Welcome!

Artificial intelligence for Disaster Risk Management

UCPM Knowledge Series Workshop (22 October 2024)

Agenda

- *09.00 – 09.15 Welcoming Coffee*
- 09.15 – 09.30 Opening of the workshop
- 09.30 – 11.00 Panels - What is the state of the art?
- *11.00 – 11.30 Coffee Break*
- 11.30 – 12.45 Breakout - What does the future hold?

Full agenda and extra info here:

- Q&A available at …

Join at **slido.com** **#3039 145**

European Union

Union Civil Protection Knowledge Network

European Union

Union Civil Protection Knowledge Network

Opening of the workshop

Erwan Marteil
Head of Unit, DG ECHO.B3
Prevention and Preparedness Capacity Building

AI for Societal Good

AI Office
22 October 2024

Martin Bailey, HoU CNECT A5
Miguel Alvarez, Policy officer

EUROPEAN ARTIFICIAL INTELLIGENCE OFFICE

AI for Societal Good - Overview

1/ AI tools for prediction/simulation

for Digital Twins - Smart cities, energy, health, emergency response

2/ International cooperation in AI

- aim to offer AI solutions to third countries

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AI for Societal Good

Engaging scientists, experts, research centres, national labs, industry to **develop AI-driven solutions for key societal challenges** e.g. reconstruction, emergency response, health, electricity, extreme weather

Establishing **relationships with like-minded partners**: governments e.g. US and international organisations

Deployment of AI solutions: e.g. **emergency response** (forest fires and flooding) both in Europe* and Africa/Latin America

*forest fires in Portugal/Greece; flooding in Czechia, Austria, Poland

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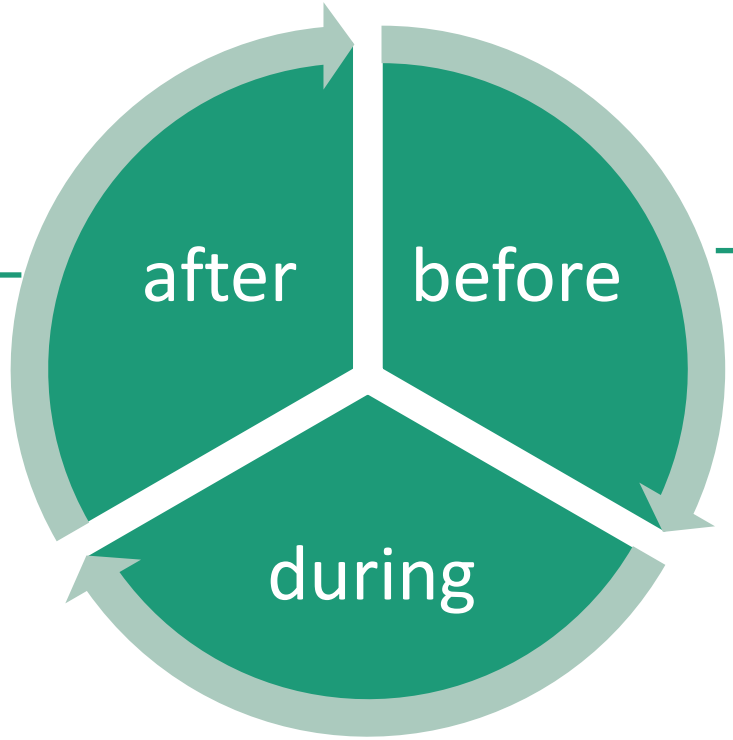
Strong focus on AI-based Solutions in Phases of Disaster Management

Digital Twin for Reconstruction



Extreme Weather forecasting:

Urban heat health

Tropical cyclones prediction

AI-based Multi-Hazard Platform on Wildfires and Flooding

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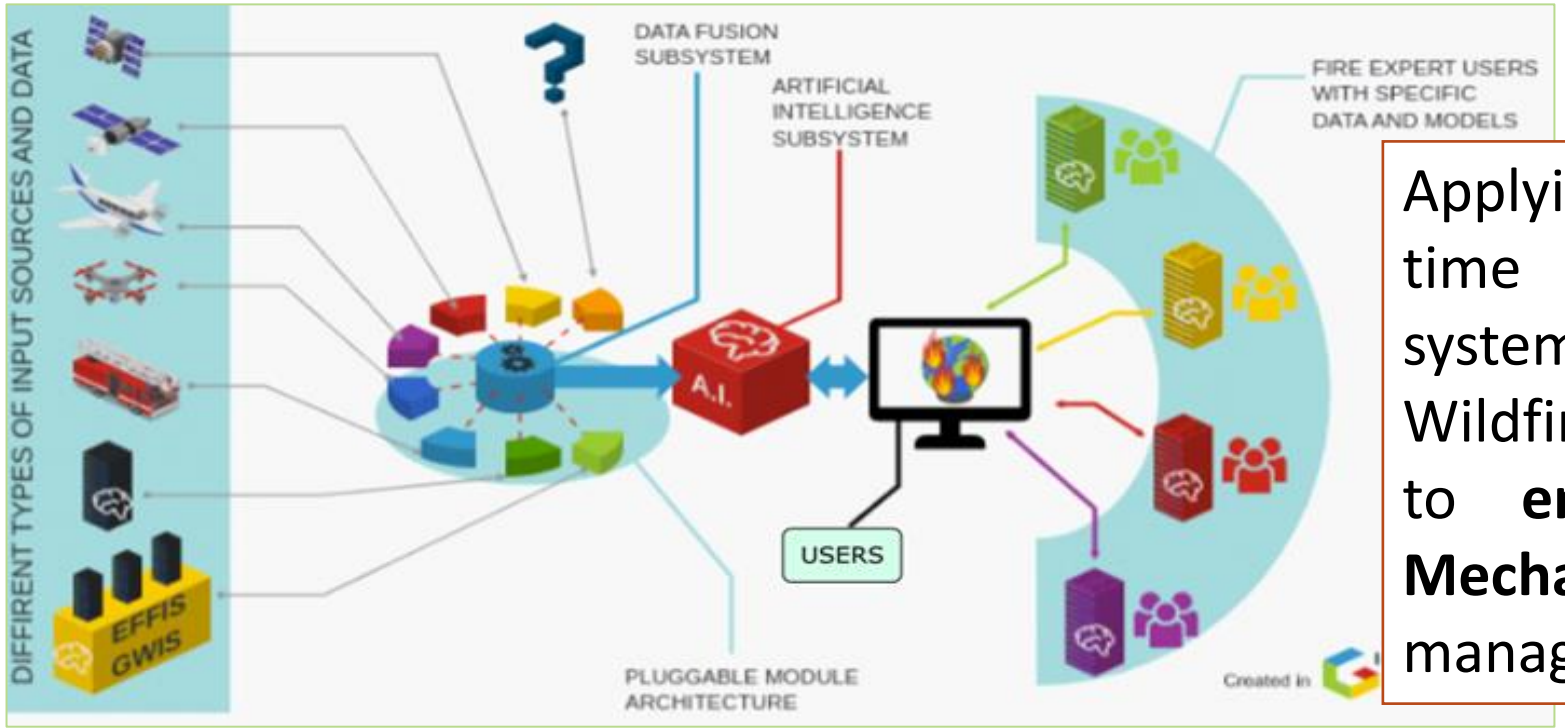
AI-based Multi-Hazard Platform for disaster management

In cooperation with JRC/ ECHO - Union Civil Protection Mechanism



Applying AI technologies and real-time data analytics to advanced systems (e.g. Copernicus and Global Wildfire Information System)
to **enhance EU Civil Protection Mechanism capabilities** for disaster management

Application of multi-hazard platform to forest fires, flooding

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AI-based Multi-Hazard Platform for Disaster Management – Harnessing full potential of AI to

Support decision-making in disaster management

Optimising *resource allocation*

Enhancing d**ecision-making** for people in the field

Optimise response to specific disasters (e.g. wildfire)

Accurate fire *detection, prediction and monitoring* of evolution

Precise estimates of the severity and progression (e.g. *fire behaviour modelling*)

Deployment in third-countries as part of international cooperation- Latin America and Caribbean

Multi-hazard platform to be extended to a 2nd disaster type - floods

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Seeking also cooperation with key US organisations

- U.S. Fire Administration
- U.S. Forest Service
- U.S. Department of Interior
- National Oceanic and Atmospheric Administration
- University of California, San Diego
- Univ. Maryland
- CALFIRE
- Colorado State Fire Marshal Office
- USAID

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UN Focus Group on AI for Natural Disaster Management

Andrea Toreti,
Team Leader – Scientific Research DG JRC.E1

European Commission

AI for Natural Disaster Management

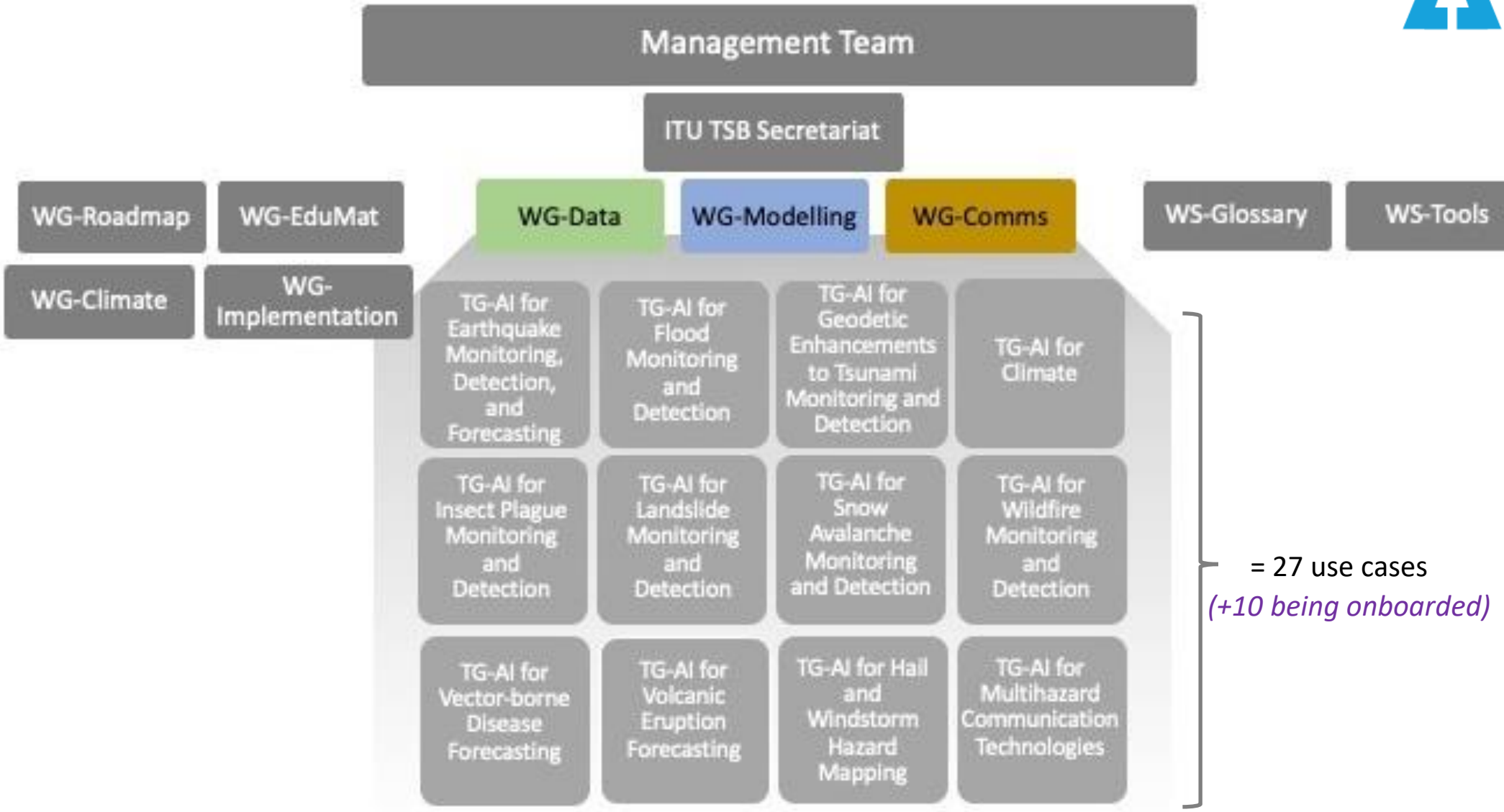
ITU Focus Group

- Est. 2020
- Community of experts & stakeholders
- Systematically evaluating AI use to identify challenges & opportunities
- Developing best practices
- Supporting capacity sharing

ITU

UN environment programme

European Commission

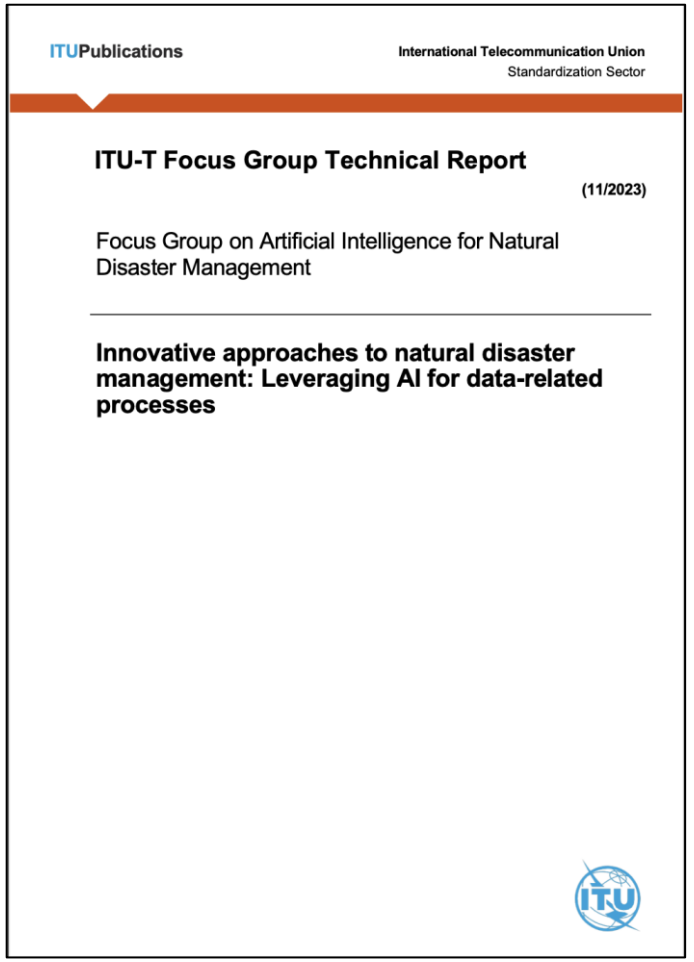


= 27 use cases

(+10 being onboarded)

WG-Data

- Data themes
- Data interoperability
- Metadata
- Curation & delivery
- Temporal data processing
- Annotation
- Validation
- Bias
- Visualization



ITUPublications

International Telecommunication Union
Standardization Sector

ITU-T Focus Group Technical Report

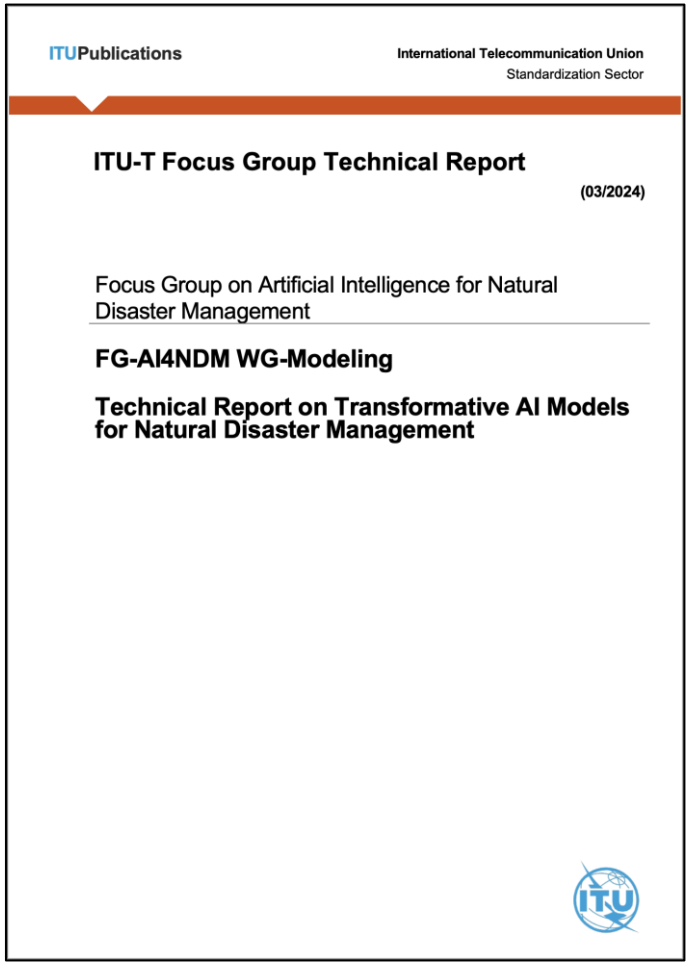
(11/2023)

Focus Group on Artificial Intelligence for Natural Disaster Management

Innovative approaches to natural disaster management: Leveraging AI for data-related processes

WG-Modelling

- Problem statements
- Guiding principles
- Data preparation
- AI training
- AI algorithm selection
- AI evaluation approaches
- Transparency & open source
- Explainability
- Legal & ethical considerations


ITUPublications

International Telecommunication Union
Standardization Sector

ITU-T Focus Group Technical Report

(03/2024)

Focus Group on Artificial Intelligence for Natural Disaster Management

FG-AI4NDM WG-Modeling

Technical Report on Transformative AI Models for Natural Disaster Management

Fraunhofer HHI

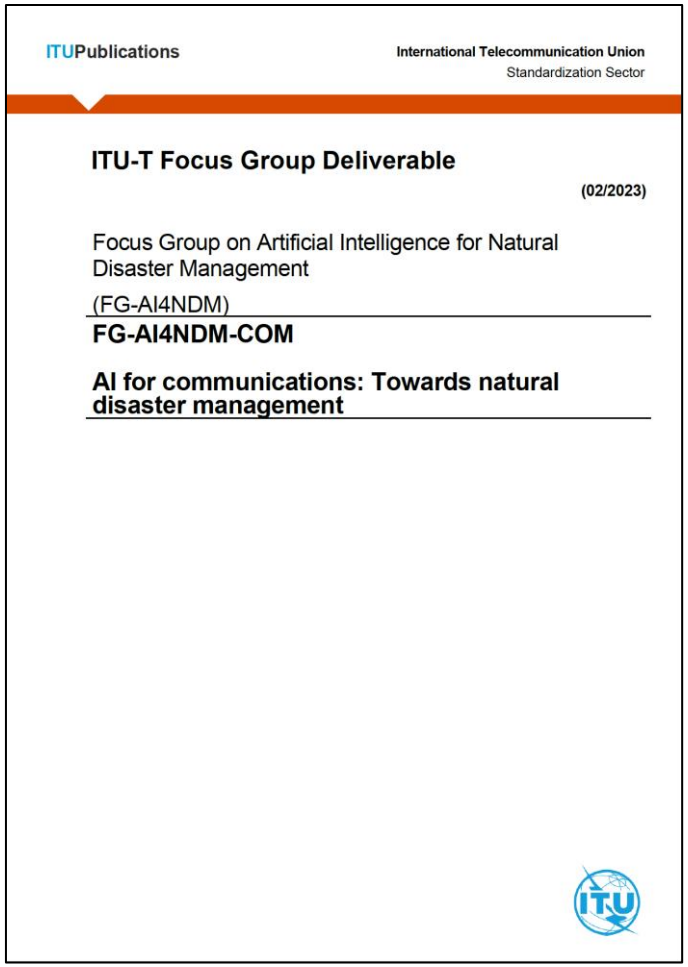
European Commission

ECMWF

European Commission

WG-Comm

- Alerts & early warnings
- Forecasts
- Hazard maps
- Decision support systems
- Dashboards & apps
- Chatbots
- Added value of AI
- Warning, oversight, & failsafes
- Human-centric design



