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EUROPEAN COMMISSION CONTRIBUTION TO THE 3RD MEETING OF THE GLOBAL INITIATIVE ON RESILIENCE TO NATURAL HAZARDS THROUGH AI SOLUTIONS

The European Commission recognises the transformative potential of Artificial Intelligence (AI) and Machine Learning (ML), both referenced from here onwards as AI, in advancing Disaster Risk Management (DRM) and bolstering our capacity to prevent, prepare for and respond to natural hazards. As part of the EU's commitment to preparedness, resilience, and sustainability, we are actively working towards integrating AI into our DRM at European level, across the Union and in our collaboration with partner countries outside the Union.

In an era marked by escalating climate-related hazards, renewed security threats and increasing budgetary pressures on public finance, innovation is essential for enhancing our efficiency and effectiveness DRM and crisis preparedness. European civil protection stands at a pivotal moment, with a real opportunity to take bold but thoughtful steps in integrating AI tools, systems and technologies into all phases of our work – from early warning and preparedness to crisis response and recovery. AI for preparedness activities contribute to implementing the Preparedness Union Strategy's actions on e.g., foresight and anticipation, population preparedness, public-private cooperation, and crisis response.

In this framework the Apply AI Strategy sets out a European roadmap to boost AI adoption and integration to unlock the societal benefits of AI, including for DRM. The European Research and Innovation programme, Horizon Europe, has generated a significant portfolio of advanced, AI-enabled solutions that have been co-developed and validated with DRM stakeholders. These include capabilities for rapid situational awareness, multi-hazard forecasting, evacuation and response optimisation, wildfire and flood intelligence, robotics enhanced with AI for search and rescue, and integrated multi-risk platforms. The EU Space programme, the Copernicus Emergency Management Service, and the Commission flagship initiative Destination Earth illustrate how AI supports decision making for a better DRM and are continuously integrating new technologies, including the outcomes from EU-funded projects, into an operational framework. The European Commission's science and knowledge service, the Joint Research Centre, is embracing AI strategically to accelerate its research for policy support ([1]). The upcoming 2030 Roadmap on the future of digital education and skills will promote the development of AI literacy in primary and secondary education ([2]) and in a lifelong learning and inclusive manner, boosting the critical understanding and use of the technology, as an important enabler for individual and collective preparedness.

([1]) See e.g., the science for policy brief on AI approaches for DRM.

([2]) Building on the draft AI literacy framework for primary and secondary education, developed with the OECD and planned for finalisation in 2026.

1. AREAS OF POTENTIAL

AI has shown promising applications throughout the entire DRM cycle. Its enhanced processing power, enabling faster and more advanced data processing as well as pattern recognition have been widely recognised as one of the core strengths of AI for DRM. Improving **disaster preparedness**, **forecasting** and **early warning**, **situational awareness, impact and damage assessment**, **hazard simulation** and evolution and **scenario building** are some of the analytical capabilities that AI has the potential to transform at both national and EU level. It can contribute to enhancing the analytical capacities of the Emergency Response Coordination Centre (ERCC) for increased preparedness, anticipation and response to emergencies at European level.

AI can play a fundamental role in:

1. Reinforcing the EU's **operational capabilities** and protecting its **technological *sovereignty and independence* in critical scenarios**—such as disaster preparedness and relief—by leveraging advanced AI technologies and high-value data resources. Scalable, innovative, and easily deployable AI solutions need to be developed and made available for public authorities and public-private partnerships across the Union.

2. **Mitigating and adapting to the impacts of climate change** across European societies and communities, supporting the adoption of efficient policies and improved decision-support from national to local scale. Enabling equitable access to information and data for European Member States and risk management services as well as their supporting operational systems in the field of environmental protection and climate adaptation.

3. Adapting, transferring and scaling-up selected AI solutions for countries in need as part of **international partnerships for AI development** while also serving as a powerful lever for external action — advancing the concept of *AI for Public Good*. Under the Global Gateway strategy, the EU aims to cooperate with trusted partners on AI innovation globally. The EU aims to address the digital divide by investing in infrastructure and AI capacity-building programmes that empower local experts and institutions, enhancing data availability and access and.

AI allows for better understanding and modelling of the Earth System and its interaction with the socio-economic system, opening the way to better management of the creation and prevention of risk. Flagship initiatives such as ***Destination Earth*** are already showing how AI-powered digital twins progress weather and climate modelling, providing high-resolution, interactive simulations with improved predictive capacity and support evidence-based decision-making. These tools enable cities and regions to design more resilient and sustainable infrastructures, ultimately reducing the effects of climate-related events through thoughtful spatial planning.

