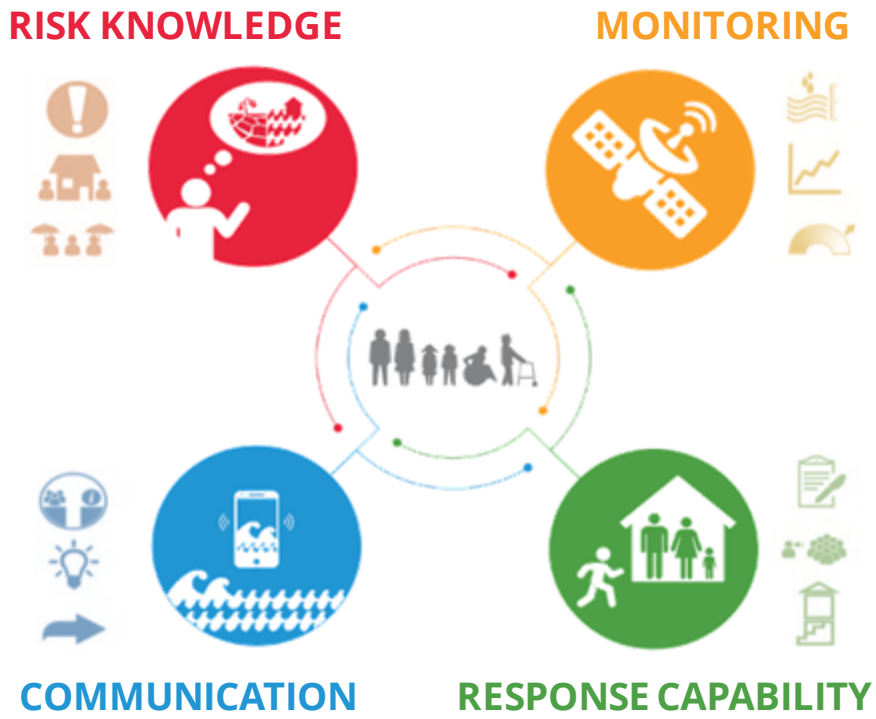
AMHEWAS
Africa Multi-Hazard Early Warning and Early Action System for Disaster Risk Reduction

Africa Multi-Hazard Early Warning and Early Action System for Strengthening Resilience to Natural Hazards

Andrea Libertino (andrea.libertino@cimafoundation.org) ,
Lorenzo Alfieri, Laura Poletti, Nicola Testa, Alessandro Masoero, Simone Gabellani, Marco Massabò, Jully Ouma, Ahmed Amdihun, Godefroid Nshimirimana, John Mathias KiriwaiJ, Lusajo Ambukeje, Luca Rossi, Katarina Soltesova, Huw Beynon

The vision



- Design of a **legal and institutional framework** consistent between the different levels
- Set up of **Situation Rooms** with 24/7 operation and shared **Standard Operating Procedures**
- Implementation of **operational tools** for monitoring and **impact-based forecasting** at different scales
- Issue of **uniform standard bulletins** for disseminating **advisories for early actions**
- **Capacity building** for staff and experts from Member States and RECs

MHEWS/EA Framework - Nairobi, October 2021

An African Multi-Hazard Early Warning and Action System (AMHEWAS) for Disaster Risk Reduction