ITUPublications

International Telecommunication Union
Standardization Sector

ITU-T Focus Group Deliverable

(02/2023)

Focus Group on Artificial Intelligence for Natural Disaster Management

(FG-AI4NDM)

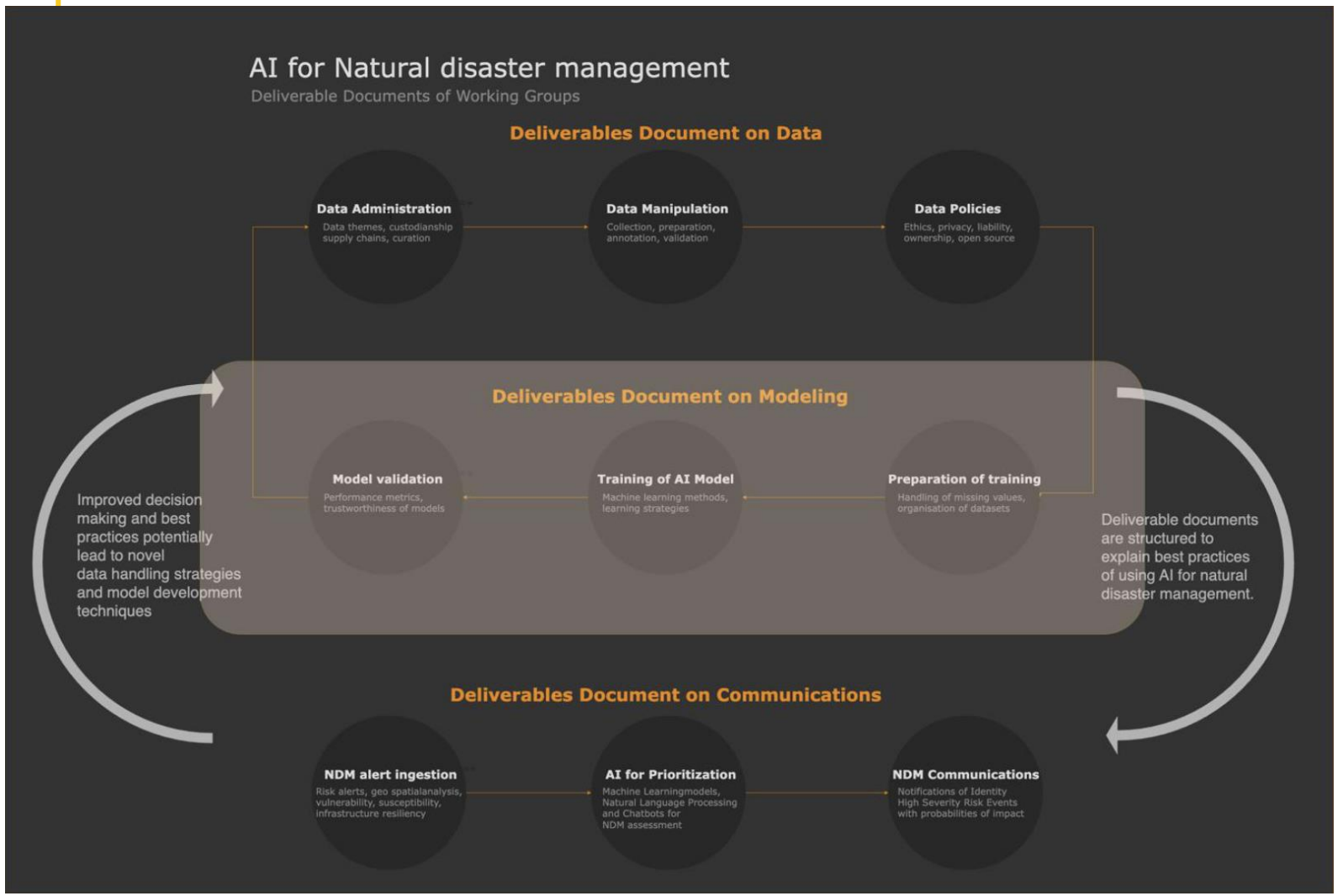
FG-AI4NDM-COM

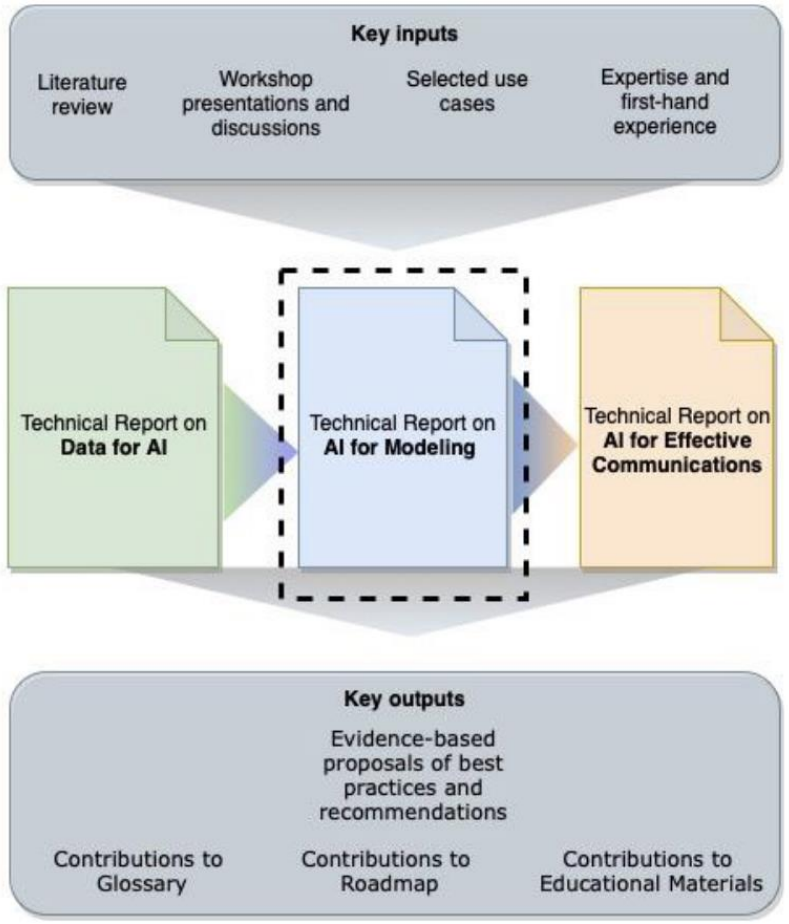
AI for communications: Towards natural disaster management

Fraunhofer HHI

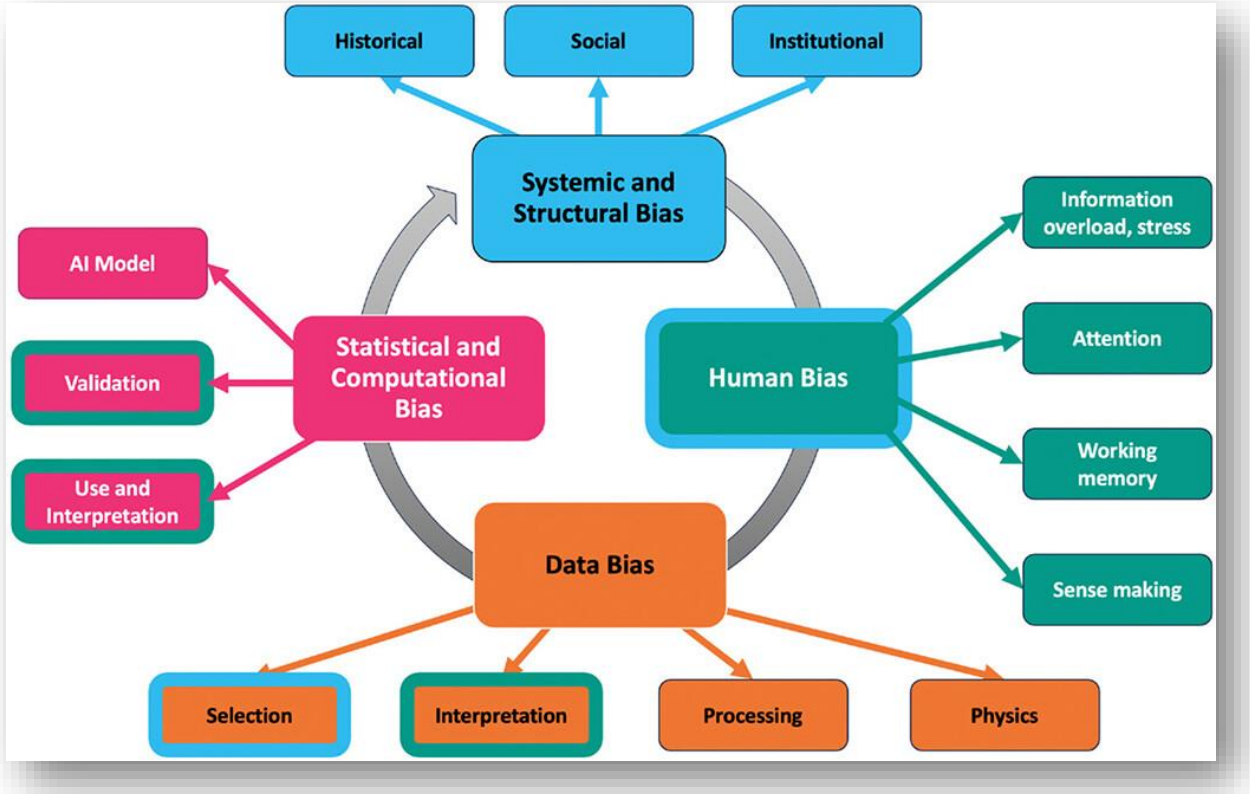
IBM

European Commission





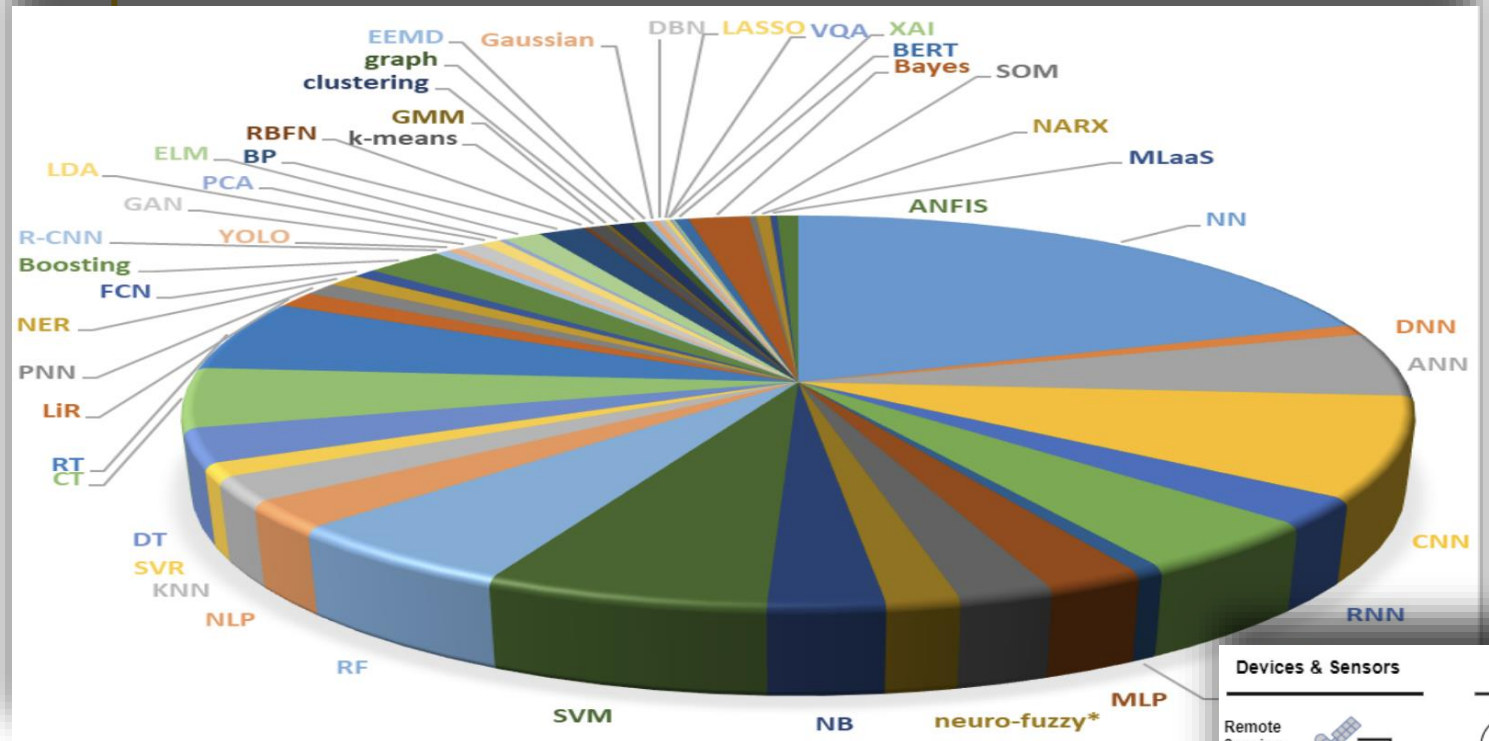
European Commission

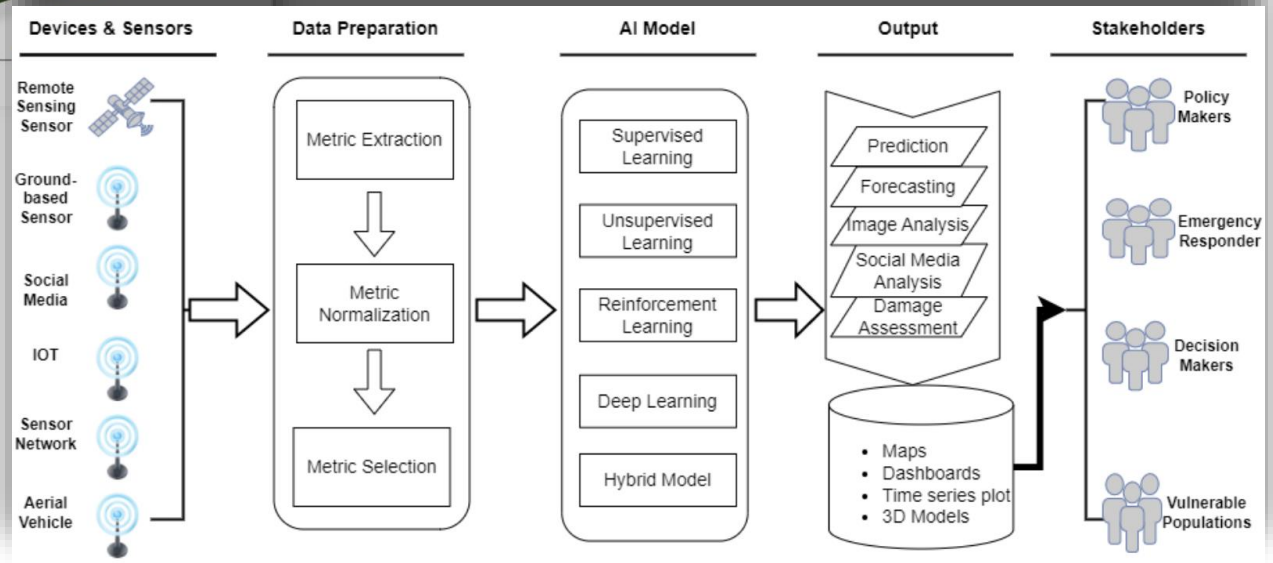


Source: McGovern et al. 2024. BAMS 105

> *Transparency with respect to the data, training, evaluation, and limitations of artificial intelligence (AI) for disaster management is critical to ensure the safety and robustness of these tools.*