Generative and agent-based AI, two sub-domains of AI powered by large language models (LLMs), mark a new frontier for AI in DRM by turning scientific, climate, and risk knowledge into integrated and actionable insights that can strengthen analysis and coordination across all phases of disaster management.

Technologies benefit from being enhanced by AI such as **autonomous drones and robotics**, satellites and equipment. In view of the record-breaking wildfire season 2025, further technologies such as AI enhanced firefighting planes or pumps as well as AI-based

situational awareness for search-and-rescue command and control centres, coupling earth observation with AI technologies for rapid damage assessment, or integrated multi-hazard early warning systems show potential in the fight against increasing climate-related hazards.

Through Horizon Europe, the European Commission has supported initiatives boosting AI innovations for DRM with an estimated volume of more than EUR 300 million. For AI science development, additional EUR 100 million of investments in the Resource for AI Science in Europe (RAISE) have been leveraged, with a ramp-up of EUR 600 million in connection with AI factories. In the private sector AI startups working on climate and environmental issues, also pertaining to DRM, have attracted over EUR 700 million in venture capital since 2019 ([3]). Among others, the Technical Support Instrument (TSI) can support EU Member States with tailor-made technical expertise to design and implement reforms, such as on AI. A non-comprehensive overview of other funding opportunities for capacity building in DRM can be found here.

To better understand the state-of-the-art of AI in crisis management and the lessons learned from applications related to it, the Scientific Advice Mechanism (SAM) to the European Commission and associated experts have produced a report on *AI in Emergency and Crisis Management*. Its policy options can serve both the EU and the broader civil protection community as they seek to integrate AI in DRM.

2. CHALLENGES IN OPERATIONALISATION

While many of AI tools and systems are already at a certain level of technological maturity, a large gap remains between innovation and uptake, particularly in DRM.

2.1. Technological challenges

Availability and accessibility of **relevant datasets and data sources** is a major barrier for AI training, and implementation. DRM is traditionally a data-poor field, and initiatives to document the impacts of past disasters have had modest success, resulting in incomplete datasets for the training of AI models. This is particularly true for socio-economic and local datasets that need to be identified, validated and collected. Despite large developments and results in a range of AI models (e.g., weather forecast), integration of a trustable multi-risk approach (e.g. fire behaviour to water resources) needs further development and research. **Validation** is equally critical; LLMs and AI agents should be systematically tested, benchmarked, and verified before integration into civil protection systems, with special attention paid to **reproducibility** of results. **Cybersecurity** also remains a concern: current operational paradigms make it easy for malicious actors to hide commands in the context data, a technique known as prompt injection. In the worst cases this can lead to exfiltration of sensitive information or AI agents carrying out tasks on behalf of bad actors. **Contingency plans** need to be put in place in case of a lack of connectivity, energy, cyber or hybrid threats where the use of AI may not be possible in response operations.

Another challenge is the lack of robust, real-time reactive tools and an integrated end-to-end platform capable of supporting the entire process — from weather forecasting and

([3]) https://dealroom.co/eu-apply-ai-climate-environment

strategic planning to on-the-ground resource deployment. The lack of interoperability and harmonised data across national systems inhibits deployment.

2.2. Ethical standards and trustworthiness

A key issue for the uptake of AI solutions remains the **ethics, trustworthiness, explainability** and **security** issues of the employed tools. The open availability of AI solutions is a pre-requisite for democratisation and equity.

Trustworthiness of AI solutions is a key requirement for informed decision making. Explainable AI (XAI) plays an important role in this regard. Given the sensitive and life-saving nature of DRM, any tool that is to be taken up into operations should follow a **human-in-the-loop** approach. AI systems can provide decision support and recommendations; however, they should never replace human decision making. Ethical standards, as those set out in the AI Act ([4]), set a benchmark for this.

Additionally, the risk of **cognitive bias** when handling AI outputs needs to be adequately managed: For an LLM to produce natural-sounding language, the system necessarily prioritises plausibility over accuracy, easily leading to losses of information in results that will nevertheless appear superficially correct. This is especially relevant in the field of DRM, since crises by their very nature are often characterized by unexpected elements.

Given the growing need of data and computational power, sustainability is recognised as a criterion for development, considering the trade-off between mitigating human suffering versus adding to environmental and climate pressure.

2.3. Institutional capacity and financing

AI literacy and AI specialised skills among policy and operational staff remain low and provide one barrier to identifying the correct AI solutions and employing them in operations. Further capacity-building at all levels is necessary to enable end-users to effectively select, understand, trust and use AI tools in an adequate manner. It is the role of academia and product developers to ensure that solutions are **open**, **transparent**, **explainable**, **fit-for-purpose**, and strike a **balance between complexity and usability** by operational stakeholders.

