Social Media Data Platform

Platform Summary

- Analyzes real-time and historical social media data during disasters
- Provides actionable insights for decision-makers and first responders
- User-friendly interface suitable for non-technical users
- Operationalized for natural disasters and crisis events

Key Features

- Real-time and historical data analytics
- Interactive dashboards for multiple social media platforms
- Customizable dashboard views and filters
- Drill-down capabilities for detailed insights

Dashboard Overview

- Main Dashboard: Consolidated view of all platforms
- Platform-Specific Dashboards: Twitter, YouTube, TikTok, Instagram, News
- Dashboards support filtering by sentiment, location, content type

Main Dashboard Capabilities

- Number of mentions and trending topics
- Real-time monitoring and sentiment aggregation
- Geospatial visualization and heat maps
- Clustering distribution by time and disaster types

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

C2IMPRESS Social Media Data Platform – AI Integration

- Probabilistic topic detection and dynamic clustering
- Real-time sentiment analysis (positive, neutral, negative)
- Geospatial and trend detection through NLP and clustering
- Language detection and translation support

AI-Powered Analysis – Core Capabilities

1. Sentiment Analysis

Detects emotional tone of social media texts

Identifies positive, negative, or neutral sentiments

2. Disaster Event Detection

Classifies if a post refers to a disaster

Sub-models identify type: earthquake, flood, fire, etc.

3. Thematic Content Detection

Recognizes political, religious, voluntary, or ironic content

Labels tweets to assess community reactions and themes

4. Topic Clustering

Groups posts by emerging topics (e.g. calls for help, news sharing)

Uses NLP and dynamic clustering for topic distribution insights

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C2IMPRESS Social Media Data Platform – AI Integration

Figure 48 C2IMPRESS Social Media Data Analysis Dashboard Interface

Figure 17 Main Dashboard Sentiment Analysis

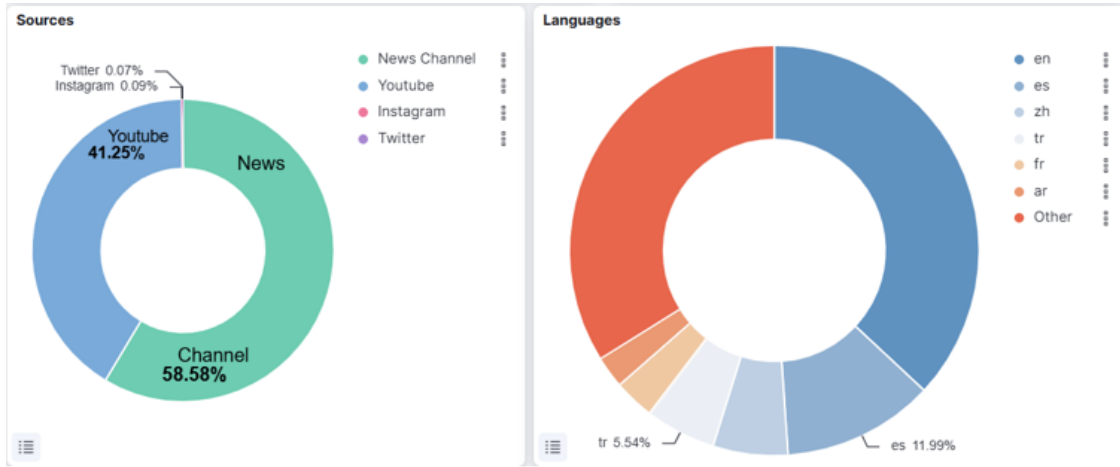

Figure 21 Main Dashboard Languages and Sources

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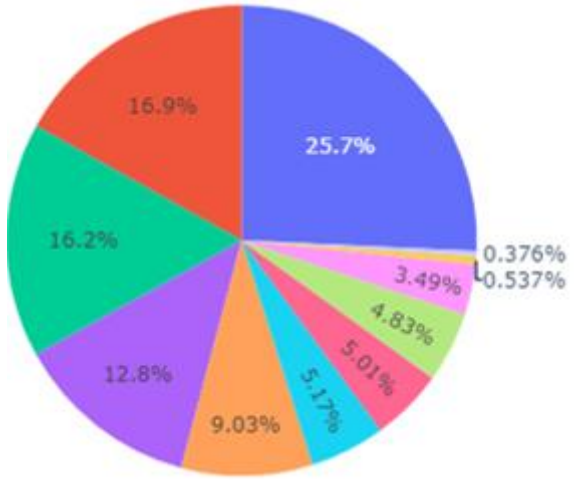
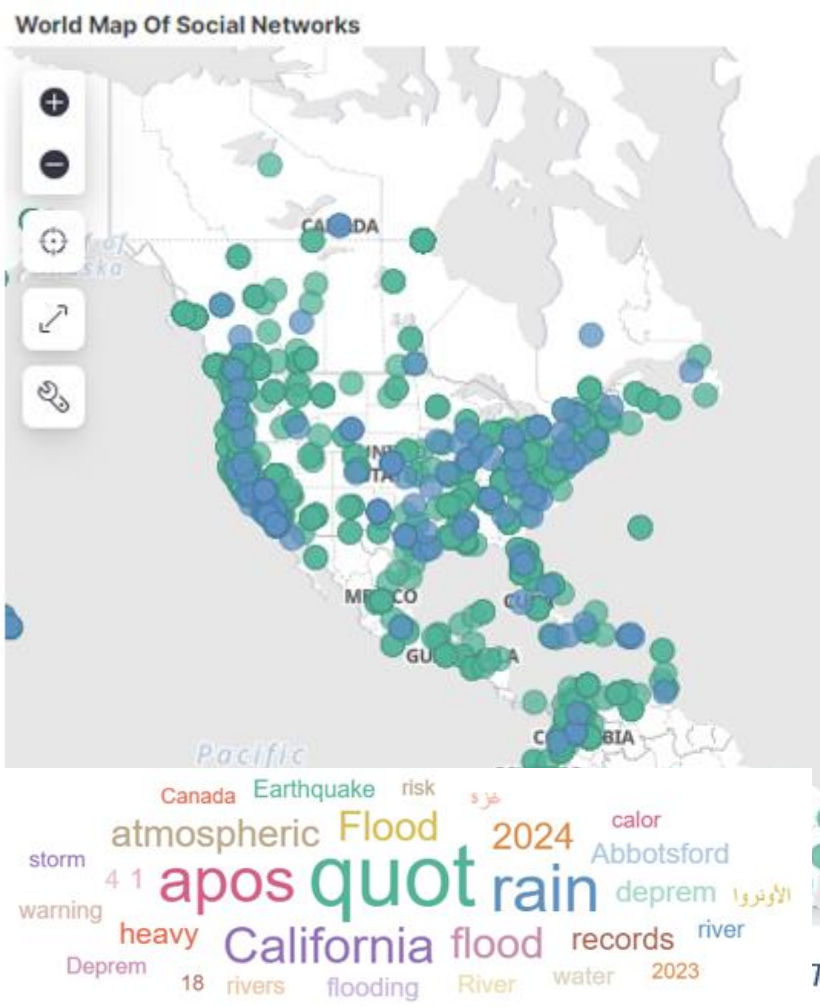
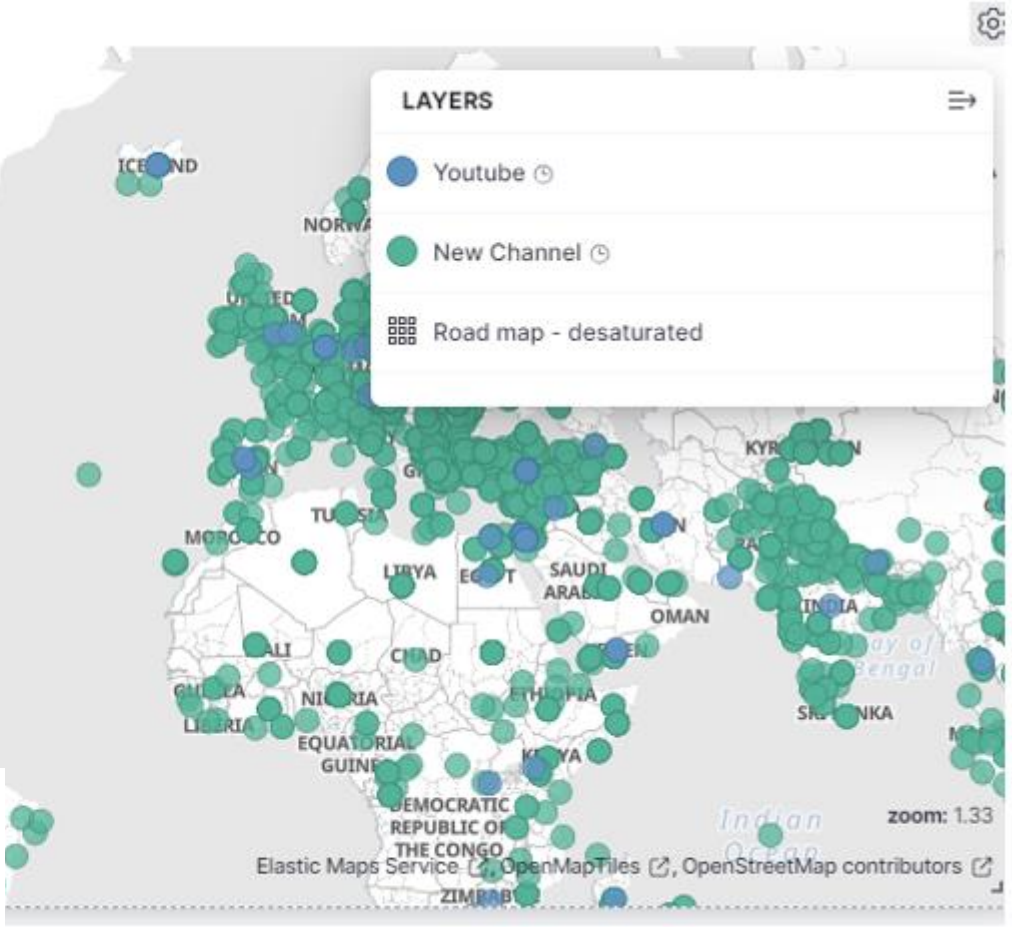
C2IMPRESS Social Media Data Platform – AI Integration







Text Locations – Kibana

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C2IMPRESS Social Media Data Platform – AI Integration