Source: Kuglitsch et al. 2024. EOS 105

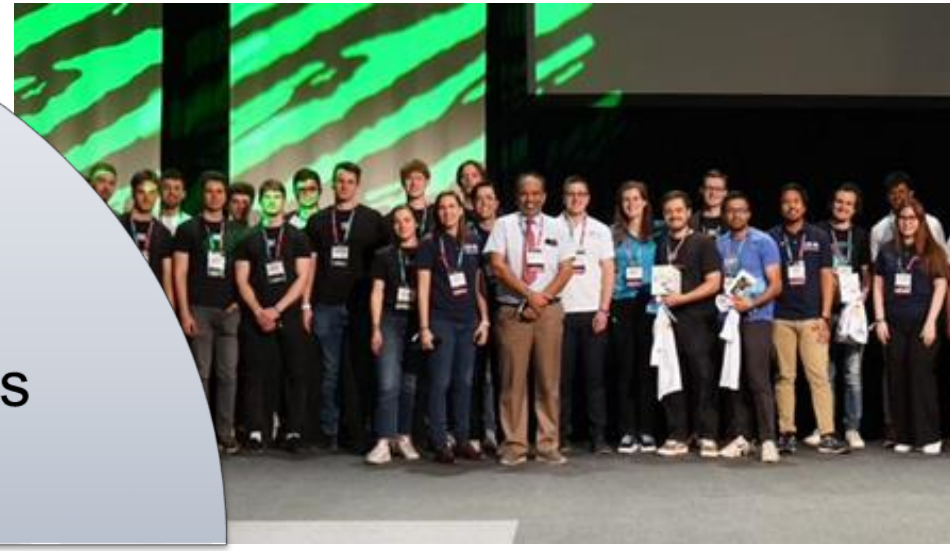




European Commission

workshops & webinars

hacks & challenges



scientific papers

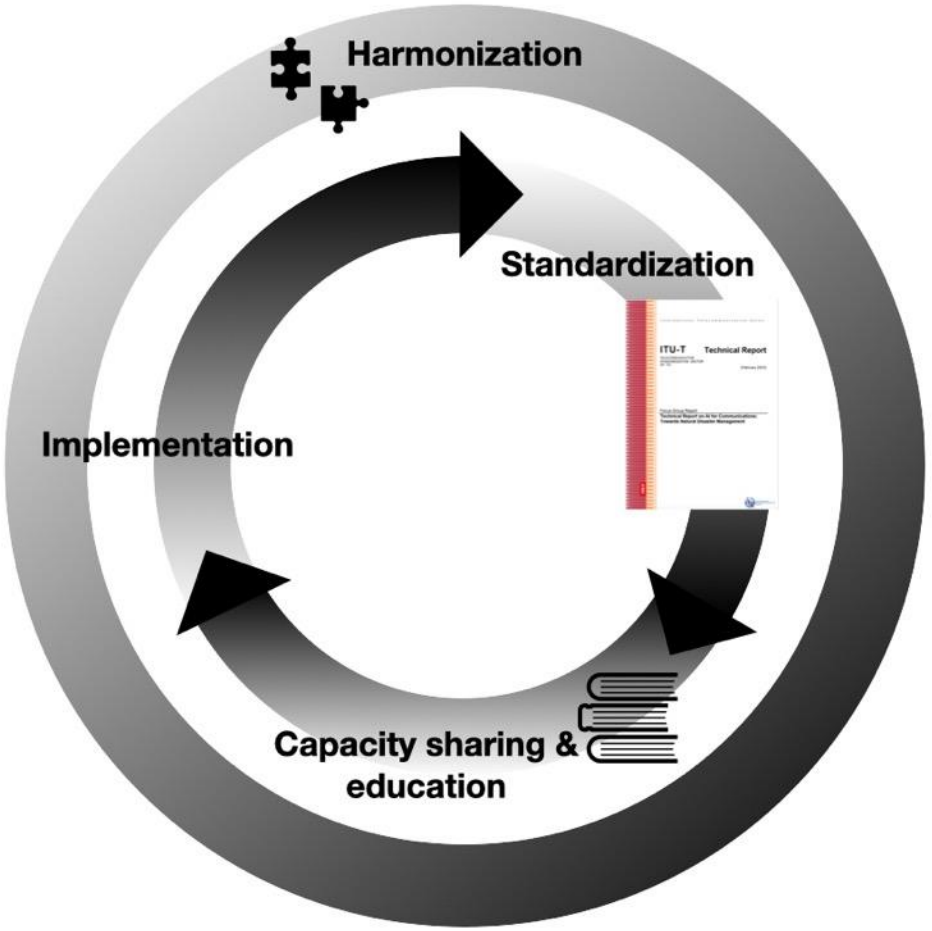
hands-on training session

COMMENT

https://doi.org/10.1038/s41467-022-29285-6 OPEN

Facilitating adoption of AI in natura disaster management through collaboration

Next steps



Research & innovation

- Explore new AI applications for managing natural hazards
- Delve into advancements in related emerging technologies

Standards & best practices

- Update technical reports from FG-AI4NDM
- Deep-dive on topics of relevance
- Develop AI readiness framework and PoC studies
- Support capacity sharing

European Commission

Kick-off meeting of the ITU • WMO • UNEP • UNFCCC • UPU Global Initiative on Resilience to Natural Hazards through AI Solutions

6 November 2024

Barcelona Supercomputing Center, Spain & online

Co-hosted by: ITU, BSC Barcelona Supercomputing Center, Centro Nacional de Supercomputación

With the support of: ECMWF

Details and registration: https://www.itu.int/en/ITU-T/extcoop/ai4resilience/Pages/First-Meeting.aspx

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European Commission

DESTINATION EARTH

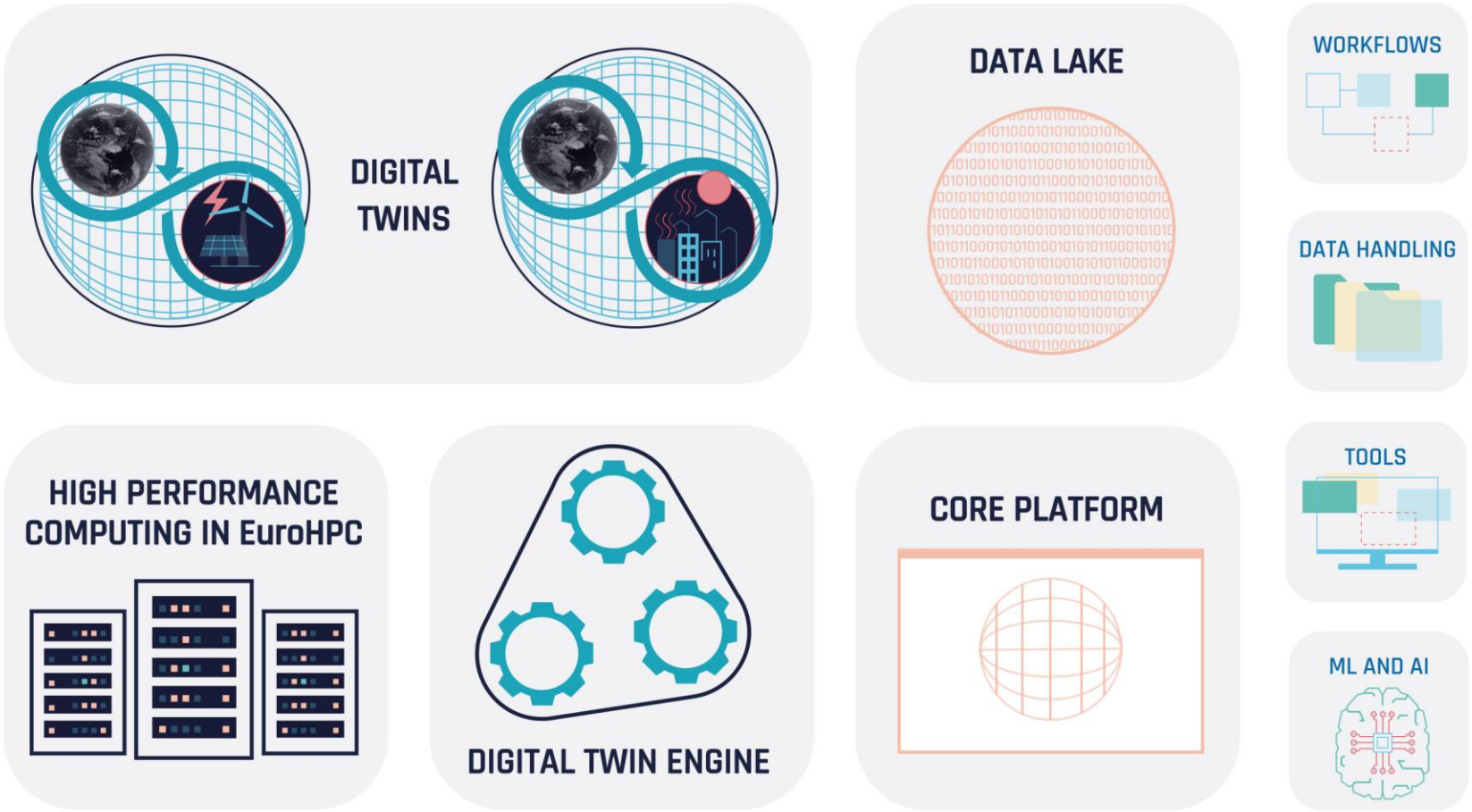
AI FOR DISASTER RISK MANAGEMENT - EU WORKSHOP

22 OCT 2024

Stephan Siemen, ECMWF

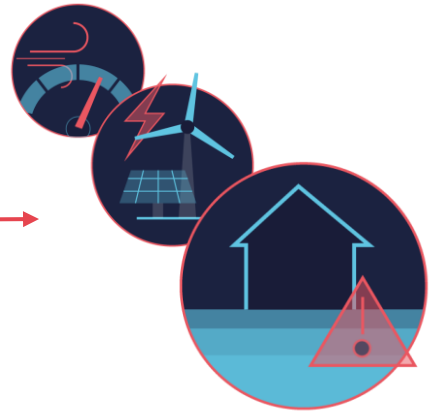
Funded by the European Union
Destination Earth implemented by ECMWF esa EUMETSAT

DESTINE COMPONENTS



EXTREMES DT : A MAGNIFYING GLASS ON EXTREME WEATHER EVENTS

DETECTION/ TRIGGERING



Global and **daily** simulations of extreme weather
4 days ahead at **4.4km**

On-Demand regional simulations
2 days ahead at **750m** to **500m**

Impact-sector models:
user-relevant information for societal impacts

IFS-NEMO

ECMWF

Arome
Harmonie-Arome
Alaro

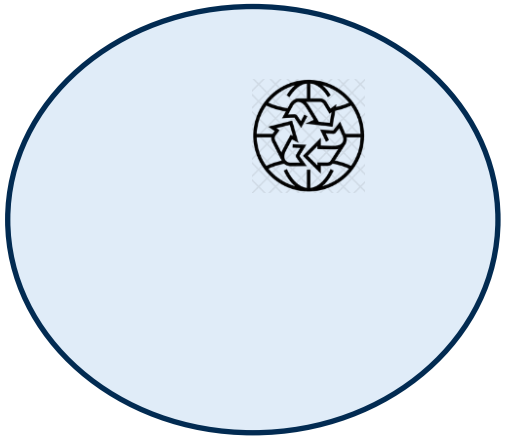
METEO FRANCE
À VOS CÔTÉS, DANS UN CLIMAT QUI CHANGE

Norwegian Meteorological Institute · METEO FRANCE · Danmarks Meteorologiske Institut · AEMet · FMI · SMHI · LVGMC · IPMA · RMI · DHMZ · HNMS · CHMI · TAL TECH · Republic of Estonia Environment Agency · ZAMG · Koninklijk Nederlands Meteorologisch Instituut · IMGW · Icelandic Met Office · ARSO METEO Slovenia · INRAE · CSC · Lietuvos hidrometeorologijos tarnyba · RIVM · Barcelona Supercomputing Center · SHMÚ · Országos Meteorológiai Szolgálat · GeoSphere Austria

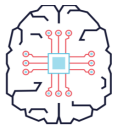
BUILDING AN AI EARTH SYSTEM MODEL

EXPANDING TOWARDS AN EARTH-SYSTEM AI MODEL WITH DESTINE

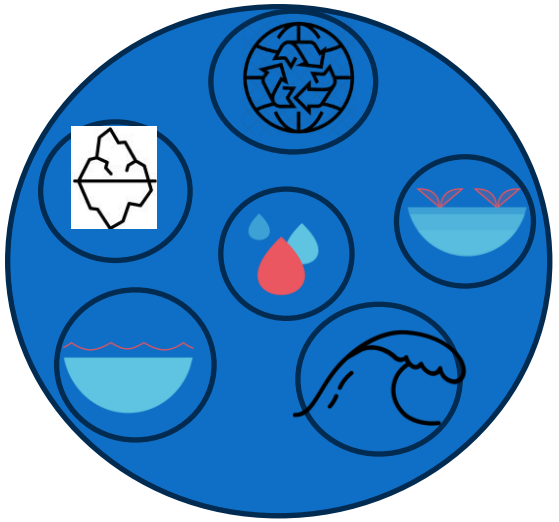
Atmospheric component



Forecasting the weather (ECMWF's AIFS)

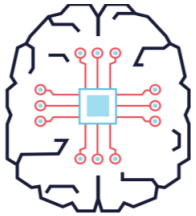


Adding land, wave, ocean, sea-ice, hydrology

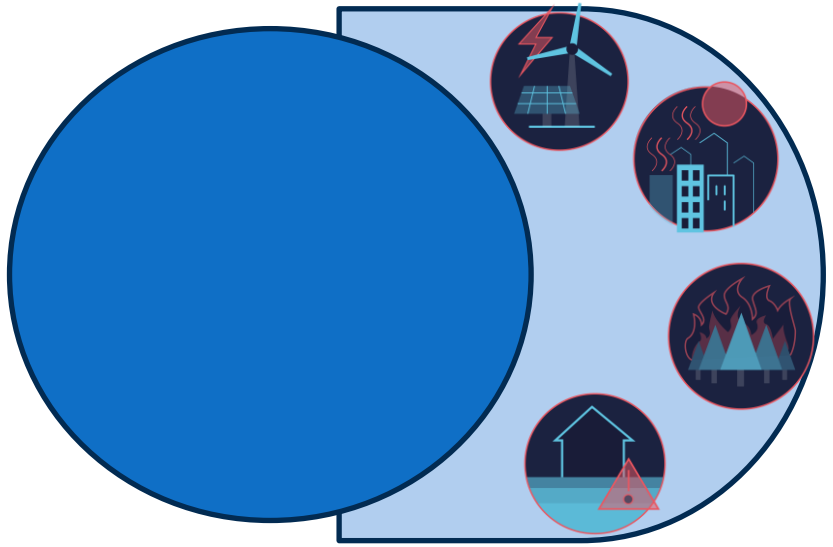


For weather extremes

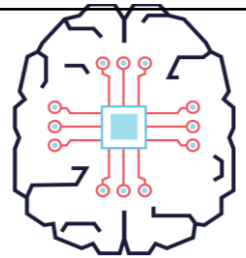
For Climate projections



Adding impact sectors

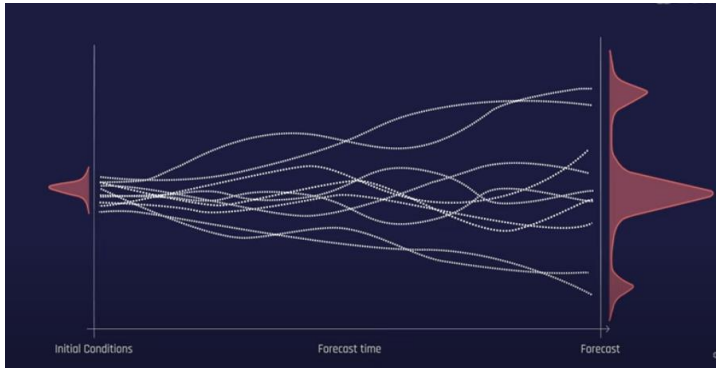


Demonstrators for impact sectors.



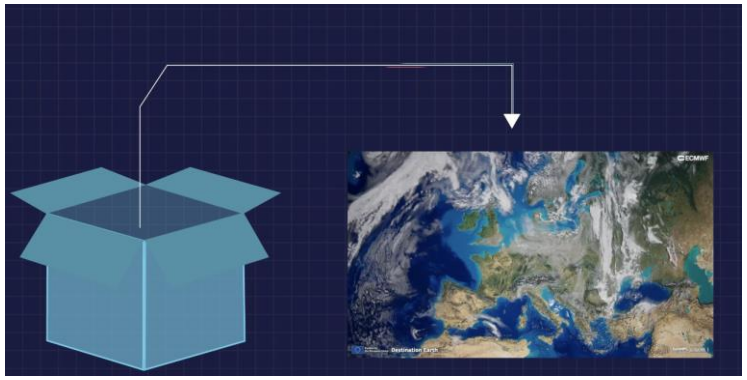
AI IN DESTINE

Quantify uncertainty



Around DestinE simulations and overcome high computational costs.

Forecast in a box



To augment DestinE's interactive features with local knowledge and impact models.

LLM - Chatbots

To enhance the access to complex information.

AI ACTIVITIES IN PHASE 2 (JUNE 2024 – JUNE 2026)

Towards an earth-system machine learning model leveraging DestinE data

Developing end-to-end workflows for ML model components like land, ocean, sea-ice, hydrology

Enhance DTE with ML pipelines from training to post-processing

Using data-driven methods for uncertainty quantification of Extremes and Climate DT

Climate emulator to rapidly explore 'what-if' scenarios

Enhanced interactivity

Developing a forecast-in-a-box concept.

Building ML demonstrators for impact-sectors (e.g., health, agriculture, urban)

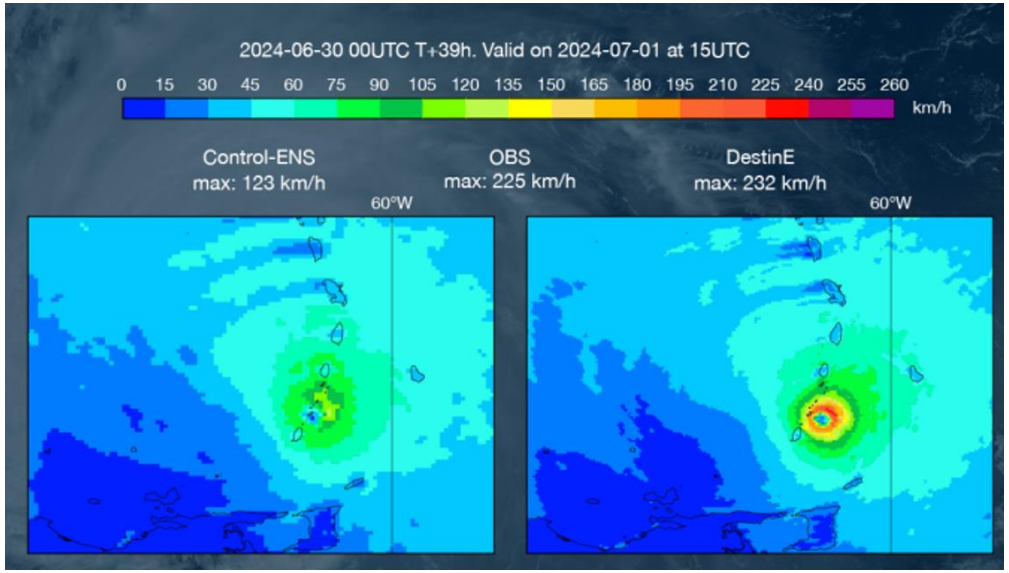
Develop of a weather and climate chatbot

Partnership and training

Training i.e. MOOC AI through the lens of the earth system

AI 4 Public Good (US-EU partnership)

Ethical AI / EU AI Act

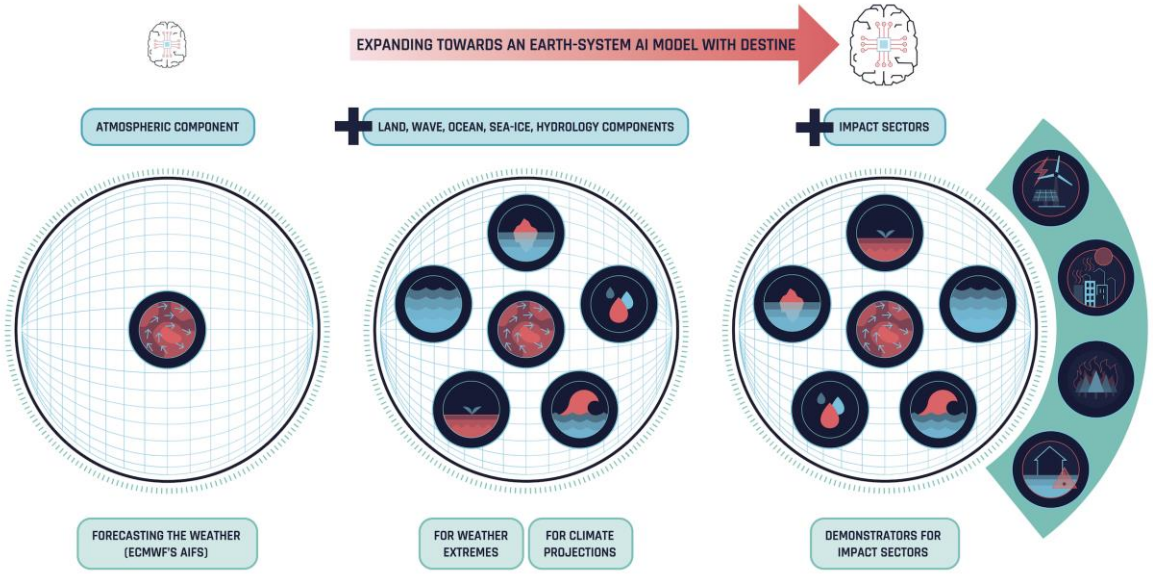


https://destine.ecmwf.int/news/destine-weather-induced-extremes-digital-twin-improves-the-forecasts-of-tropical-cyclones-and-heavy-rain/