To help new products bridge the innovation to uptake gap we need to ensure that end users, such as DRM competent authorities, are involved in a **co-design process of new solutions from early stages of development**. Ensuring that systems are understandable and usable by operational staff who do not have AI expertise is vital.

A key shortcoming lies in ensuring that **financial instruments can effectively scale up and translate the valuable research outputs** emerging from EU programmes, such as Horizon Europe, into practical and impactful applications. Processes such as **Pre-Commercial Procurement** can aid this by de-risking development, end-user involvement and taking first steps towards market integration. AI tools, like any innovation, should be designed in such a way to allow for integration into legacy processes and procedures, not create entirely new ones.

([4]) Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act).

It is essential to establish **mechanisms that ensure the long-term sustainability** and integration into existing programmes — within the EU but also internationally, as part of broader efforts to promote **global cooperation and shared resilience**.

3. CONCLUSION

The adoption and integration of Artificial Intelligence in disaster risk management provides a significant opportunity on the pathway to the Preparedness Union by enhancing our capacity in preventing, preparing for and responding to crises. Key initiatives such as the Apply AI Strategy and partnerships with global entities under the Global Gateway strategy reflect this ambition, offering pathways to reinforce the EU's operational capabilities using advanced AI solutions. AI-driven projects like Destination Earth and Copernicus Emergency Management Service illustrate the transformative potential of AI by providing data-driven insights and simulations to support evidence-based decision-making.

Actions listed in Annex A serve scale-up and integration of AI across various DRM-relevant sectors. These activities are based on existing funding; no additional funding is foreseen as part of this meeting contribution. The implementation of these actions will be integrated into sectoral mechanisms under the Apply AI Strategy.

To advance the integration of AI in DRM effectively, the EU must tackle technical, ethical and operational challenges and emphasize capacity-building across institutional frameworks. Enhancing **AI literacy** and skills among policy and operational staff is paramount for successful implementation, urging academia and product developers to offer open, transparent, and **explainable AI solutions that are understandable and usable by non-experts**. The co-design of AI tools with end-users and ensuring they fit seamlessly into existing operational procedures are critical steps for bridging the gap between innovation and practical application. Overall, **AI is a tool and not a standalone solution: It can support human decision-making, not replace it.** Ensuring accountability and ethical oversight should remain in human hands. The AI Act sets a benchmark for ethical and trustworthiness requirements of AI systems. Financial mechanisms like Pre-Commercial Procurement can facilitate the scaling of AI technologies from research to practice. Establishing long-term sustainability mechanisms for AI systems within existing EU programmes will not only **maximise the societal benefits of AI in DRM** but also position the EU as a leader in global resilience and cooperation. Building **European strategic autonomy** in AI will be essential to reduce external dependencies.

With this contribution, the European Commission invites the Global Initiative on Resilience to Natural Hazards through AI Solutions, its associated partners and working groups, and similar institutes or entities working on AI for DRM to examine the findings and needs as well as opportunities arising from it and base their future work on it.

Annex A List of Actions

AI for DRM Capacity Building Programme
An eLearning pathway for policymakers and operational staff, introducing key concepts and thematic areas of application for AI along the DRM cycle (Q4 2026)
A dedicated objective for the development of AI tools under selected UCPM capacity-building funding tools (Q2 2026)
Facilitate end-user involvement in product development through industry-public sector matchmaking initiatives (Q4 2026)
Increase awareness and capacity of innovation procurement tools of the Commission among Member States and third countries
Innovation Uptake and Deployment of AI Solutions from Horizon Europe (Q1 2026 onward)
Establish a structured EU-level pathway for the operational uptake of AI-enabled solutions developed under the Horizon Europe
Launch pilot actions to deploy and evaluate selected AI tools (e.g., multi-hazard forecasting, decision-support systems, AI-enabled situational awareness) in real operational contexts
Facilitate innovation procurement, including Pre-Commercial Procurement and Public Procurement of Innovative Solutions, to enable the scaling of validated AI tools for end-users
Research and Innovation projects
Development and validation of integrated forecasting models that enhance the prediction and management of multi-hazard scenarios, incorporating real-time data, AI-driven analytics, and remote sensing technologies
Disaster preparedness: Advanced local digital twins using AI for Early warning and preparedness (Q4 2027) Developing local digital twins for urban areas, powered by advanced AI algorithms, to model flood impacts, simulate planning scenarios, identify flood-prone structures, and propose effective mitigation strategies—enhancing urban preparedness and reducing disaster risk
Crisis management: Multi-hazard management platform underpinning an intelligent decisional-support platform designed to strengthen crisis management and response due to natural disasters The platform will enable **dynamic** allocation of resources, improving operational efficiency and reducing the incidence of casualties during disasters (e.g. wildfires and floods), applying AI to existing services (e.g. European Forest Fire Information System (EFFIS) and Global Wildfire Information System (GWIS) of the Copernicus Emergency Management Service). Q1 2027 (wildfires), Q4 2027 (floods)

