



## EUROPEAN COMMISSION

DIRECTORATE-GENERAL FOR EUROPEAN CIVIL PROTECTION AND HUMANITARIAN AID  
OPERATIONS (ECHO)  
Strategy and Policy  
Prevention and Preparedness Capacity Building

### AI for Preparedness: Building capacity for AI-powered Disaster Risk Management

#### Technical Sessions – Session Descriptions

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#### SESSION 1) DESTINATION EARTH FOR DISASTER RISK MANAGEMENT APPLICATIONS

Setting the scene		
10'	Introduction to Destination Earth	Luca Girardo, ESA
25'	The DestinE Digital Twins – what they are, what they provide, and how they can be used	Jörn Hoffmann, ECMWF
10'	The DestinE data portfolio – more than Digital Twin data	Danaële Puechmaille, EUMETSAT
Extreme weather and floods application examples		
15' (remote)	Introduction: AI for the Earth system	Matthew Chantry, ECMWF
10' (remote)	From Concept to Application: Addressing Weather Extremes with Destination Earth in Norway	Jørn Kristiansen, Met Norway
10'	AI and DestinE for Flood Forecasting and Adaptation	Kun Yan, Deltares
20'	Coffee break	
Application examples: hydrology and urban		
10' (remote)	Improving DRM for hydrologic extremes on climate timescales	Aparna Chandrasekar, Stephan Thober, Helmholtz Center for Environmental Research
10'	AI for urban health applications	Ana Oliviera, +Atlantic
10' (remote)	Urban Square - Supporting decision makers in assessing climate related challenges and their impact on urban areas	Fabien Castel, Murmuration sas
20'	Discussion: requirements and needs for integrating ML-tools in DRM.	

## Part 1: Expert validation of AI-generated graphs on disaster events

### Context and scope

As complex crises and multi-hazard or multi-risk contexts increasingly challenge traditional disaster risk models, the integration of advanced AI tools, particularly Large Language Models (LLMs), offers transformative potential. This workshop offers you the opportunity to harness the transformative potential of advanced AI tools, particularly Large Language Models (LLMs), reshaping how disaster narratives are constructed and analyzed. While expert insights remain invaluable, AI-driven tools provide a supportive framework that enhances efficiency without replacing human judgment. We will explore the role of LLMs and Retrieval-Augmented Generation (RAG) in generating crisis storylines and causal diagrams, aiming to support disaster risk managers, practitioners, and policymakers. By facilitating the synthesis of complex datasets, these technologies offer a novel approach to understanding past events and preparing for future scenarios. However, the human-in-the-loop framework remains essential, ensuring that insights are validated through human oversight and ethical considerations are upheld. This session showcases a JRC tool for generating and validating AI-driven disaster storylines, focusing on practical applications that ensure transparency, equity, and sensitivity to local contexts.

### Contents and structure of the activity

#### 15 minutes: Introduction to LLMs and Causal Loop Diagrams

- Gain a high-level understanding of LLM applications in disaster risk management
- Explore graphs, causality, impact chains, and causal loop diagrams
- Experience a demonstration of a Hugging Face dashboard to illustrate AI's potential in accelerating discovery and supporting real-time decision-making

#### 50 minutes: Evaluation of Disaster Storylines and Graphs

- Explanation on how to evaluate graphs, focus on assessing accuracy and relevance of nodes and links, computing metrics like F1 score
- Work in groups to critically analyze AI outputs, engaging in open discussions on ethical Considerations

#### 25 minutes: Survey on Tool Usage and Future Applications

- Structured survey with 5 to 10 questions to capture perceptions on tool applications.
- Discussion on utility for immediate disaster response, scenario generation, knowledge enhancement, or report creation.
- Discuss challenges and opportunities for responsible AI in disaster risk management, ensuring alignment with human values and ethical principles

### Outputs

- Validation of about 100 to 200 AI-generated graphs on past disaster events (out of more than 2000 graphs)
- Survey on possible usages of the tool in the disaster risk management cycle

### Speakers

Michele Ronco, PhD in Physics, Researcher and Data Scientist in AI for DRM, DG JRC