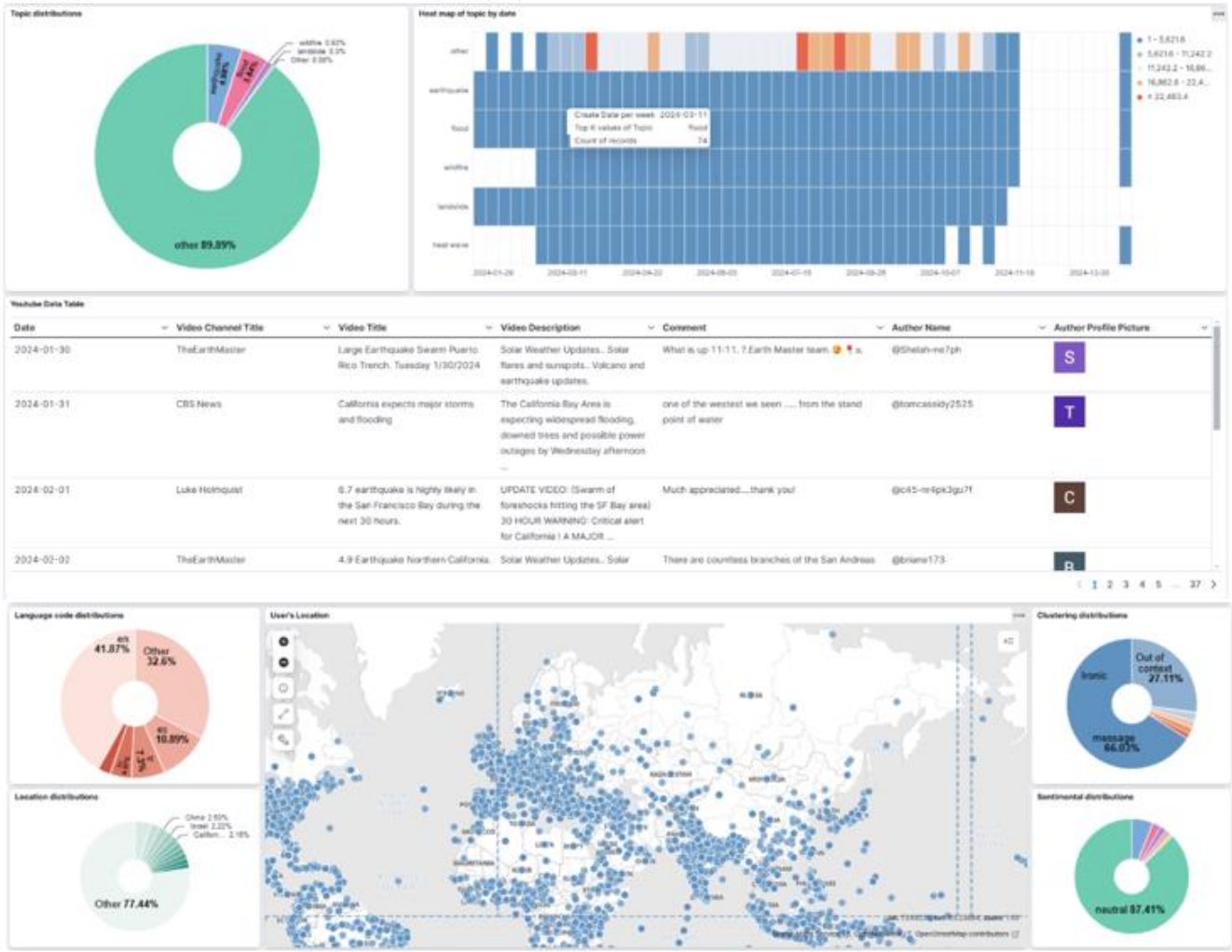


Figure 26 YouTube Dashboard

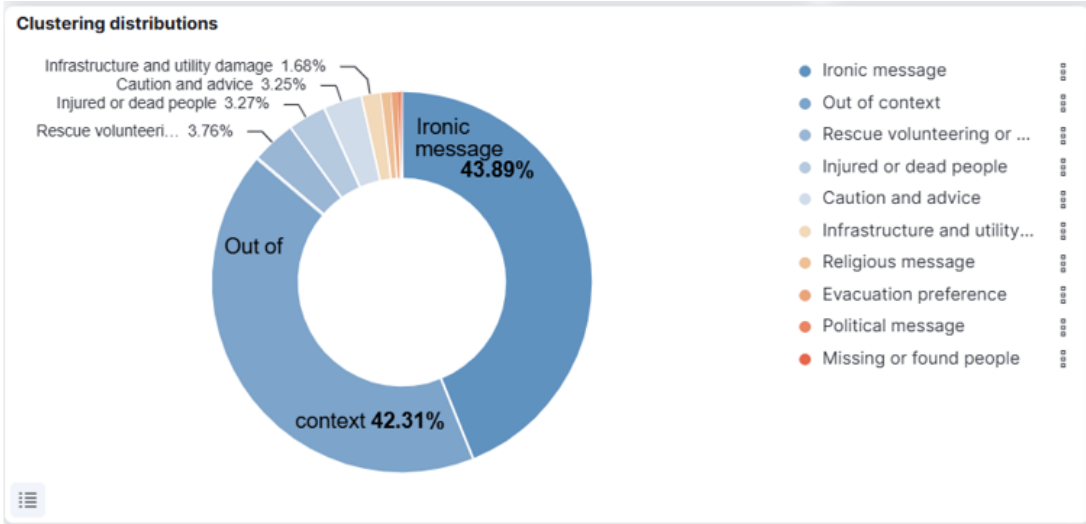


Figure 22 Main Dashboard Clustering Distribution

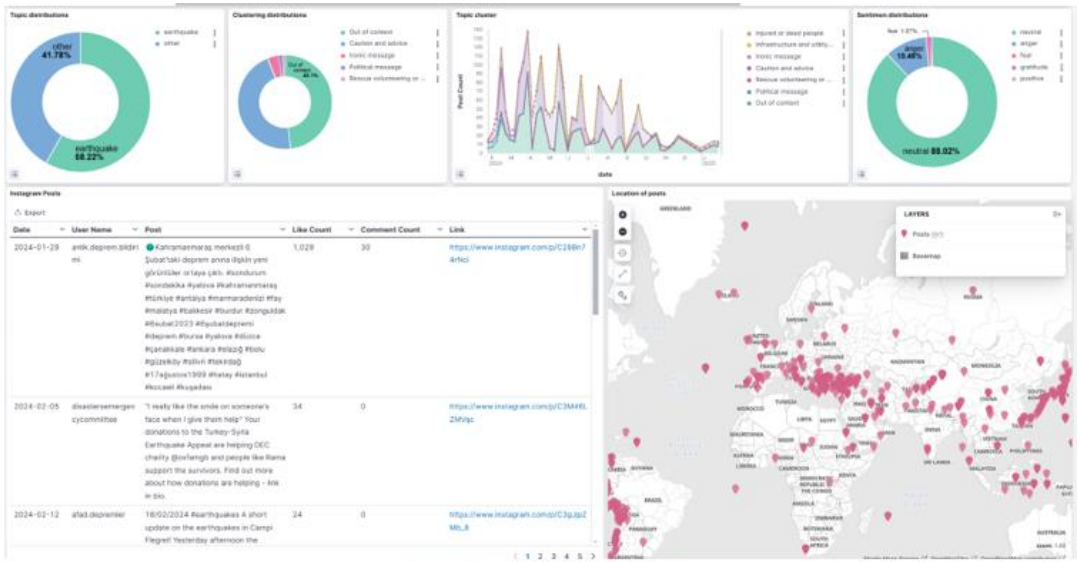


Figure 28 Instagram Dashboard

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101074004

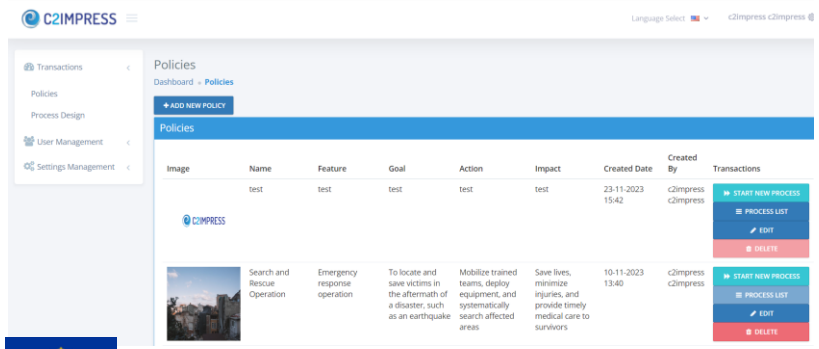
“C2IMPRESS Decision Support Tool” to support policy makers

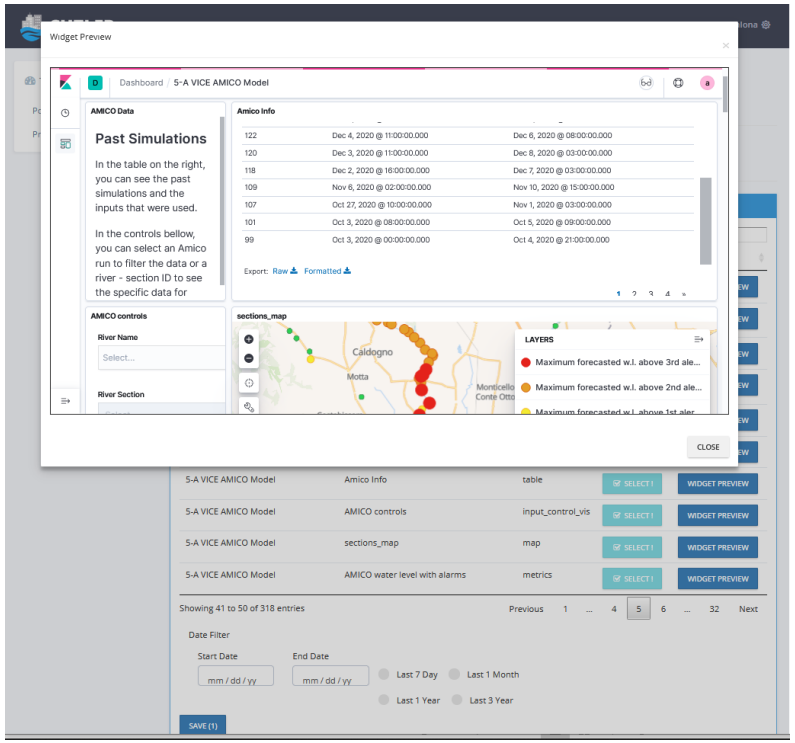
Model the process in the Business Process Engine

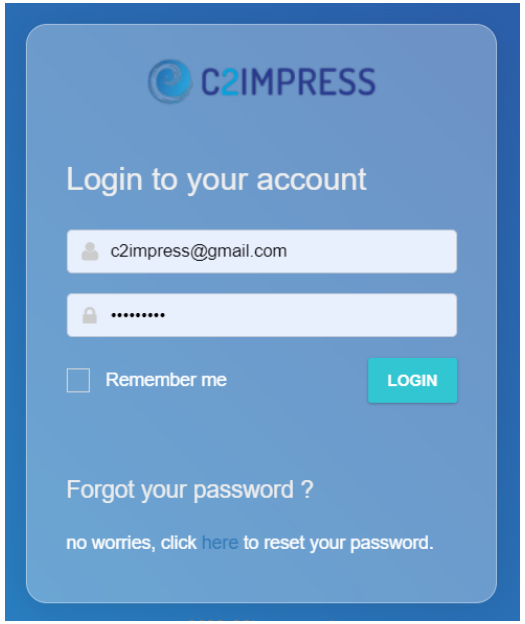
Deploy the process in the frontend

Design the facet of each process task in the frontend

- Use the wizard to design the facet of each task
- Easily **import social media data analysis visualizations** by selecting from the list of available widgets & dashboards





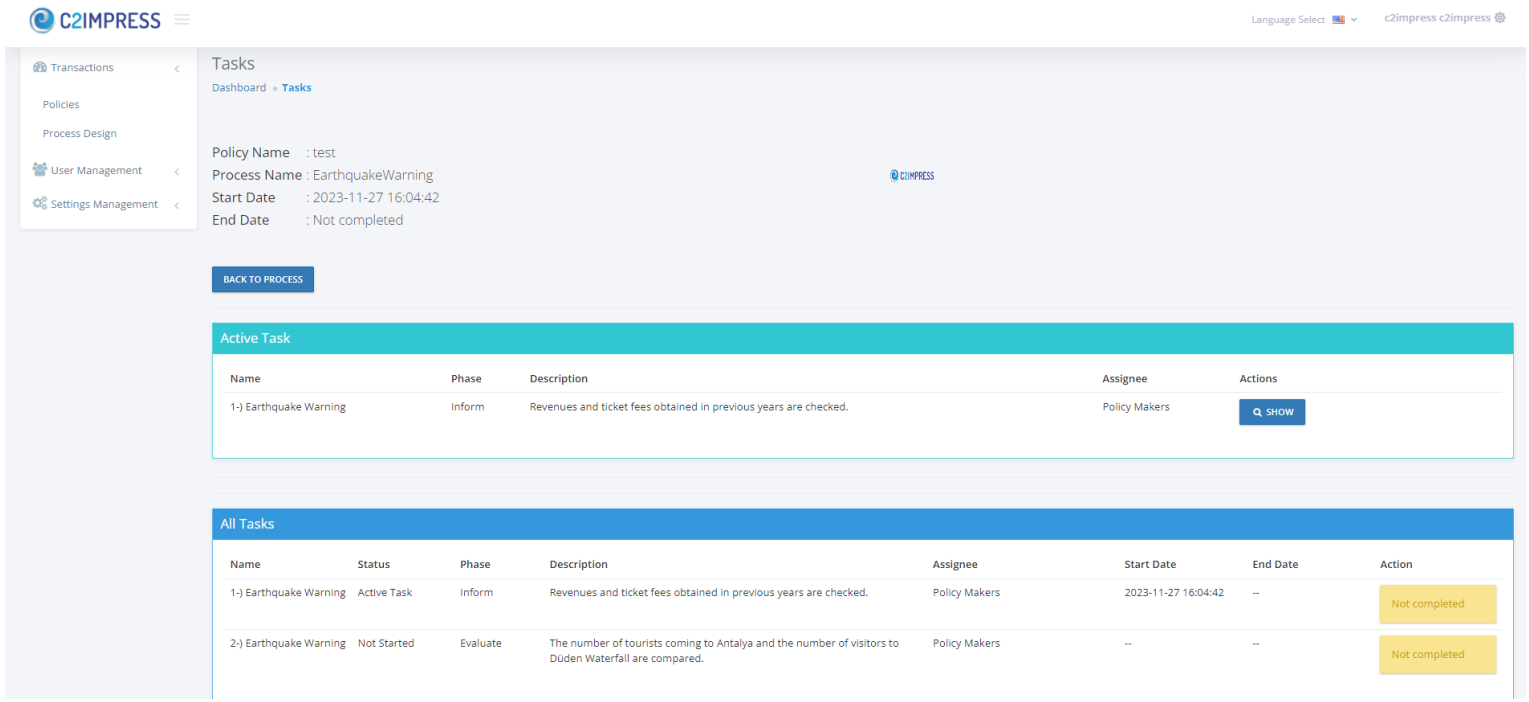


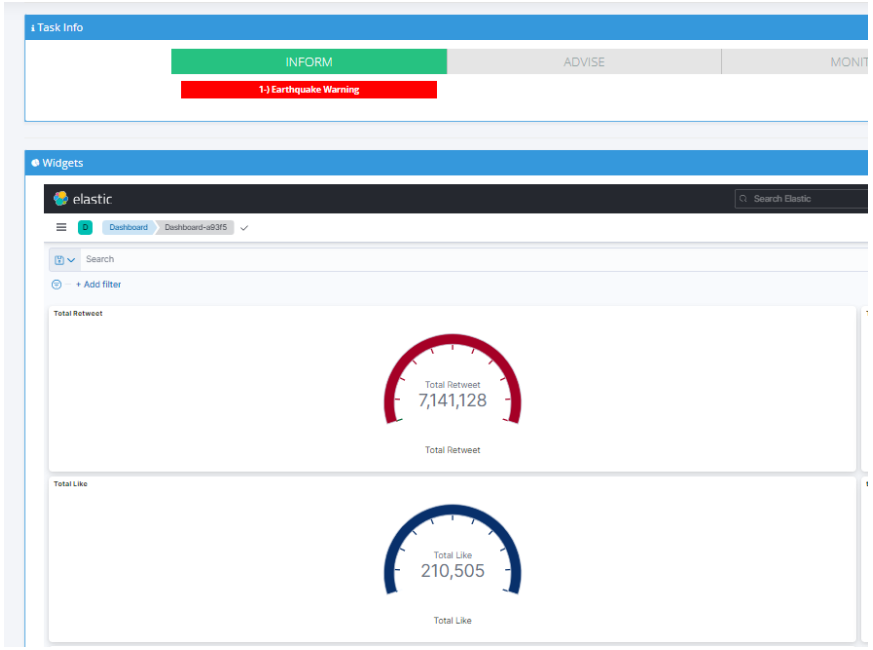
Platform is accessible on: https://dss-c2impress.sampas.com.tr/

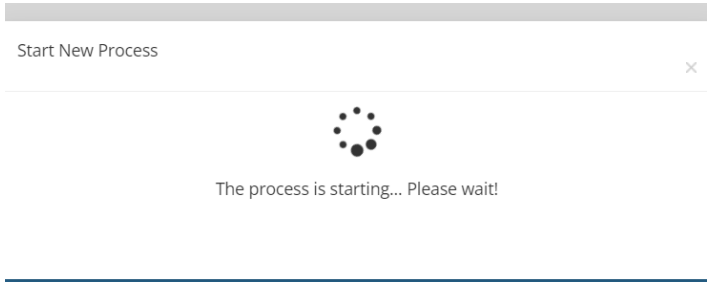
This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No 101074004

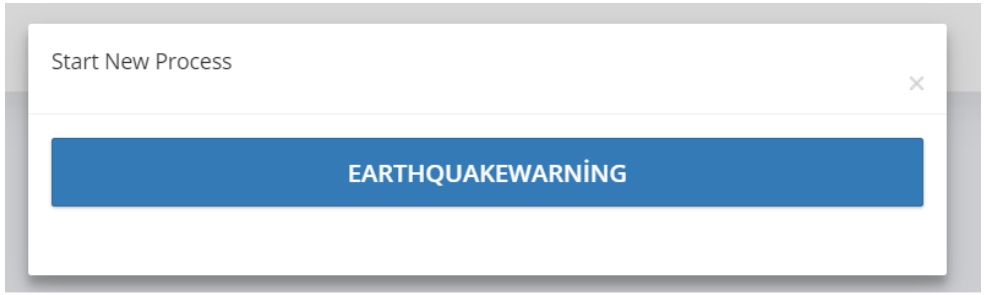
“C2IMPRESS Decision Support Tool” to support policy makers

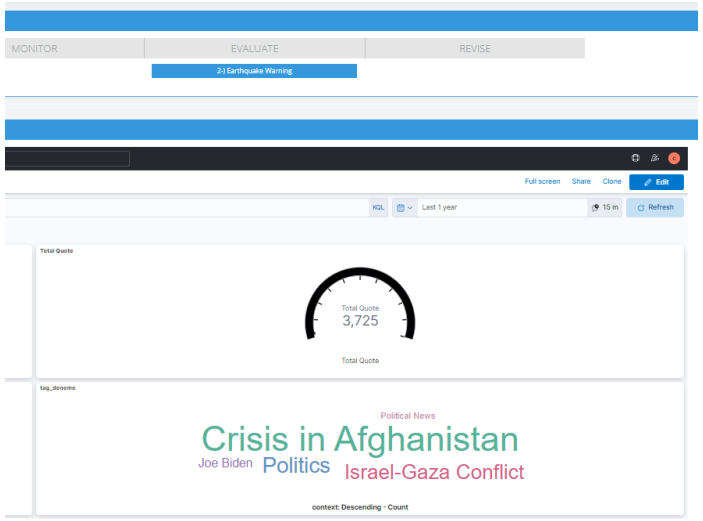
Decision Support Platform Interface











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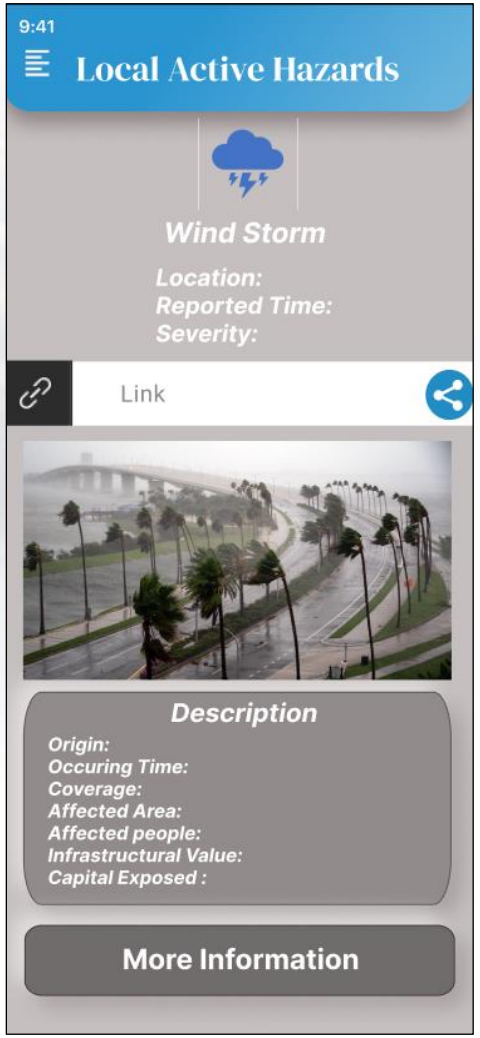
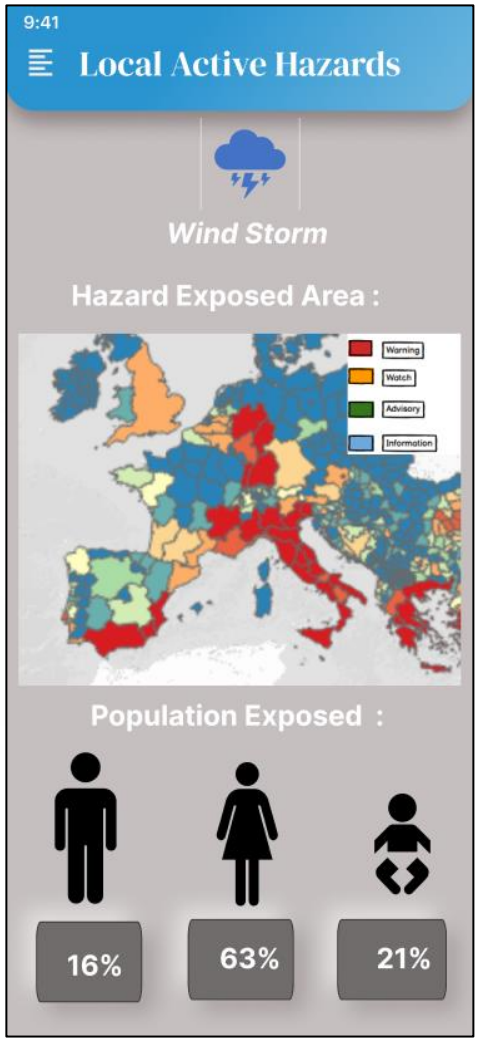
“C2IMPRESS HazardMonitor app” for coproducing community-driven data for disaster risk models and early warning systems:





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C2IMPRESS

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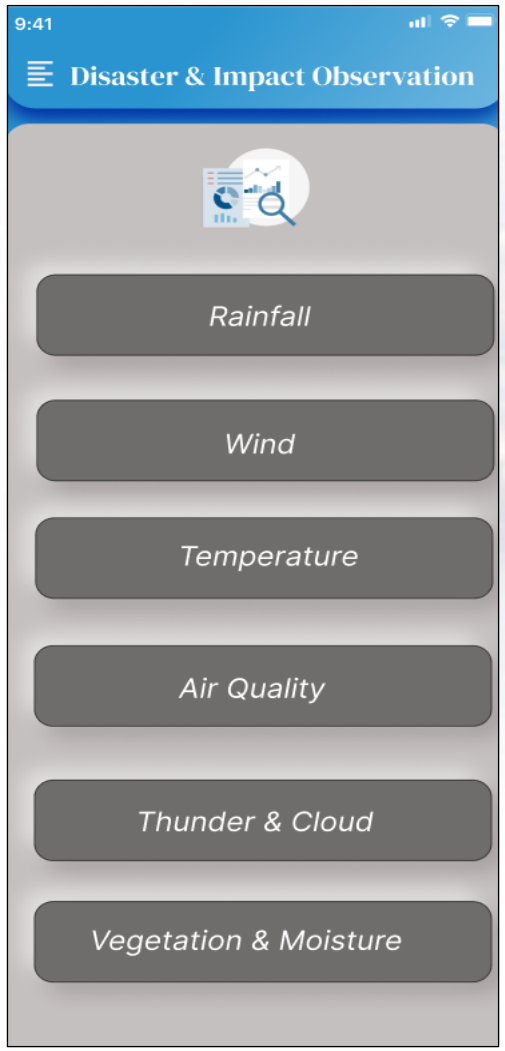

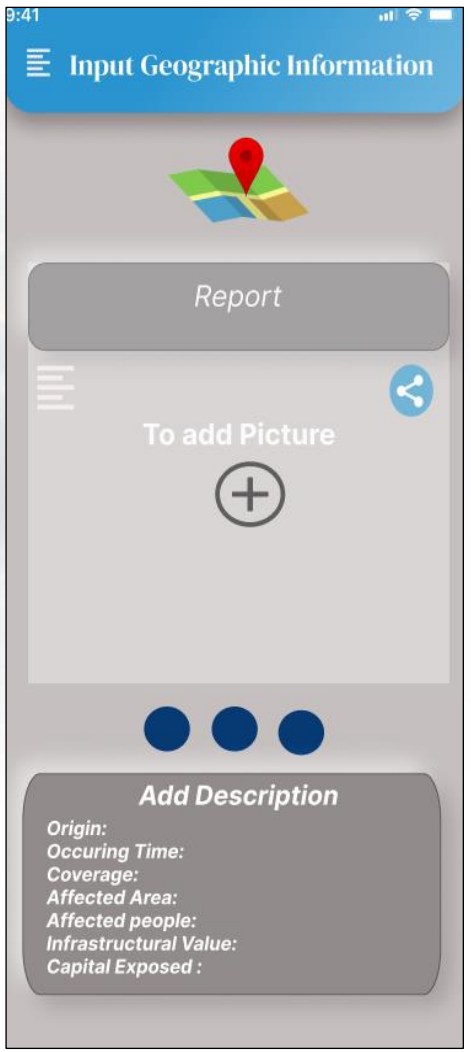

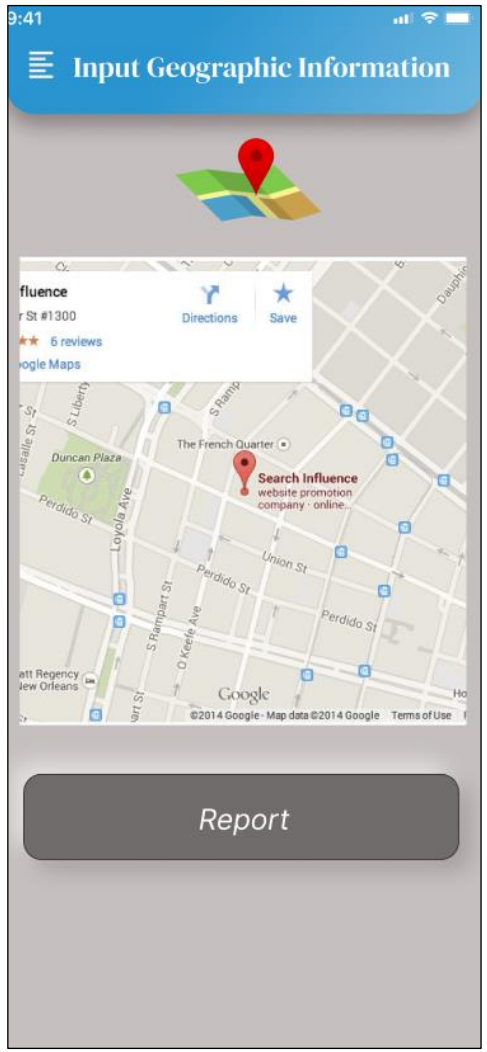

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C2IMPRESS

Thank You!!

Serhan Karahan

serhan.karahan@sampas.com.tr

SAMPAŞ Holding

Funded by
the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101074004.

SAFE-LAND
Mitigating the risk of flooding and landslides via artificial intelligence with a view to extreme climate events

Union Civil Protection Knowledge Network

Co-funded by the European Union

SAFE-LAND

MITIGATING THE RISK OF FLOODING AND LANDSLIDES VIA ARTIFICIAL INTELLIGENCE WITH A VIEW TO EXTREME CLIMATE EVENTS

Project: 101140345 — UCPM-2023-KAPP

Elisabetta Cattoni and Francesco Pistolesi

eCAMPUS UNIVERSITÀ

UNIVERSITÀ DI PISA

MEĐIMURSKA ŽUPANIJA

CRNA GORA MONTENEGRO

SAFE-LAND: Development of a system combining AI and analytical/numerical methods

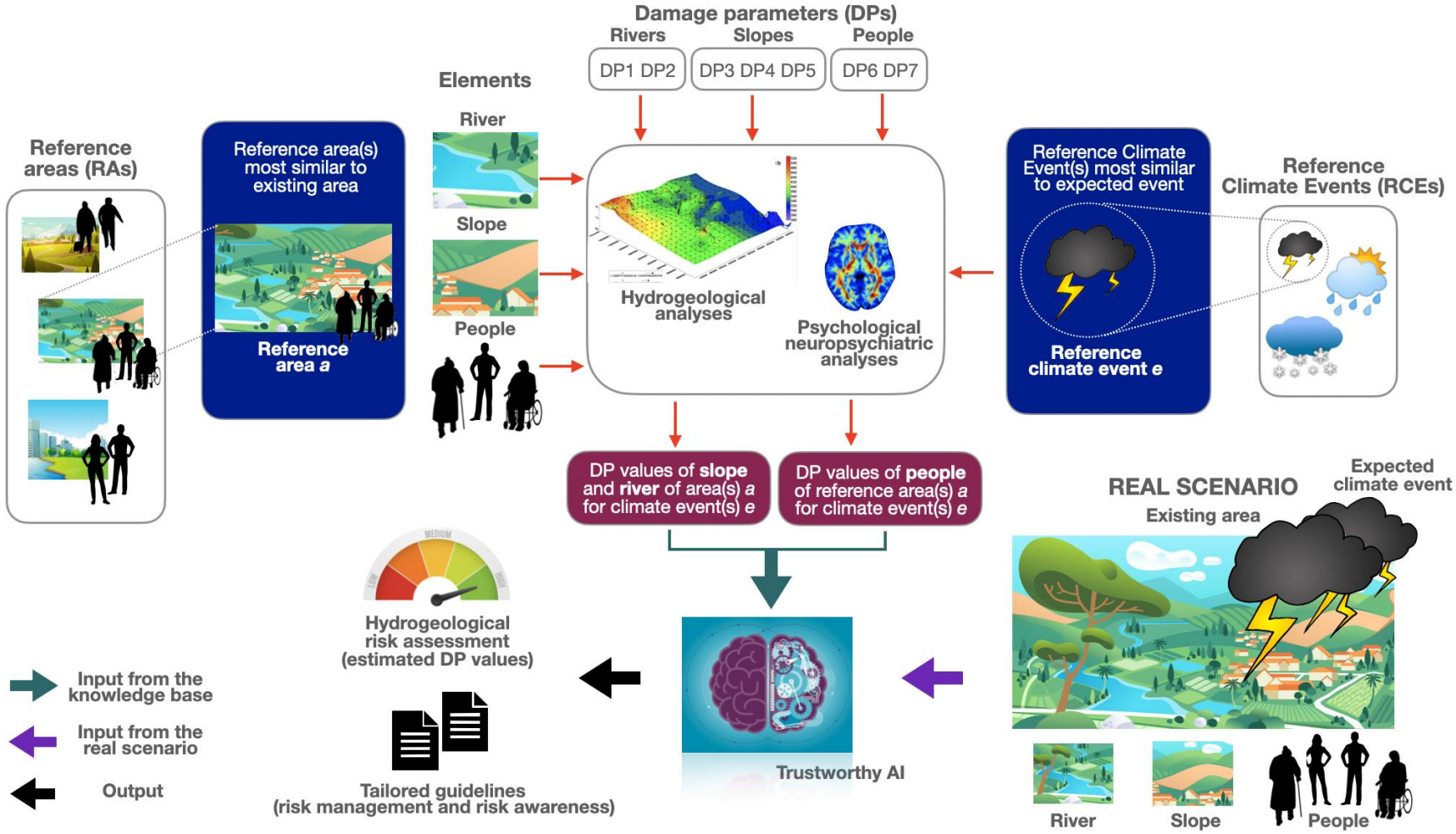
EXPECTED OUTPUTS

AI system to:

- perform landslide and flooding risk assessment and risk awareness
- Provide guidelines suggesting risk mitigation measures and to raise risk awareness

ENGAGEMENT WITH END-USERS:

Public Administrations, Civil Protection Authorities, Stakeholders interested in using the tool in critical areas.



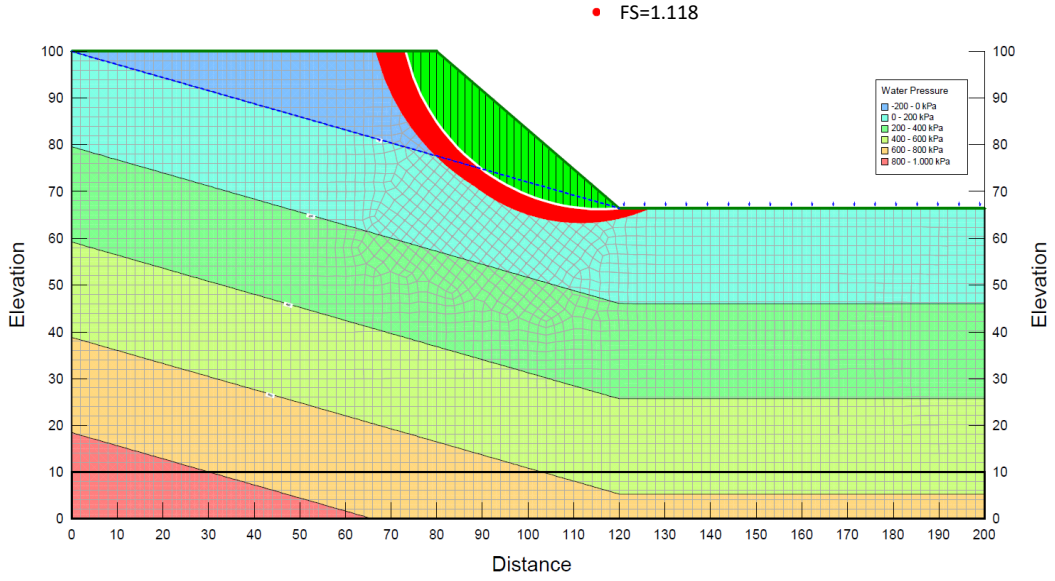
Example of DATASET for LANDSLIDE risk assessment and mitigation measures

LANDSLIDE risk assessment

About 23,500 numerical analyses for Reference Slopes subjected to Reference Rainfalls were performed.

The results of the numerical analyses of the reference slopes provide the dataset to train the AI system. The following DPs are considered:

- **Factor of safety (*FoS*)**
- **Maximum depth of the critical sliding surface (z_s)**
- **Maximum depth of the piezometric level (z_w)**



HAZARD LEVELS

FoS_0	FoS_1	FoS_2	FoS_3	Hazard levels
<=1	<=1	<=1	<=1	Very high (landslide certain)
>1	<=1	<=1	<=1	High (almost certain)
>1	>1	<=1	<=1	Medium (likely)
>1	>1	>1	<=1	Low (unlikely)
>1	>1	>1	>1	Very low (almost null)

CONSEQUENCES LEVELS (on properties and people)

	On	Adjacent	Near	Out
Very deep depth of sliding surface> 15 m	D5	D5	D4	D2
Deep 10 m<depth of sliding surface≤ 15 m	D5	D4	D3	D2
Intermediate 5 m<depth of sliding surface≤ 10 m	D5	D4	D3	D1
Shallow depth of sliding surface < 5 m	D4	D3	D2	D1

Di=class of damage:
D5=very high level of consequences; D4=High; D3=Medium; D2=Low; D1=Very Low

RISK MATRIX		LEVEL OF CONSEQUENCES				
		Very High	High	Medium	Low	Very Low
HAZARD LEVELS	Very High	VH	VH	H	M	L
	High	VH	H	M	L	VL
	Medium	H	M	M	L	VL
	Low	M	L	L	VL	VL
	Very low	L	VL	VL	VL	VL

Slopes stabilization measures (if FoS <= 1)

Example: Group G4 (TRANSFERRING LOADS TO COMPETENT GROUND)

EFFECTIVENESS OF THE INTERVENTION

1= high effective (green); 0,5 = quite effective (orange); 0,25 = moderately effective (yellow); 0 = ineffective (white).