TAKEAWAY MESSAGES

- Destination Earth embraces AI on all levels; from large forecast model to local impact assessment & tooling

- Destination is crucial source of high-resolution data for DRM, but also offers a lot more through interactive coupling of impact models



- All work is done within existing system & processes and with mandated European/national/reginal agencies
  - Faster integration and acceptance

DESTINATION EARTH

FURTHER INFORMATION

Destination Earth main page: https://destination-earth.eu

Destination Earth use cases: https://destination-earth.eu/use-cases/

DestinE @ ECMWF: https://destine.ecmwf.int

ECMWF Science Blog: https://www.ecmwf.int/en/about/media-centre/science-blog

ECMWF AIFS Blog: https://www.ecmwf.int/en/about/media-centre/aifs-blog

Funded by the European Union

Destination Earth implemented by ECMWF esa EUMETSAT

Artificial Intelligence for Disaster Risk Management

Michele Ronco, AI Specialist, JRC.E1.DRMKC

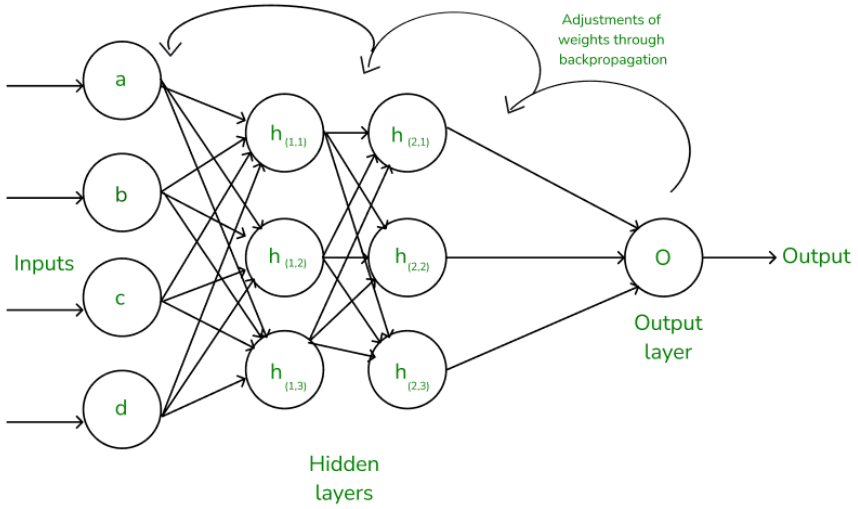
UCPM Knowledge Series Workshop,
Brussels, 22/10/2024

The Dream

- Interactive Capabilities with Digital World
- Advanced Reasoning and Action Planning
- Hierarchical Problem-Solving
- Understanding of Complex Scenarios
- Transparent Decision-Making

Image generated by DALL-E3

Nobel prizes go to.. AI!



The 2024 chemistry laureates

The Nobel Prize in Chemistry 2024 was awarded with one half to David Baker "for computational protein design" and the other half jointly to Demis Hassabis and John M. Jumper "for protein structure prediction".

Demis Hassabis and John Jumper have successfully utilised artificial intelligence to predict the structure of almost all known proteins. David Baker has learned how to master life's building blocks and create entirely new proteins.

David Baker, Demis Hassabis and John Jumper. Ill. Niklas Elmehed © Nobel Prize Outreach

The 2024 physics laureates

The Nobel Prize in Physics 2024 was awarded to John J. Hopfield and Geoffrey E. Hinton "for foundational discoveries and inventions that enable machine learning with artificial neural networks."

John Hopfield created an associative memory that can store and reconstruct images and other types of patterns in data. Geoffrey Hinton invented a method that can autonomously find properties in data, and so perform tasks such as identifying specific elements in pictures.

John Hopfield and Geoffrey Hinton. Ill. Niklas Elmehed © Nobel Prize Outreach

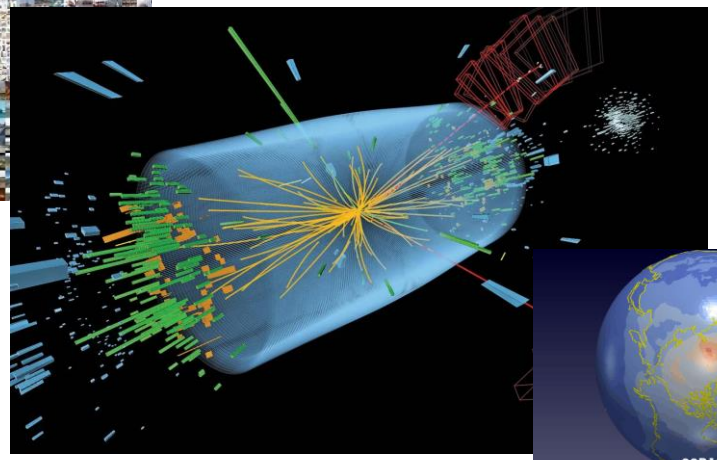
Data is all you need

Hundreds of GBs

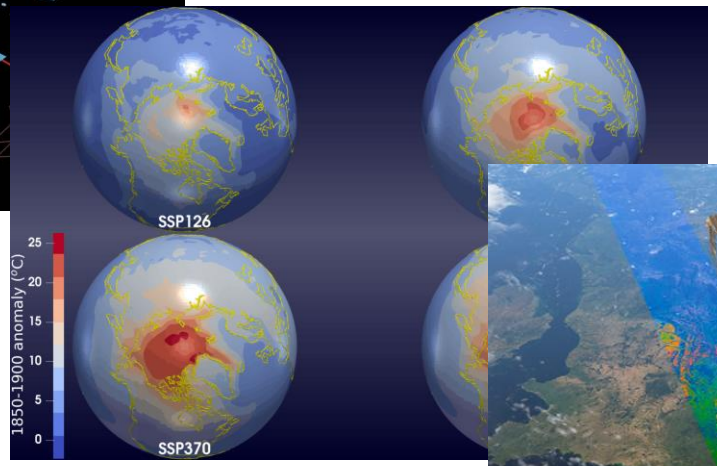
About 24TB uploaded daily

YouTube

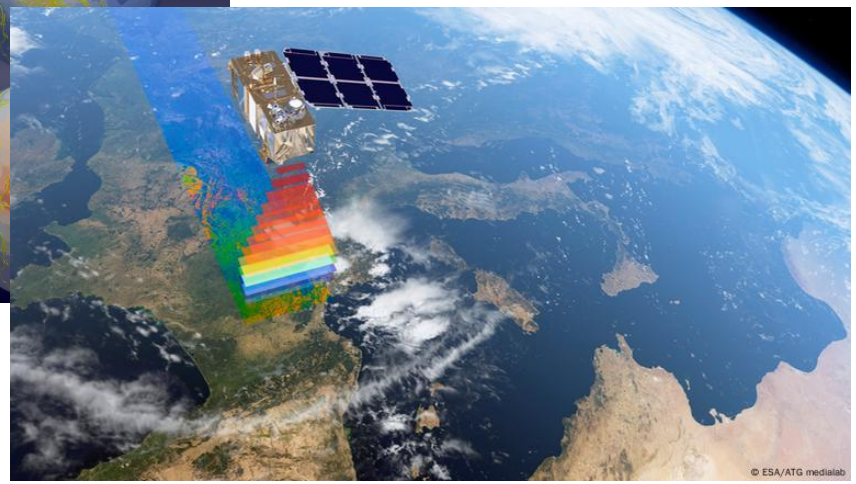
15PB per year



Hundreds of GBs



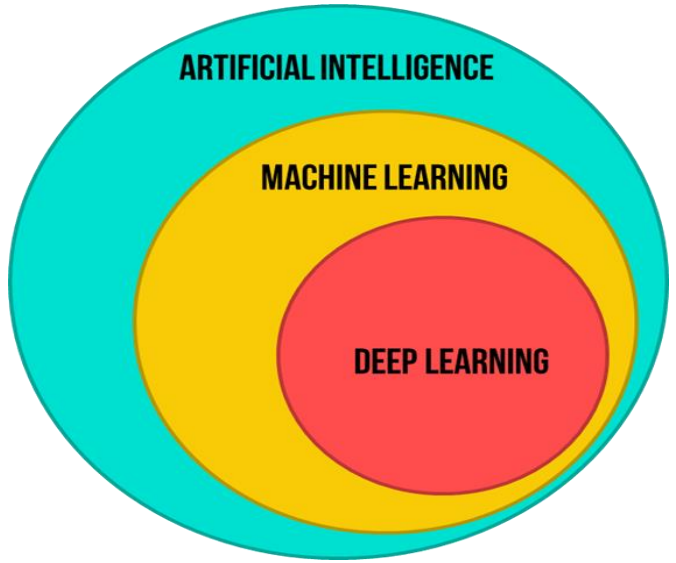
Hundreds of TBs per year



Almost 2TB in total

Open Street Map

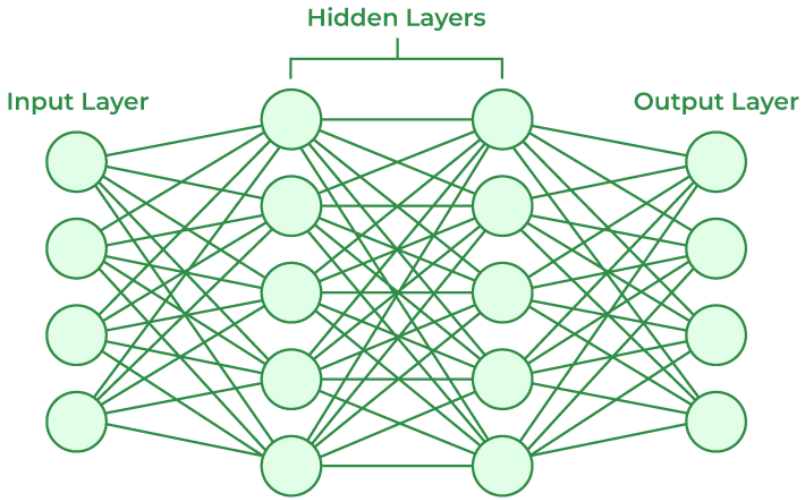
How do we learn from data?



Input data:

- Tabular data
- Text data
- Time series
- Images, videos
- …

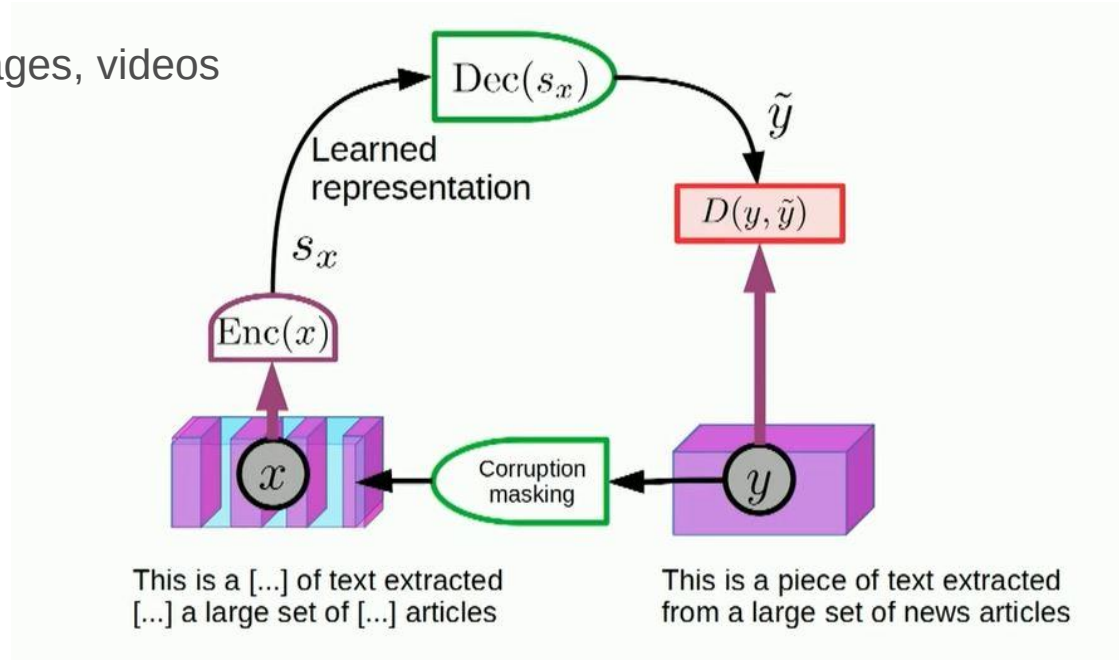
Model with trainable parameters



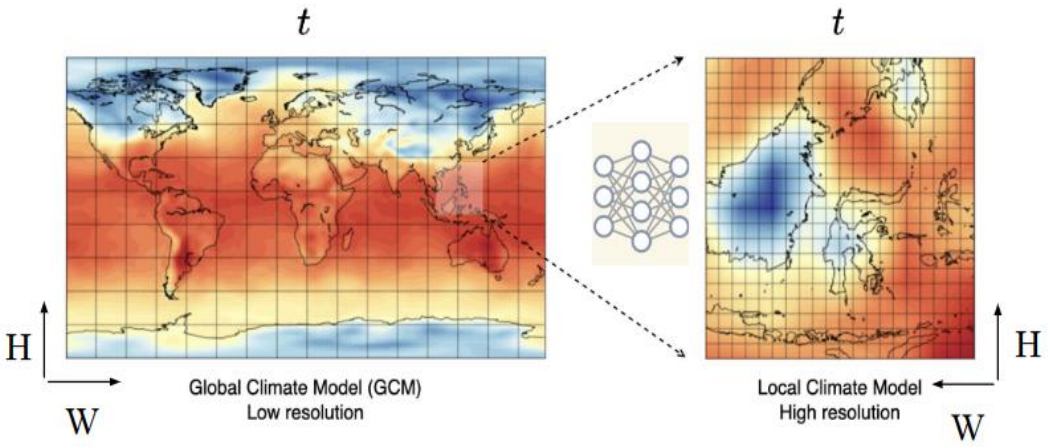
Optimization via loss or cost function

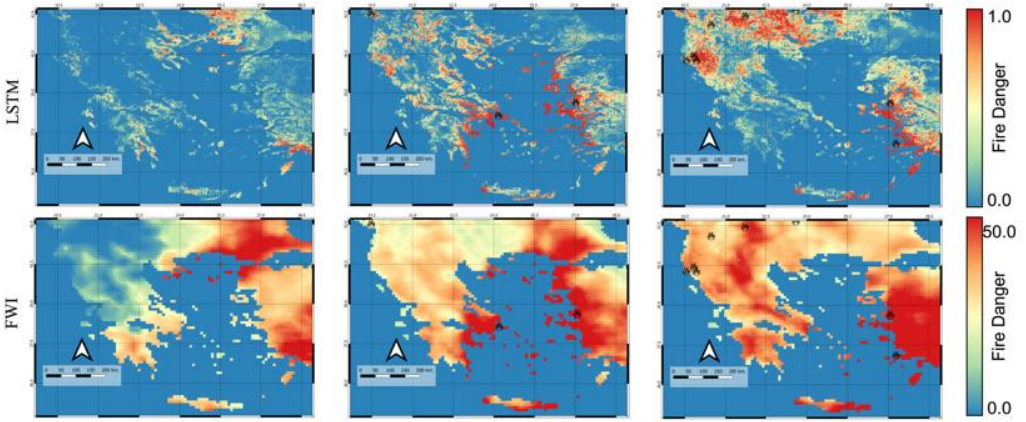
Output data:

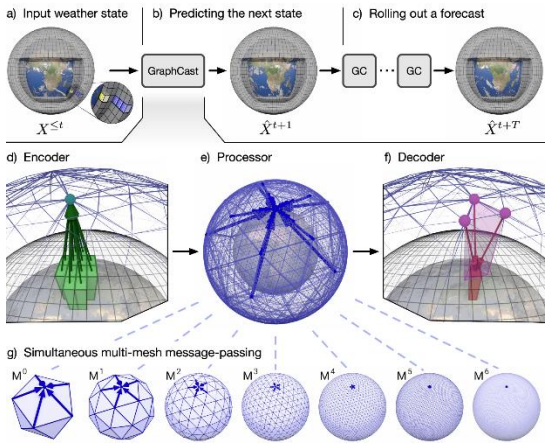
- Tabular data
- Text data
- Time series
- Images, videos
- …

