

# Modern Technologies for Disaster Management

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Resilience to Disasters & Conflicts Global Support Branch

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Paula Padrino Vilela

01 November 2021, Geneva

# Agenda

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1. UNEP's work in Modern Technologies for Disaster Management
  - AI for Disaster Management
  - IoT for Disaster Management
  - Robotics for Disaster Management
  - Drones for Disaster Management
2. Efforts to promote collaboration on this topic
  - LinkedIn Expert group: AI and AI and other New Generation Technologies for Disaster Management
  - Introduction to AI for Disaster Management Focus Group

# Introduction to the Resilience to Disasters and Conflicts Global Support Branch

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# Key Activities

Resilience to Disasters & Conflicts Global Support Branch



**Post-crisis Environmental Assessments**



**Post-crisis Environmental Recovery**



**Disaster Risk Reduction**



**Policy and Analyses (Security)**

# Key Achievements

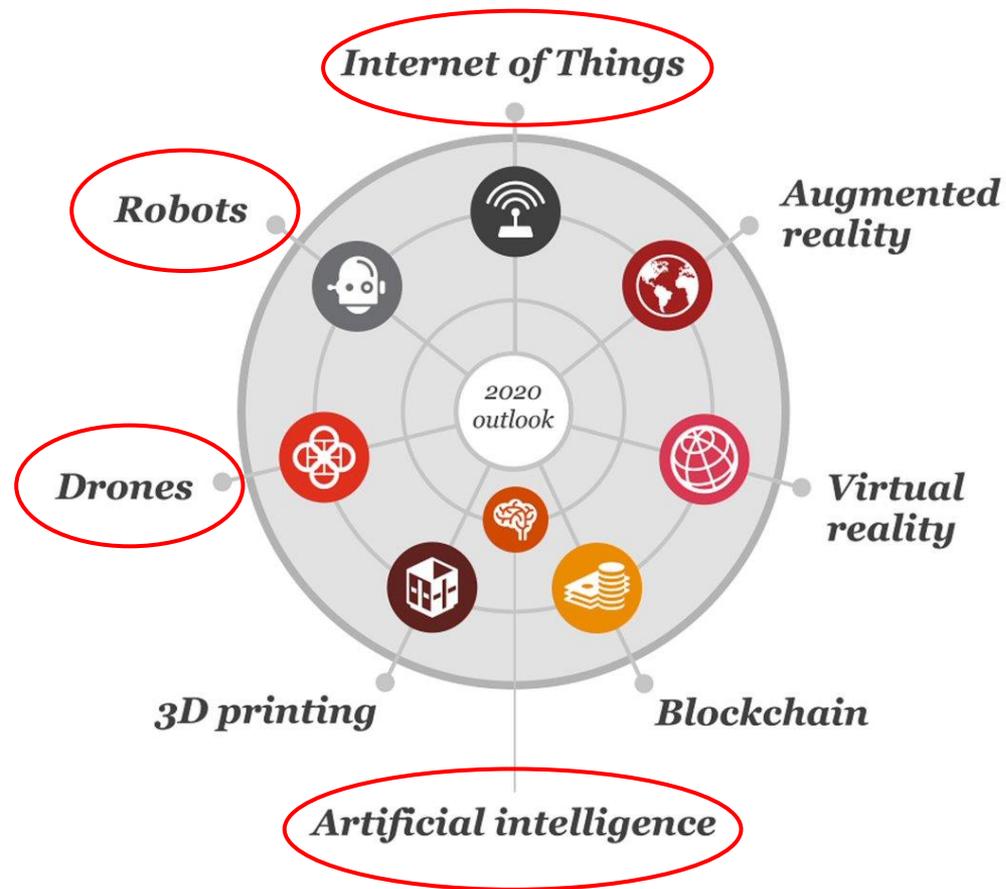
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- Responded to **more than 200 emergencies** (including the UNEP/OCHA Joint Environment Unit)
- Operated in **more than 30 countries**, including in Afghanistan since 2003
- Raised **more than 250 million USD** for assessment, clean-up and capacity building
- Our assessment reports have led to:
  - Establishment of new **Environmental Protection Agency in Afghanistan**;
  - Establishment of new **solid and liquid waste facilities**, worth more than 250 million USD in the Gaza Strip, a new **400 million USD desalinization plant planned**;
  - Establishment of a new **clean-up agency** and **1-billion-dollar fund in Nigeria**;
  - New **environmental legislations** in Afghanistan, Iraq, Liberia.