G4.1 PILES			Depth of the piezometric water		
			High	Low	Absent
			0,5	1	1
Depth of the sliding surface	Superficial (<1.0 m)	0	0	0	0
	Shallow (1 to 3 m)	0,5	0,25	0,5	0,5
	Medium (3 to 8 m)	1	0,5	1	1
	Deep (8 to 15 m)	0,5	0,25	0,5	0,5
	Very deep (>15m)	0	0	0	0

G4.2 DIAPHRAGM WALLS			Depth of the piezometric water		
			High	Low	Absent
			0,5	1	1
Depth of the sliding surface	Superficial (<1.0 m)	0	0	0	0
	Shallow (1 to 3 m)	0	0	0	0
	Medium (3 to 8 m)	0,5	0,25	0,5	0,5
	Deep (8 to 15 m)	1	0,5	1	1
	Very deep (>15m)	0,5	0,25	0,5	0,5

G4.3 SOIL NAILING			Depth of the piezometric water		
			High	Low	Absent
			0	0,5	1
Depth of the sliding surface	Superficial (<1.0 m)	1	0	0,5	1
	Shallow (1 to 3 m)	1	0	0,5	1
	Medium (3 to 8 m)	0,5	0	0,25	0,5
	Deep (8 to 15 m)	0	0	0	0
	Very deep (>15m)	0	0	0	0

G4.4 STRAND ANCHORS			Depth of the piezometric water		
			High	Low	Absent
			0,5	1	1
Depth of the sliding surface	Superficial (<1.0 m)	0	0	0	0
	Shallow (1 to 3 m)	0	0	0	0
	Medium (3 to 8 m)	0,5	0,25	0,5	0,5
	Deep (8 to 15 m)	1	0,5	1	1
	Very deep (>15m)	0,5	0,25	0,5	0,5

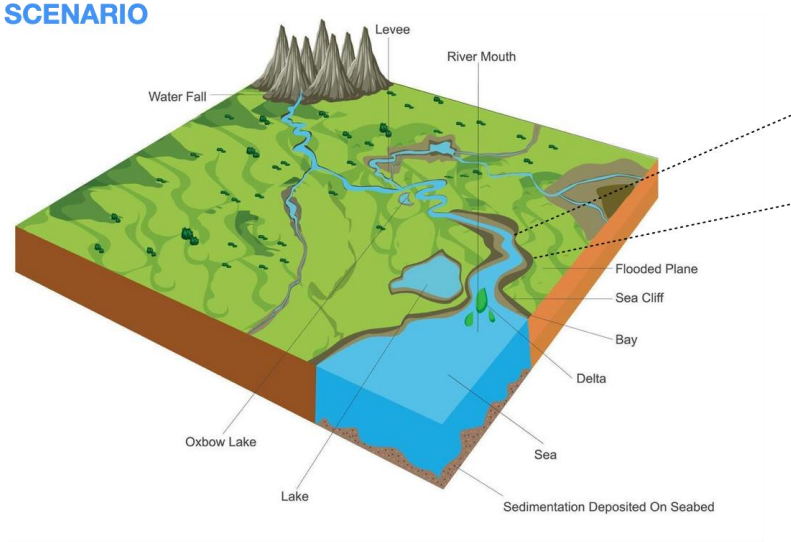
SUITABILITY OF THE INTERVENTION

Score > 3 (green) = highly recommended;
2 > Score ≥ 3 (orange) = suggested;
1 > Score ≥ 2 (yellow) = less suitable;
Score < 2 (white) = not recommended.

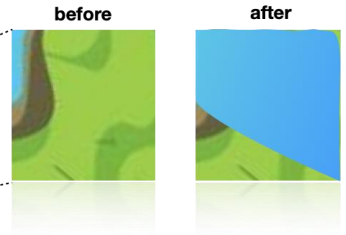
	G4.1	G4.2	G4.3	G4.4
Reliability	1	1	0,5	0,5
Feasibility	1	1	0,5	0,5
Implementation	0,5	0,5	0,5	0,5
Typical cost	0,5	0,5	0,5	0,5
tot.	3	3	2	2

Hydrogeological risk assessment via AI

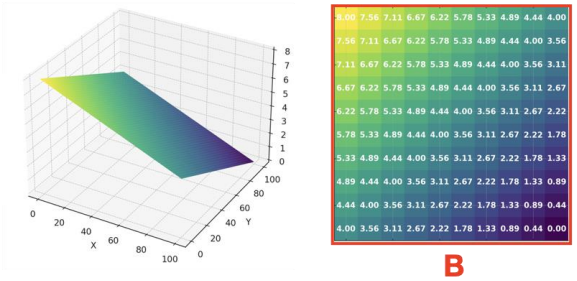
SCENARIO



Basin



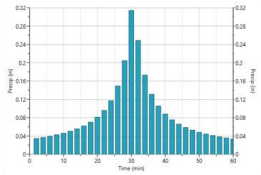
Linearization
(best-fit plane that approximate the basin)



B

Each element contains the height of that part of the basin in relation to the x-y plane

Precipitation



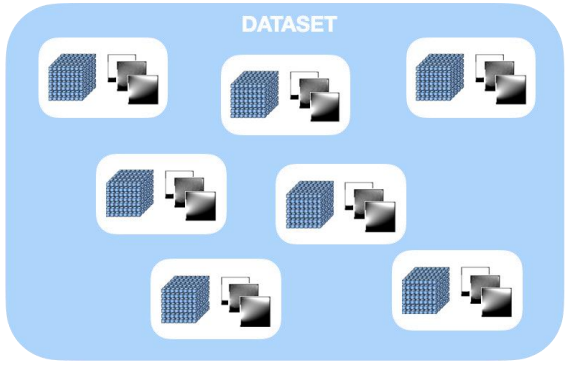
Chicago hyetograph

duration
total accumulated rainfall
quantity…

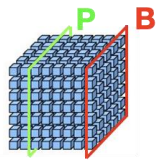
P

```
rain_event_vector = [
    3.5,    # duration (h)
    42.0,   # total_precipitation (mm)
    30.0,   # peak_intensity (mm/h)
    1.0,    # time_to_peak (h)
    5.0,    # initial_loss (mm)
    12.0,   # average_intensity (mm/h)
    8.0,    # antecedent_rainfall_24h (mm)
    2,      # storm_type_index (categorical)
    0.6     # rainfall_skewness
]
```

ARTIFICIAL INTELLIGENCE

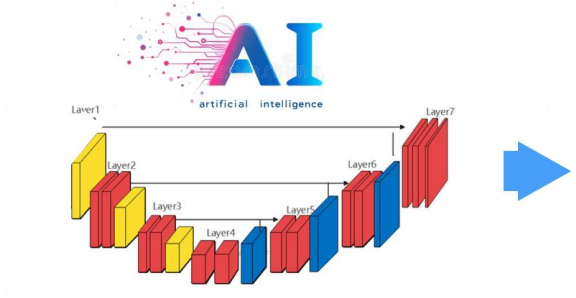


Tensor modeling



3d-tensor

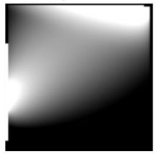
The basin is one **channel** of the tensor and the other channels contain the features regarding the precipitation



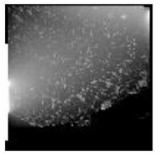
The network builds a **compressed representation** of the input tensor based on 3D convolutions which combine basin topology, river break point, and precipitation features, then decodes it into three regression maps via deconvolution and skip connections

The output is made up of **3 regression maps** that predict, for each point of the basin:
1) the maximum water **height**
2) the maximum water **velocity**
3) the **arrival time** of the water

Depth tiff



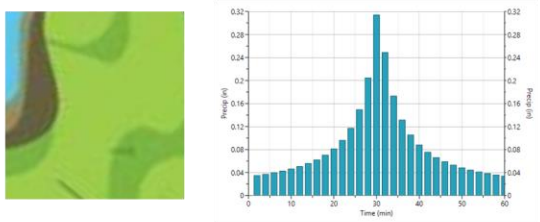
Velocity field



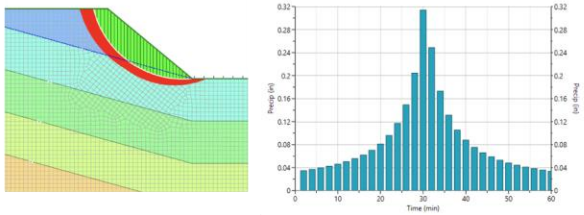
Arrival time

From risk assessment to guidelines

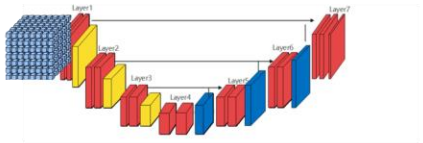
River



Slope

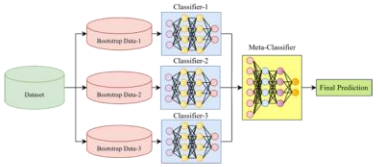


People



Deep learning

1) maximum water **height**
2) maximum water **velocity**
3) **arrival time** of the water



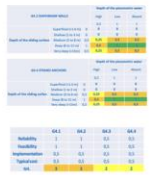
Ensemble learning

1) Slope **safety factor** safe/unsafe
2) Max **depth of the sliding surface**
3) Max **depth of the piezometric level**

Unsupervised learning

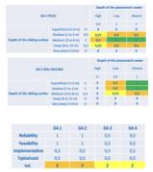
Determining the **human factors** that influence hydrogeological risk awareness

Guidelines for risk mitigation



Levee reinforcement strategies under critical rainfall (e.g., 50- or 100-year return periods), such as increasing crest height in low-lying zones or adding riprap at high-velocity sections to prevent erosion.

Guidelines for risk mitigation



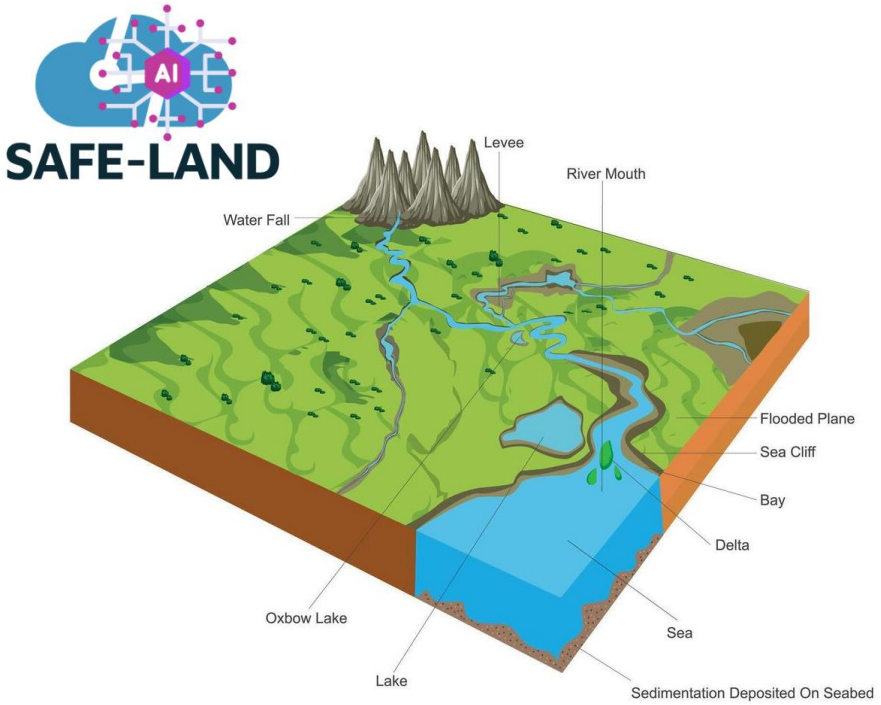
Stabilization for unstable slopes under extreme rainfall, such as installing piles to increase shear resistance or using retaining diaphragms to prevent surface displacement.

Guidelines to raise awareness

"Develop accessible educational materials (e.g., illustrated leaflets, videos) explaining flood risks and safe behaviors, tailored for the elderly and people with disabilities."

"Organize community workshops in at-risk areas to train caregivers and vulnerable individuals on recognizing danger signs and preparing emergency kits."

Why AI is so powerful for hydrogeological risk assessment?



Speed

- **near-instantaneous predictions** once trained.
- **multiple scenarios in real-time** across large areas, (key during emergencies).

Robust to Uncertain or Incomplete Data

- **noisy, sparse, or estimated input data**
- useful in data-poor or evolving environments.

Early Warning & Preparedness

- can anticipate impacts in **urban, riverine, and hillside contexts** from a single rainfall input.

Support for Decision-Making

- helps define **mitigation strategies**, such as:

where and how to reinforce riverbanks, which slopes are most at risk, optimize costs and effectiveness

Thank you

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SAFE-LAND

Co-funded by the European Union

A FRENCH CIVIL PROTECTION ACADEMY FOR INNOVATION

VALABRE

ENSOSP
École nationale supérieure des officiers de sapeurs-pompiers

European Union

Union Civil Protection Knowledge Network

Our missions :

- Initial and specialities training of 28 000 french officers
- Strenghtening firefighter school network
- Participating in international cooperation
- Training of all civil protection actors from citizen to politics
- **Research, innovation, knowledge management**

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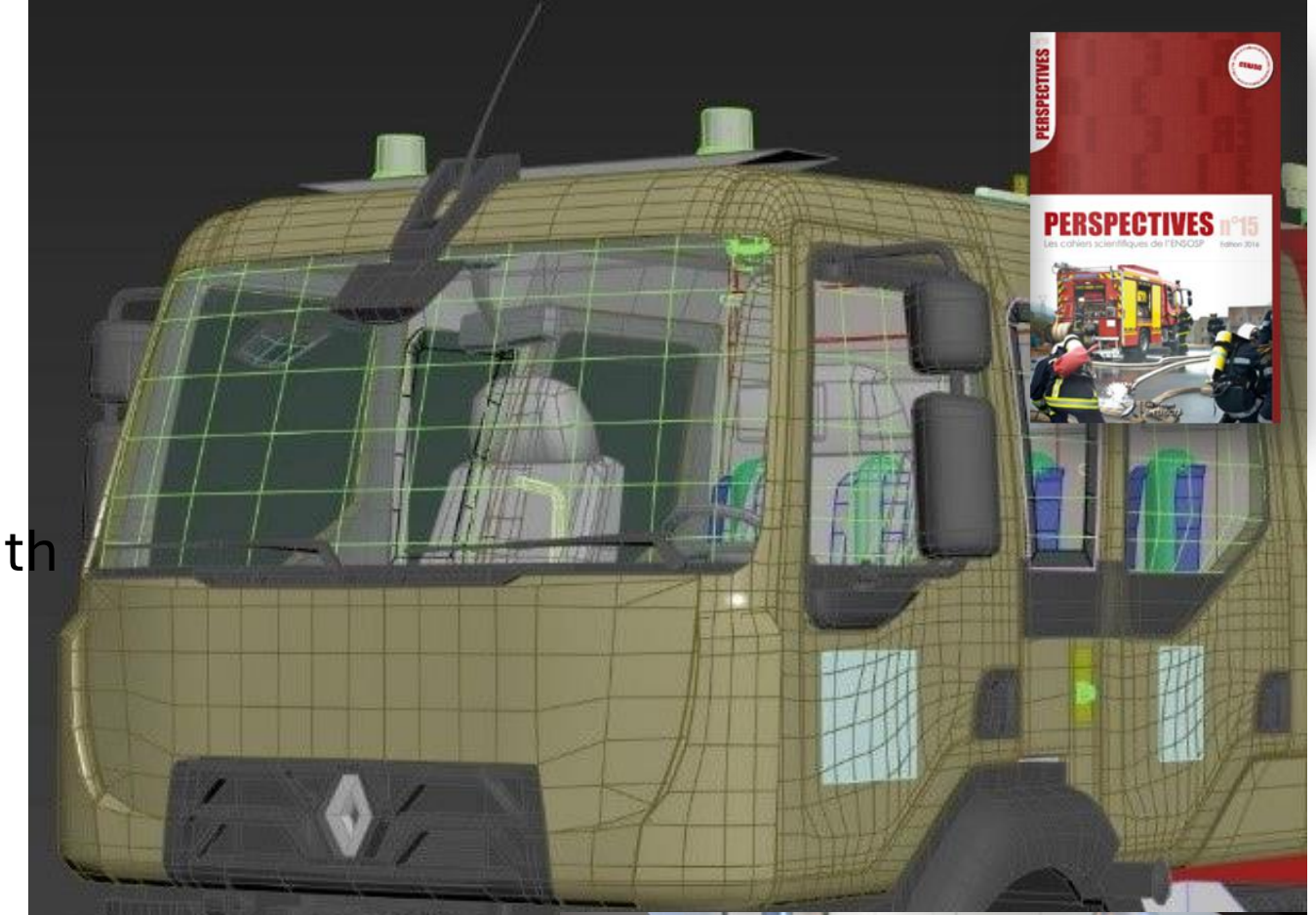
VALABRE