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AMHEWAS Africa Multi-Hazard Early Warning and Early Action System for Disaster Risk Reduction
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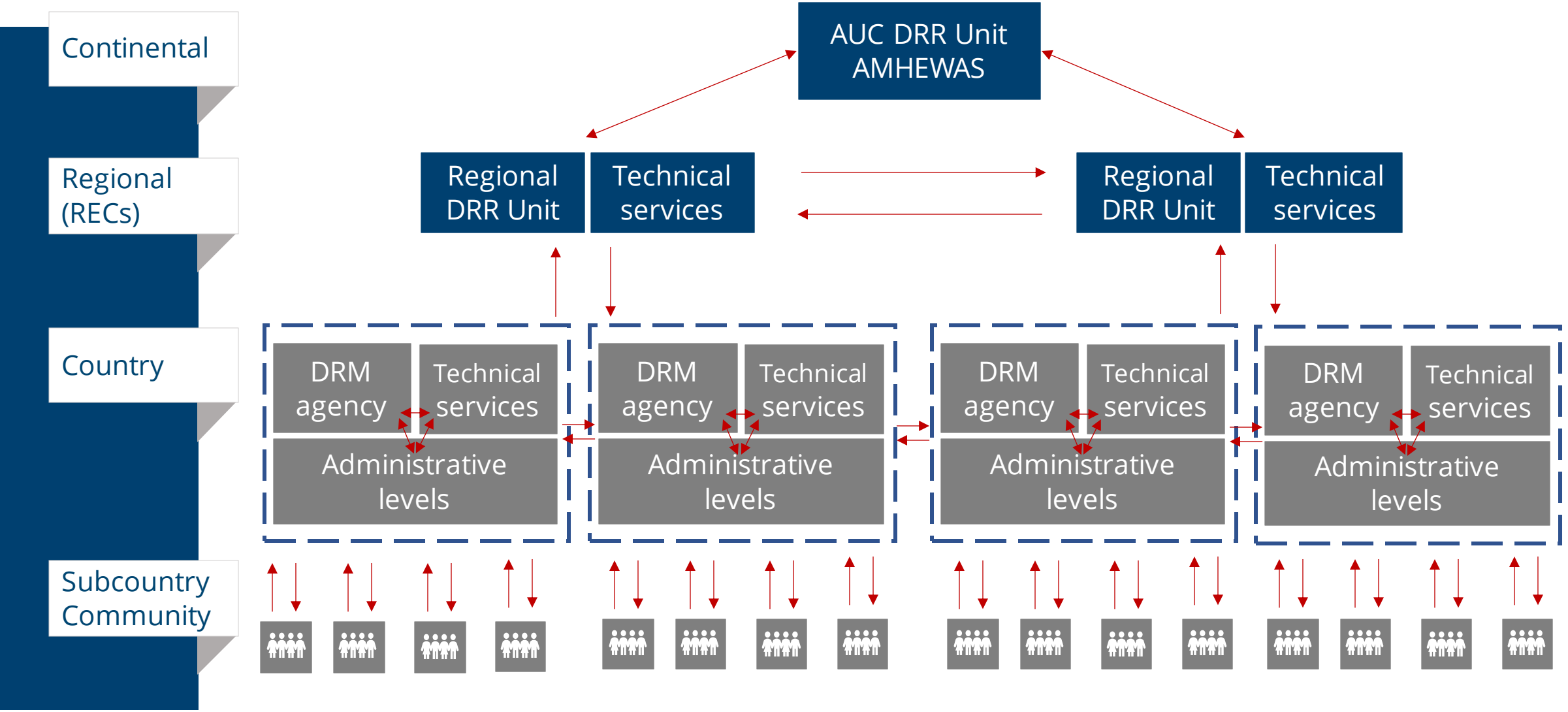
A multi-level framework



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The situation room network

- Operational core of AMHEWAS
- Coordinate the monitoring, communications and interventions according to their own mandates stated in the SOPs
- Manage local data/products developement and collection
- Contribute to the co-production of AMHEWAS operational products
- The myDewetra.world platform is the common interface between the centres

myDEWETRA world

- Open source
- Cloud-based system
- Multiple user profiles
- Interactive webGIS
- International standards
- Bulletin issue tools

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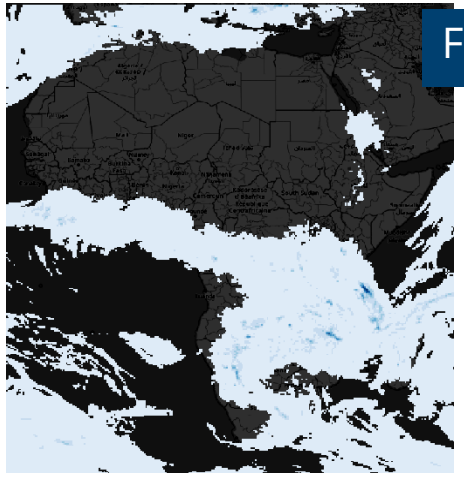
ACMAD | CEDEAO ECOWAS | IGAD ICPAC | SADC

The continental operational forecast system

An operational automatic **impact-based forecast system** at the continental scale for feeding the AMHEWAS products, based on the use of global free meteo-hydro forecasts and drought indices.



