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Artificial Intelligence as a driver for the sustainable development

Application to disaster risk reduction



UNESCO

science for
Sustainable
Development in
Africa

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Why is disaster risk reduction important ?

DRR FACTS

\$1.4 trillion in damage

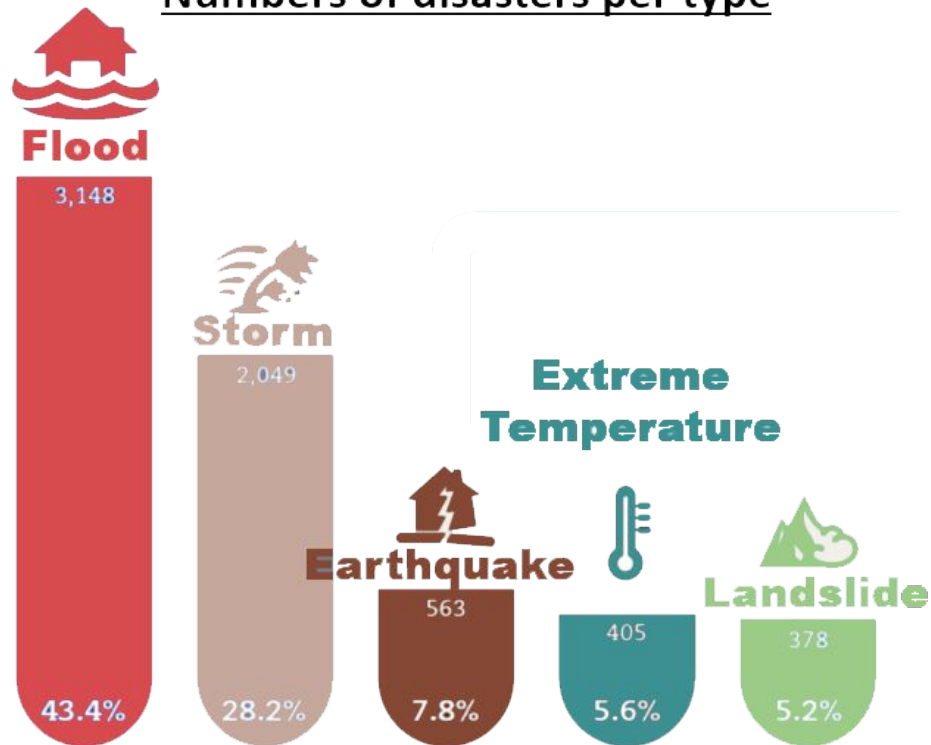
affected 4.4 billion people injured worldwide

From 1998 to 2017, natural hazards caused:

claimed 1.3 million lives

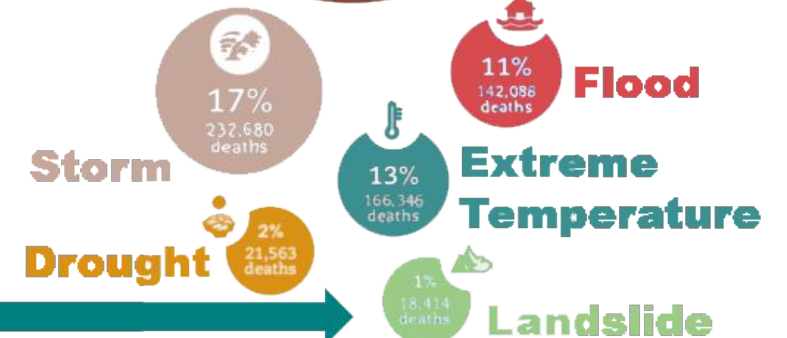
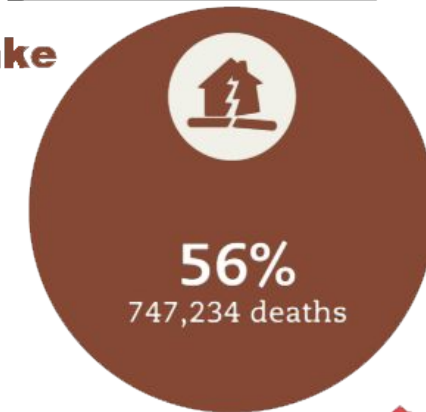
Earthquakes account for more than half of the fatalities

Numbers of disasters per type



Number of deaths

Earthquake



UNESCO's approach to DRR

- At the interface of a wide mandate - Natural and Social Sciences, Education, Culture, and Communication and Information, UNESCO takes a **multi-hazard, multi-disciplinary and multi-stakeholder participatory approach**.
- **8 cross-cutting thematic**
- UNESCO explores **both conventional and innovative solutions** for effective preparedness and response.
- **UNESCO's priority areas:** Africa, gender, SIDS, youth.