Knowledge is power :

- Build of the first
  - CP’s AI LAB

- Animation of AI initiatives with interior ministry and local actors
- Promotion of projects
- Funding of projects
- Testing and benchmarking
- News survey
- Links with EU and international actors



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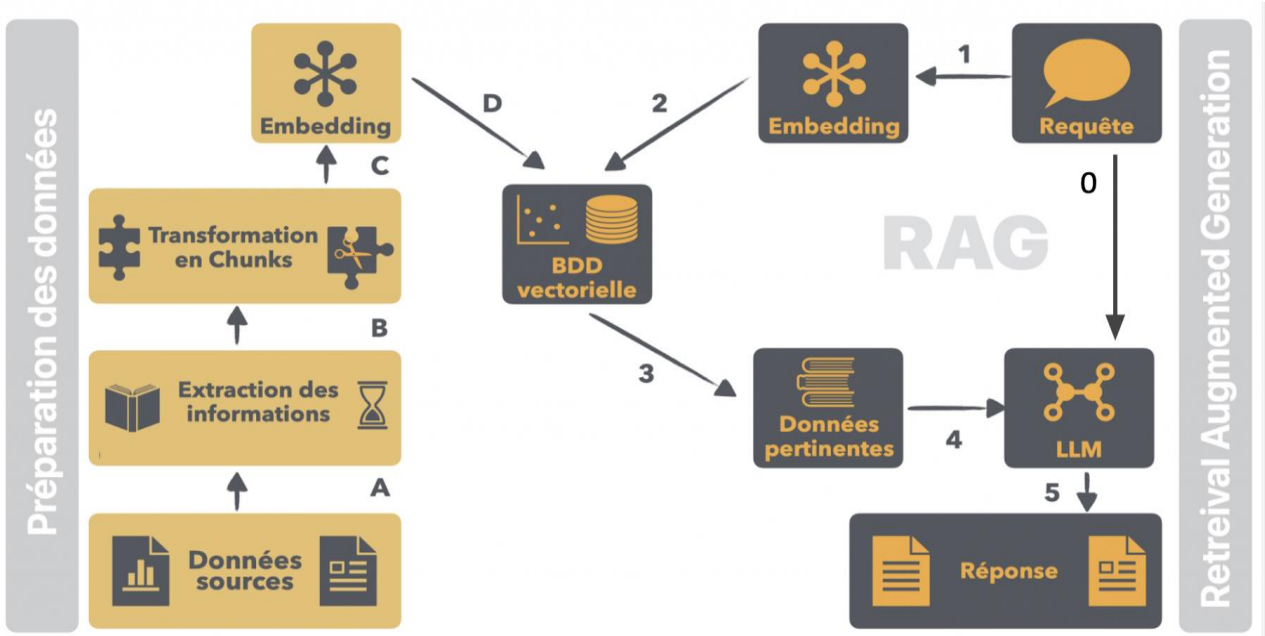
European Union

Union Civil Protection Knowledge Network

ATHENIA

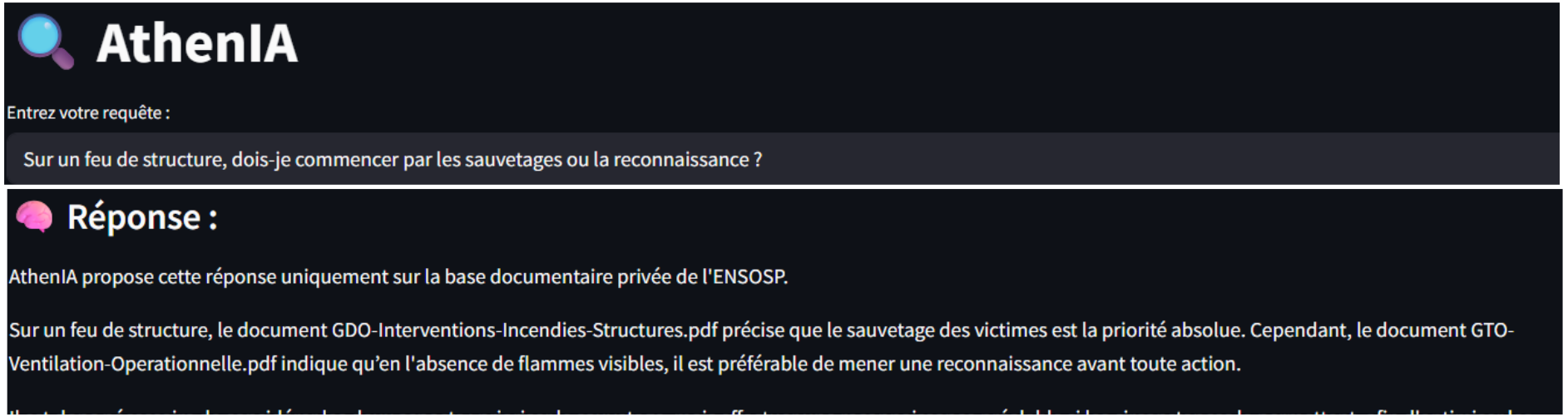
LLM dedicated to Civil Protection



Training

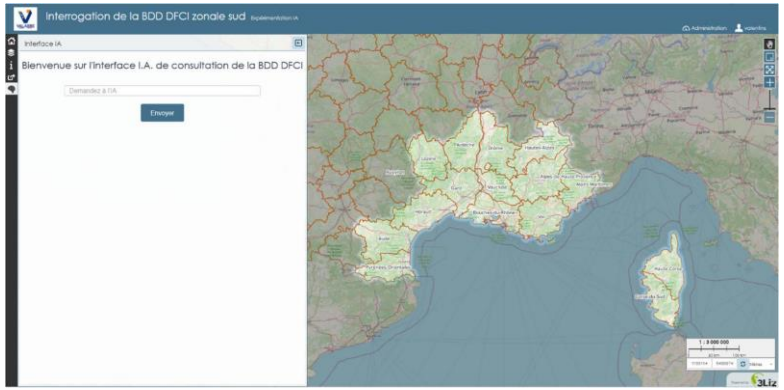
Efficiency on operation

Knowledge dissemination



PREDICTOPS

The PredictOps project is an innovative initiative that uses artificial intelligence to predict firefighting operations. Developed by the Service Départemental d'Incendie et de Secours du Doubs (SDIS 25) in collaboration with the FEMTO-ST research institute, PredictOps makes it possible to optimise the operational response by predicting the future volume of interventions by geographical area.

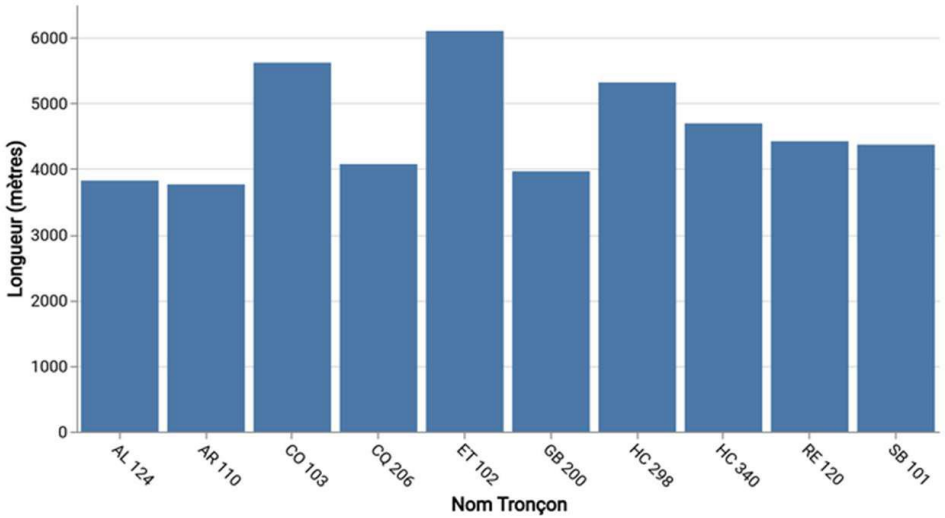


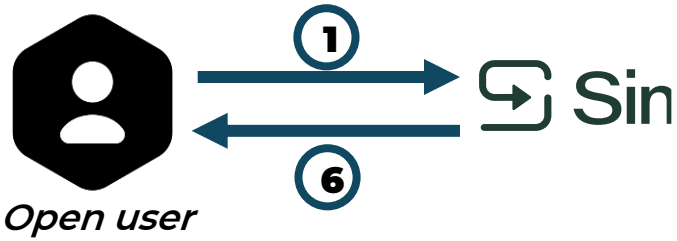
Question 1 :

```
Je veux une représentation visuelle avec un diagramme en barre des 10 premiers tronçons par rappor
t à leur longueur dans le 13
```

Réponse de l'IA :

```
Voici le résultat des 10 premiers tronçons du département 13 classés par ordre décroi
ssant de longueur. Le graphique en barres montre les tronçons avec leur nom sur l'axe
des X et leur longueur en mètres sur l'axe des Y. La légende est affichée en grande t
aille pour une meilleure lisibilité.
```





Database

Interaction steps :

1. *Asks question*
2. *Requests user database access verification*
3. *Verifies user database access*
4. *Returns authorization*
5. *Reads data and generates answer*
6. *Returns generated answer*

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Union Civil Protection Knowledge Network

Thank you for your attention

- **Capitaine Quentin BROT**
- **ENSOSP**

Lieutenant Colonel Philippe MERESSE
VALABRE

ARMA

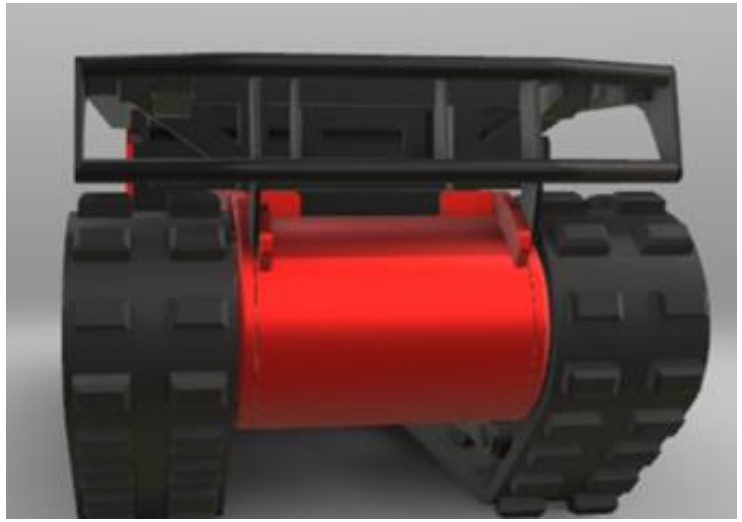
Collaborative Autonomous Robots for eMergency Assistance

17th of June 2025

Alexandre AHMAD, CS GROUP

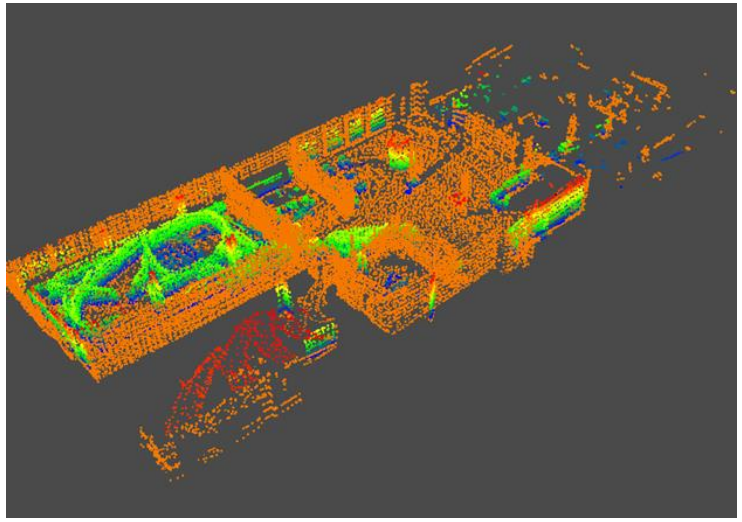
Nicholas VRETOS, CERTH

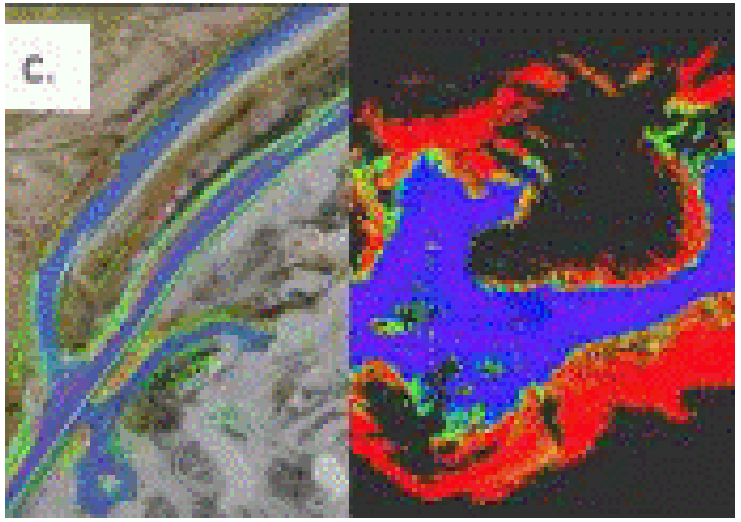
They need to « move » « autonomously »

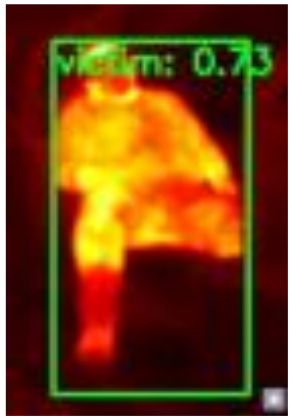


- Caterpillar tracks
- Foldable flippers
- Legged robot

They need to « see » and « analyse »