Reconstruction: Local Digital Twin (Q1 2027) AI can be used to quantify level of urban damage in disaster-hit areas. As well as to help local authorities to simulate reconstruction scenarios, estimate costs and track cost deviations. All of this ensures accountability and transparency and thereby reducing the risk of fraud−throughout the whole lifecycle of the project. This is part of a Digital Twin for reconstruction project established under AI for public good initiative to support Ukraine and other low and middle-income areas of the planet
Enhancing reliability, adaptability and efficiency of decision support systems by integrating emerging technologies such as trustworthy AI to improve civil preparedness and crisis management
Interdisciplinary digital twins for modelling and simulating complex phenomena (Biodiversity Digital Twin, Digital Twin for Geo-Physical extremes, etc.) and new digital twins for Destination Earth (Digital Twin of the Cryosphere and Land Systems, Urban Simulation for Air Quality and Heat Resilience Strategies, AI-based Climate modelling for a changing world)
Digital twins and/or their major components for environment, climate and security, aiming at improved capacity of key users and decision-makers to anticipate, mitigate and contain risks in the vulnerable societal sectors, as well as improved security and preparedness for a more disaster-resilient society.
Destination Earth initiative
The DestinE Digital Twin for Weather-Induced Extremes (**Extremes DT**) helps address extreme weather by providing tailored simulations and exploring what-if scenarios across different timeframes across present and future climates. It complements existing capabilities and uses advanced models and observations to offer high-resolution forecasts, globally at 4.4 km and 500–750 m over Europe, for events a few days ahead.
The DestinE Digital Twin for Climate Change Adaptation (**Climate DT**) aids adaptation by delivering innovative global and multi-decadal climate information at scales where impacts are most observed. It integrates advanced Earth-system models, sector-specific applications, and observations into a unified framework to provide projections and insights from 1990 to ~2050, at high spatial resolutions of 5 to 10 km.
Pilot services and machine learning demonstrators for high-resolution precipitation-to-flood signals, rainfall-induced floods, tide and surge forecasts, marine safety, wildfire evolution, simulation of extreme-weather events in future climates, etc.
Digital twins to analyse and anticipate environmental threats in areas of human settlements, including air quality, fluvial flood, sea level rise, urban heat, infrastructure damages and impact on resources.
Copernicus Emergency Management Service (CEMS)
Deep learning assisted wildfire burnt area analysis and flood monitoring for the European Forest Fire Information System (EFFIS), the European and Global Flood Awareness Systems (EFAS & GloFAS) and the CEMS On-Demand Mapping component

Enhanced **AI-based tracking of droughts** for the European and Global Drought Observatories (EDO & GDO)
Integration of **machine learning based numerical weather predictions into the CEMS Early Warning and Monitoring component** including EDO, GDO, EFAS, GloFAS, and EFFIS
Usage of **hybrid models (physics based and AI based)** to enhance flood (EFAS, GloFAS) and drought (EDO, GDO) forecasting
Mapping global building infrastructure and population with the Global Human Settlement Layer (GHSL) using deep learning
The Commission's science and knowledge service
The Joint Research Centre has a portfolio of research projects on "AI and data" exploring the opportunities and risks, including through the Centre of Excellence on Algorithmic Transparency and HUMAINT (human behaviour and machine intelligence). This portfolio will look into innovative solutions and will help contribute to an EU ecosystem of excellence and trust in AI and data. The JRC has a portfolio of research project on "Anticipation, risks, resilience" contributing to shaping the EU's path towards a resilient future, increase its security, cohesion and stability, and develop the future EU approach to crisis management. It develops and applies AI-based solutions to address all phases of risk management: from prevention and preparedness to response and recovery. These include projects on conflict risk forecasting, disaster loss data collection, situational awareness briefs, expert support systems for ERCC staff, disaster forensics.
From text corpora to actionable insights: LLMs for preparedness and anticipation (Q3 2027) 1) Response: Utilize LLMs to geolocate disaster events from news and enrich records with contextual storylines, enhancing spatial detail and understanding of cascading dynamics. 2) Awareness: Integrate LLMs with historical narratives and diverse data sources to generate reliable disaster scenarios, aiding decision-makers in planning and mitigation strategies. 3) Anticipation: Employ LLMs to continuously extract signals from news, facilitating the anticipation of humanitarian crises.