## Part 2: Empowering Disaster Risk Management with Explainable AI

### Context and scope

The increasing frequency and complexity of disasters combined with the ever-growing availability of information pose significant challenges to traditional risk management approaches. Effectively investigating multi-hazard scenarios and understanding their cascading impacts requires the ability to process and interpret vast amounts of diverse data. Artificial intelligence (AI) offers immense potential in this context, providing powerful tools for analyzing complex datasets, accelerating analytical processes, and uncovering valuable insights for disaster preparedness, response, and recovery. This workshop focuses on demystifying AI and exploring its practical applications in Disaster Risk Management (DRM). We will delve into how AI systems can efficiently handle large volumes of data, enabling rapid analysis and supporting advanced techniques like probabilistic modeling in a context of agricultural risks in Europe. The workshop will highlight the critical role of Explainable AI (XAI) in DRM, contrasting "black box" approaches with XAI tools, thus providing transparency into AI decision-making and fostering trust, ultimately allowing experts to validate AI-driven insights with their own domain knowledge. This session aims to equip disaster risk managers, practitioners, and policymakers with a foundational understanding of AI's capabilities in DRM. While acknowledging the transformative potential of AI, we will emphasize that human expertise remains central. Our approach will prioritize clarity and accessibility, ensuring that participants with limited or no prior AI knowledge can grasp the core concepts and their relevance to their work.

### Contents and structure of the activity

#### 10 minutes: Introduction to XAI and its Potential in DRM

- Concise overview of how AI is being used in various aspects of DRM, such as early warning, risk assessment, and impact analysis.
- Capabilities of AI in handling large datasets and providing rapid analyses, setting the stage for the importance of understanding these AI outputs
- The concept of "black box" AI models and the challenges they pose for trust and effective decision-making in critical domains like DRM.
- XAI introduction as a solution, emphasizing its ability to provide insights into how AI models arrive at their predictions. This will highlight the importance of transparency and the ability for human experts to understand and validate AI outputs.

#### 10 minutes: Understanding Simple AI Models for Hazard Detection

- Introduction of two simplified, non-technical fundamental AI models relevant to DRM: Random Forests and XGBoost models.
- The concept of "features" or input variables (e.g., temperature, rainfall, soil moisture) that AI models use to make predictions about agricultural hazards.
- How XAI techniques can help us understand which of these features are most important to the model's predictions for different types of hazards (e.g., drought vs. heatwave).

#### 50 minutes: Hands-on Exploration of AI for Agricultural Risk

*Participants are requested to have their own laptop, have access to internet, and to download the data to be used during the workshop's activities in advance*

- Introduction to the concept of Areas of Concern (AOC) – regions where unfavourable meteorological conditions are expected to impact agriculture.
- Introduction to the exercise for exploring simplified outputs from an AI model designed to detect these AOCs based on environmental data and expert knowledge

- Participants are expected to generate the following outputs:
  - Simplified Feature Importance Charts: Showing which environmental factors (e.g., temperature anomalies, precipitation deficits) were most influential for the AI model in identifying different AOCs (e.g., drought, heat stress).
  - Simplified Impact Visualizations: Illustrating how changes in specific environmental factors tend to affect the model's likelihood of predicting a particular AOC.
- The focus is on understanding why the AI model is highlighting certain areas as being of concern and which factors are driving those predictions.
- Participants are invited to discuss their results and observations from the XAI outputs.

#### **20 minutes: Summary, conclusions and the potential of Explainable AI in DRM**

- Summarize the main takeaways: XAI's potential for handling data and speeding up analysis, the importance of XAI for building trust and understanding, and how XAI can be applied to detect agricultural risks.
- Briefly discussion on the future directions in XAI for DRM, emphasizing the ongoing need for collaboration between AI experts and domain specialists to develop robust and trustworthy solutions for building resilience.

#### **Outputs**

- Enhanced understanding of AI fundamentals and its relevance to Disaster Risk Management (DRM), particularly in the context of agricultural risks in Europe.
- Appreciation for the critical role of Explainable AI (XAI) in building trust and enabling the effective use of AI in DRM.
- Increased capacity to critically evaluate AI-driven information in the context of disaster risk assessment and management.