UNESCO Field Office Network



UNESCO DRR Activities around the globe

Europe

- ✓ Issue Based Coalition for Environment and Climate Change
- ✓ OPERANDUM (Nature based solution for DRR) in 7 countries
- ✓ RURITAGE (Rural Regeneration) in 6 countries
- ✓ SHELTER (Culture Heritage DRR) in 10 countries
- ✓ The Portuguese Sea and Atmosphere Institute (IPMA) as Tsunami Service Provider (TSP)
- ✓ Collective community management approach and capacity building activities in 6 countries

Arab

- ✓ Science and Technology Advisory Group for DRR
- ✓ Nature-based solution for natural hazards
- ✓ Atlas on Natural Hazards: A tool for socio-ecological system resilience in the Arab States
- ✓ Urgent Interventions to Build Socio-Ecological System Resilience to Natural Hazards in MENA region

ASIA and Pacific

- ✓ U-INSPIRE: young professional platform for DRR
- ✓ Science and Technology Advisory Group for DRR
- ✓ Disaster Risk Reduction and Management Training in Nepal
- ✓ International Workshop for Disaster Risk Reduction Knowledge Service in China
- ✓ Monsoon School on Urban Floods in India
- ✓ The South China Sea Tsunami Advisory Centre (SCSTAC)
- ✓ Landslide Early Virtual Observatories in Nepal