Forecast

GLOFAS
Global Flood Awareness System

The continental operational forecast system

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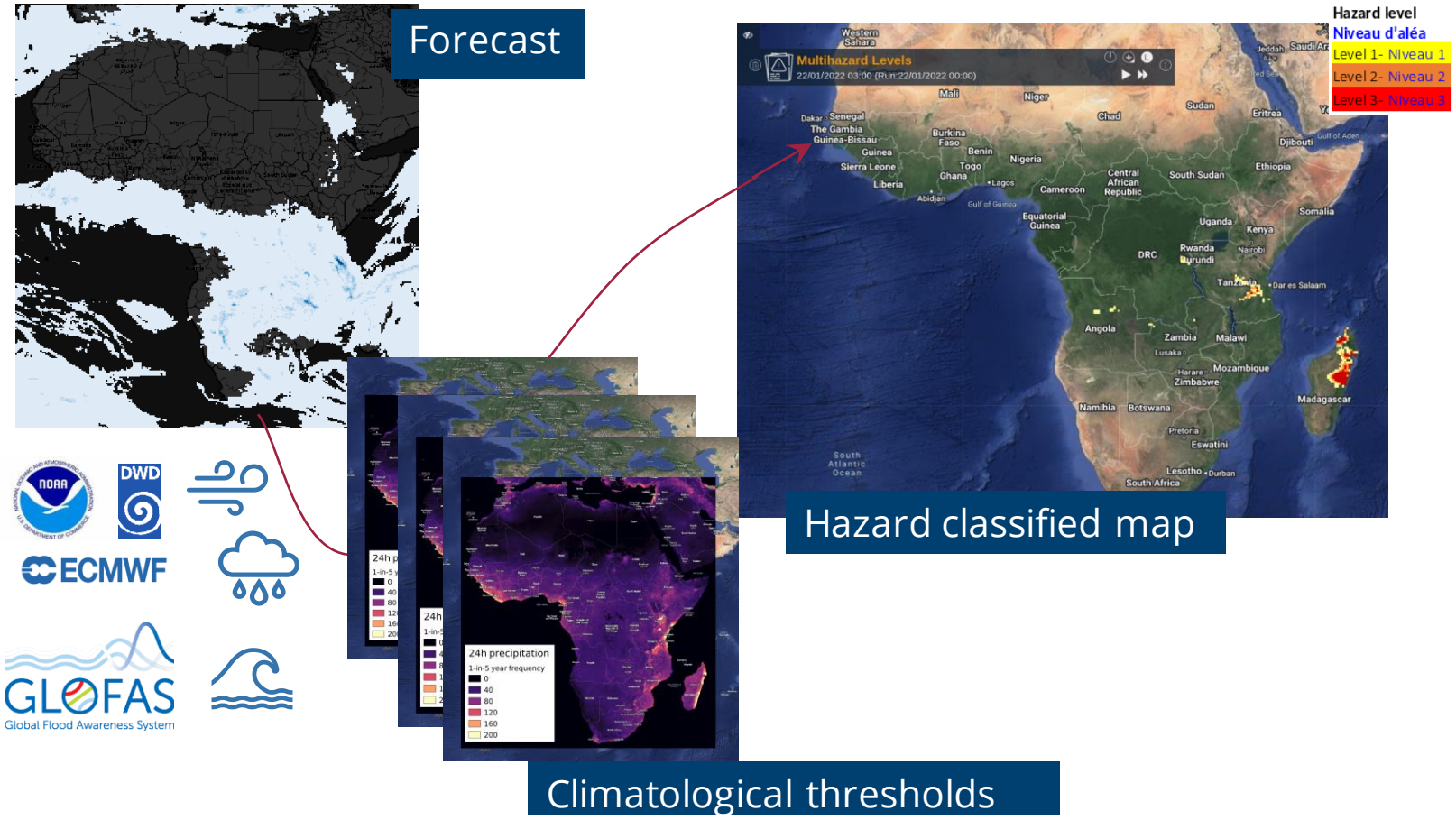