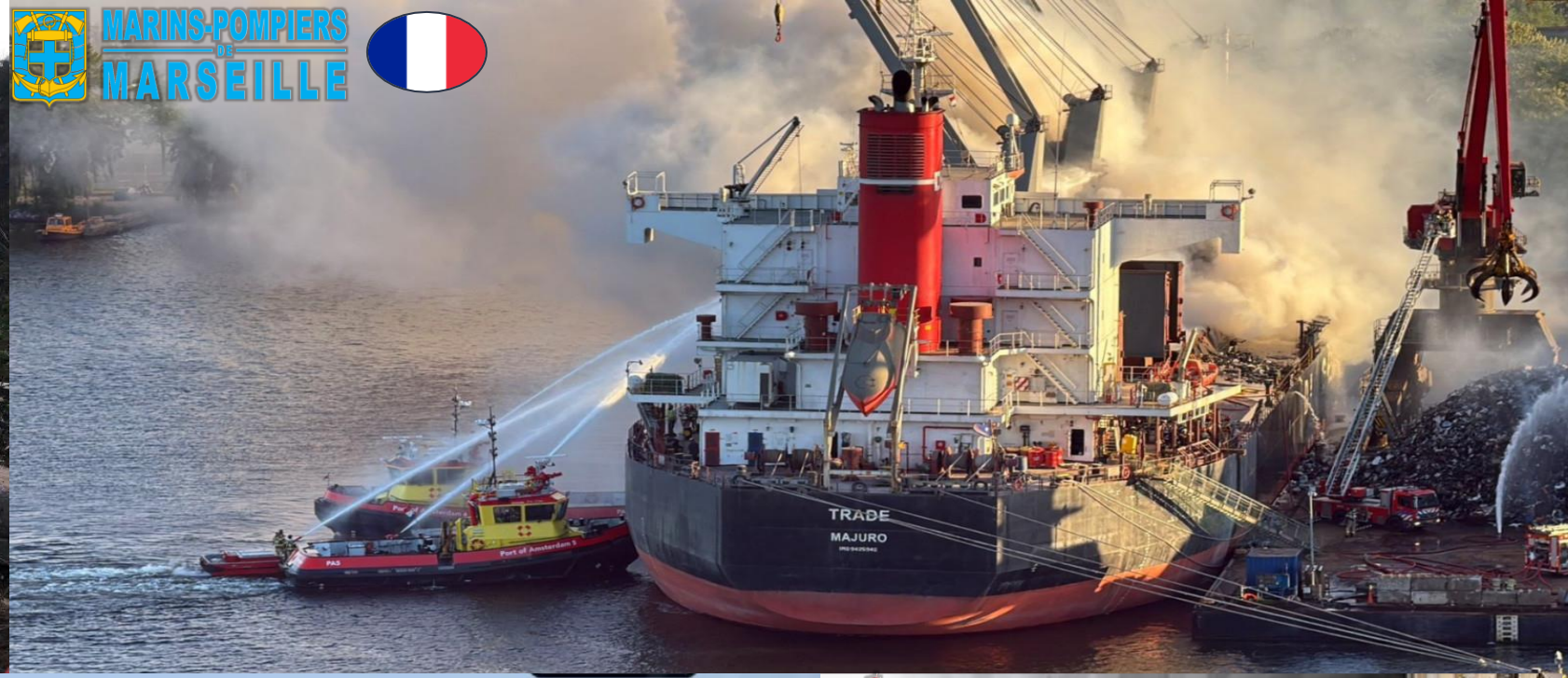




- Radar
- LiDAR
- RGB-D, thermal, CBRN sensors,

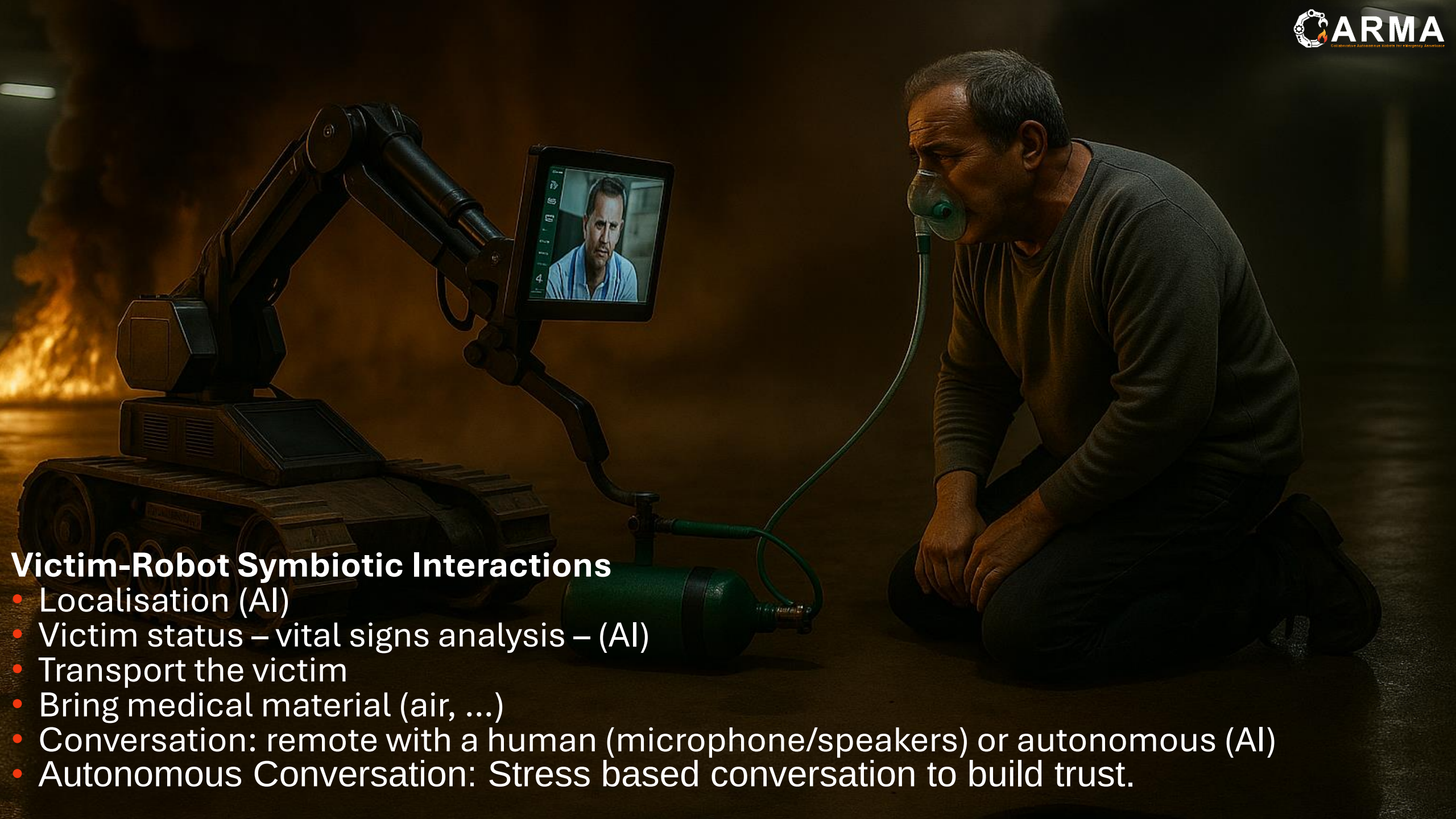
They need to "act" and to "react"


ATTICA


MARINS-POMPIERS
DE
MARSEILLE
TRADE
MAJURO


POLICÍA
MUNICIPAL MADRID
CBRN

Human-AI Symbiosis

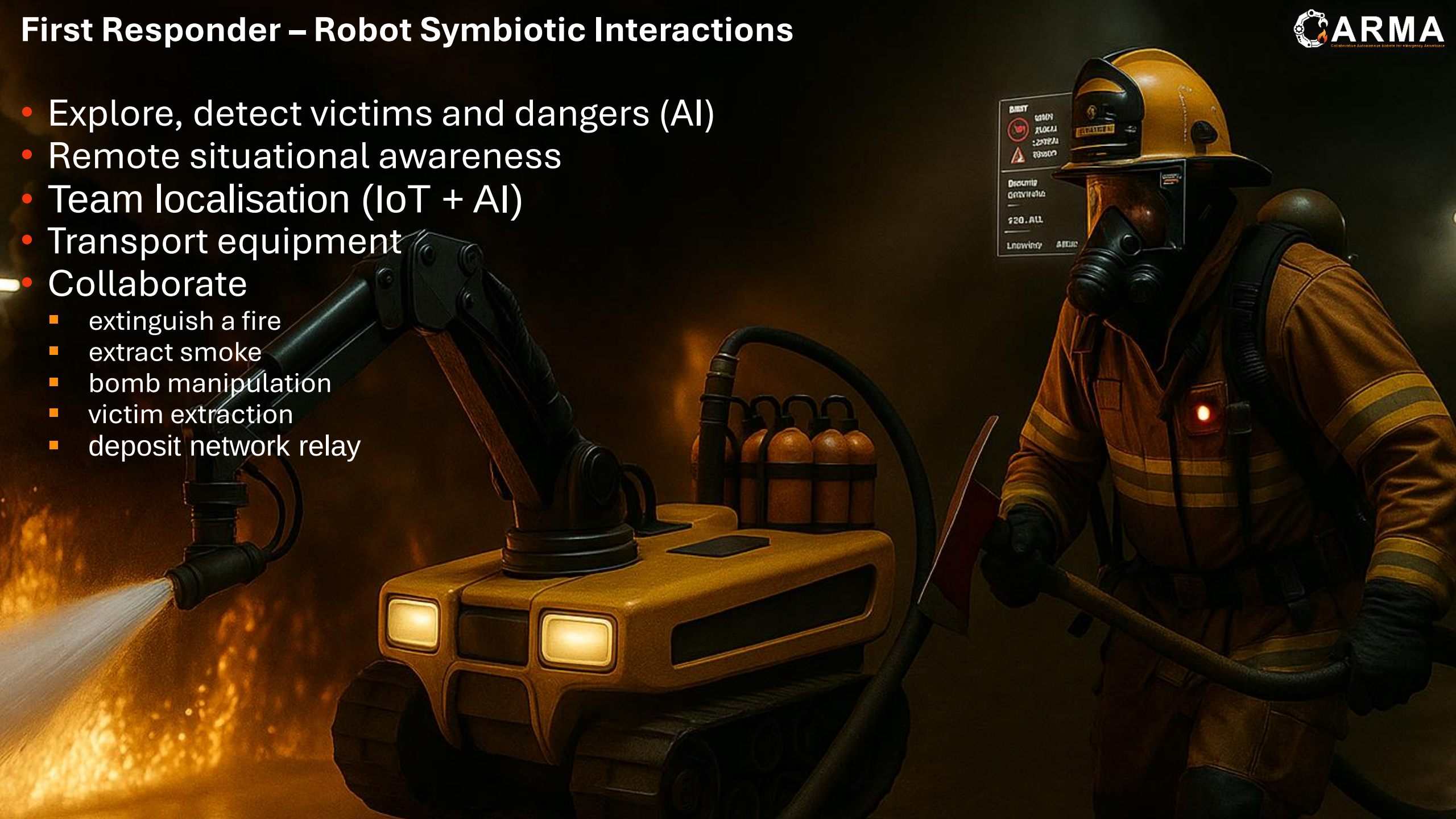


Victim-Robot Symbiotic Interactions

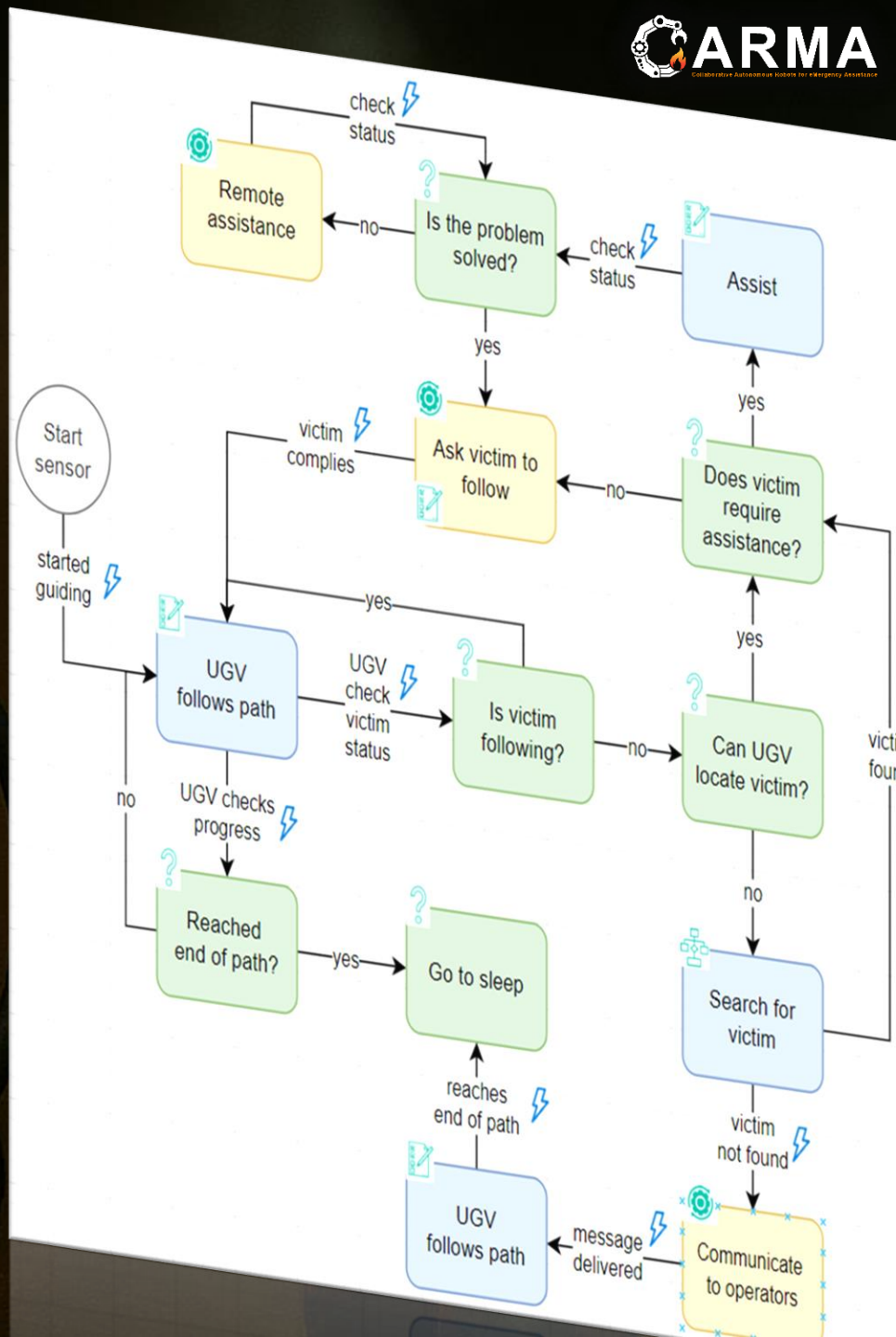
- Localisation (AI)
- Victim status – vital signs analysis – (AI)
- Transport the victim
- Bring medical material (air, …)
- Conversation: remote with a human (microphone/speakers) or autonomous (AI)
- Autonomous Conversation: Stress based conversation to build trust.