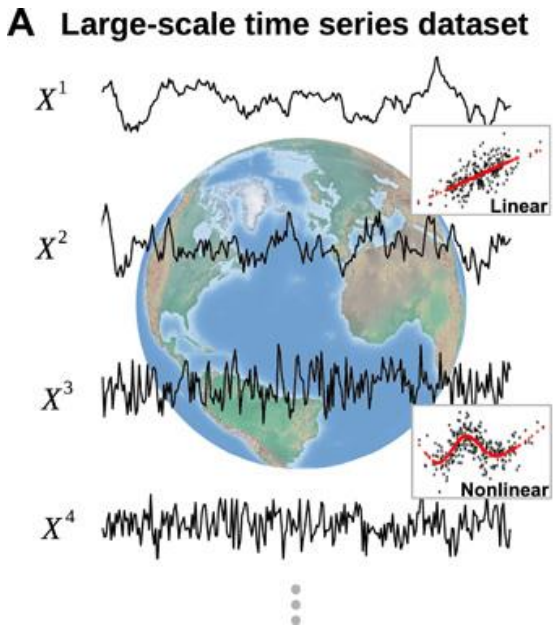


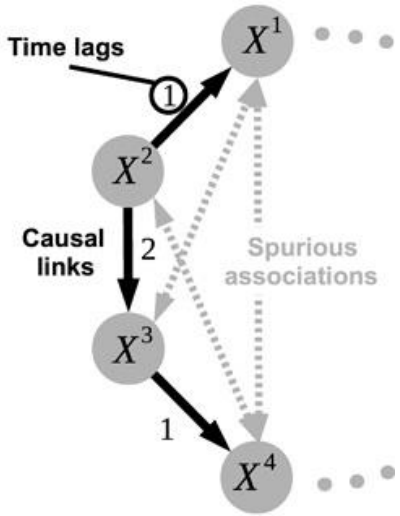
Hot topics in AI for DRM

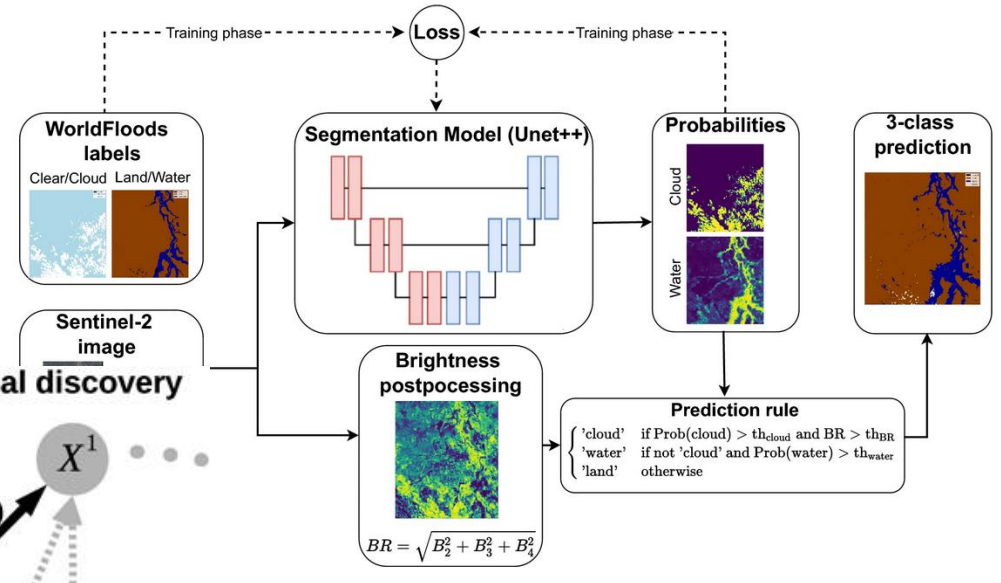








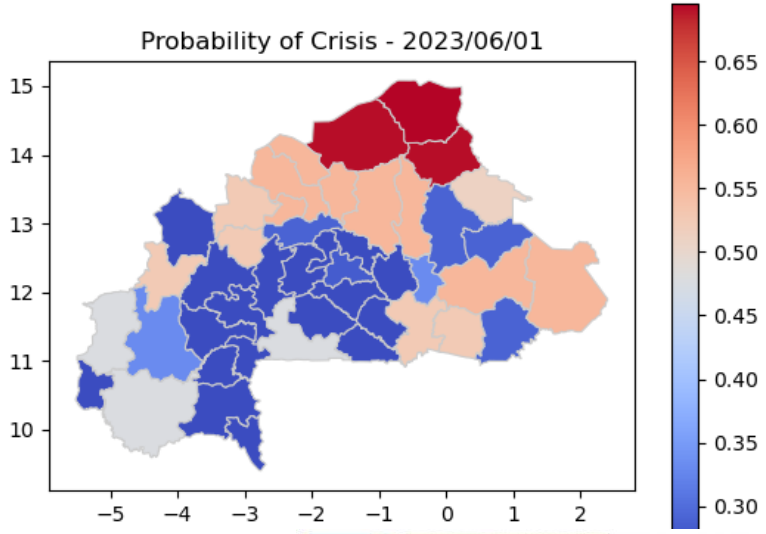




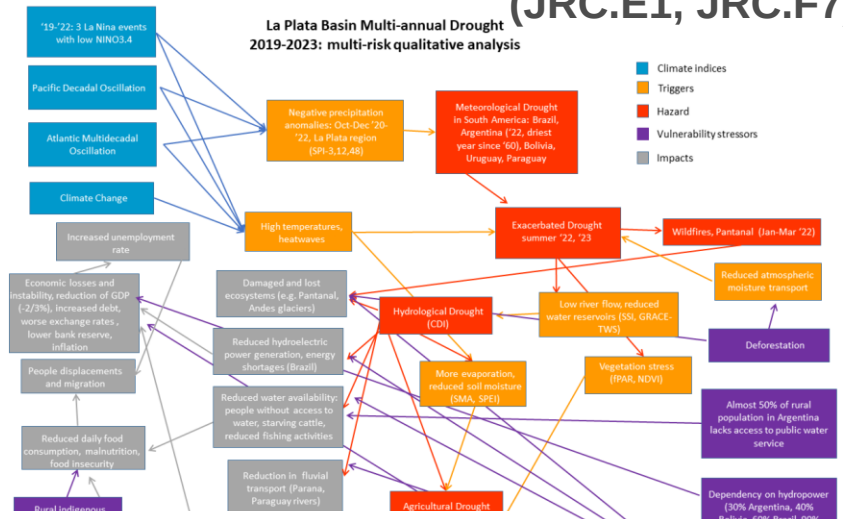
European Commission

What is JRC doing

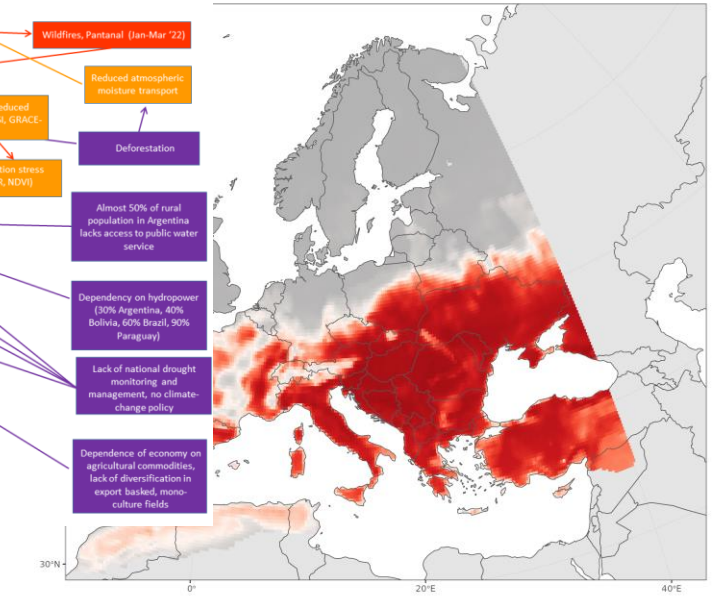
Forecast food crises months in advance (JRC.E1, JRC.D5)



Build causal graphs (JRC.E1, JRC.F7)



Identify areas of concern for droughts (JRC.E1, JRC.D5)



Compile loss data from daily flash (JRC.E1)

Echo Flash

The daily flash provides a daily snapshot on unfolding disasters and main humanitarian crises, in Europe and the world. The product consists of short summaries of the main events of the past few days, presented in short bullet points, in neutral, simple language, sticking to facts and figures, with an emphasis on DG ECHO's added-value.

Full Text Search into echo flash... Search

17 October 2024

I. International

Türkiye - Earthquake

(AFAD, media)

- A 5.9 M earthquake (as registered by the Disaster and Management Unit - AFAD) at a depth of 10 km occurred on 16 October at 7.46 UTC (10.46 local time) in Kale district, Malatya province, eastern Türkiye. The epicentre was located approximately 42 km east of Malatya city and 48 km south-west of Elazig city.
- USGS PAGER estimates that up to 2,000 people were exposed to severe shaking, 40,000 to very strong shaking and 65,000 to strong shaking.
- According to media, almost 200 people have been injured, four others have been rescued from a partially damaged building and two buildings have been seriously damaged. There were no reports of any fatalities.
- On 6 February 2023, the interested area experienced the effects of two earthquakes of 7.7 and 7.6 M that struck 11 provinces, including Malatya as well as Adana, Adiyaman, Diyarbakir, Elazig, Hatay, Gaziantep, Kahramanmaras, Kilis, Osmaniye, and Sanliurfa. These two seismic events resulted in more than 56,000 fatalities across the aforementioned provinces and northern Syria.

Philippines - Flood

(PAGASA, ADINet)

Extract flood info from social media (JRC.E1, JRC.T5)

Social Media Activity Analysis

Region name	Meurthe-et-Moselle	Date			

La ville de Bar_URL_le_URL_D inondations dans la Meuse Per services mob_URL__URL_
go to tweet

Region name	Meurthe-et-Moselle	Date	2021-07-13T15:52	Relevance	0.96

En raison des pluies fortes et continues de ces derniers jours, et des risques de débordement des cours d'eau de_URL__URL_
go to tweet

Region name	Meurthe-et-Moselle	Date	2021-07-15T12:55	Relevance	0.92

Enhance wildfire management (JRC.E1, DG CONNECT)

A realistic goal

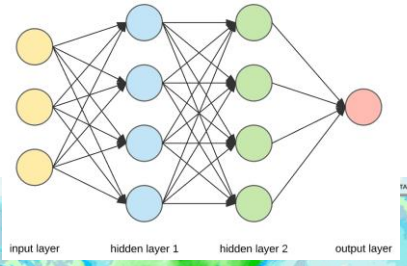
IPC

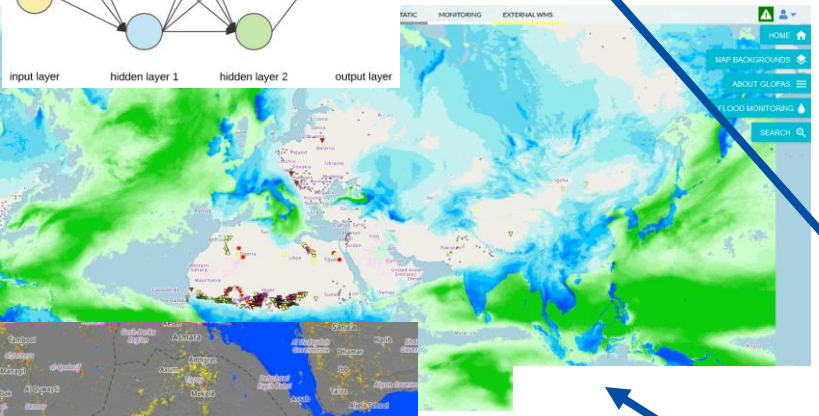
iDMC internal displacement monitoring centre

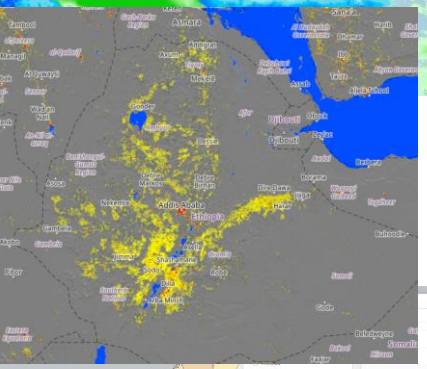
EM-DAT
The International Disaster Database
Centre for Research on the Epidemiology of Disasters

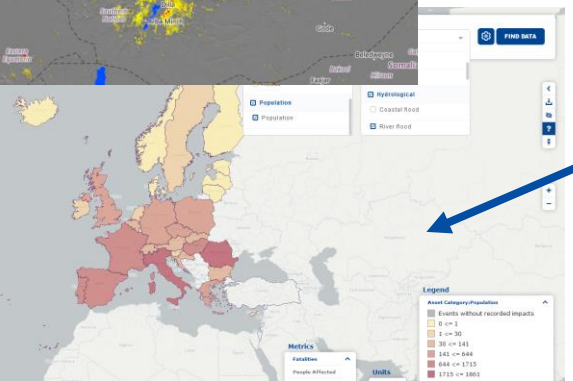
emm

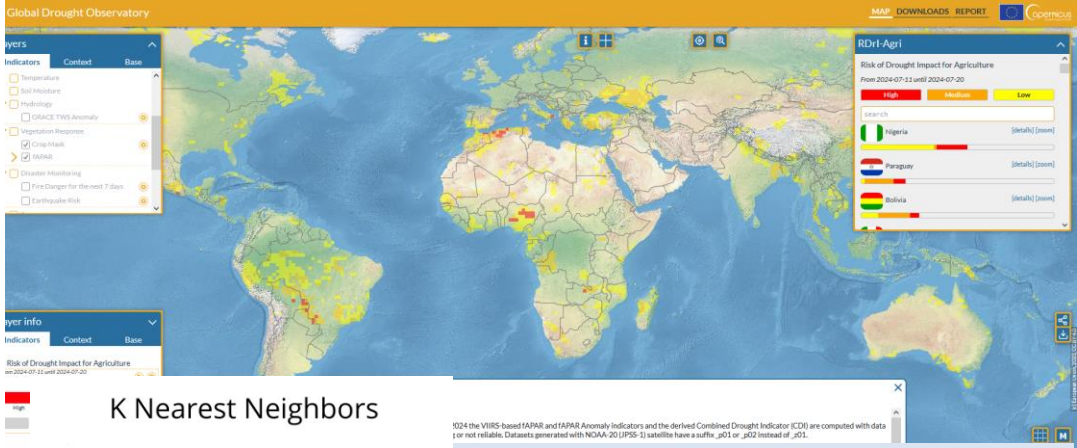
GPT@JRC

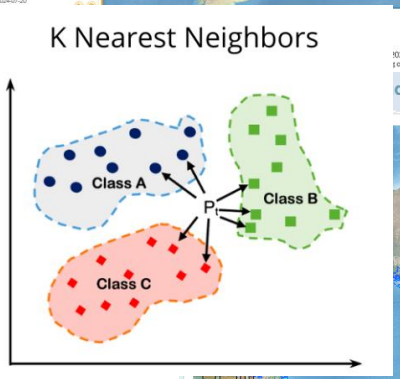








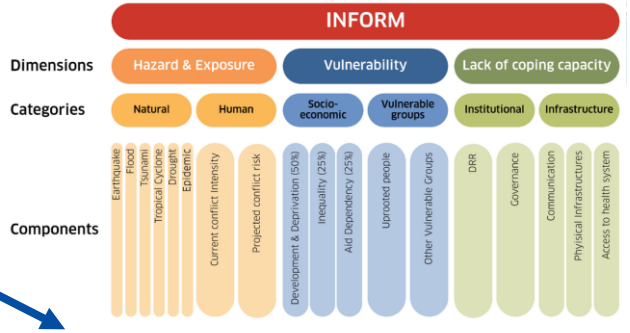




What can I help with?

What humanitarian and economic impacts could a cascading crisis caused by a flood in Ethiopia have within the next month?

Create image | Summarize text | Help me write | Get advice | More



European Commission

Thanks for your attention ☺

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https://it.linkedin.com/in/michele-ronco-bb4789180

European Commission

MedEWSa

European Commission

Mediterranean and pan-European forecast and Early Warning System against natural hazards