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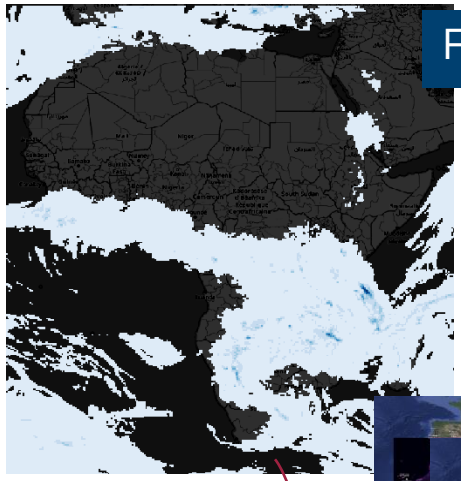
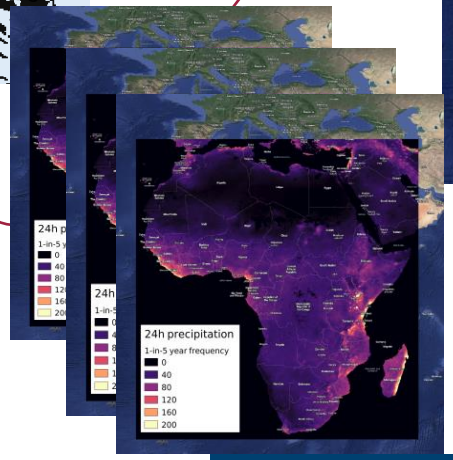
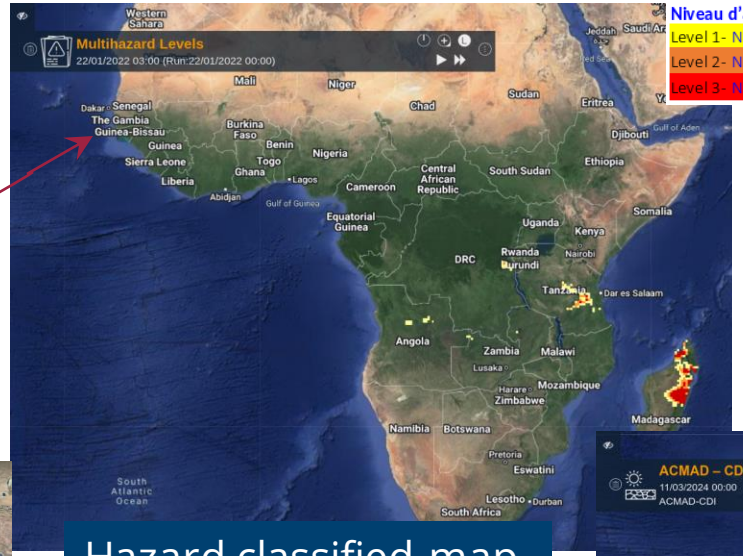