First Responder – Robot Symbiotic Interactions

- Explore, detect victims and dangers (AI)
- Remote situational awareness
- Team localisation (IoT + AI)
- Transport equipment
- Collaborate
  - extinguish a fire
  - extract smoke
  - bomb manipulation
  - victim extraction
  - deposit network relay



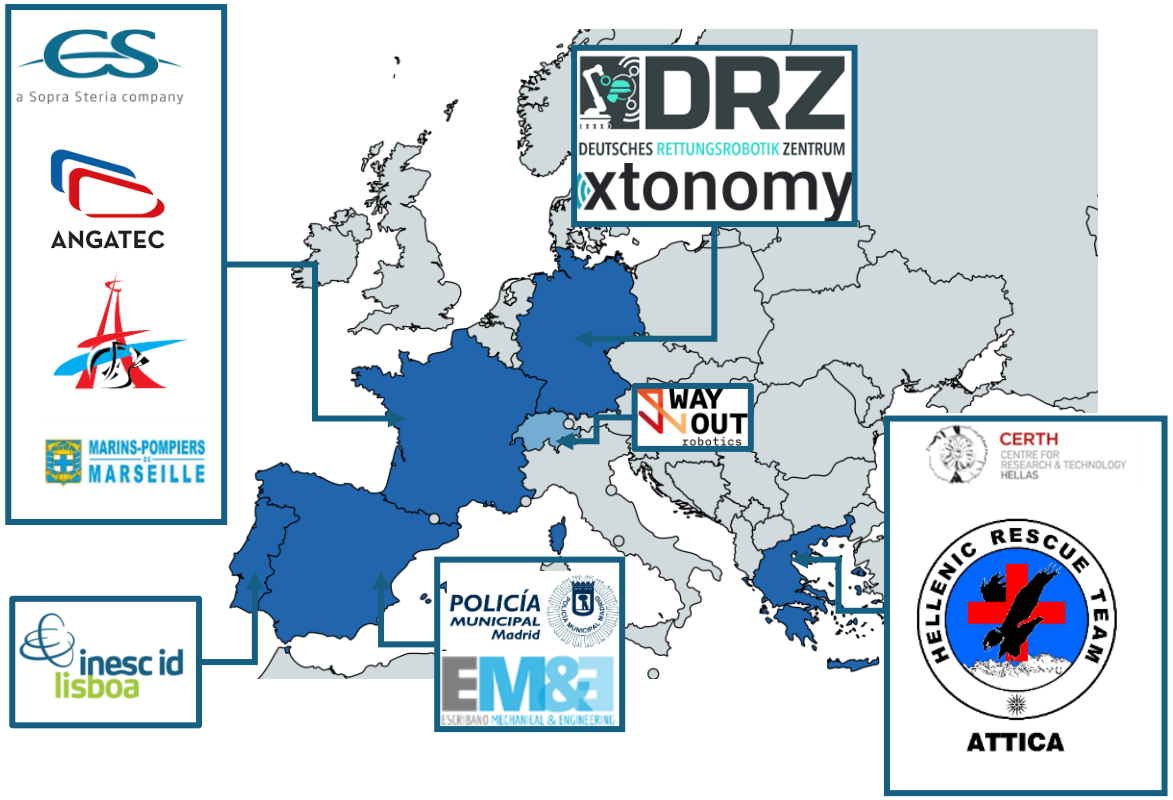
AI, Autonomy & Trust:
Customizable Doctrine, Training & Adoption



How to integrate in legacy systems

- Human – AI symbiosis can be seamlessly integrated into legacy system
- It goes beyond Decision Support Systems
- From a piece of program to a valued collaborator
- Interfacing in a more human way builds trust
- AI debrief build trust
- Change the AI paradigm from tool to collaborator: can be integrated into legacy systems

CARMA Key Facts



Coordinator: CS Group, France

Partners: 12 organisations from 5 EU countries (4 End-users)

Start Date: 1st September 2024

End Date: 31st August 2027

Type: Research & Innovation Action

Budget: €3.9million

Autonomous or semi-autonomous UGV systems to supplement skills for use in hazardous environments

CARMA

Collaborative Autonomous Robots for eMergency Assistance

For more information

Yana Lazarova
CS GROUP
Project Coordinator
yana.lazarova@cs-soprasteria.com

Website:
https://www.carmarobots.eu/
LinkedIn: CARMA EC Project

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

17.06. 2025

SYNERGISE

AI applications for crisis management in SYNERGISE project and beyond

Presenter: Dr. Sabina Ziemian, Technical Coordinator

ASTRIAL GmbH

Co-funded by the European Union

ASTRIAL

REDEFINING COMMAND, CONTROL & INTELLIGENCE

SYNERGISE Project

- Aims at developing Novel Integrated Toolkit for **improving FRs' safety** and **enhancing Response tasks and Situational Awareness**.
- AI-driven solutions can ensure improved operational efficiency, situational awareness, optimise team performance, and management of natural and man-made hazards.

1. **ASTRIAL**: Outdoor Drone-based Object Detection
2. **NTNU RMF-OWL**: Autonomous Exploration and Object Detection
3. **ETH ANYmal:** Autonomous Exploration and Automated Actions
4. **ASTRIAL/SATWAYS:** ENGAGE Automatic Fire Detection System
5. **CERTH**: AR Robot/UAV Control
6. **WEARIN' Wearables**: ML Algorithms for Wellness Index Calculation
7. **CERTH:** eXplainable AI Methods
8. **VIRNECT**: Remote Collaboration AR

ASTRIAL: Outdoor Drone-based Object Detection

- DJI Matrice 350
- DJI Mavic 3E

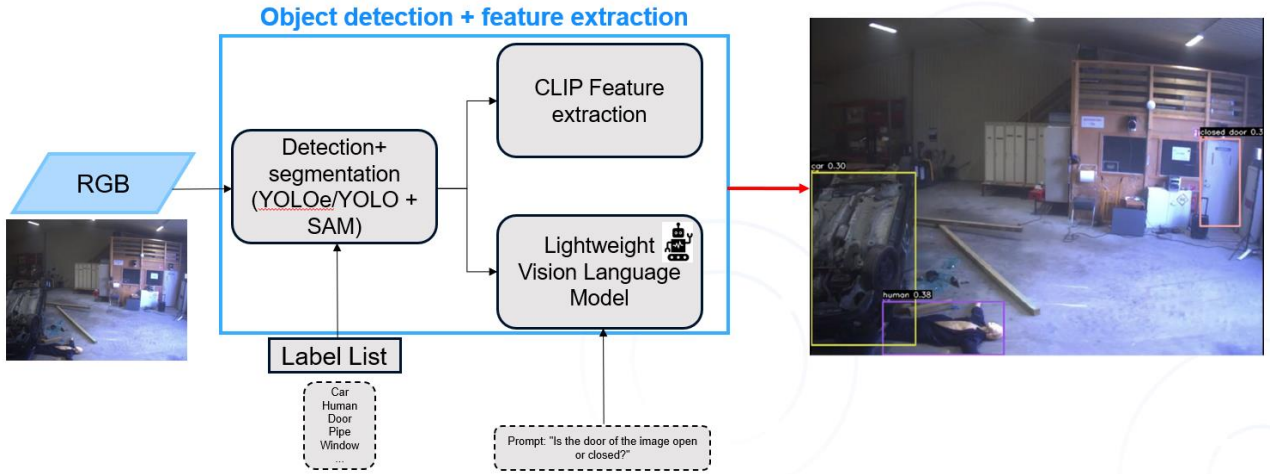
- Area surveillance
- **Person and Vehicle Detection using AI algorithms**
  - **Detection of FRs and victims**
  - **Person fall down**
  - **People fighting**
  - **People running**
  - **Vehicle overspeeding**
  - **People and vehicle in restricted area**
- Live video stream (RGB, Thermal)
- 2D/3D mapping

Model training with images, applying data augmentation techniques in diverse environmental conditions

NTNU RMF-OWL: Autonomous Exploration and Object Detection

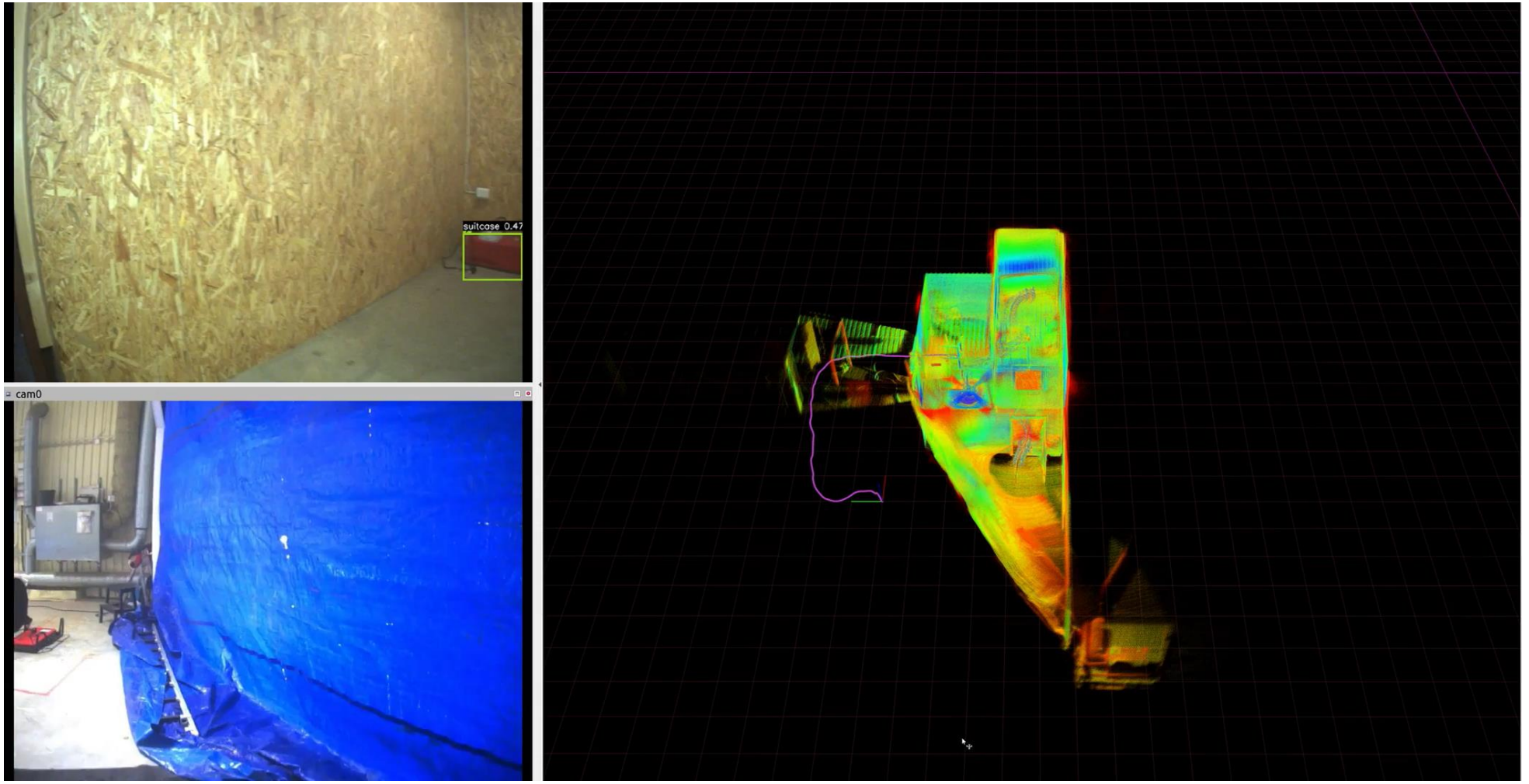
- **Specifications: Weight:** ~1.4 kg, **Size:** 38 × 28 × 24 cm, **Flight time:** ~ 10 min
- **Sensing and Processing Payloads: LiDAR:** Ouster OS0-64 , Range: 50 m, **Camera:, LED:**
- **Functionalities in Disaster Scenarios**
  - Autonomous exploration and 3D mapping of environment
  - Capabilities to operate in smoke-filled areas
  - Object/Human detection and state detection of selected objects
  - Video streaming

OWL uses lightweight internet-scale pre-trained Vision Foundation Models and Vision Language Models to detect objects of interest and reason about them



NTNU
Norwegian University of Science and Technology

NTNU RMF-OWL: Autonomous Exploration and Object Detection



OWL Perception demonstration

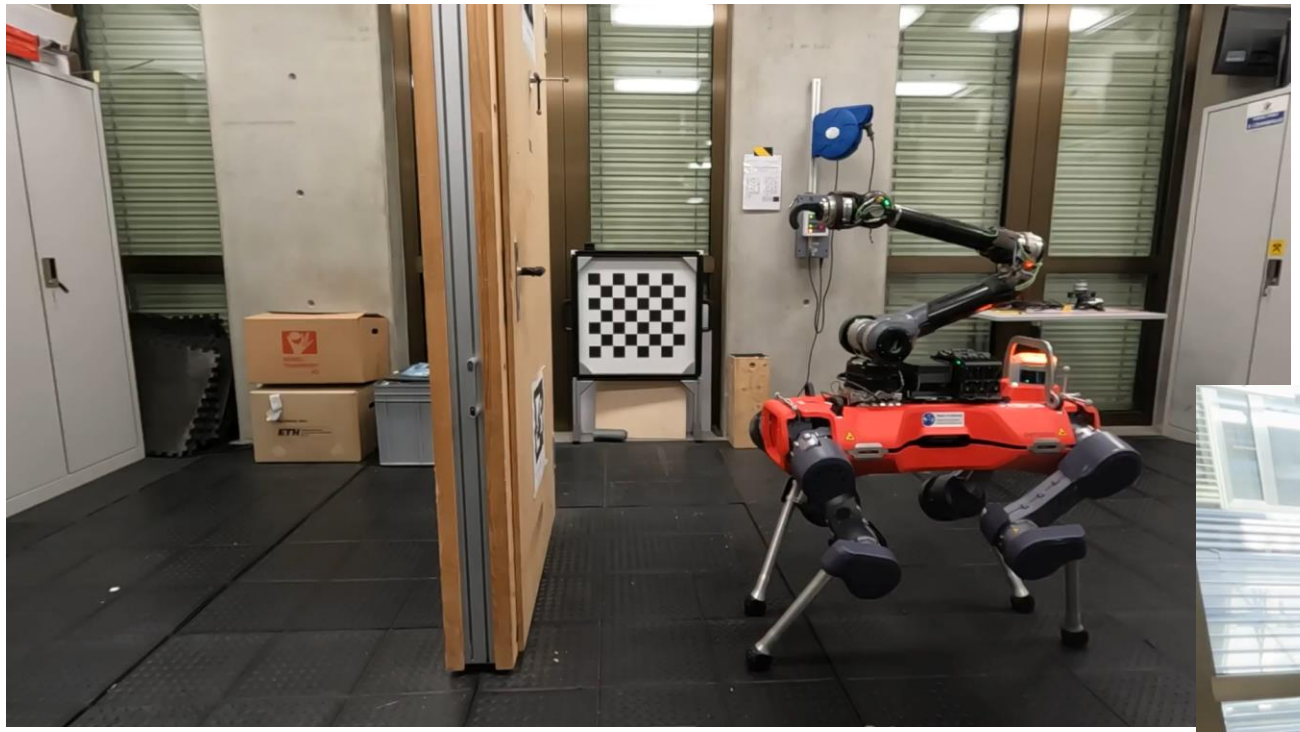
ETH ANYmal: Autonomous Exploration

Reinforcement Learning for Mobility

ETH zürich

RSL Robotic Systems Lab

ETH ANYmal with Arm: Basic Skills



Basic skills such as autonomously opening a door allow for more complex independent missions

Basic body control using RL suited for rough terrains with high accuracy

ETH zürich

RSL Robotic Systems Lab

ASTRIAL/SATWAYS: ENGAGE Automatic Fire Detection System (AFD)

Using cameras and AI algorithms, fire outbreaks are **immediately detected at the ignition before escalation**.

The field data are automatically transmitted to the Crisis Coordination and Management Software **ENGAGE™ AFD**, which significantly enhances situational awareness and enables informed decision-making, optimal use of operational resources, and effective coordination of civil protection agencies. Response time is highly reduced, while human casualties, material damage, and environmental destruction are effectively prevented.

- **Surveillance/Detection Equipment:** 20 km range, including: 360° continuous-rotation mobile cameras with 40 km zoom range, weather stations, solar panels, wireless communication equipment, local security systems
- **Forest Fire and Population Evacuation Evolution Simulator**
- **Interoperability** with the Fire Service's operational system ENGAGE IMS/CAD

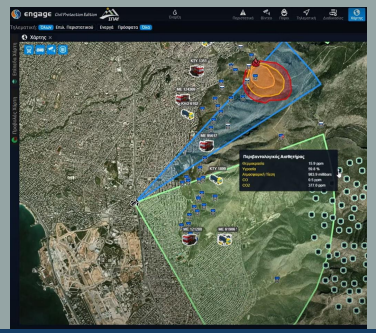
ASTRIAL
REDEFINING COMMAND, CONTROL & INTELLIGENCE

ASTRIAL/SATWAYS: ENGAGE AFD

With a current coverage area in Europe of over 2.7 million hectares, the algorithm used by the ENGAGE™ AFD system is one of the most tested and reliable worldwide.

The specialized algorithm responds through rapid smoke detection and confirmation using multiple criteria (color texture, pattern recognition, direction, and meteorological data) and maintains a very low false-alarm rate under varying environmental conditions.

By leveraging AI and ML technologies, it offers a detection range up to 20 km.