# Modern Technologies for Disaster Management

# Focus work

## Fourth Industrial Revolution Technologies



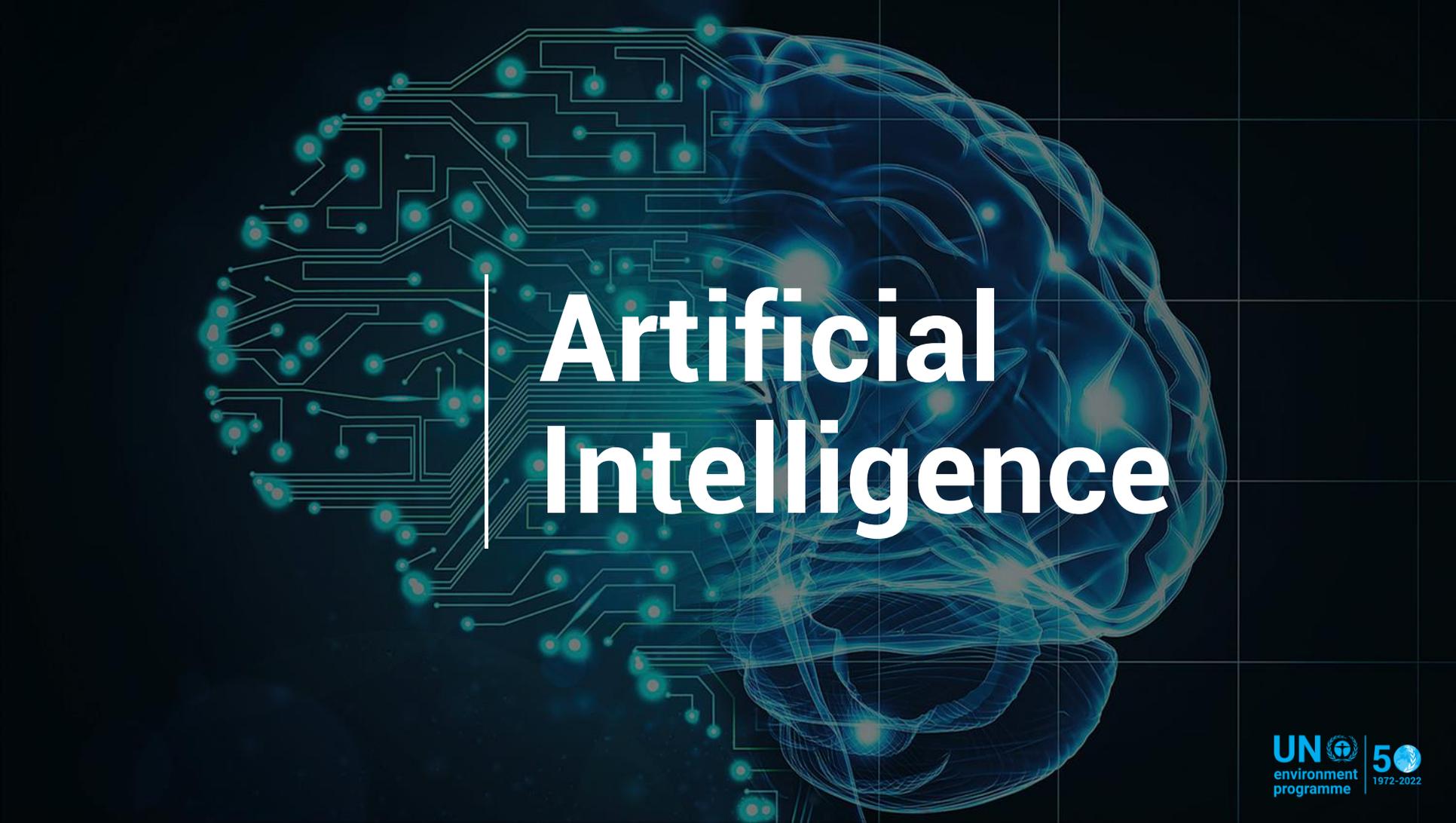
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#TechMegatrend

## Report on “Modern Technologies for Disaster Management”

### Objectives:

- To illustrate the potential of 4IR technologies and their current application in disaster risk reduction and response
- Show how existing 4IR technologies have been implemented in successful case studies
- To present the key institutions, private companies and organizations involved in 4IR technologies & disaster management
- To promote the use of 4IR technologies for environmental emergency prevention and response in the future.



# Artificial Intelligence

- Applications of AI in Disaster Management

- **Mitigation**

- Susceptibility Mapping
    - Forecasting vulnerabilities
    - NLP for disease outbreaks

- **Preparedness**

- Early warning systems
    - Evacuation mapping
    - Training systems



- **Response**

- Disaster mapping
    - AI chatbots
    - Crisis response through social media

- **Recovery**

- Damage assessment
    - Resource allocation

# Internet of Things (IoT)

- Applications of IoT in Disaster Management
- IoT-based early warning systems
  - Information dissemination
  - Combating Covid-19 and contagious illnesses
  - Logistics and cold-chain monitoring



**Controlant** Rokit



# Robotics



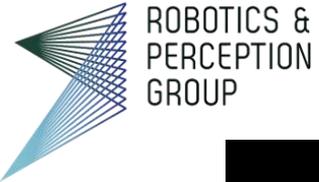
- Applications of Robotics in Disaster Management: Mitigation, Preparedness, Response, Recovery: search and rescue, rubble removal, extinguishing forest fires
- Application of drones during pandemics
  - Detecting correct use of facemasks, monitoring crowd density, and giving public service announcements.
  - Disinfect large areas including public spaces, points of care, workplaces, and schools.
  - Disinfect objects or people's hands.
  - Measuring body temperatures and oxygen levels.
  - Provide telepresence between COVID-19 patients and their doctors and families
  - Deliver goods like medicines and COVID-19 test samples and keep track of the inventory.
  - Deliver food or other products to quarantined citizens.