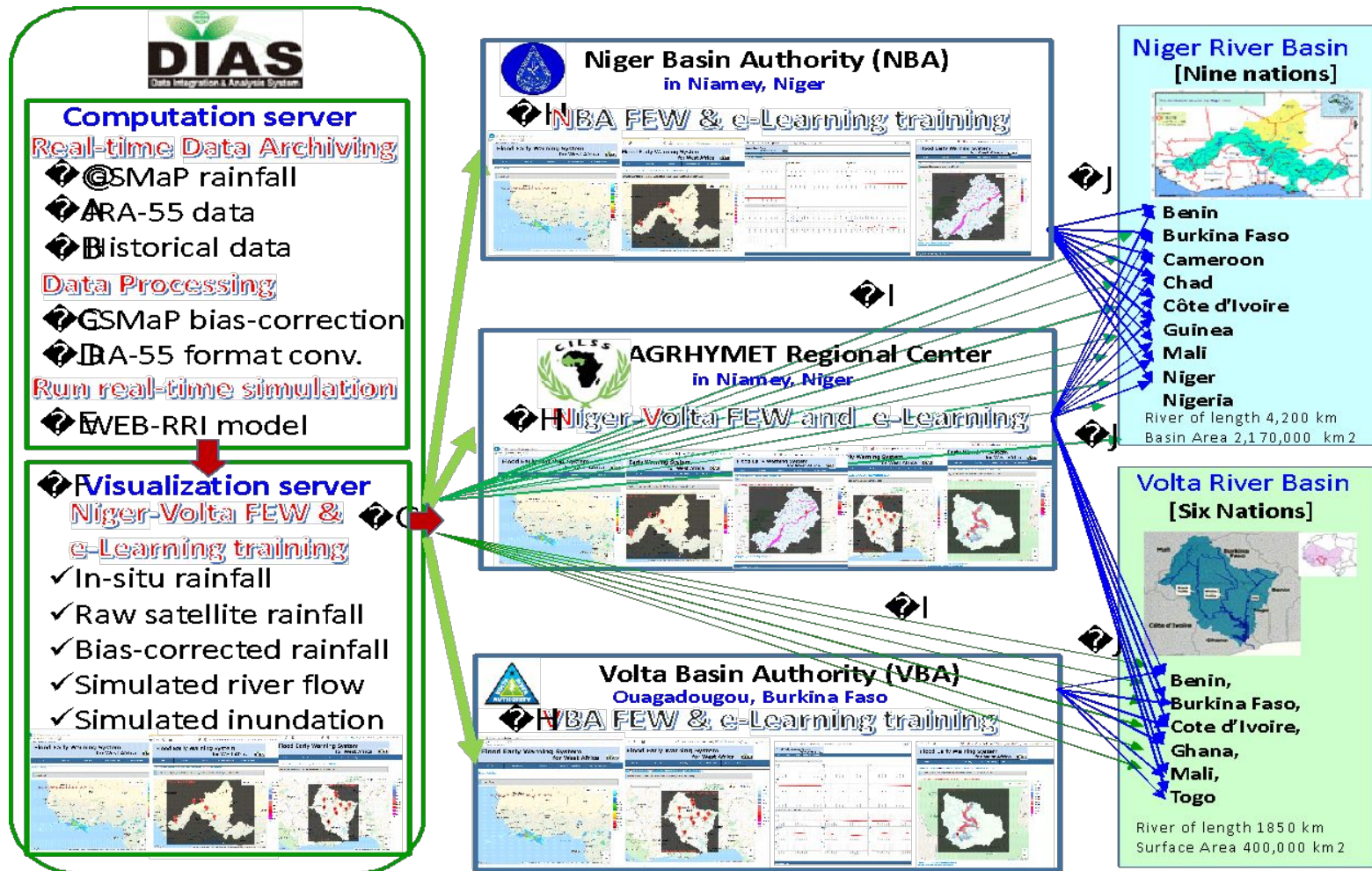
Latin America and Caribbean

- ✓ Decision support by Bayesian Model
- ✓ Science and Technology Advisory Group for DRR
- ✓ PRERADE (Risk governance) in Mexico
- ✓ Earthquake DRR in Lac5 (Built) in 5 countries
- ✓ VISUS (School) in Haiti, Peru, Dominican republic
- ✓ CARIDIMA Youth Platform: young professional network on DRR and CC in Caribbean SIDS)
- ✓ Guidelines for developing a National Strategy for DRR in the Caribbean Culture Sector
- ✓ Workshop on Climate Impacts & Vulnerabilities in Guyana
- ✓ Tsunami inundation and evacuation maps in 6 countries

Africa

- ✓ AI Chatbot and SMS analysis for DRR in East Africa (STEDPEA)
- ✓ Social Media analysis by AI in East Africa
- ✓ Flood risk management in West Africa
- ✓ Post Hurricane Idai flood risk management (Southern Africa)
- ✓ Earthquake early warning system in Ghana
- ✓ Integrated DRR courses in Ethiopia
- ✓ Enhancing Climate Services for Improved Water Resources Management in climate sensitive Regions
- ✓ Strengthening of evidence-based decision and policy making in Gambia