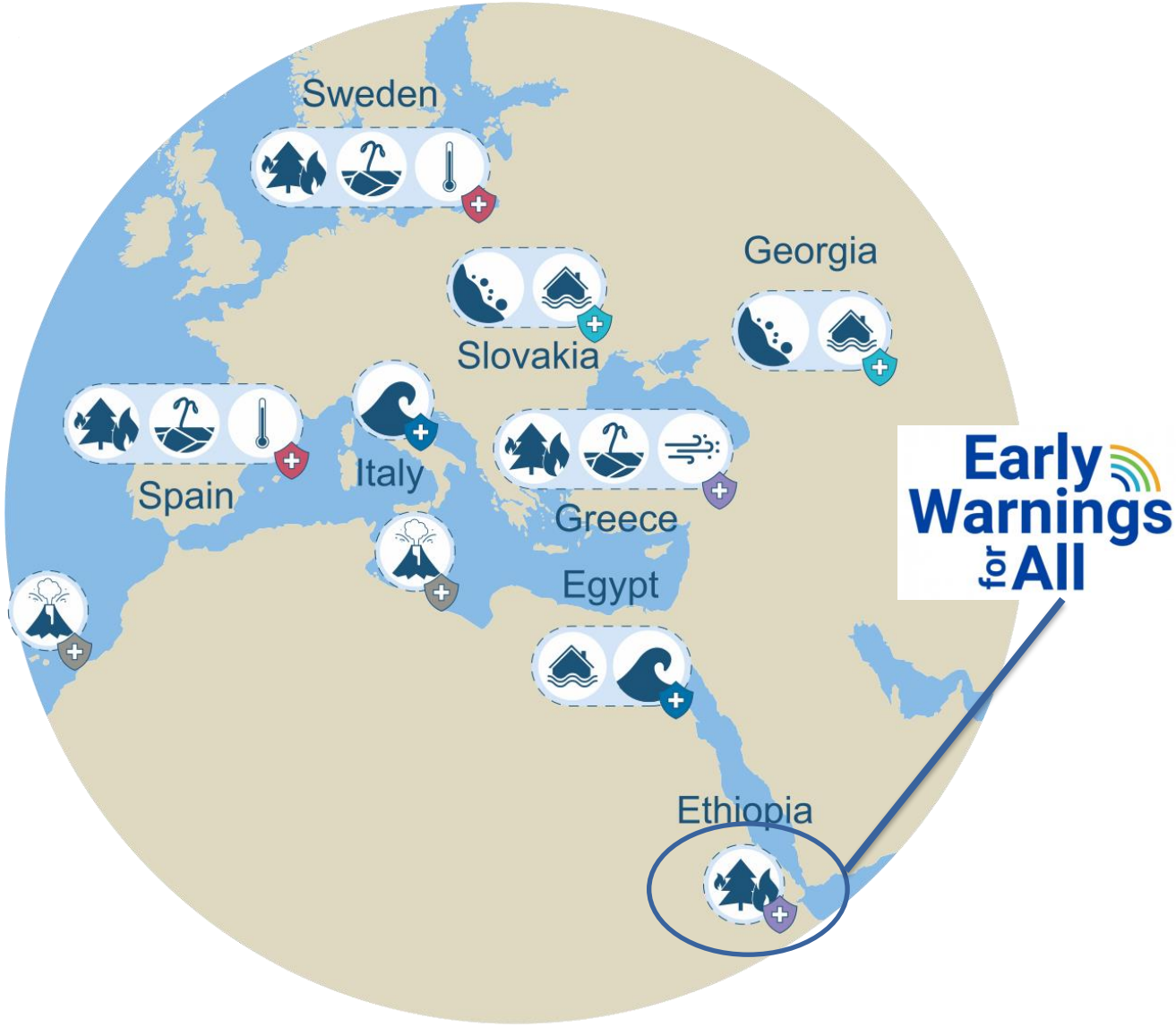
Justus Liebig University Giessen

Elena Xoplaki
Elena.Xoplaki@geogr.uni-giessen.de

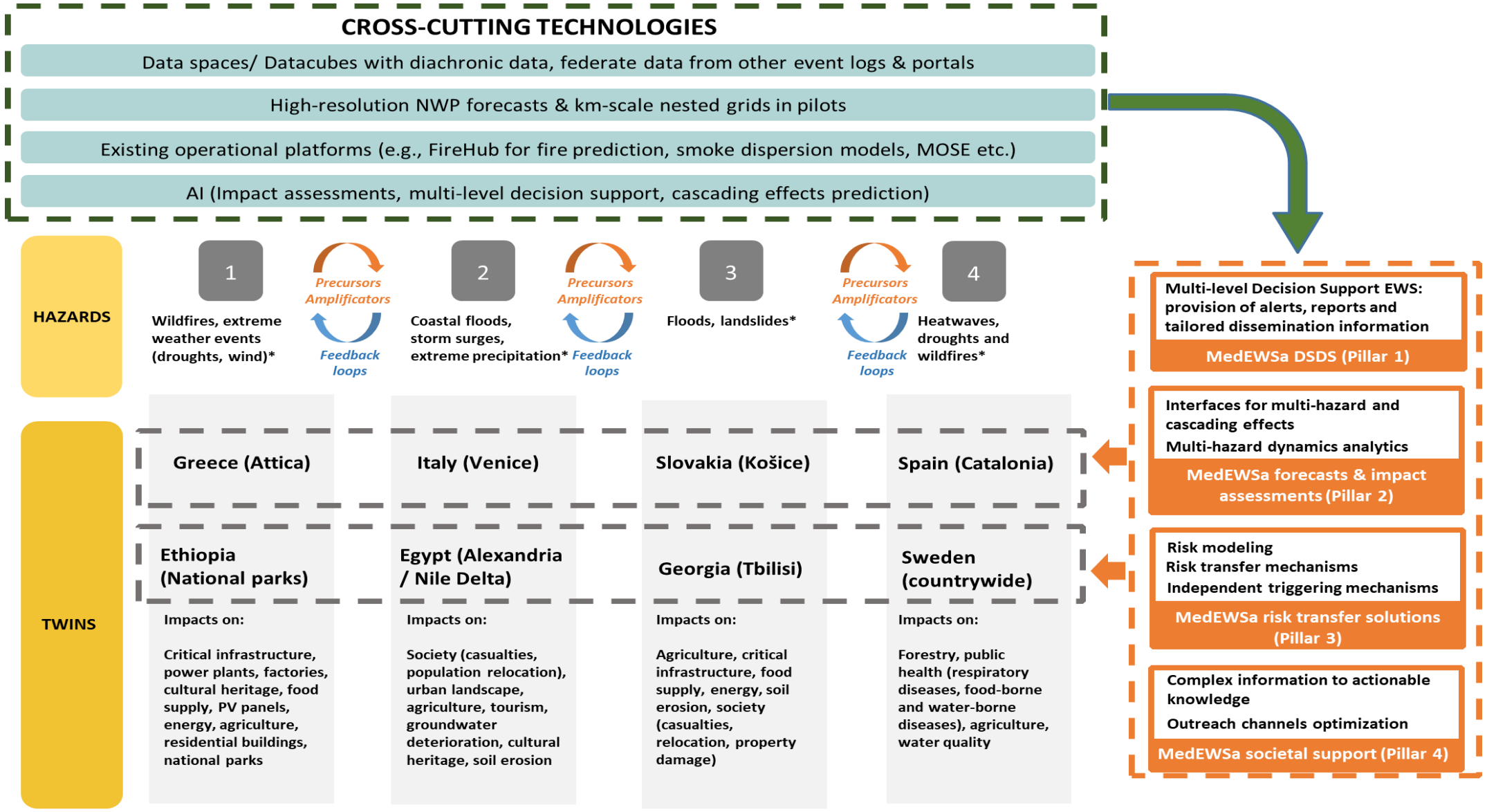
www.medewsa.eu

MedEWSa offers – L&D, emergency response

- **Multi-hazard** capacity building for **emergency responders**
- Timely handle unexpected **cascading effects**
- **Efficient** response mechanisms to extreme events
- Fully address the **early warning cycle**, from data and models to public safety



MedEWSa concept – The four twins

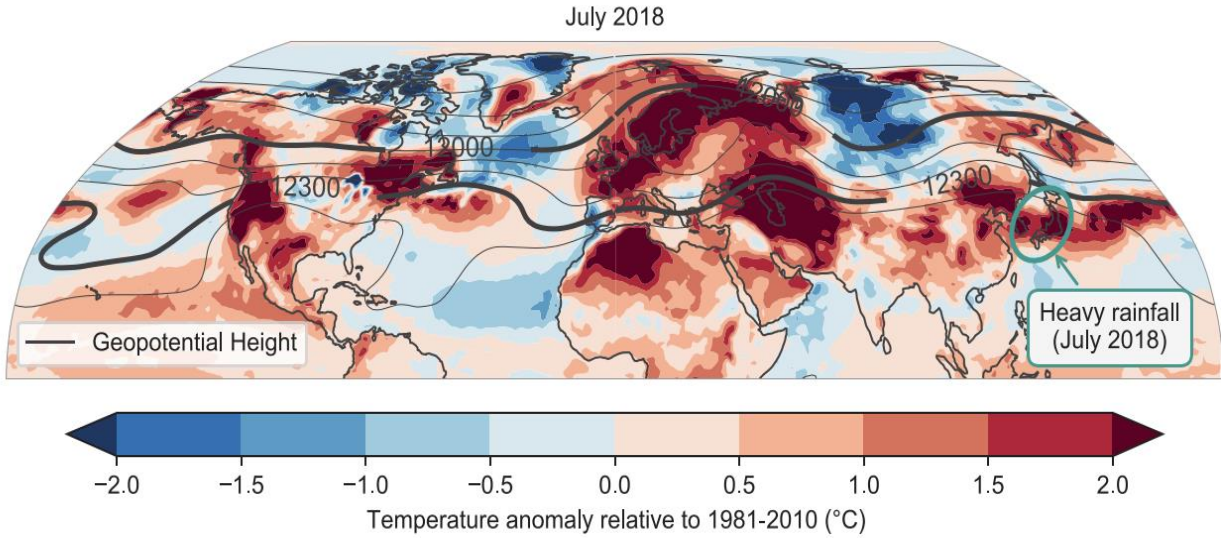


**potential volcanic eruptions will be included across all pilots/twins due to the large-scale impact*

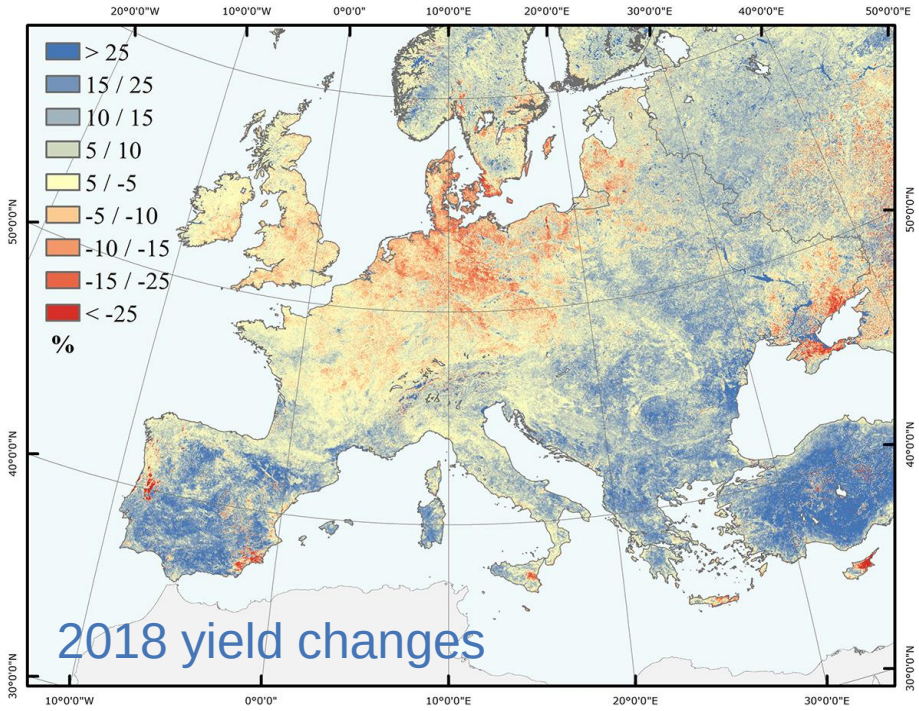
Detection of extremes

Compound events, Concurrent extremes
The exceptional year 2018

Combination of multiple drivers and/or hazards that contribute to **societal / environmental risk**



IPCC 2021



Toreti et al. 2019

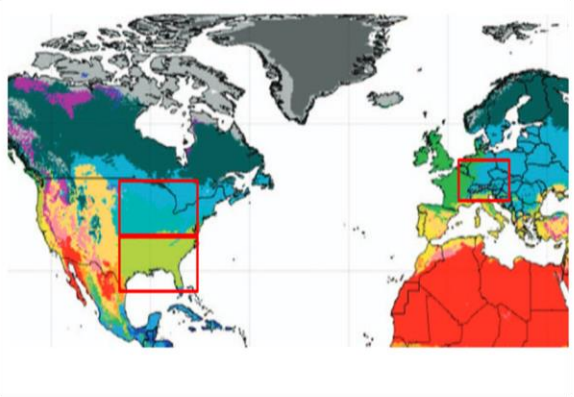
Concurrent extremes – large scale heatwaves and droughts

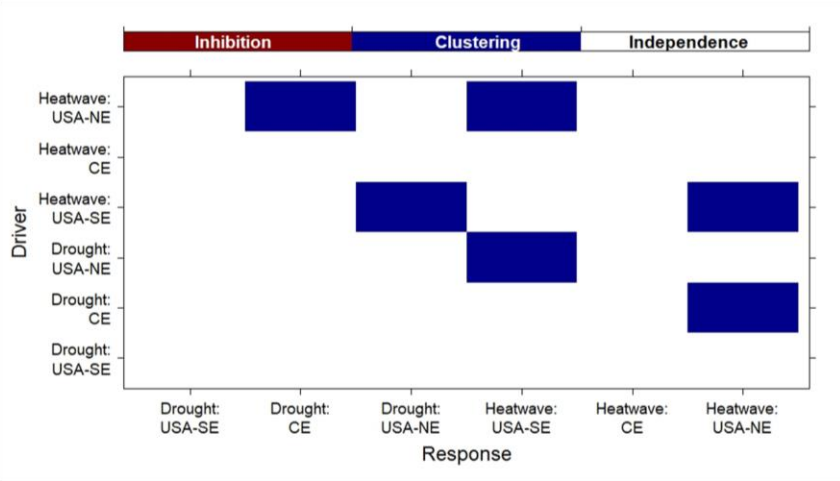
J-Functions

AI-tool for interpretation of J-Functions

Detection of heatwaves and droughts

Dependence classification (concurrent event detection)

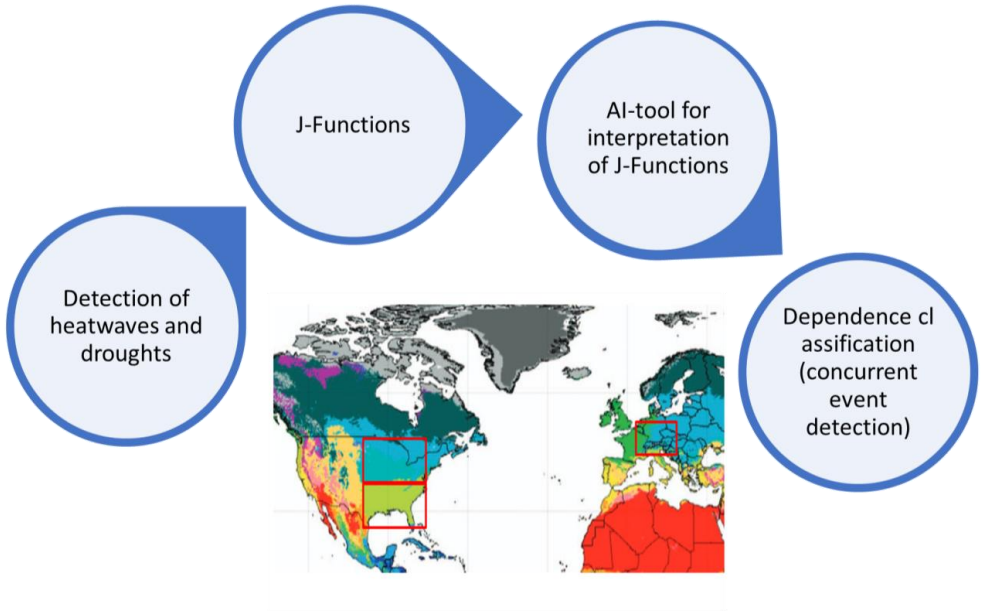




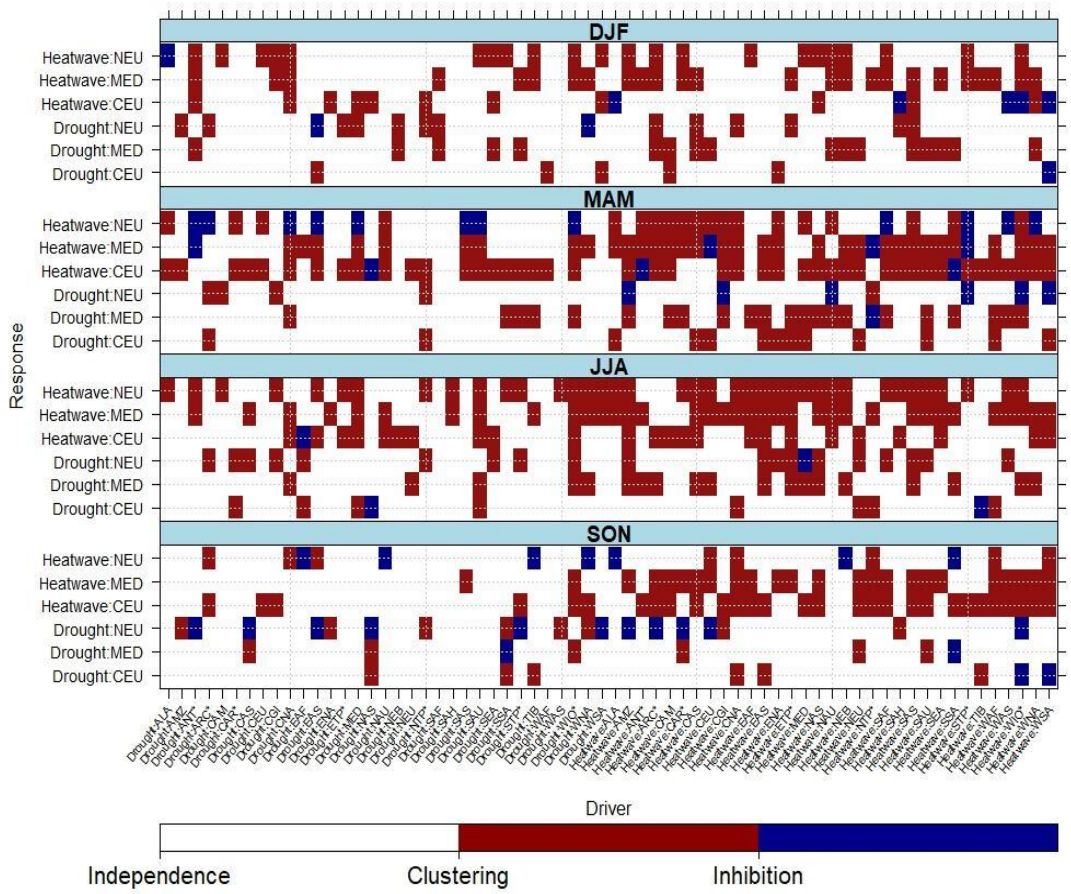
Luther et al. in prep.

CLINT
CLIMATE INTELLIGENCE

Concurrent extremes – large scale heatwaves and droughts



Large scale extreme events dependencies, > 95% accuracy

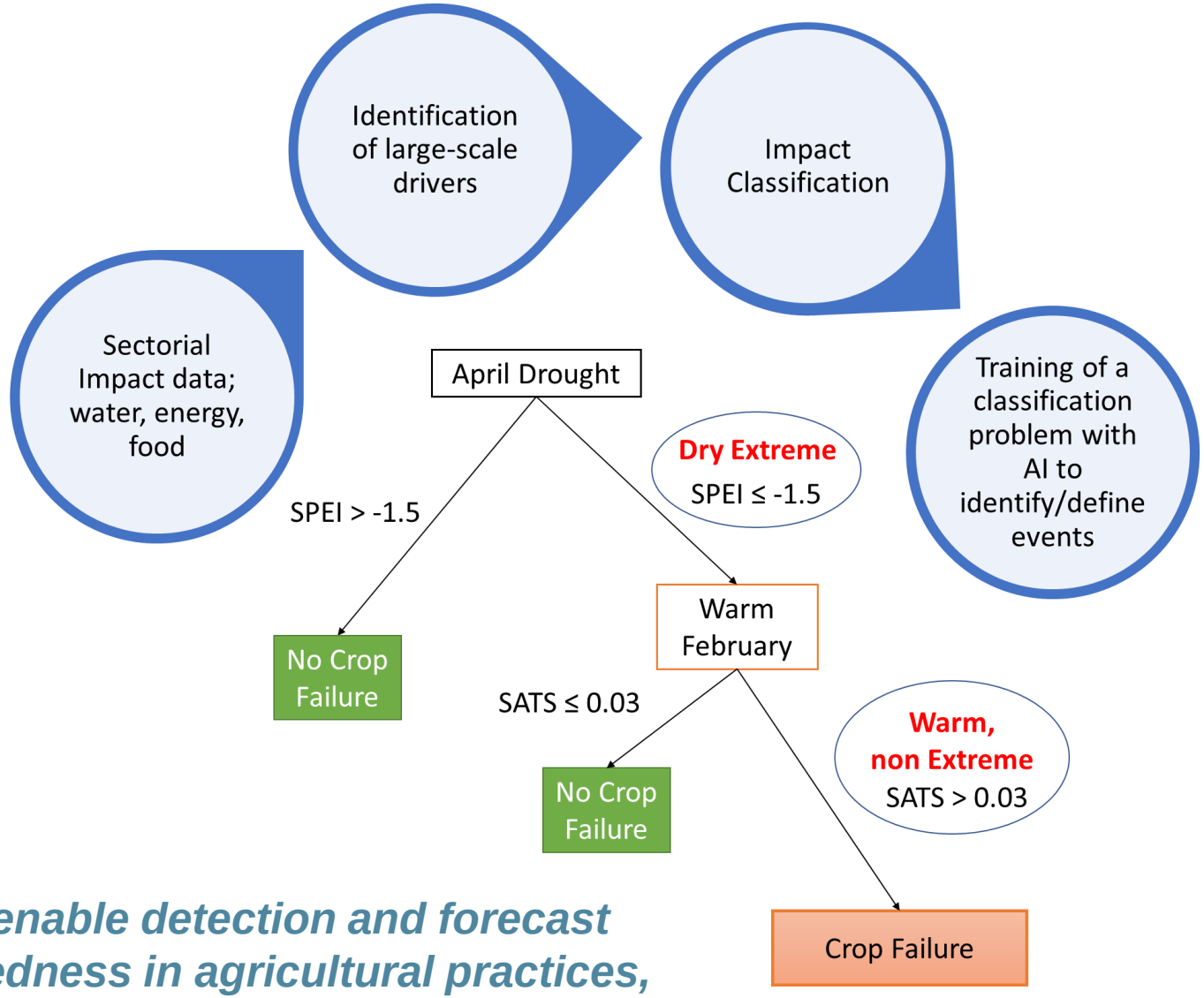


AI-enhanced J-Functions offer in very short time, with high accuracy, objective dependency assessments of large scale extreme events

Luther et al. in prep.