A grey quadcopter drone is shown in flight, hovering over a dense field of green plants. The background is a soft, hazy sunset with a warm orange and yellow glow. The drone's propellers are blurred, suggesting motion. The word "Drones" is overlaid in large white text on the left side of the image.

# Drones

# Drones

- **Applications of Drones in Disaster Management**
  - Mapping
  - HealthCare
  - Search and Rescue
  - Surveillance
  - Oil Spills
  - Delivery
  - Situational Awareness



Garuda Aerospace (P) Ltd

# Annexes

## A – Artificial Intelligence



## B – Robotics



## C – Drones



## D – Internet of Things



# Conclusion

- Disasters are responsible for countless injuries, mortalities, displacements, damages to property and infrastructure, and disturbances to nature and natural resources.
- In order to minimize the risks and consequences of disasters action needs to be taken.
- The advantages and challenges vary among each of the technologies.
- Our research shows that the 4IR technologies mentioned above have a great potential to contribute to the reduction of threats to health and livelihoods from environmental causes and consequences of disasters.
- In order to address the challenges, it is important to have a holistic approach and foster partnerships.

# Webinar Series on Modern Technologies for Disaster Management



**UN** environment programme | **50** 1972-2022

Registrants: 2072  
Participants: 728

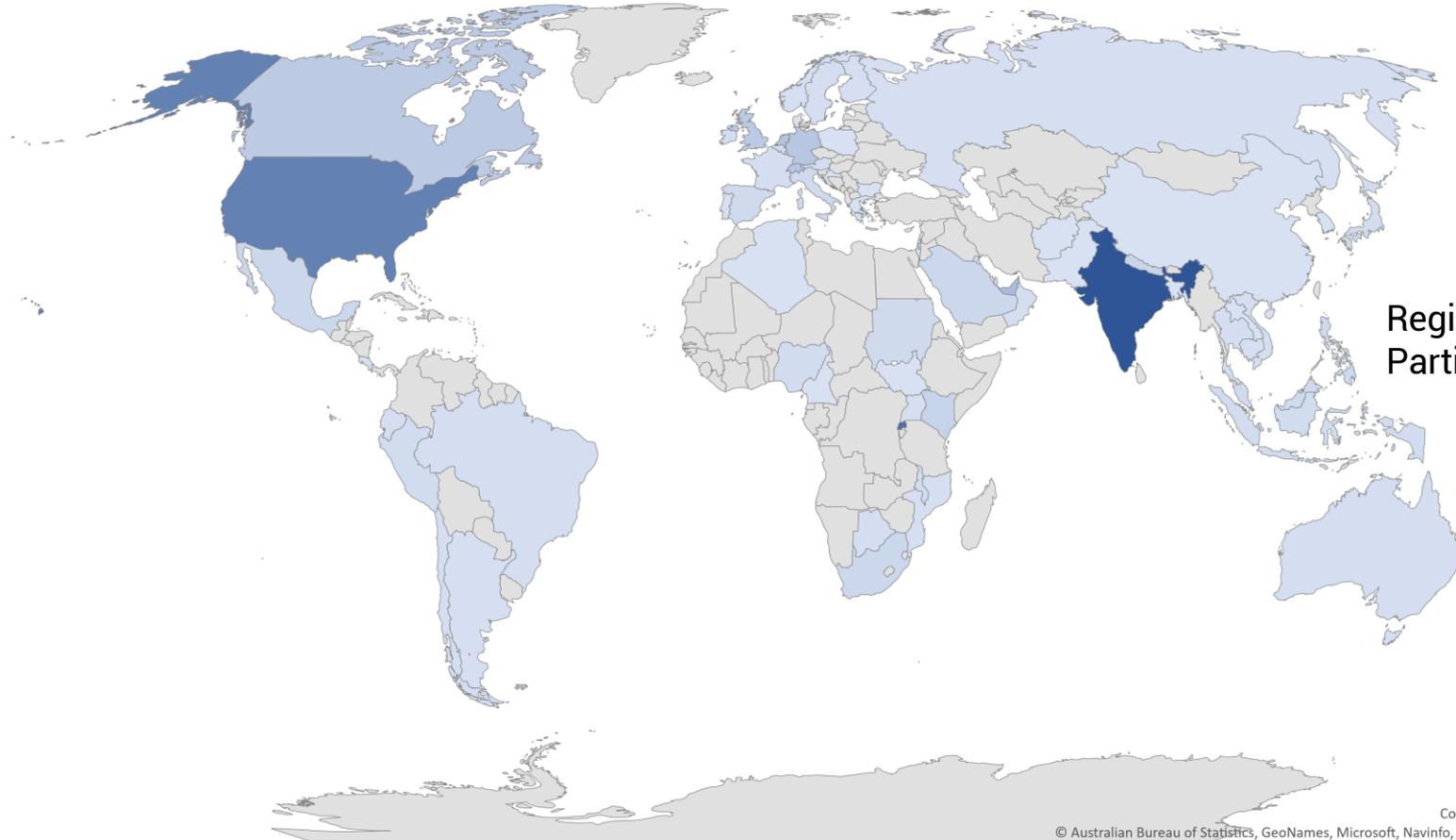
## Webinar Series Modern Technologies for Disaster Management