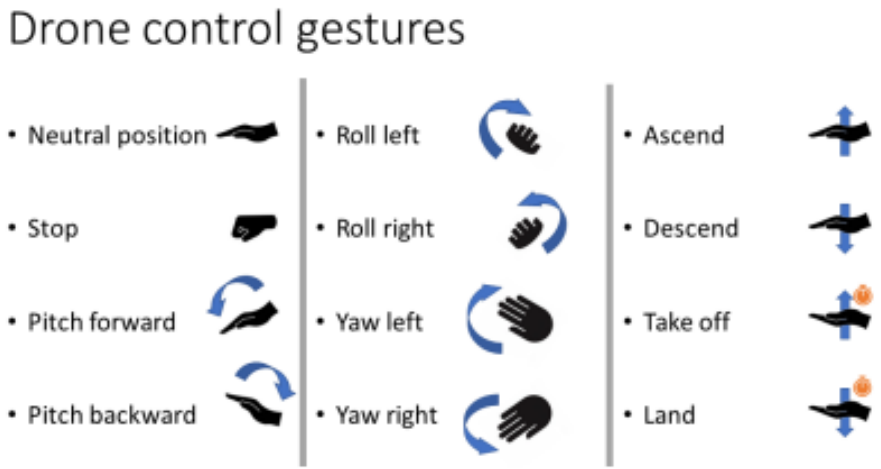


satways Redefining Command & Control

ASTRIAL REDEFINING COMMAND, CONTROL & INTELLIGENCE

CERTH: Robot/UAV Control

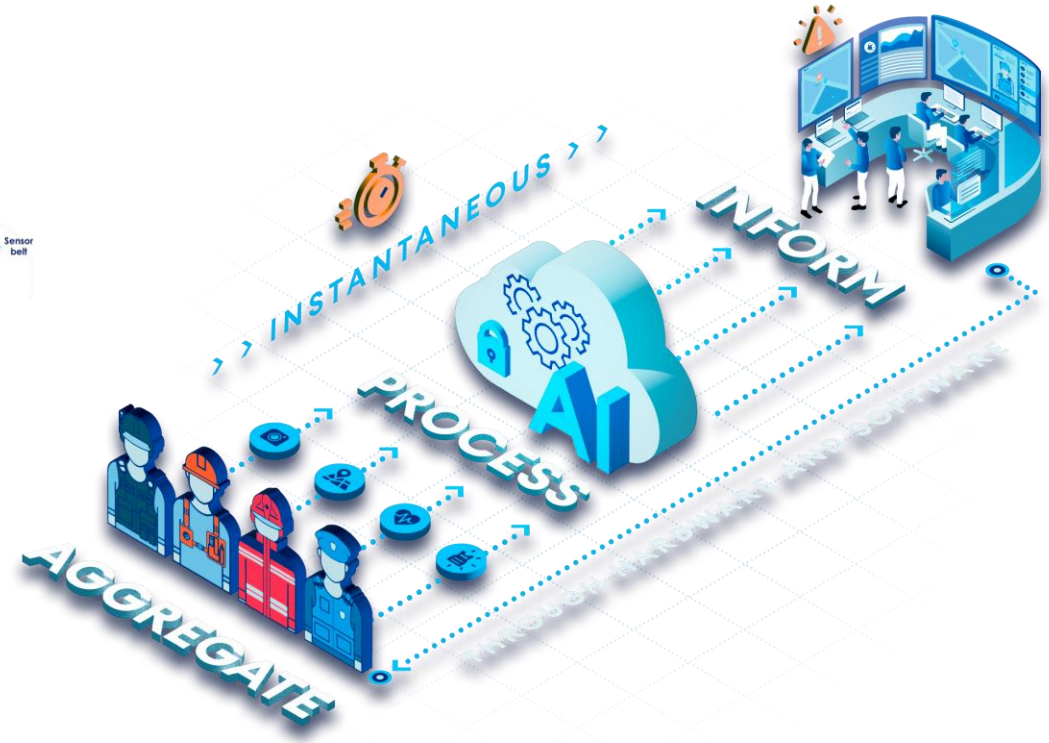
- Aim to control ANYmal and SNAKE using AR glasses
- UAV Gesture-based control - Using Google's MediaPipe Hands model and defined gestures to perform different movements



WEARIN' Wearables: ML algorithms for wellness index calculation

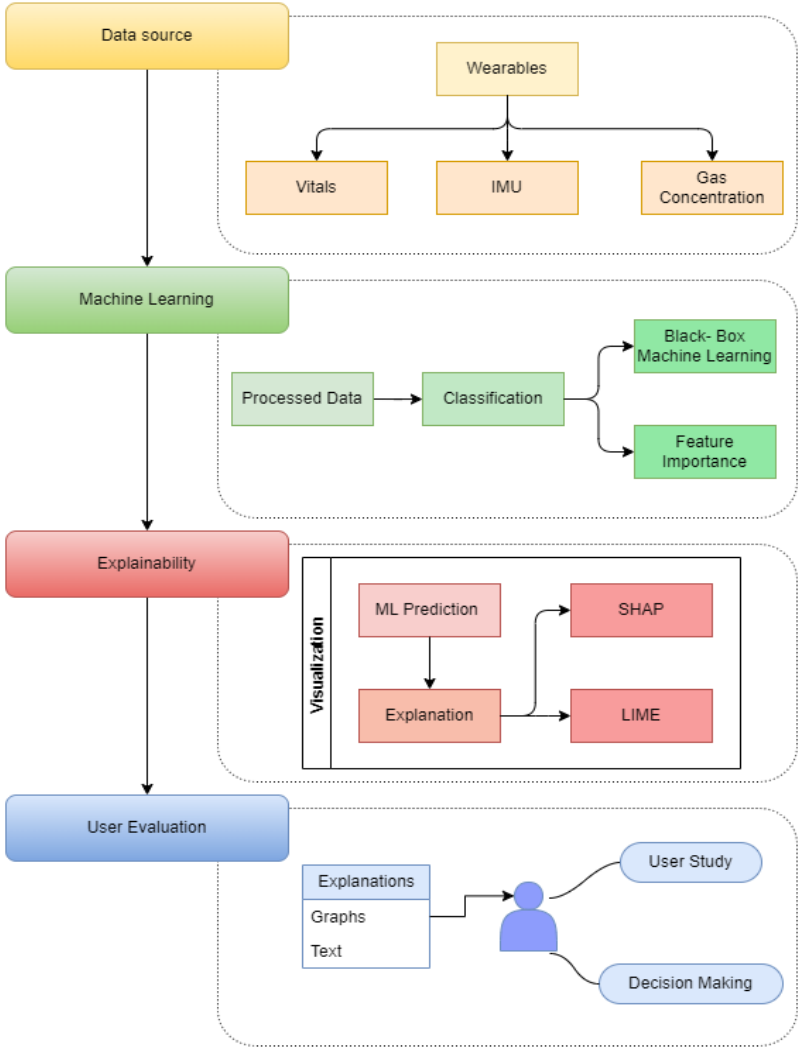
- Data collection by users in their daily activities and SYNERGISE field testing

- Data processed and fused by WEARIN' AI data algorithms for wellness index



CERTH: eXplainable AI methods

- Real-time alerting for environmental hazards and physiological vitals
- Enhances the alerts using Explainable techniques, particularly when there are anomalies
- Provides parallel analysis to infer causal relationships at absence of a combined dataset of gas and vitals during action
- SHAP Explainability Module: interprets the classifier's decisions. In case of alert, SHAP technique is deployed to evaluate cause and guide decision-making
- Random Forest model applied to accurately predict FR wellness status



Information Technologies Institute

VIRNECT: Remote Collaboration AR

1. Whisper model: Speech to Text
   - Remote app: Disaster situation specialised Whisper model (Speech to Text)
   - Whisper model to detect disaster-related verbal orders better during extremely loud conditions
2. LLM: User's Intention Prediction
   - LLM predicts intention and gives a call to the Commander
3. Real-Time Translation

Thank you!

On behalf of the SYNERGISE technical team

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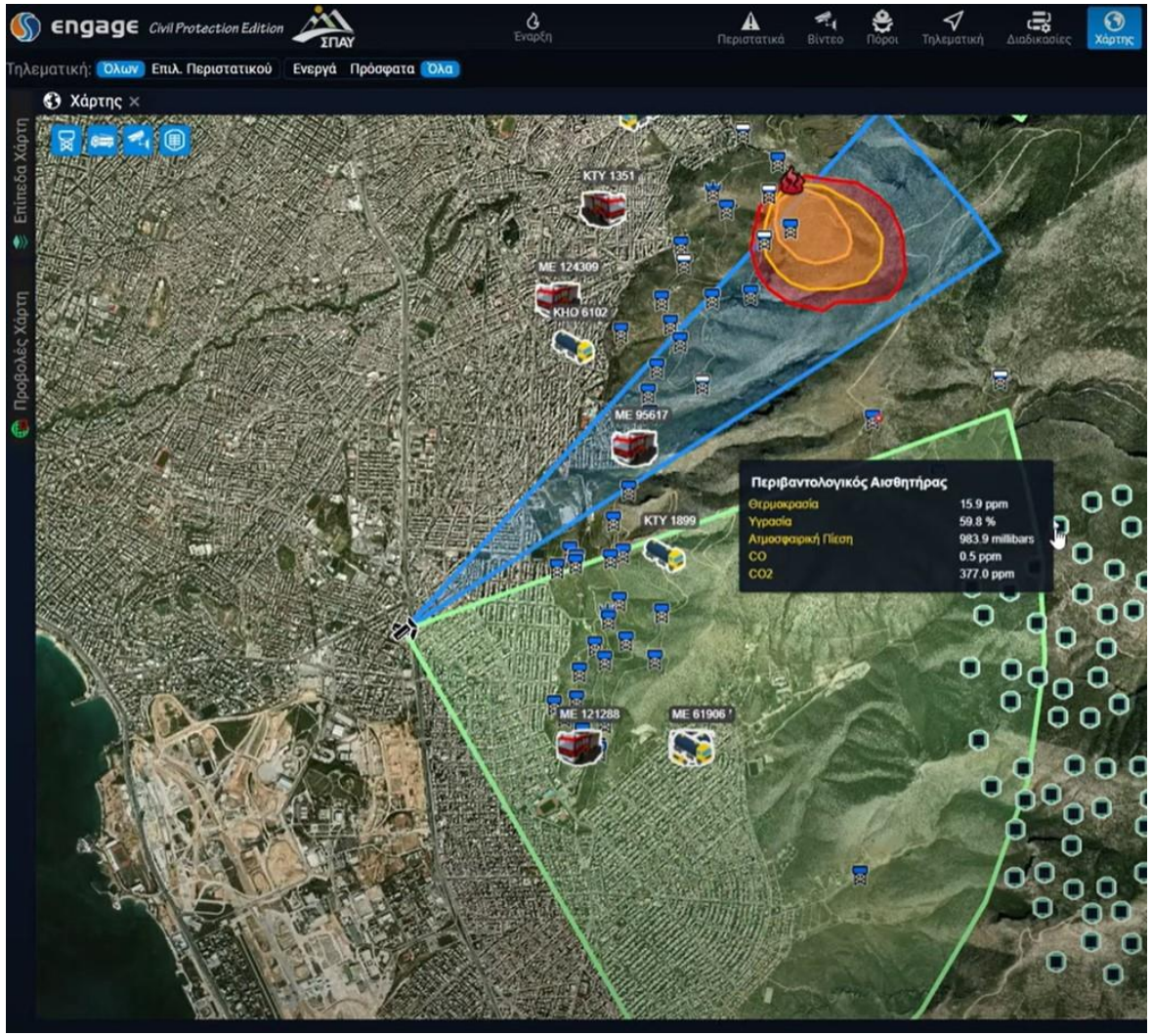
ENGAGE AFD – Forest Fire Simulator

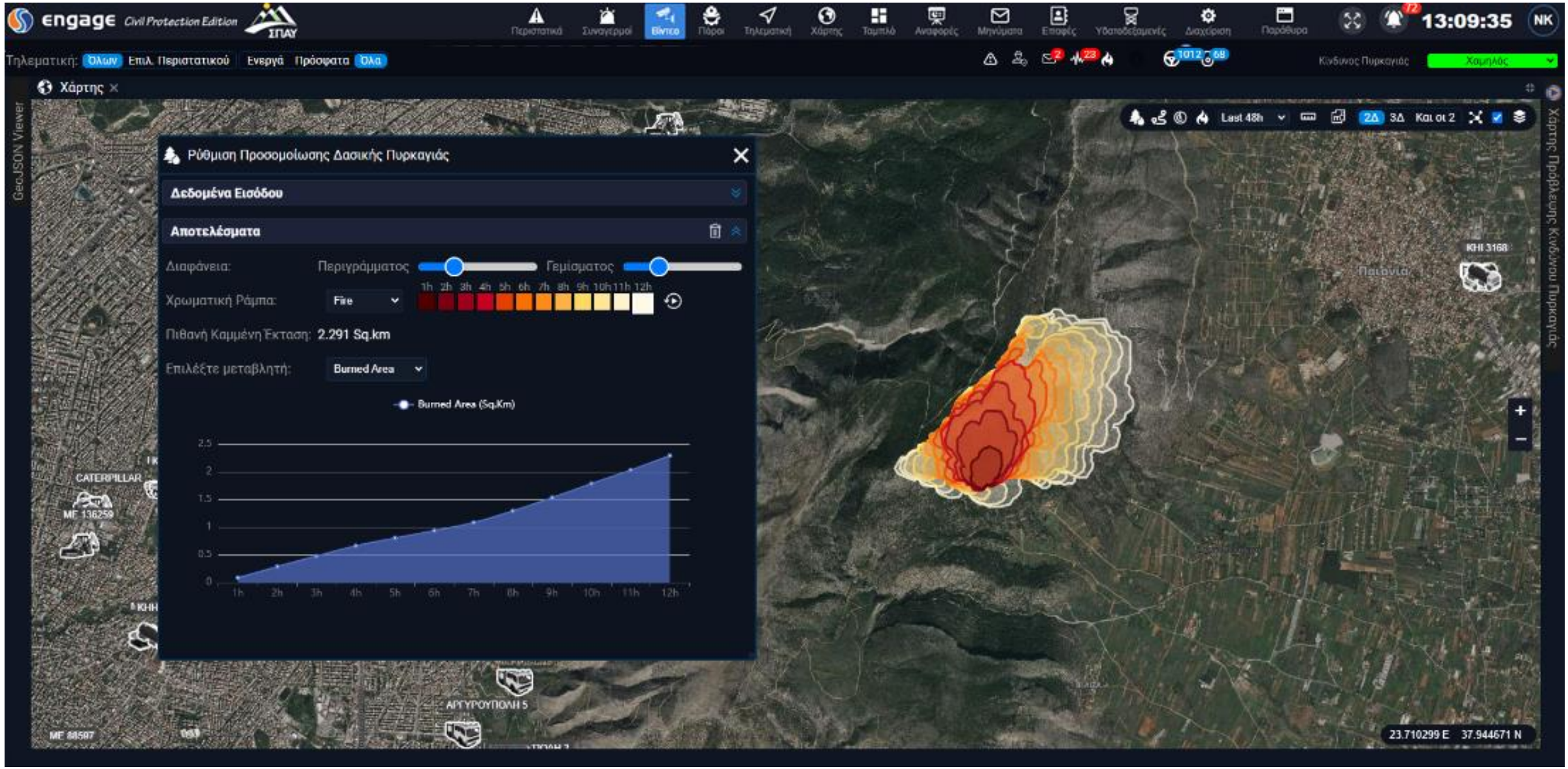
The forest fire simulation software provides an assessment service for the spread and behavior of forest fires through calculations based on the BEHAVE system approach and Rothermel's equations, suitably adapted for the fuel models of the Mediterranean/Greece region.

BEHAVE is the most widely used system for predicting forest fire behavior and spread, and has been tested in various parts of the world, including Mediterranean areas and Greece.

The simulation software is offered as a service (Web Service) so that more users can independently run simulations with different input data and corresponding results through the Crisis Coordination and Management Platform.



ENGAGE AFD – Forest Fire Simulator



ENGAGE AFD – Desktop Client