Early warning system: flood forecasting with AI

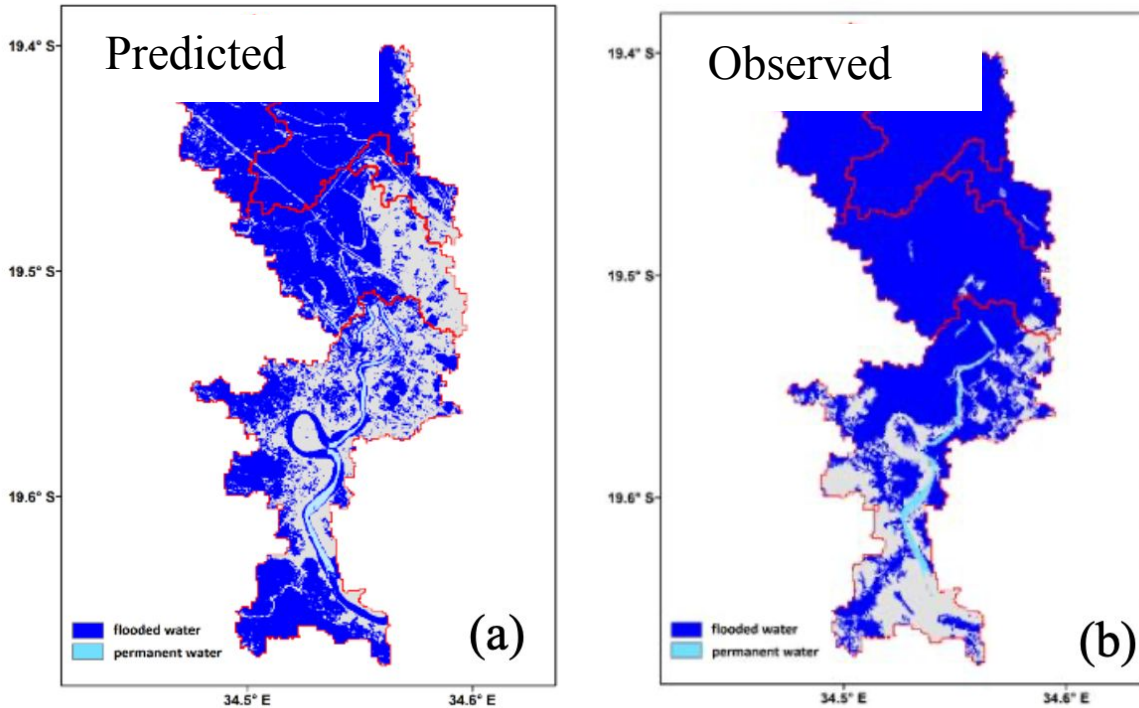


WADiRE- Africa Donor:
Ministry of Foreign Affairs
of Japan

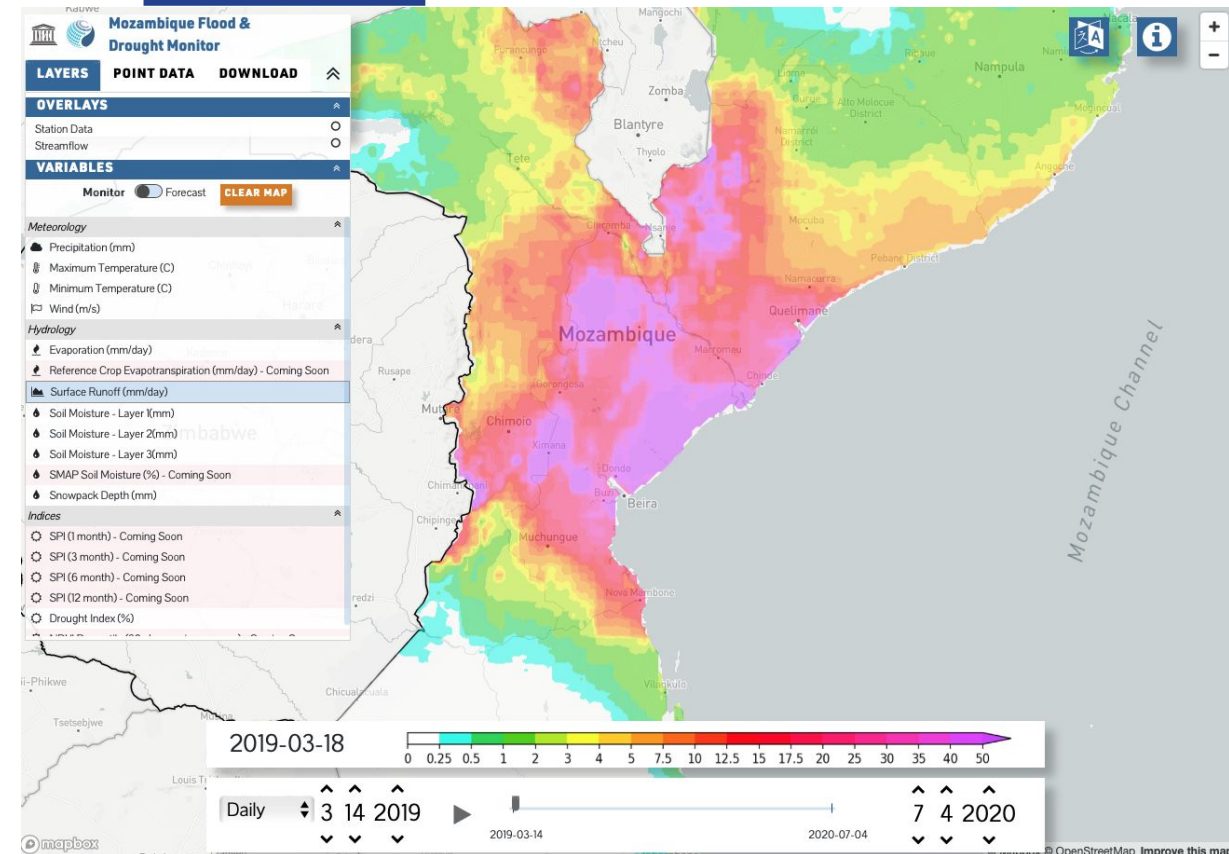
Schematic diagram of the
flood early warning
system (FEWS) prototype
version 1.0 for West
Africa on Data Integration
and Analysis System
(DIAS).