<b>14</b> Sept	<b>Robotics</b> 15.00-16.30 CEST	<b>28</b> Sept	<b>Artificial Intelligence</b> 15.00-16.30 CEST
<b>12</b> Oct	<b>Drones</b> 15.00-16.30 CEST	<b>26</b> Oct	<b>Internet of Things</b> 15.00-16.30 CEST

Register at: [bit.ly/ModernTech4DisasterMgmt](https://bit.ly/ModernTech4DisasterMgmt)



# Webinar Series on Modern Technologies for Disaster Management



Registrants: 2072  
Participants: 728

# Webinar Series on Modern Technologies for Disaster Management

Photo: Getty Images



UN environment programme 50 1972-2022

## Artificial Intelligence in Disaster Management

Modern Technologies in Disaster Management Webinar Series Part 2

Artificial Intelligence (AI) is undoubtedly one of the biggest tech trends at the moment, and in the upcoming years it will become an even more valuable tool for helping us to interpret and understand the world around us. This Fourth Industrial Revolution (4IR) technology holds incredible predictive capabilities and can analyze large sets of data to help prepare for various disasters. It can provide both immediate and long-term relief in a capacity far greater than what humans achieve by themselves.

Leading companies and institutions which are at the forefront of AI will come together for this second webinar highlighting a variety of AI applications in disaster risk reduction and response.

28 September, 15.00-16.30 CEST

Register at: [bit.ly/ModernTech4DisasterMgmt](https://bit.ly/ModernTech4DisasterMgmt)



### Agenda

- **Opening remarks:** Monique Kuglitsch (Chair of the ITU/WMO/UNEP Focus Group on AI for Natural Disaster Management)
- **AI-powered Wildfire Detection Systems:** Andre Cheung (CEO & Founder, Robotics Cats)
- **Monitoring and forecasting floods with artificial intelligence:** William Cistangs (Chief Technology Officer, Temeva)
- **Extracting information from social media for crisis response and management:** Dr. Muhammad Imran (Senior Scientist, Qatar Computing Research Institute)
- **Integrating AI with hazard science to improve disaster resilience:** Craig Fugate (Chief Resilience Officer, One Concern)
- **Question & Answer session**

Moderated by: Maxime Croft & Thomas Matheickal (Interns at the Resilience to Disaster and Conflicts Global Support Branch, UNEP)

Photo: Shutterstock



UN environment programme 50 1972-2022

## Robotics in Disaster Management

Modern Technologies in Disaster Management Webinar Series Part 1

One of the Fourth Industrial Revolution technologies that can have a great impact in disaster management is Robotics. Robots can go to places that are either impossible or unsafe for humans to reach. They can perform preventive inspections, quickly locate and rescue humans, and map disaster struck areas. The capabilities of robots and their possibilities for use in disaster management keep increasing.

This first webinar will highlight a variety of robotics applications in disaster risk reduction and response and feature some of the leading companies and institutions at the forefront in using this technology.

14 September, 15.00-16.30 CEST

Register at: [bit.ly/ModernTech4DisasterMgmt](https://bit.ly/ModernTech4DisasterMgmt)



### Agenda

- **Opening remarks:** Muralee Thummarukudy (Acting Head of the Resilience to Disasters and Conflicts Global Support Branch, UNEP)
- **Application of robotics in disaster management:** Prof. Robin R. Murphy (Vice President, Center for Robot-Assisted Search and Rescue)
- **Robotic AI in search and rescue:** Dr. Ali-akbar Agha-mohammadi (Group leader and Technologists, NASA's Jet Propulsion Laboratory)
- **Unmanned marine vehicles for disaster management:** Ed.D. Paige Day (Director of Sales, Hydronalix)
- **The use of robotics in emergency response:** Gordon Pelic (Business Development Manager, DOK-ING)
- **Social and service robots in combatting the COVID-19 pandemic:** Jayakrishnan T. (CEO, ASIMOV Robotics)
- **Question & Answer session**

Moderated by: Tameko Makati & Maxime Croft (Interns at the Resilience to Disaster and Conflicts Global Support Branch, UNEP)

UN environment programme 50 1972-2022



## Drones in Disaster Management

Modern Technologies in Disaster Management Webinar Series Part 3

With the current state of climate change and natural disasters, it has become extremely crucial to incorporate technologies in dealing with the latter. As one of the 4IR technologies, drones have seen a rapid increase in their usage across different sectors, one of them being disaster management. Drones can perform tasks such as surveillance, mapping, delivering essentials and reconnaissance in extremely dangerous situations and in the places that are often inaccessible to humans within a short period of time. This webinar will focus on different leading drone companies and institutions and how they use their technologies in disaster risk reduction and response.