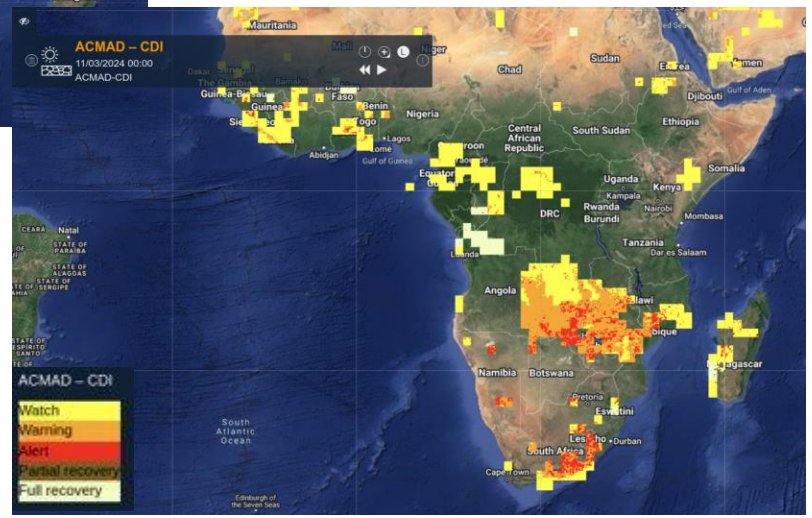
Forecast



Climatological thresholds



Hazard classified map



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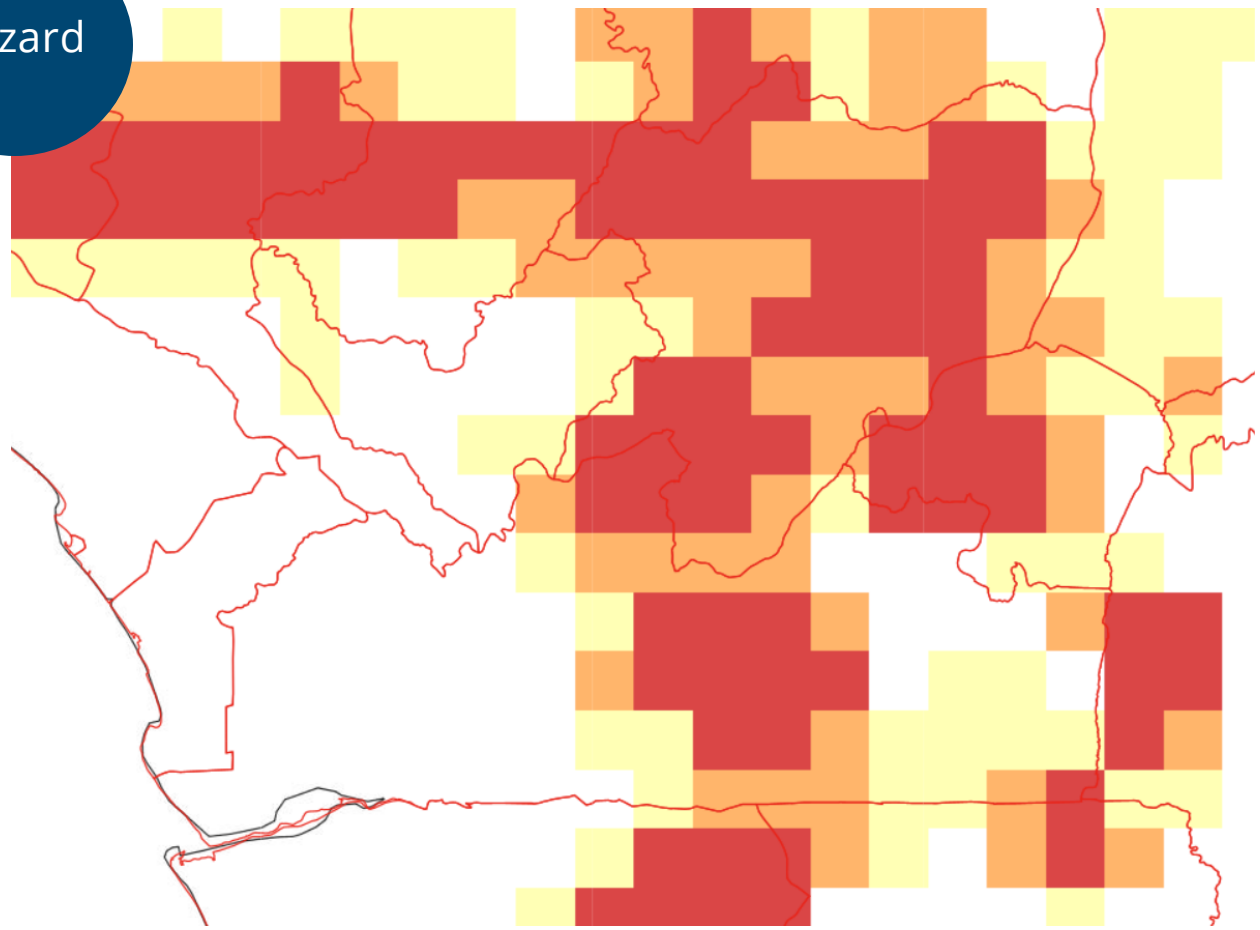
The impact-based classification