Early warning system: flood forecasting with AI

Artificial Intelligence is used to predict areas with a high likelihood of flooding in the next 24h



24-hour AI-based forecasts of inundated areas in the flood-prone areas of Mozambique



Risk Governance: better risk communication with AI

Strengthening Disaster Prevention Approaches— STEDPEA

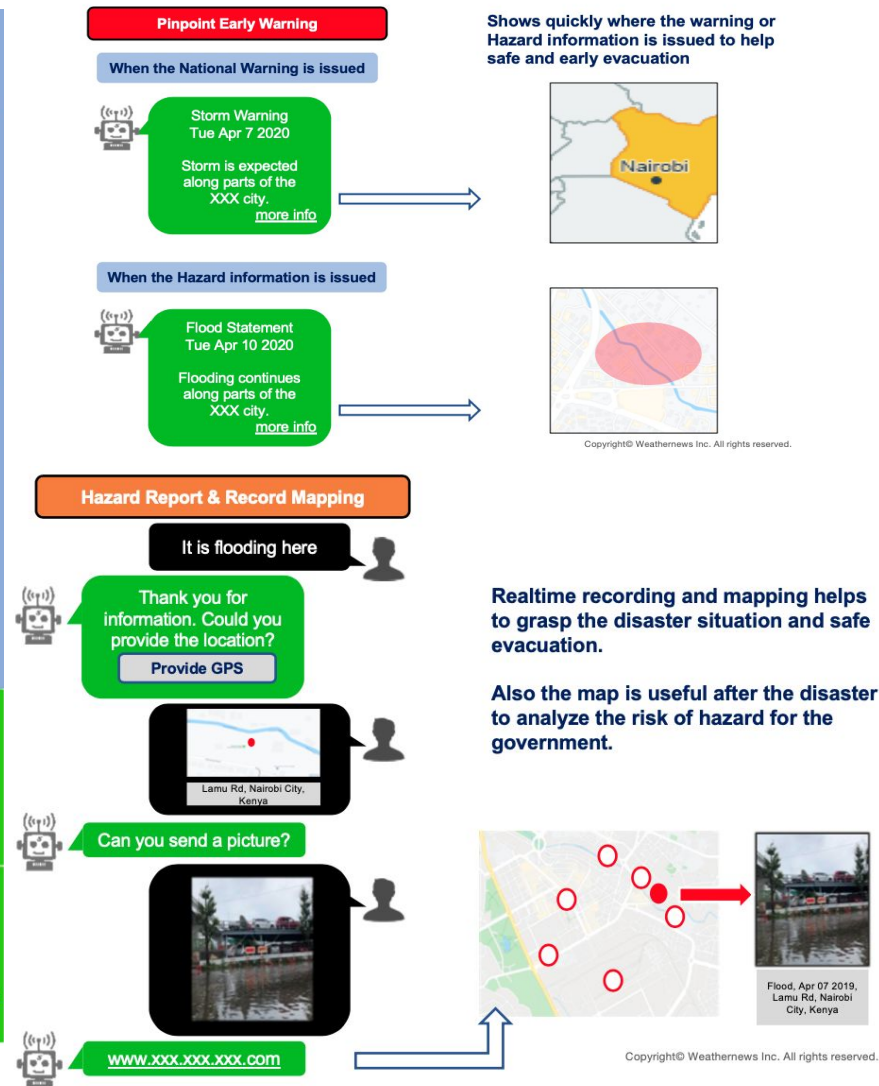
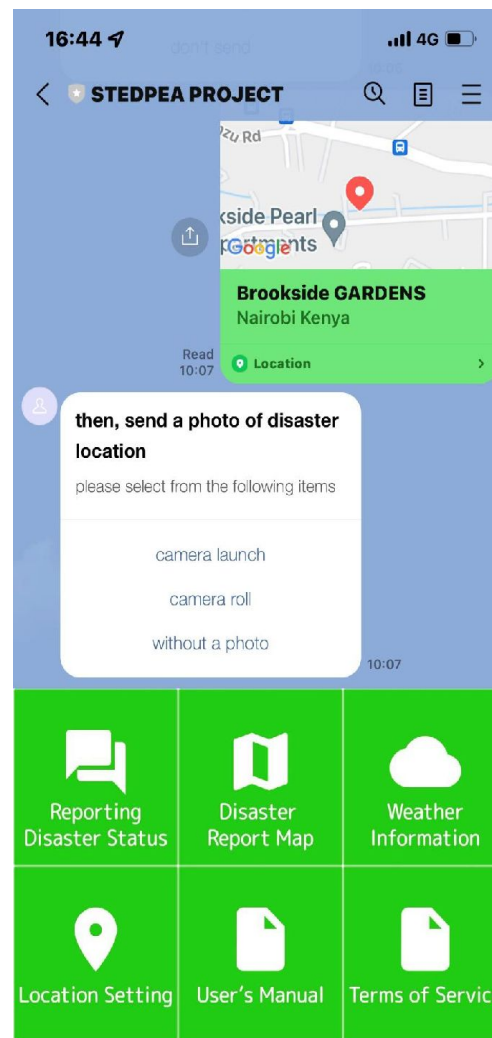
Donor: Ministry of Foreign Affairs of Japan