#### **Speakers**

Guido Fioravanti, Statistician, Researcher in drought team, DG JRC, European Commission

### SESSION 3) DESTINATION EARTH: DATA AND PLATFORM SERVICES

5'	Setting the scene	Danaele Puechmaille, EUMETSAT
10'	<b>The DestinE Platform</b>	Luca Girardo, ESA
10'	<b>On-going and future AI Activities</b>	Luca Girardo, ESA
10'	<b>Using the DestinE Platform</b> (e.g. registration)	Alexis Longuet, Serco
20'	<b>Using the GeoAI Service</b> <ul style="list-style-type: none"> <li>• Early detection of refugee camps to monitor and optimize support</li> <li>• Extreme events Damage assessment (fire, floods)</li> </ul>	Sergey Sukhanov, FlyPix AI
25'	<i>Coffee break</i>	
30' (remote)	<b>DestinE Edge services</b> supporting application development	Patryk Grzybowski, Cloud Ferro
10' (remote)	<b>Drought in Italy use case demonstrator</b> in DestinE	Christoph Reimer, EODC
10'	<b>On-going developments in the field of AI</b>	Miruna Stoicescu, EUMETSAT
10' (remote)	<b>AI4Clouds AIML application demonstrators</b> using DestinE	Fernando Iglesias, Predictia
30 min	User feedback discussion: on data portfolio and services	

#### SESSION 4) INNOVATIVE SOLUTIONS FOR DRM DEVELOPED BY EU FUNDED PROJECTS AND MEMBER STATES

**C2IMPRESS** Co-Creative Improved Understanding and Awareness of Multi-Hazard Risks for Disaster Resilient Society, Horizon Europe project, *Serhan Karahan*

C2IMPRESS aims to bring a novel ‘place and people’ centred integrated multi-hazard risk and resilient assessment framework. Breakthrough innovations will be **System-of-Systems for Multi-Hazard Risk Intelligence Network platform**, supported by the robust **Earth System Dynamic Intelligence (ESDI)** and **Information Physical Artificial Intelligence (IPAI)**, **innovative Agent Based Model**, polycentric risk governance, multi-actor **decision support microservices** and a suite of citizen engagement technologies and tools.

**SAFE-LAND**, Knowledge For Action in Prevention and Preparedness project, *Elisabetta Cattoni, Francesco Pistolesi*

This project proposes a tool that uses **trustworthy artificial intelligence to assess hydrogeological risk and generate guidelines on risk management planning and increasing risk awareness**, even if hydrogeologic/demographic data is incomplete. The tool uses a knowledge base consisting of representative sets of reference areas and reference climate events. Each reference area has elements (slopes, rivers, people) described by hydrogeological and demographic data, whereas meteorological data characterise each reference climate event.

**French National Fire Officers Academy** (ENSOSP) and **Entente VALABRE**, *Quentin Brot, Philippe Meresse*

Presentation on Member State activities on to usage of **AI to predict operational pressure, to fight the climate crisis, to use AI for the preparation of end users**. Additionally, cooperation between different stakeholders for operational efficiency will be a focus of the discussion.

**CARMA**, Collaborative Autonomous Robots for eEmergency Assistance Horizon Europe project, *Alexandre Ahmad, Nicholas Vretos*

CARMA aims to co-create, a groundbreaking, modular and intuitive platform offering a complementary set of **semi-autonomous and autonomous UGVs capable of working in symbiosis with humans to support and supplement first responders** and assist citizen in a wide range of disaster situations, including those with very low visibility. The project aims to develop robotics, making them autonomous thanks to novel **3D radar-based environment mapping** and analysis combined with Artificial Intelligence for **enhanced path and mission planning** as well as victim and threat detection.

**SYNERGISE**, Horizon Europe project, *Sabina Ziemian*

SYNERGISE will develop a Novel **Integrated Toolkit for Collaborative Response and Enhanced Situational Awareness (NIT-CRES)**, at the service of response agencies This will comprise a multitude of tools and services required for: 1) boosting situational awareness and sense-making by offering them the means to **autonomously and synergistically perform indoor and outdoor exploration of incident sites** towards victim identification whilst receiving at all times information about responders’ position and vitals as well as analyses **of passive and active threats and hazards at the area of operations** and 2) upgrading collaborative response and incident as well resources management by continuously sharing and updating the common operational picture across deployed teams, among the chain of command and between participating agencies.