12 October 15.00-16.30 CEST

Register at: [bit.ly/ModernTech4DisasterMgmt](https://bit.ly/ModernTech4DisasterMgmt)



### Agenda

- **Opening remarks:** Yves Barthelemy (Senior Geospatial and Resilience Specialist, UNEP World Bank) Dr. Patrick Meier (Co-Founder and Executive Director at WeRobotics)
- **Drones - Emergency Response, COVID-19 and Beyond:** Cameron Chell (Chairman/CEO of DraganFly)
- **Foldable Drones in Search & Rescue:** Davide Scaramuzza (Associate Professor of Robotics and Perception at the University of Zurich)
- **Delivery and Environmental Monitoring:** Dumisani Kalati (Founder & CEO Micromek)
- **Crisis Mapping using Drones:** Mr. Taichi Furuhashi, Founder of Drone Bird and President at CrisisMappers Japan)
- **Ethical Implications of the Humanitarian Use of Drones:** Dr. Ning Wang (Researcher, Institute of Biomedical Ethics and History of Medicine (BME) & Digital Society Initiative (DSI), University of Zurich)

Moderated by: Aman KC and Melissa Puerto (Interns at the Resilience to Disaster and Conflicts Global Support Branch, UNEP)

UN environment programme 50 1972-2022



## Internet of Things in Disaster Management

Modern Technologies in Disaster Management Webinar Series Part 4

Several natural and man-made disasters occur every year, causing catastrophic consequences in terms of human loss and other types of damages. The Internet of Things (IoT) is a novel technology that has the potential to minimize the impact of disasters through the immense connectivity of readily available sensors. IoT applications can significantly improve the effectiveness of disaster management policies by precisely visualizing operations, creating information resources, and optimizing all emergency management processes.

Experts around the world will present a variety of IoT applications in disaster risk reduction and response during the final webinar of this series.

26 October 15.00-16.30 CEST

Register at: [bit.ly/ModernTech4DisasterMgmt](https://bit.ly/ModernTech4DisasterMgmt)



### Agenda

- **Welcoming remarks:** Muralee Thummarukudy (Acting Head of the Resilience to Disasters and Conflicts Global Support Branch, UNEP)
- **IoT for wildfire detection:** Mr. Carsten Brinkschulte (Co-founder & CEO, Dryad Networks)
- **IoT Technologies during and beyond COVID-19:** Mr. Justin Greenberg (Director of Strategic Communications & Government Affairs, Kinsa)
- **IoT for Proximity Solutions:** Mr. Jonathan Duque (Sales & Customer Success, Estimote)
- **IoT for Earthquake Early Warning Systems:** Mr. Andres Meira (Founder & CEO, Grillo)
- **Closing remarks:** Paula Padirino Vilella (Project Coordinator, UNEP)

Moderated by: Thoms Matheickal & Melissa Puerto (Interns at the Resilience to Disaster and Conflicts Global Support Branch, UNEP)



# AI for Natural Disaster Management

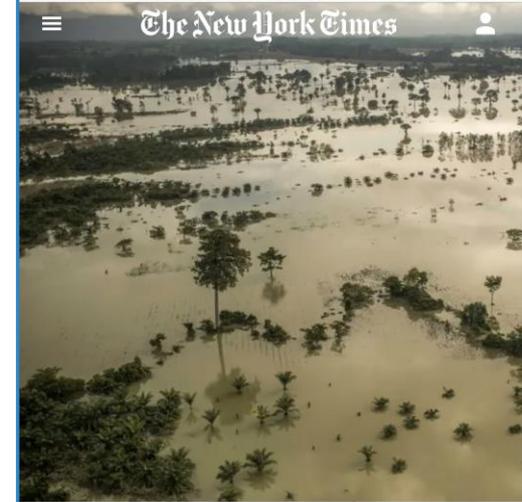
ITU Focus Group

Paula PADRINO VILELA

Focal Point of UNEP at FG-AI4NDM

# The challenge.

- ▶ **Natural disasters** can result in injury, mortality, displacements, damage to property (including cultural heritage) and infrastructure, and disturbance to nature and natural resources.
- ▶ The situation is exacerbated in **certain regions (SIDS and LDCs)** and for certain **populations** (e.g., women and children); and is expected to **worsen** due to population growth, rapid urban development, and growing frequency/intensity of some events.