AI Chatbot (Mobile Applications)

In 5 countries (Kenya, Rwanda, South Sudan, Tanzania and Uganda)

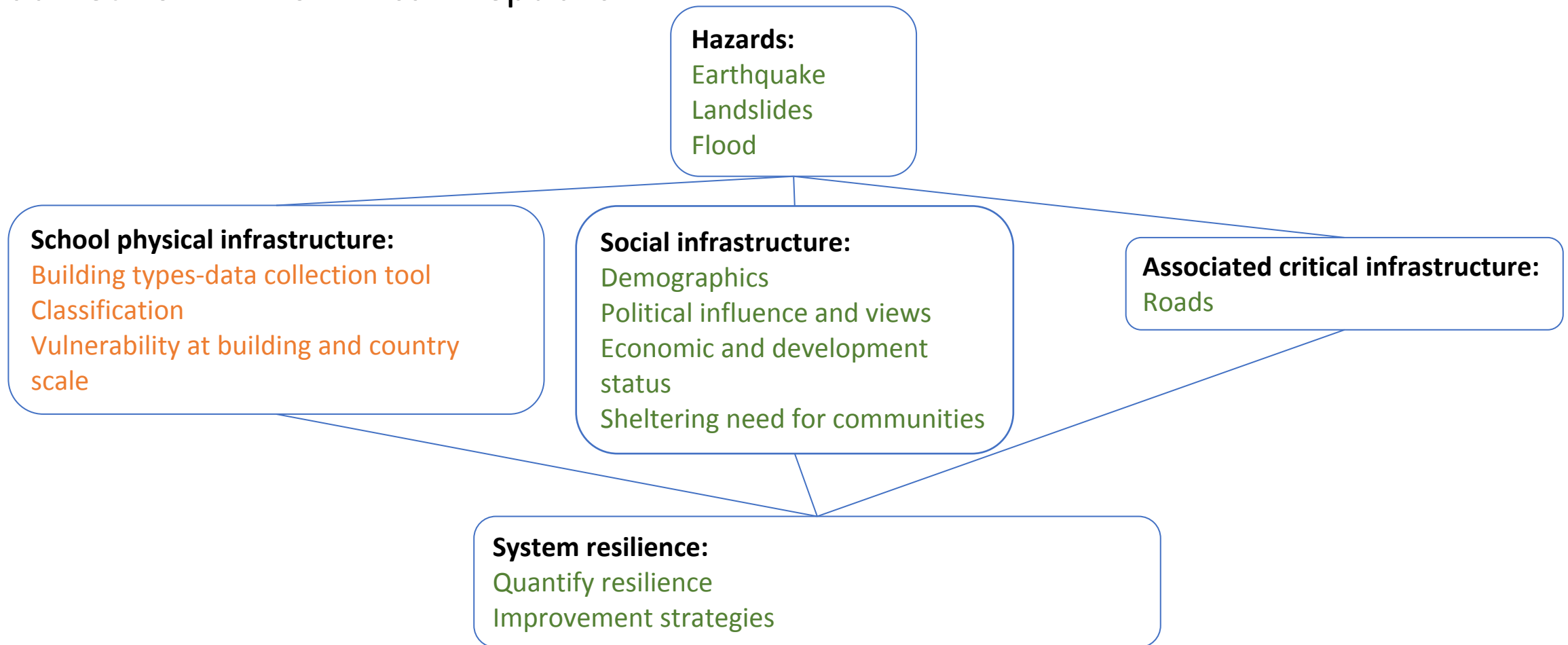
AI chatbot enable sharing information on disasters and connecting communities to expedite relief efforts during disasters.