CLINT
CLIMATE INTELLIGENCE

Compound events and impacts – the not extreme events



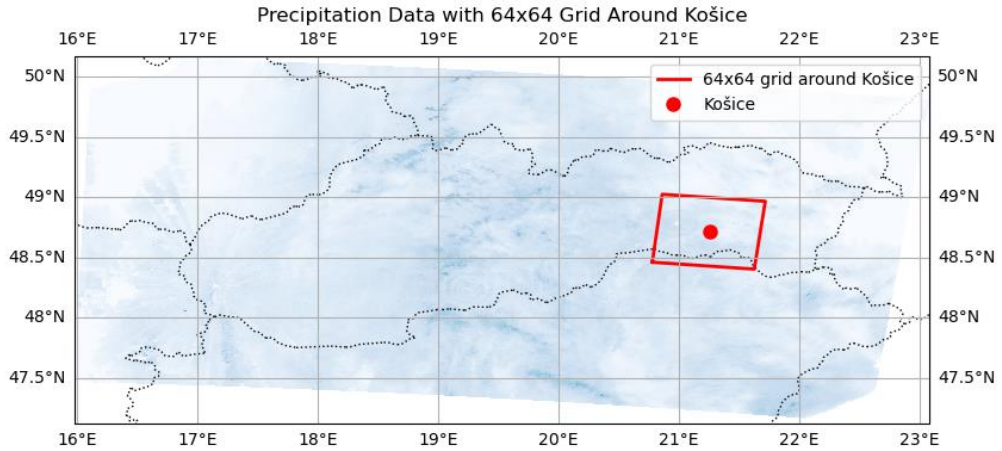
Updated definitions enable detection and forecast AI-enhanced preparedness in agricultural practices, competition between sectors, multi-sectoral impacts

Luther et al. in prep.

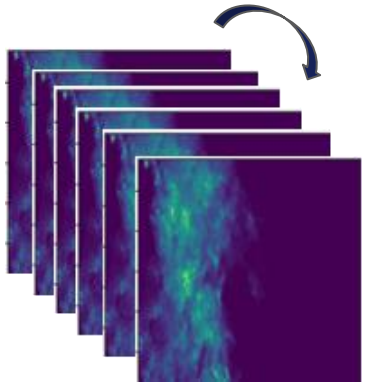
CLINT
CLIMATE INTELLIGENCE

Floods, flash floods forecasting

Slovakia: Radar-Rainfall intensity data
for the period 2020-2023.
Area of interest: **Košice**



5-min interval



Methods:

Deterministic

- Pysteps
- Unet
- Transformer-based

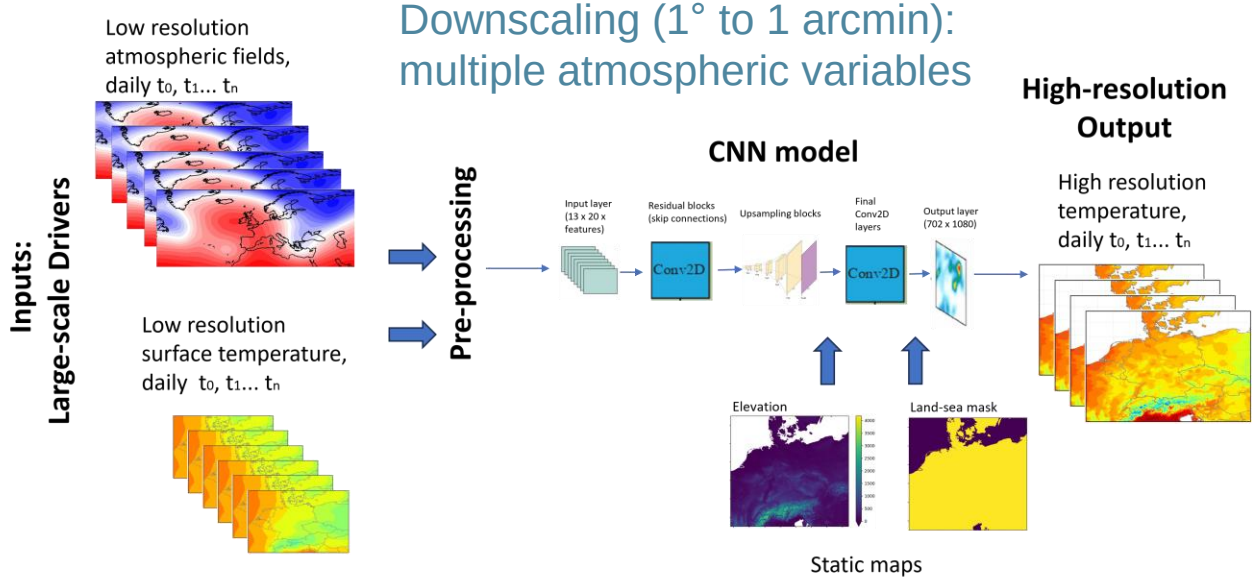
Probabilistic

- Diffusion models (LDCast)
- Generative models (DGM)

AI-enhanced precipitation nowcasting
Higher accuracy for floods, flash floods forecasting

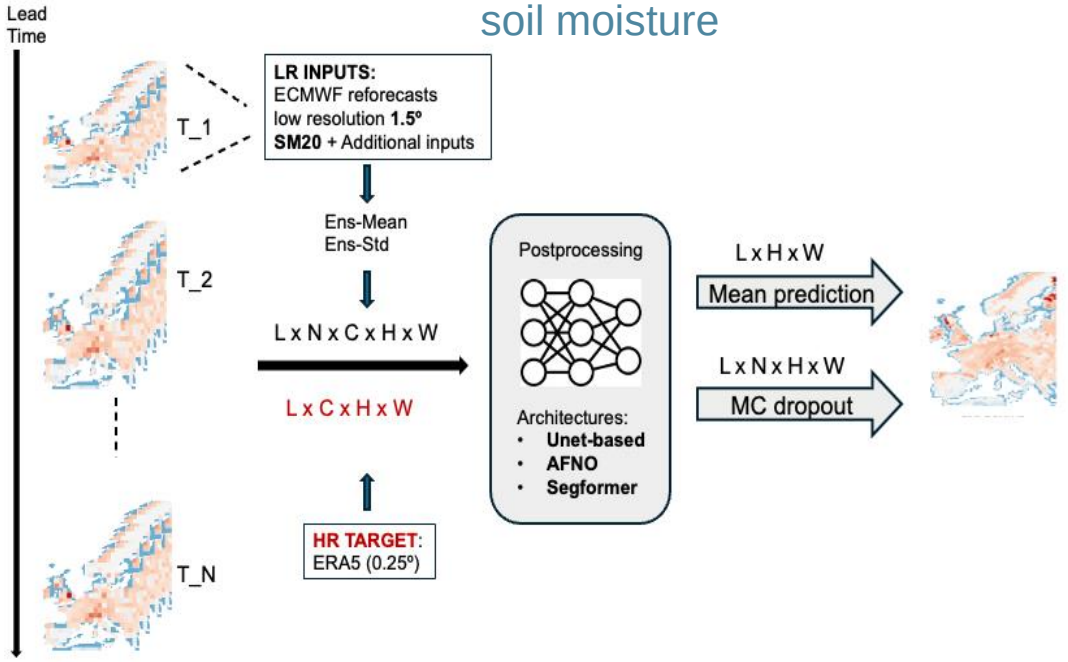
Post-processing of seasonal, sub-seasonal forecasts

Downscaling (1° to 1 arcmin): multiple atmospheric variables

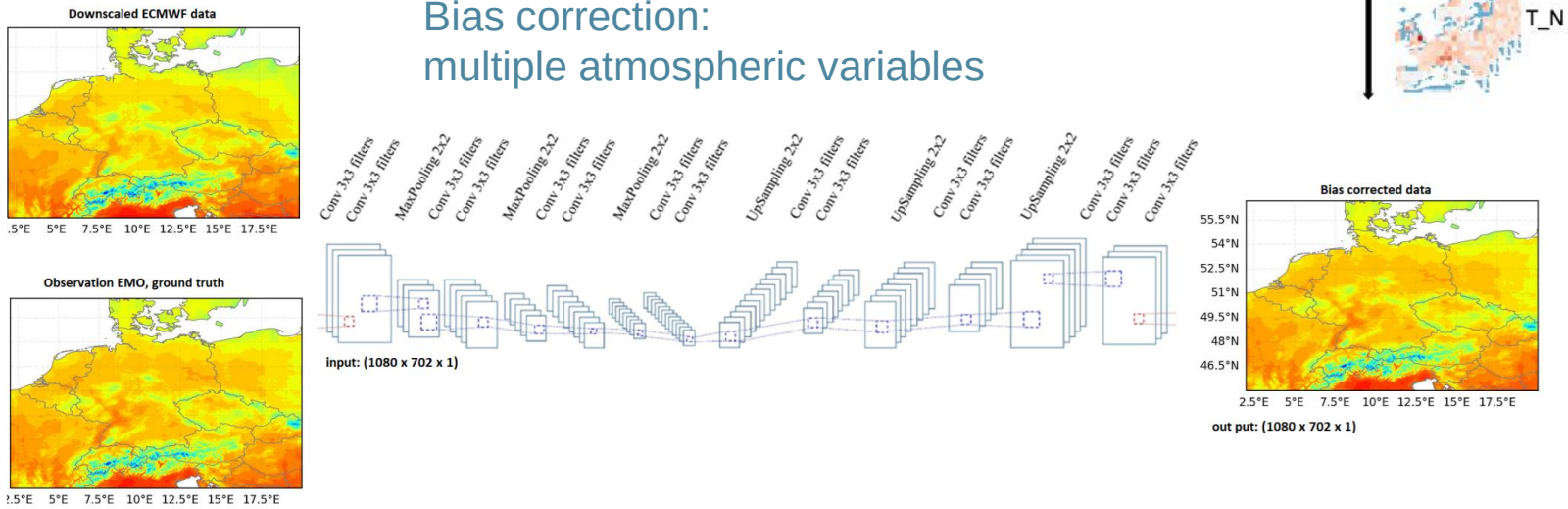


Seasonal: Diaz et al. in prep.

Downscaling, bias correction: soil moisture



Bias correction: multiple atmospheric variables



Sub-seasonal: Otero Felipe et al. in prep.

Post-processing of seasonal, sub-seasonal forecasts

Low resolution atmospheric fields, daily t_0, t_1... t_n

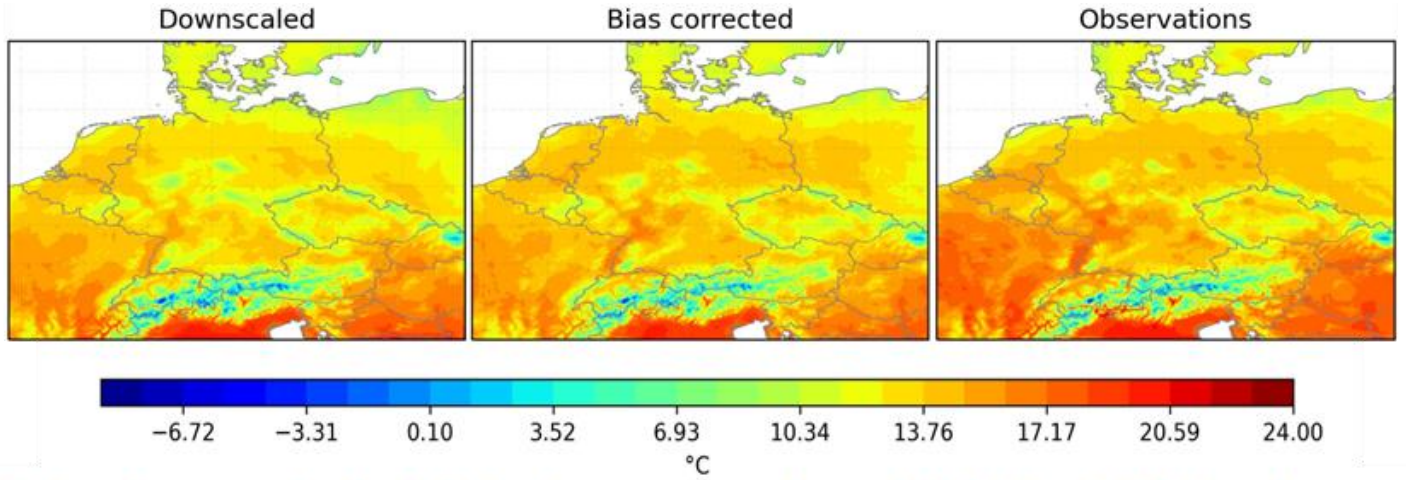
Inputs: Large-scale Drivers

Downscaling (1° to 1 arcmin): multiple atmospheric variables

High-resolution Output

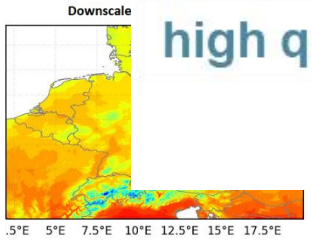
Lead

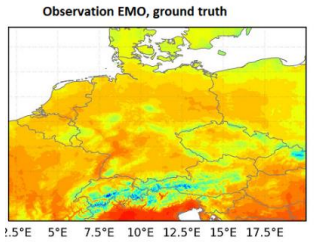
Downscaling, bias correction: soil moisture

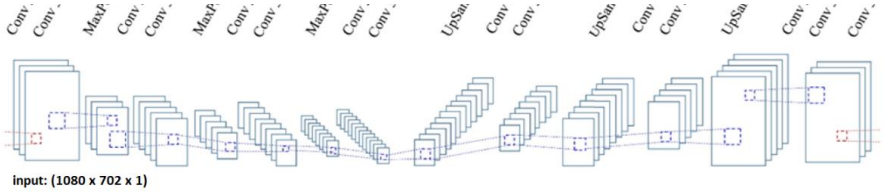


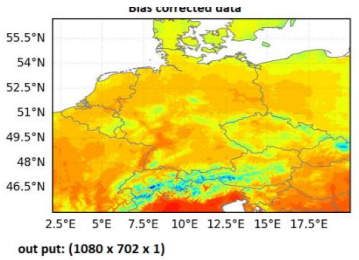
Seasonal

high quality, 1° to 1 arc min (~1.5 km), seasonal and 1.5° to 0.25° sub-seasonal forecasts









Sub-seasonal: Otero Felipe et al. in prep.

THANKS

MedEWSa

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Multidimensional seismic risk assessment through explainable artificial intelligence

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MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Call: UCPM-2022-PP: Prevention and Preparedness Projects on Civil Protection and Marine Pollution

Priority 1: Cross-border risk assessment for identified cross-border risks

BENEFICIARIES

eCampus University – Italy
Francesco Focacci

University of Pisa – Italy
Francesco Pistolesi

Gasilska Zveza Slovenije - Slovenija
Neža Strmole

Medjimurje County – Croatia
Alan Resman

➡ TWO SHARED BORDERS

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MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

SEISMIC RISK ASSESSMENT → **Prediction the probability of damages and economic losses produced by a potential seismic event**

IMPORTANCE OF SEISMIC RISK ASSESSMENT

POTENTIAL END USERS

PUBLIC ADMINISTRATIONS

PLANNING MITIGATION STRATEGIES

- Detect critical situations (poor/old structure) and plan strengthening strategies

- Rational use of economic resources

CIVIL PROTECTION AUTHORITIES

MANAGEMENT OF THE CIVIL PROTECTION EMERGENCY

- Define optimal emergency management procedures based on the expected damage scenarios

- Include planning of psychological support

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MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

SEISMIC RISK ASSESSMENT → **Evaluation of the probability of damages and losses produced by a potential seismic event**

TWO DIMENSIONS OF DAMAGE →
- **STRUCTURAL DAMAGES**
- **PSYCHOLOGICAL CONSEQUENCES**

} **PRODUCED BY A SEISMIC EVENT**

Depression
Anxiety
Post-traumatic stress disorder

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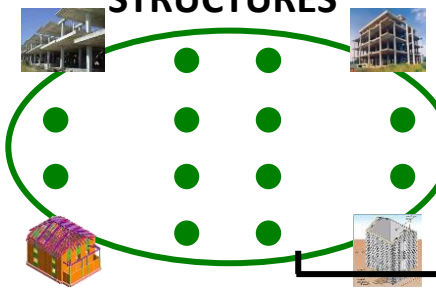
MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

CLASSES OF STRUCTURES

REPRESENTATIVE (BENCHMARK) STRUCTURES



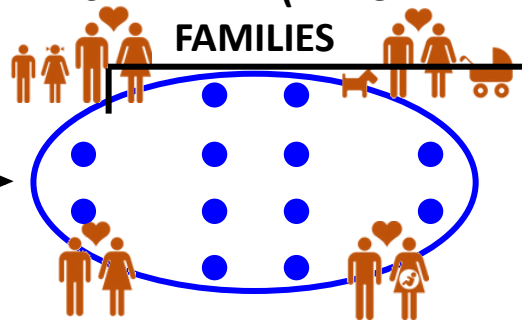
REPRESENTATIVE SEISMIC ACTIONS

STRUCTURAL ANALYSIS

STRUCTURAL DAMAGES

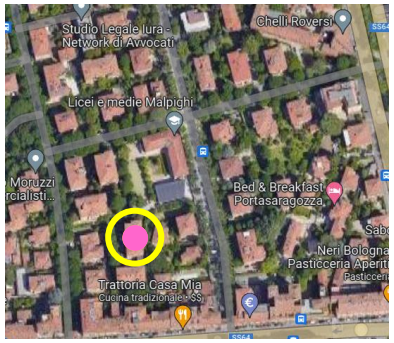
CLASSES OF FAMILIES

REPRESENTATIVE (BENCHMARK) FAMILIES



PSYCHOLOGICAL ANALYSIS

PSYCHOLOGICAL CONSEQUENCES



REAL STRUCTURES AND FAMILIES

EXPECTED SEISMIC ACTION

XAI TO ESTABLISH SIMILARITY CRITERIA

RISK ASSESSMENT INCLUDING STRUCTURAL DAMAGES AND LOSSES AND PSYCHOLOGICAL CONSEQUENCES

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Multidimensional seismic risk assessment through explainable artificial intelligence

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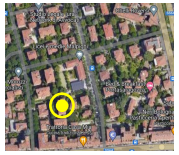
STRUCTURAL ASSESSSMENTS IN REAL AREA (real structures)

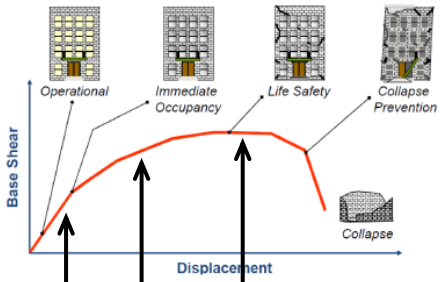
INPUT PARAMETERS FOR EACH STRUCTURE



Class
- Regular masonry structure
- Irregular masonry structure
- Reinforced concrete frames
- .....