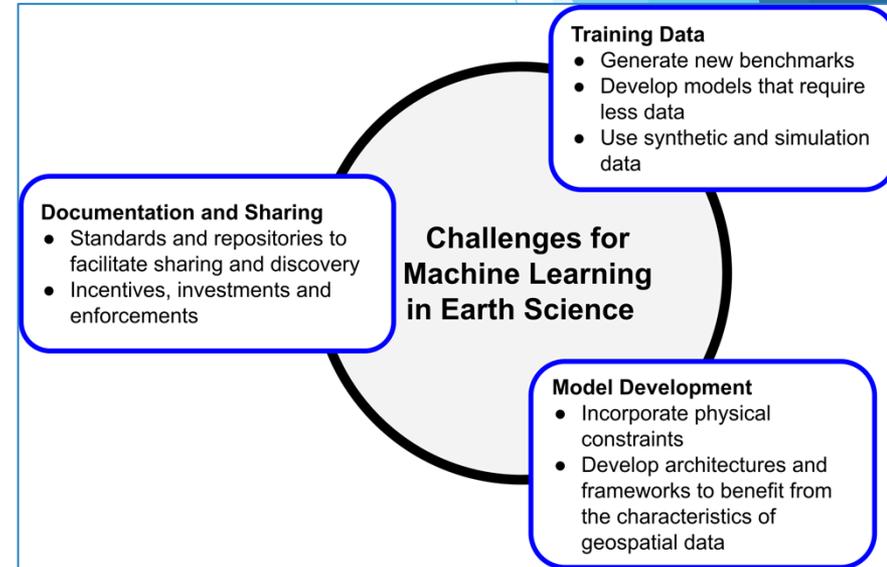
A view of the vast flooding in Guatemala after Hurricanes Eta and Iota struck one after the other last month.

2 Hurricanes Devastated Central America. Will the Ruin Spur a Migration Wave?

(4 Dec 2020, NYT)

# The questions.

- ▶ Through tapping the **potential of AI**, can we improve our **understanding** of natural hazards, our ability to **detect** events in real-time, our ability to **forecast** events, and our ability to effectively **communicate** an impending disaster?
- ▶ What are the **best practices** when using AI?
- ▶ What are the **limitations** of using AI?



(Maskey et al., 2021)

# To find answers, bring together experts.



- ▶ **ITU/WMO/UNEP Focus Group on AI for Natural Disaster Management (FG-AI4NDM)** converges the ICT expertise of ITU with natural disaster expertise from the WMO and UNEP.
- ▶ Creates an atmosphere that is conducive to international, multi-stakeholder, and interdisciplinary collaboration.

# Management & operations

## Chair



Monique Kuglitsch  
*Fraunhofer HHI,  
Germany*

## Vice chairs



Elena Xoplaki  
*University of Giessen, WMO  
Germany*



Juerg Luterbacher



Muralee  
Thummarukudy  
*UNEP*



Preeti Banzal  
*Government of India,  
India*



Yan Chuan Wang  
*China Telecom,  
China*

## ITU/TSB

Mythili Menon, Advisor  
Hiba Tahawi, Secretariat

## Operations

Ivanka Pelivan (*Fraunhofer HHI, Germany*)  
Jackie Ma (*Fraunhofer HHI, Germany*)

# Goals

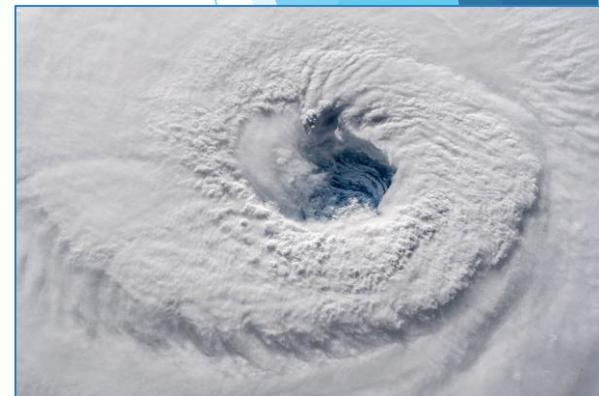
- ▶ Explore the potential (and identify the pitfalls) when using AI-based algorithms to support:
  - ▶ **data** (collection, monitoring, and handling),
  - ▶ **modeling** (reconstructions and forecasts), and
  - ▶ effective **communication**.



(Landslide in 2005, Luzern, Switzerland; [swissinfo.ch](http://swissinfo.ch))

# AI for data (collecting, monitoring, and handling)

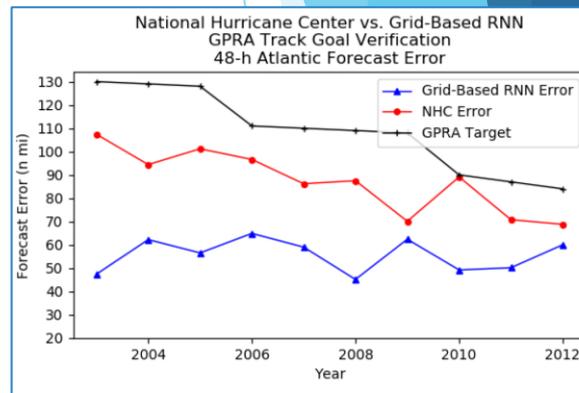
- ▶ Some questions to explore are:
  - ▶ how can AI be used to **enhance** data quantity and quality?
  - ▶ how can AI be used to support **detection** of features in **real time**; for instance, earthquake signal detection in seismic data?
  - ▶ how can AI be used to leverage **synergies** from different data sources more effectively?