- **Optimize the communication** between government and citizen
- **Share the information** of supplies and evacuation immediately
- **Grasp the situation** of damage/recovery accurately for both side



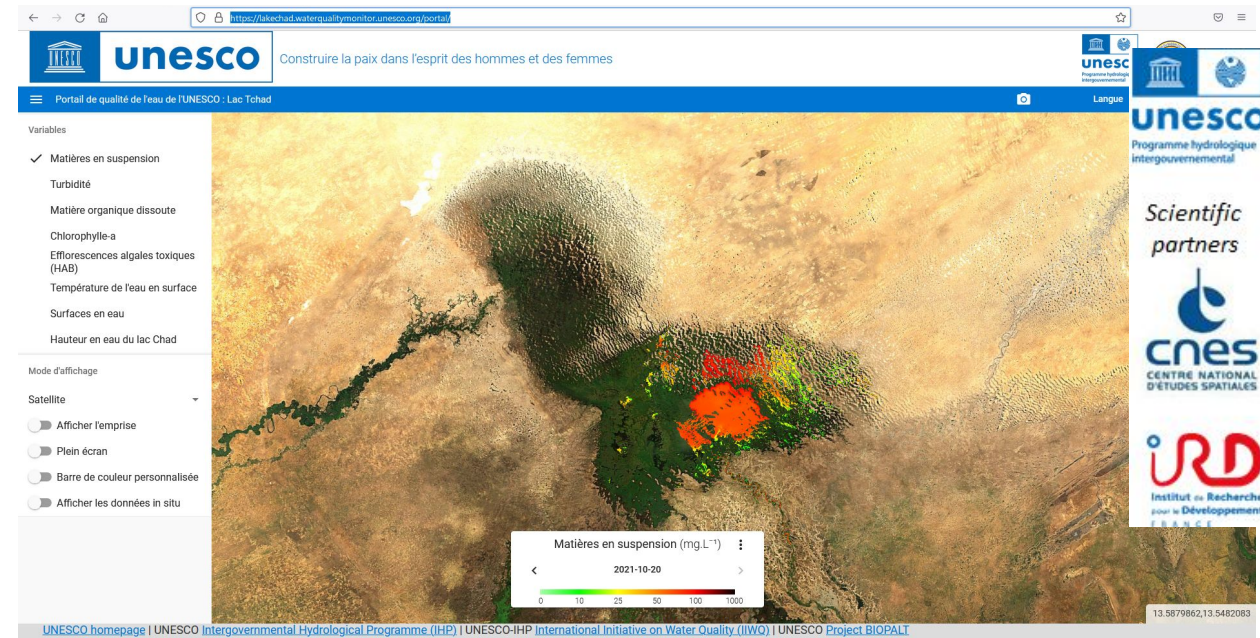
School Safety: Using AI for optimized investment decision making

Development of the modeling framework of hazard resilience of integrated school system and road network in Dominican Republic.