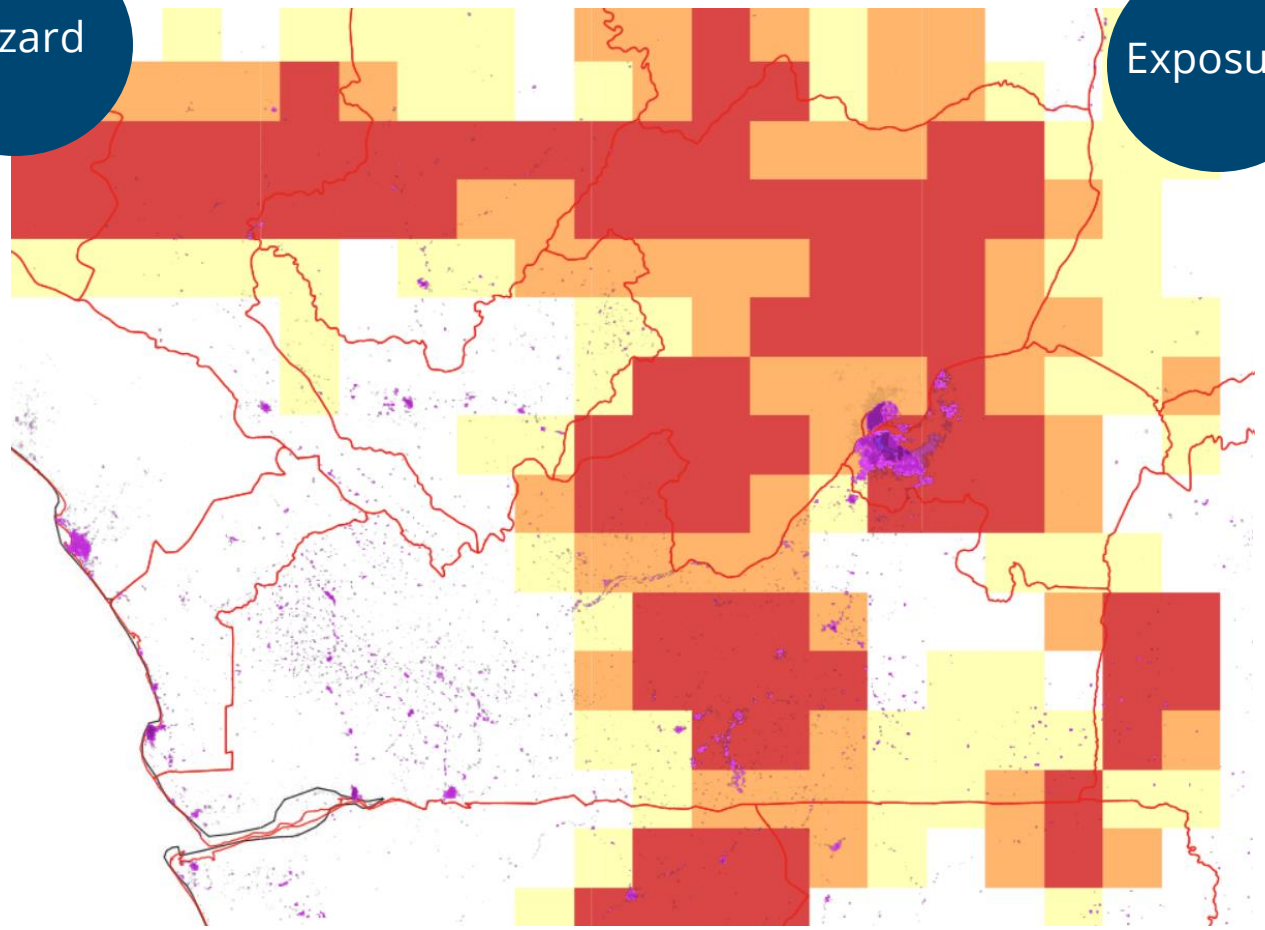
Hazard



The impact-based classification

Hazard

Exposure



PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

Emergency Management Service

GHSL - Global Human Settlement Layer

https://human-settlement.emergency.copernicus.eu

GHS-POP

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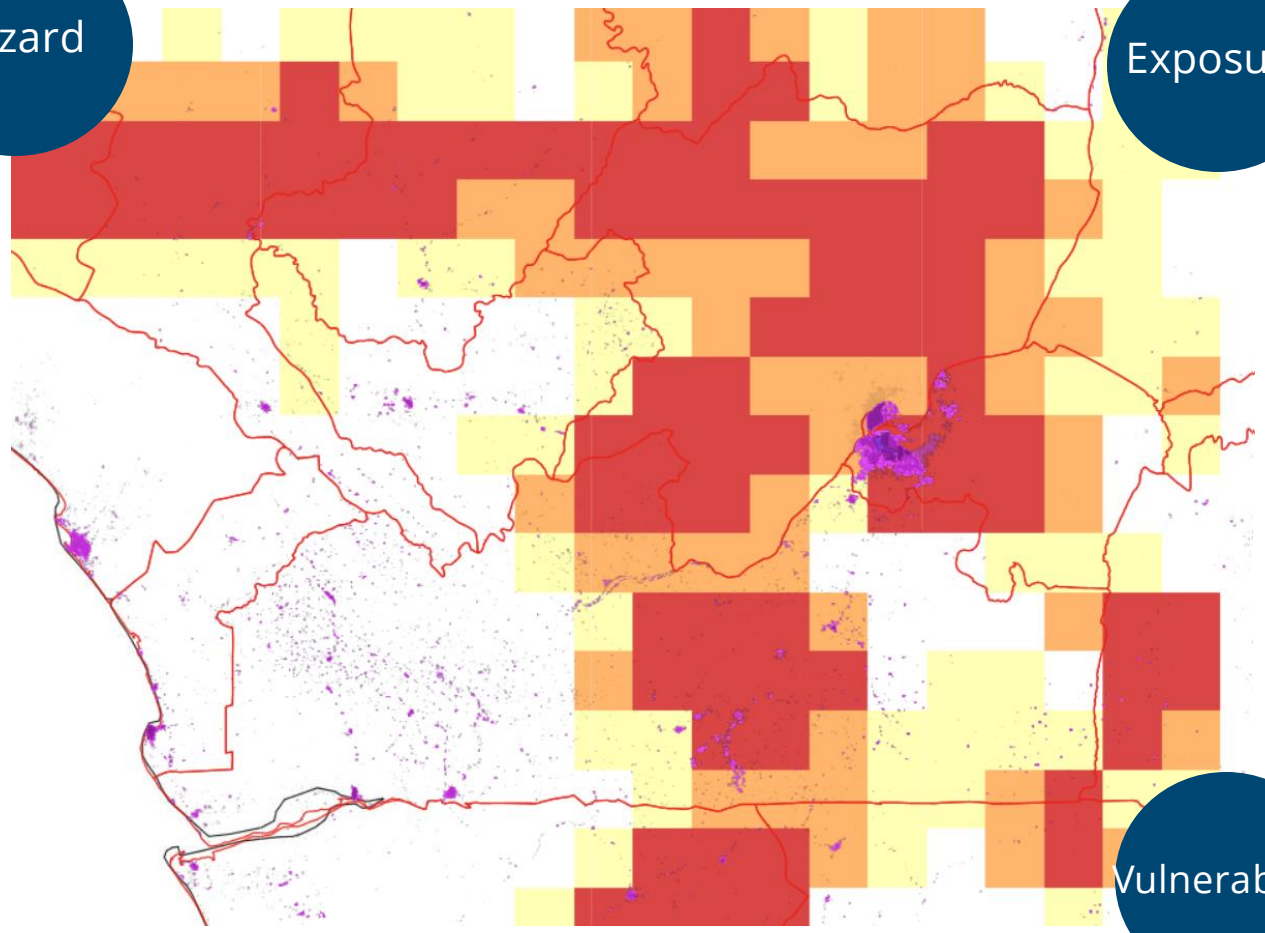