(ESA/NASA-A, Gerst)

# AI for modeling (reconstructing and forecasting)

- ▶ Some questions to explore are :
  - ▶ what is the current **gold standard** method to create reconstructions or forecasts? How can AI-based algorithms bring these methods to the **next level**?
  - ▶ what **requirements** should data meet when **training and testing** an AI-based algorithm?
  - ▶ what should be considered when **evaluating** an AI-based algorithm?



(Alemany et al., 2019)

# AI for effective communications

- ▶ Some questions to explore are :
  - ▶ once an event has been forecast or has been triggered, how can AI assist with the **immediate response**?
  - ▶ how do we ensure that communication methods are **reliable and trusted** by the population? Are they accompanied by a clear set of **protocols** to ensure that individuals know how to respond?

**!** EMERGENCY ALERTS 3h ago

**Emergency Alert**  
National Weather Service: **TORNADO WARNING** in this area until 245 AM EST. Take shelter now in a basement or an interior room on the lowest floor of a sturdy building. If you are outdoors, in a mobile home, or in a vehicle, move to the closest substantial shelter and protect yourself from flying debris. Check media.

## Tornado Sheltering Guidelines

Seek the best available refuge area **immediately** when a Tornado Warning is issued.  
Your chance of surviving a tornado is excellent if you follow these guidelines.

WORST OPTIONS	BAD OPTIONS	GOOD OPTIONS	BEST OPTIONS
Mobile homes Vehicles Underneath a highway overpass	Large open rooms like gymnasiums Manufactured housing	Interior room of a well-constructed home or building Basement	Above or below ground Tornado Storm Shelter (NNSA/ICC 500 compliant)* Specifically-designed FEMA Safe Room*

Find another option → Stay in place until all clear

PHOTO: iStock.com/Scott Ogilvie; iStock.com/Wayne C. Church \*Recommended by FEMA

## Key deliverables

- ▶ **Roadmap** of AI activities in these areas of natural disaster management.
- ▶ **Workshops** that bring together experts and stakeholders, highlight ground-breaking activities in this topic, and encourage participation in FG-AI4NDM.
- ▶ Non-normative **technical reports** that summarize the findings of our analyses, based on input from selected **use cases**.
- ▶ **Educational materials** to make the content of the technical reports accessible to all stakeholders.

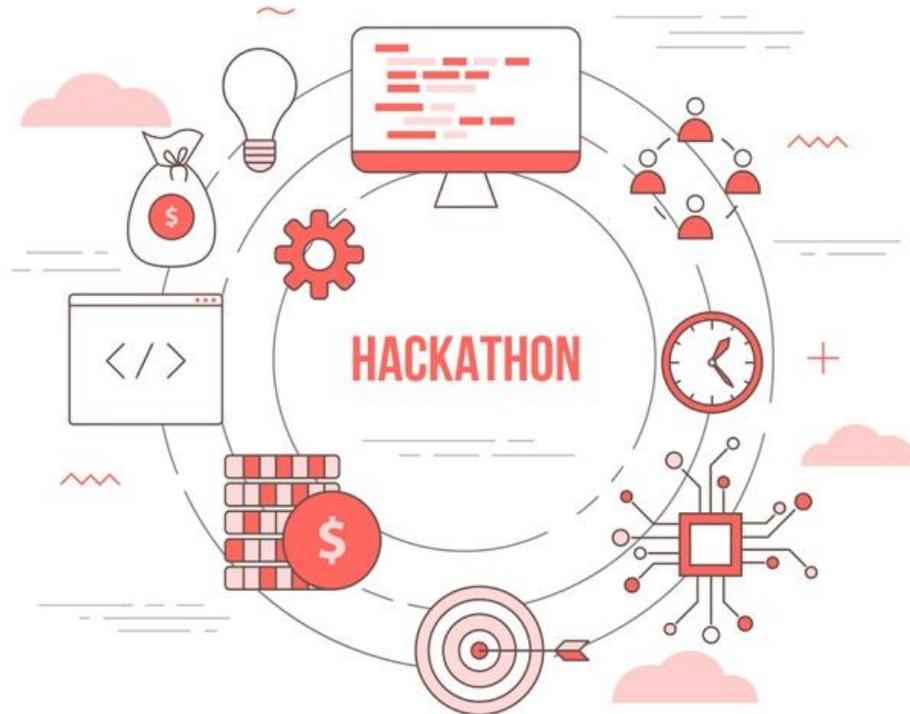
# Participation

- ▶ Visit our website (<https://itu.int/go/fgai4ndm>)
- ▶ Peruse our onboarding document for guidance on how to:
  - ▶ Create a free ITU user account
  - ▶ Join our low-volume mailing list
  - ▶ Register for workshops/meetings
  - ▶ Use our remote participation platform (MyMeetings)
  - ▶ Access our collaboration site
  - ▶ Submit written contributions (e.g., use case proposals)