STI: Satellite data for freshwater quality monitoring with AI

- The **UNESCO World Water Quality Portal** is the first innovative tool for **freshwater quality monitoring** through satellite observation **supported by AI** operational in Africa and LAC.
- The Portal provides data on water quality, even with no conventional monitoring networks for:
 - sustainable management of water resources and ecosystems,
 - protecting human health and biodiversity,
 - reducing impacts of climate change and human activities on water resources
- The Portal supports the implementation of **SDG Targets 6.3 (water quality) and 6.6 (water-related ecosystems)** and the monitoring and reporting of **SDG Indicators 6.3.2 and 6.6.1**.



Other examples of AI application in the Natural Sciences Sector



Using low cost, low power AI devices

Using low cost, low power AI devices: TinyML

Sound

Keyword Spotting



Vibration

Motion & biometric



Vision

Image Spot



Tiny machine learning [TinyML] is a fast-growing field of machine learning, capable of performing **on-device sensor data analytics** at extremely **low power consumption** and **with low-cost devices**. It does not require an internet connection, making it ideal for remote/rural areas.



TinyML can be used to detect wildfires and floods using sound.

System designed by The Abdus Salam International Centre for Theoretical Physics [ICTP]

ROCKNET

Since 2019, UNESCO and IFPEN have been developing a mobile application using artificial intelligence to promote geosciences to the general public and contribute to the dissemination of knowledge in this field.

RockNet is inspired by PlantNet.

A free application for PC and smartphone, RockNet will allow a user to identify the nature of the rock they have photographed.



For the educational world

- ✓ A modern and fun educational tool: new deep learning approach: patent application in December 2019
- ✓ Organise an inter-university challenge for image collection

For the general public

- ✓ Dissemination of a geological culture, based on from the everyday environment

For geoparks

- ✓ Artificial intelligence can be specialised on a geographical area
- ✓ Promote geo-tourism and enhance natural heritage
- ✓ Mobilise local communities to collect images



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Biodiversity; monitoring and analyzing

Monitoring of biodiversity involves collecting and **analysing** vast quantities of data over large distances and on long time-scales. **Artificial intelligence** can reduce the time and effort needed to monitor biodiversity.



<https://unesdoc.unesco.org/ark:/48223/pf0000368028>



Elephants in the United Republic of Tanzania; drones and motion-sensors can help to monitor biodiversity and stop poaching

In the **Mount Nimba Biosphere Reserve in Guinea**, UNESCO is working with Kyoto University in Japan to use drones equipped with artificial intelligence to **monitor** land use and changes in vegetation cover. Here, the aim is to **improve the conservation** of chimpanzees in this biosphere reserve.

Programme L'Oréal-UNESCO *Pour les Femmes et la Science*

Dr Laura-Joy Boulos, Lebanese neuroscientist, is analysing the effect of post-war situations in Lebanon and the Middle East on mental health and decision making with AI. Through analyzing the decisions of hundreds of people through a new mobile app and combining the results with further testing and investigation, she aims to co-create AI-based solutions that will help us deal with navigate the perpetual uncertainty.



Dr Laura-Joy Boulos, Jeune Talent International L'Oréal-UNESCO *Pour les Femmes et la Science* 2020

Dr Neema Nduma, Tanzanian computer scientist, has developed an application that addresses the problem of school dropouts in secondary schools in Tanzania, using a machine learning model. Deployed via a web application, the model allows teachers and parents to identify and support students at risk of dropping out.



Dr Neema Nduma, Jeune Talent 2020 du Programme régional L'Oréal-UNESCO *Pour les Femmes et la Science* - Afrique sub-saharienne

Thank you

*Investing 1 \$ in disaster risk reduction can save up to 15 \$
in avoided losses and reconstruction*



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United Nations
Educational, Scientific
and Cultural Organization