Geometrical and mechanical data

→ Structural capacity : capacity PGAs (using XAI)

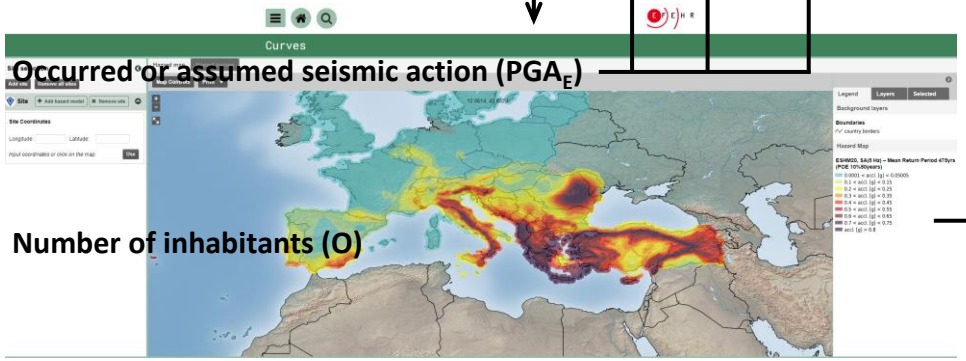


From Heintz J.A., Hamburger R.O., Mahoney M. (2014). FEMA P-58 Phase 2 – Development of performance-based seismic design criteria. 10th US National Conference on Earthquake, Anchorage Alaska.

Location (geographic coordinates)

Ground type
- A
- B
- ...
- E

Occurred or assumed seismic action (PGA_E)



http://hazard.efehr.org/en/home/

Number of inhabitants (O)

Area of the building (A)

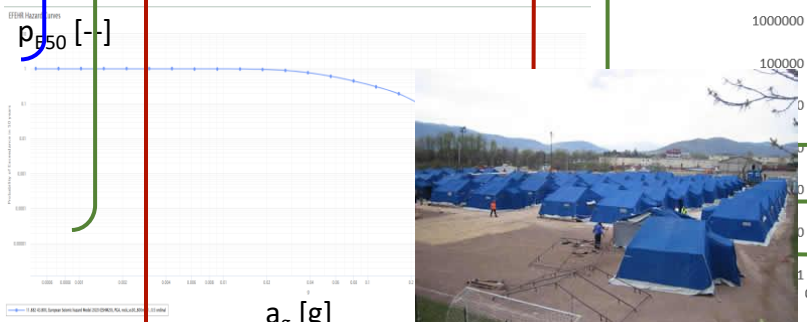
OUTPUT PARAMETERS FOR EACH STRUCTURE

EAL
(Expected annual losses)

Average annual cost needed to repair the damages and cover losses induced by seismic events (depends on site hazard and the structural vulnerability).

Expressed as a **percentage of the construction cost**

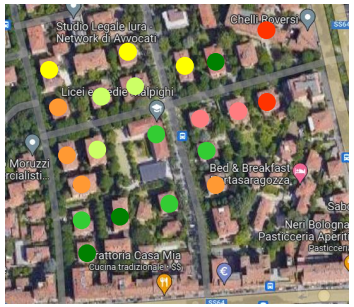
LD
(Level of damage)



Management of Civil Protection emergency

OUTPUT PARAMETERS FOR THE ENTIRE AREA

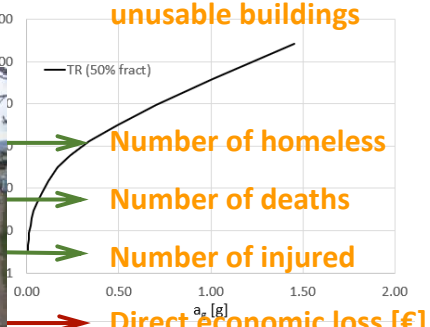
→ Map of EAL



→ Map of LD

Number of short term unusable buildings

Number of long term unusable buildings



Number of homeless

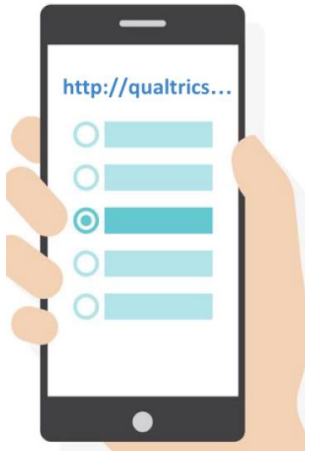
Number of deaths

Number of injured

Direct economic loss [€]

PSYCOLOGICAL ASSESSSMENTS IN REAL AREA (real structures)

PEOPLE ARE PROVIDED WITH A QR CODE TO SEE A QUESTIONAIRE → English, Slovenian, Croatian, Italian



Level 0 NO RISK	Individuals not at risk of developing vulnerability to PTSD thanks to the presence of only resources or proximal protective factors, and eventually 1 distal risk factor
Level 1 LOW RISK	Individuals with a low risk of developing vulnerability to PTSD thanks to the prevalence of resources or proximal protective facto
Level 2 RISK	Individuals with a moderate risk of developing vulnerability to PTSD caused by the compresence of proximal protective factors and distal or proximal risk factors
Level 3 HIGH RISK	Individuals with a high risk of developing vulnerability to PTSD caused by the prevalence of distal or proximal risk factors

ADULTS

1	Inventory Socio-demografico e peri-post terremoto
2	Brief Cope
3	Multidimensional Scale of Perceived Social Support (MSPSS)
4	Brief Assessment of Family Functioning Scale (BAFFS)
5	Cognitive Emotion Regulation Questionnaire (CERQ)
6	World Health Organisation-Five Well-Being (WHO-5)
7	Posttraumatic Stress Disorder Checklist (PC-PTSD-5)

ADULTS/PARENTS

8	Coparenting Relationship Scale (CRS)
9	Parenting Stress Index – Short Form (PSI-SF)
10	Child Behavior Checklist – only PTSD items (CBCL 1 ½ /5)

CHILDREN (7-18), with parents consent

1	Questionario socio-demografico
2	World Health Organisation-Five Well-Being (WHO-5)
3	Lum Emotional Availability of Parents (LEAP)
4	Cognitive Emotion Regulation Questionnaire (CERQ)
5	Coparenting Relationship Scale for children/adolescents (CRS-C; CRS-A)
6	Children's coping strategies checklist-revision 1 (CCSC-R1)
7	Child Revised Impact of Event Scale (CRIES-8)

MEDEA
Multidimensional seismic risk assessment through explainable artificial intelligence

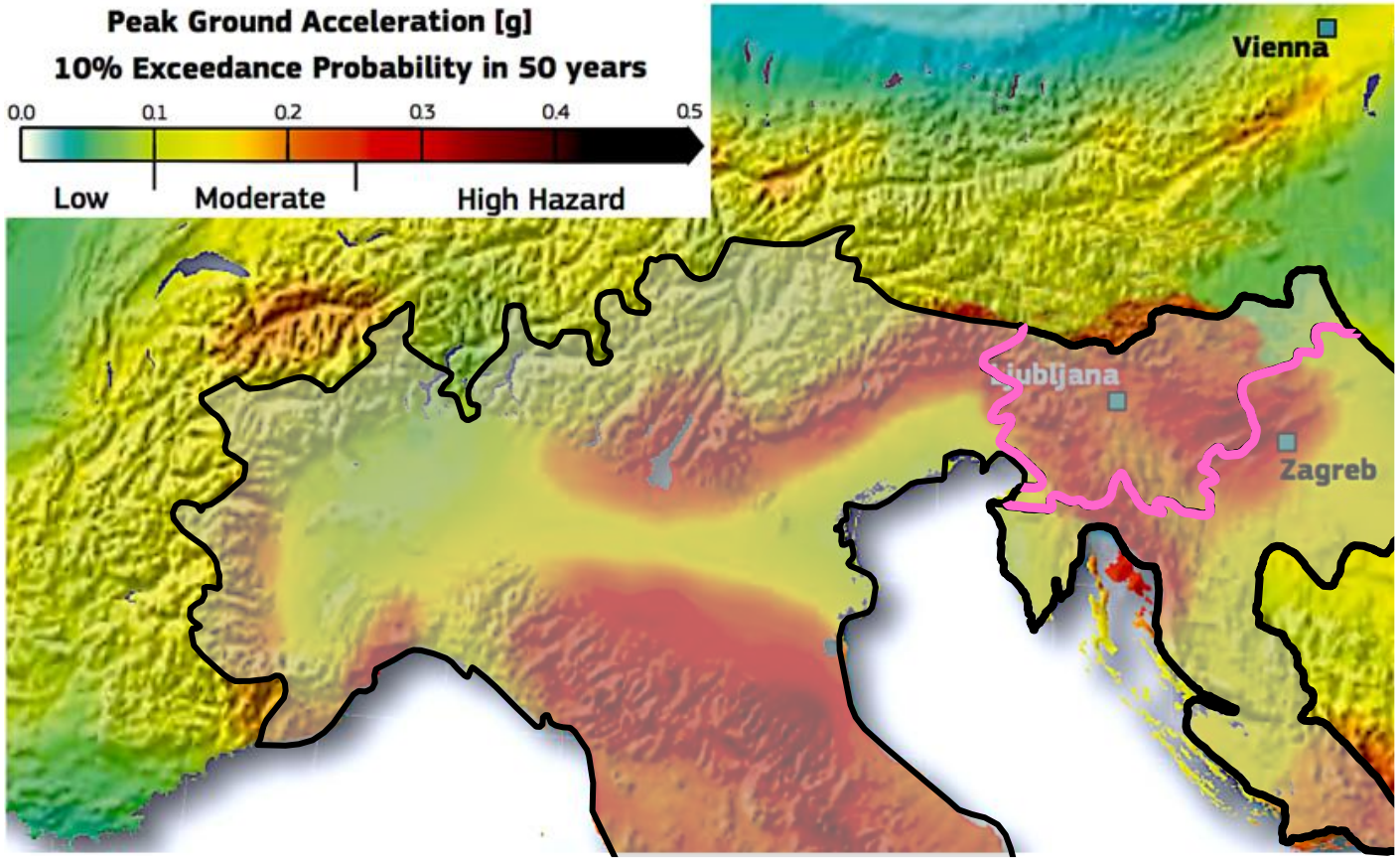
Co-funded by the European Union

eCAMPUS UNIVERSITÀ

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

RISK ASSESSMENT PERFORMED IN CROSS-BORDER PILOT AREAS

- at the border between Italy and Slovenia
- at the border between Slovenia and Croatia



What MEDEA can do?

Performs a **multi-dimensional risk assessment** considering the potential damage to structures and psychological consequences

Helps experts and Civil Protections understand **which structures need immediate attention** after an earthquake

Helps psychologists understand **how to prevent people's PTSDs** in areas where an earthquake occurred

Learns continuously from new data in order to **refine predictions**

Multidimensional data

Building data

structural parameters characterizing the building

Citizens' data

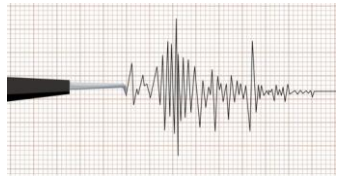
past traumatic experiences, diseases, factors influencing how people react to disasters

Knowledge base

contains data regarding a large set of structures located in various areas, and people living there

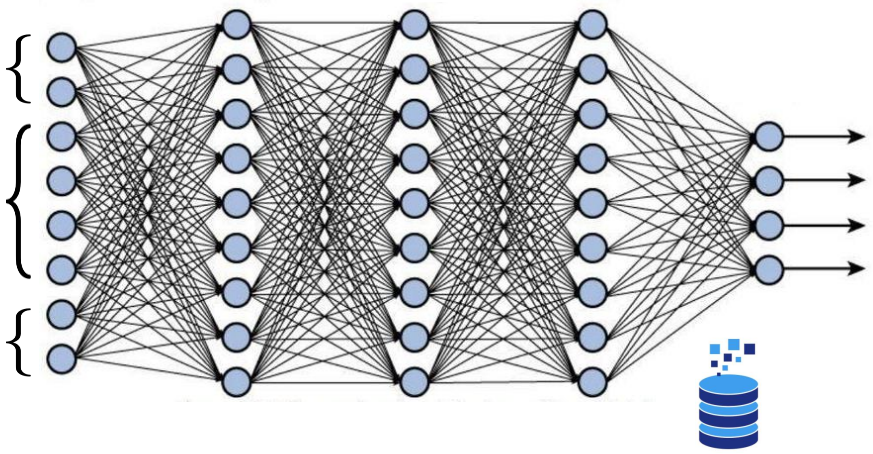
Inference

Seismic action



Building data

People data



MEDEA

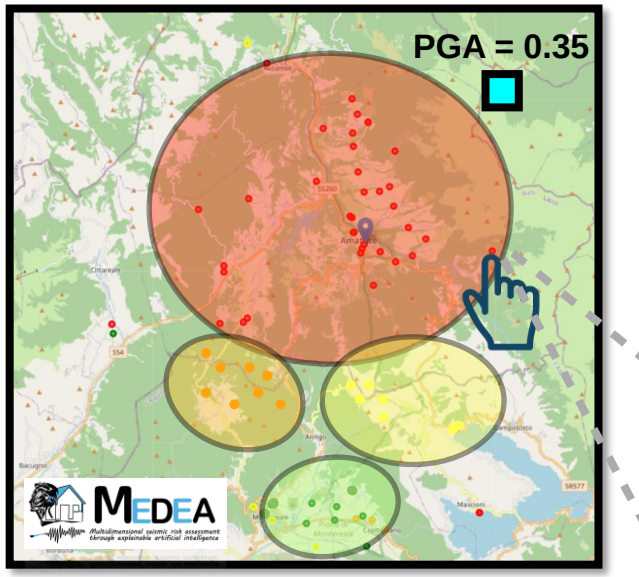
Peak ground accelerations leading to various damage states and **losses**

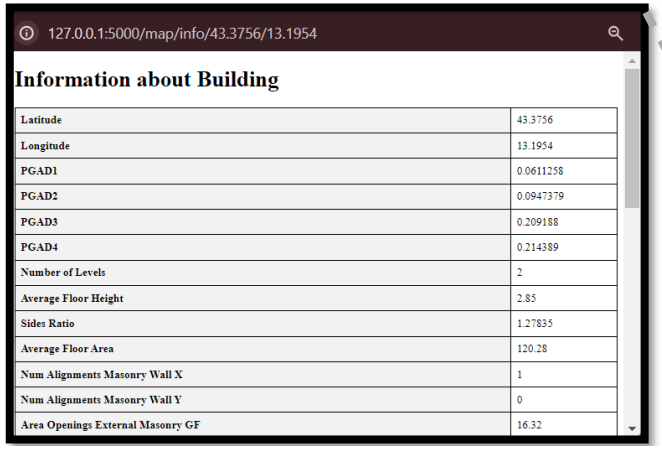
Psychological consequences

Artificial intelligence estimates the **structural damage** and **psychological consequences** of the people involved.

AI **learns to associate similar structures and people's risk factors** so that predictions are obtained inferring new consequences from the KB.

Predictions





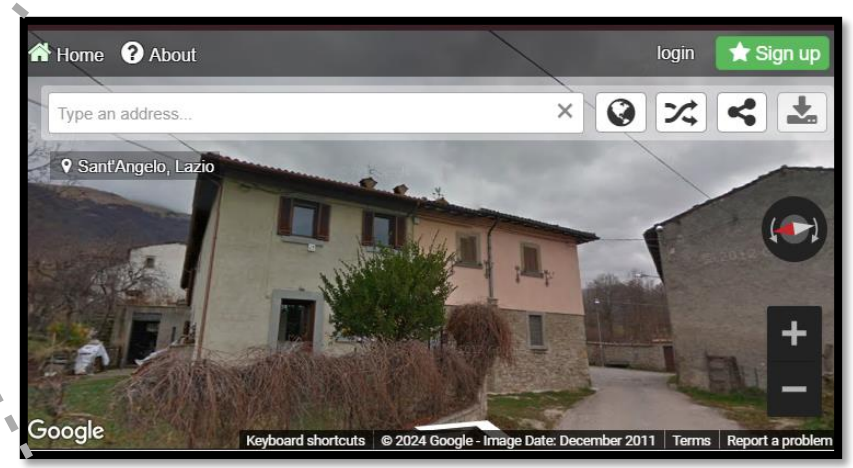
Latitude	43.3756
Longitude	13.1954
PGAD1	0.0611258
PGAD2	0.0947379
PGAD3	0.209188
PGAD4	0.214389
Number of Levels	2
Average Floor Height	2.85
Sides Ratio	1.27835
Average Floor Area	120.28
Num Alignments Masonry Wall X	1
Num Alignments Masonry Wall Y	0
Area Openings External Masonry GF	16.32

How does it work?

Based on the PGA of the nearest seismic sensor, MEDEA determines various clusters of buildings and **associates each cluster with a level of damage**.

Experts and Civil Protections can **visualize buildings** to verify if they can trust the system's predictions

This can also be done for **expected earthquakes**, to understand the potential damages and which structures necessitate intervention to limit damages



European Union

Commentary from the Emergency Response Coordination Centre (ERCC) Analytical Team

Spyros Afentoulidis
Team Leader, DG ECHO.A2

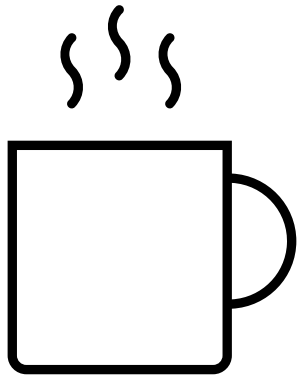
Union Civil Protection Knowledge Network

Coffee Break till 11.30 before the breakout session starts!

Artificial intelligence for Disaster Risk Management

UCPM Knowledge Series Workshop (22 October 2024)

- Livestreaming will unfortunately end, but recording is available at same link
- Extra info and eventually slides here:



Picture generated with the Adobe Firefly AI.

European Union

Union Civil Protection Knowledge Network

European Union

What does the future hold?

Breakout group session

Juha-Pekka Jäpölä
Project Officer, DG ECHO.B3

Union Civil Protection Knowledge Network

Breakout groups – What does the future hold?

Discussion 11:40 – 12:40

- Division into breakout groups: Objective to draft follow-up recommendations
  - Each group **(5-7 people)** should have a laptop! Discussion along guiding questions, but no need to limit yourself to them and you can also utilize the panel findings.
- Each group should **compile their conclusions into a Word-document and send them by the end at 12.40!**
- No need for polished conclusions!
  - In the spirit of this workshop, we will use GPT@JRC to draft the report

Breakout groups – What does the future hold?

Discussion 11:40 – 12:40

Guiding questions

1. How can the Commission **best harness the potential** of AI & ML in DRM?
2. In **which area of your portfolio** do you see the biggest potential impact of AI in DRM and how can promising AI applications be integrated?
3. What are the **expected pitfalls/challenges** we should be aware of?
4. What are the **capacity building needs for effectively using AI** in disaster risk management, and how can they be addressed?

Breakout groups – What does the future hold?

Discussion 11:40 – 12:40

Extra guiding questions

5. How can AI be used to **support transparent and accountable decision-making** in disaster risk management?
6. What actions do we need to take to identify the **biases underlying AI applications** and how do we best prepare ourselves for dealing with these?
7. What are the **potential partnerships and new stakeholders** that can be engaged to support the development and deployment of AI solutions for disaster risk management?

European Union

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Closure of the workshop

Erwan Marteil
Head of Unit, DG ECHO.B3
Prevention and Preparedness Capacity Building