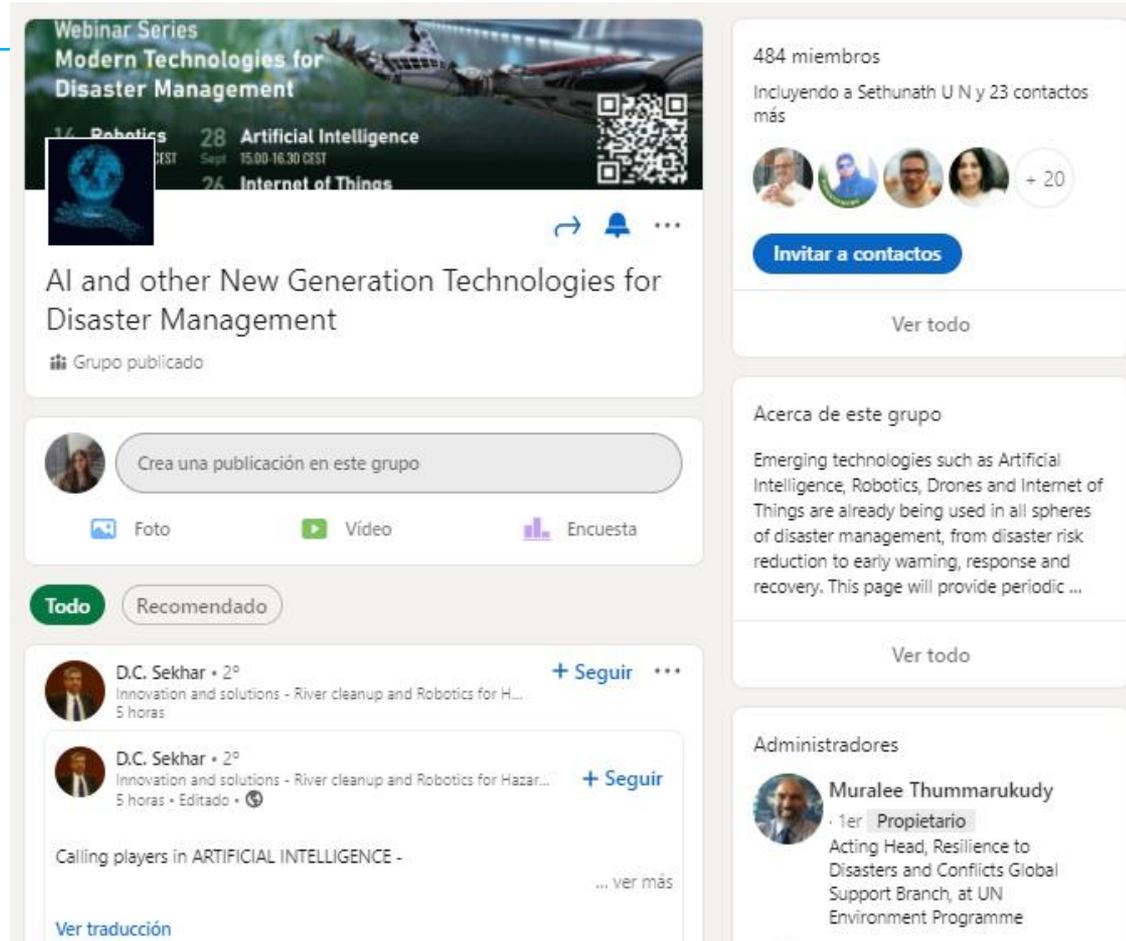
Soon to come:

## Global hackathon on AI for Natural Disaster Management 2022



# LinkedIn Group: AI and other New Generation Technologies for Disaster Management

- Creation: August 2021
- Members: 483
- More than 50 posts related to AI, Robotics, IoT and Drones for disaster management.
- Link to join: <https://www.linkedin.com/groups/13996266/>



The screenshot shows a LinkedIn group page with the following details:

- Group Name:** AI and other New Generation Technologies for Disaster Management
- Members:** 484 miembros
- Includes:** Including Sethunath U N and 23 contacts más
- Invitation:** Invitar a contactos
- Ver todo** (See all)
- Acerca de este grupo** (About this group): Emerging technologies such as Artificial Intelligence, Robotics, Drones and Internet of Things are already being used in all spheres of disaster management, from disaster risk reduction to early warning, response and recovery. This page will provide periodic ...
- Ver todo** (See all)
- Administradores** (Administrators): Muralee Thummarukudy, 1er Propietario (1st Owner), Acting Head, Resilience to Disasters and Conflicts Global Support Branch, at UN Environment Programme
- Group Description:** Webinar Series: Modern Technologies for Disaster Management. Topics include Robotics, Artificial Intelligence, and Internet of Things. A QR code is provided for access.
- Post by D.C. Sekhar:** Innovation and solutions - River cleanup and Robotics for Hazardous Waste Management. Calling players in ARTIFICIAL INTELLIGENCE - ... ver más

# Thank you for listening



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