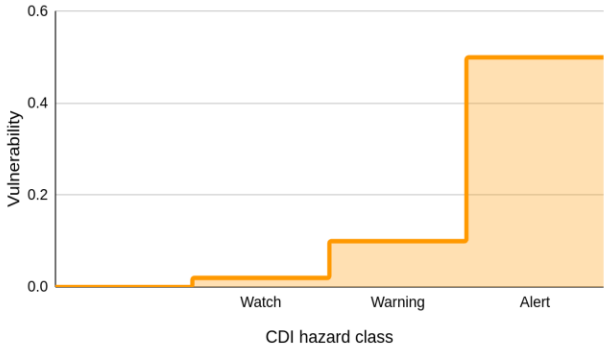
The impact-based classification

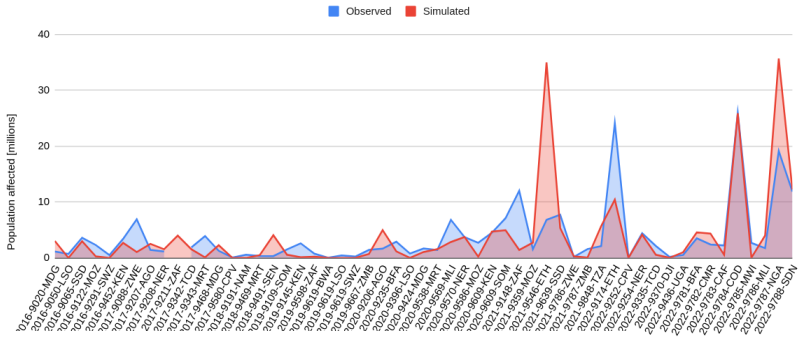
Hazard

Exposure

Vulnerability







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

Empirical step function calibrated with the EM-DAT disaster database (https://www.emdat.be/)

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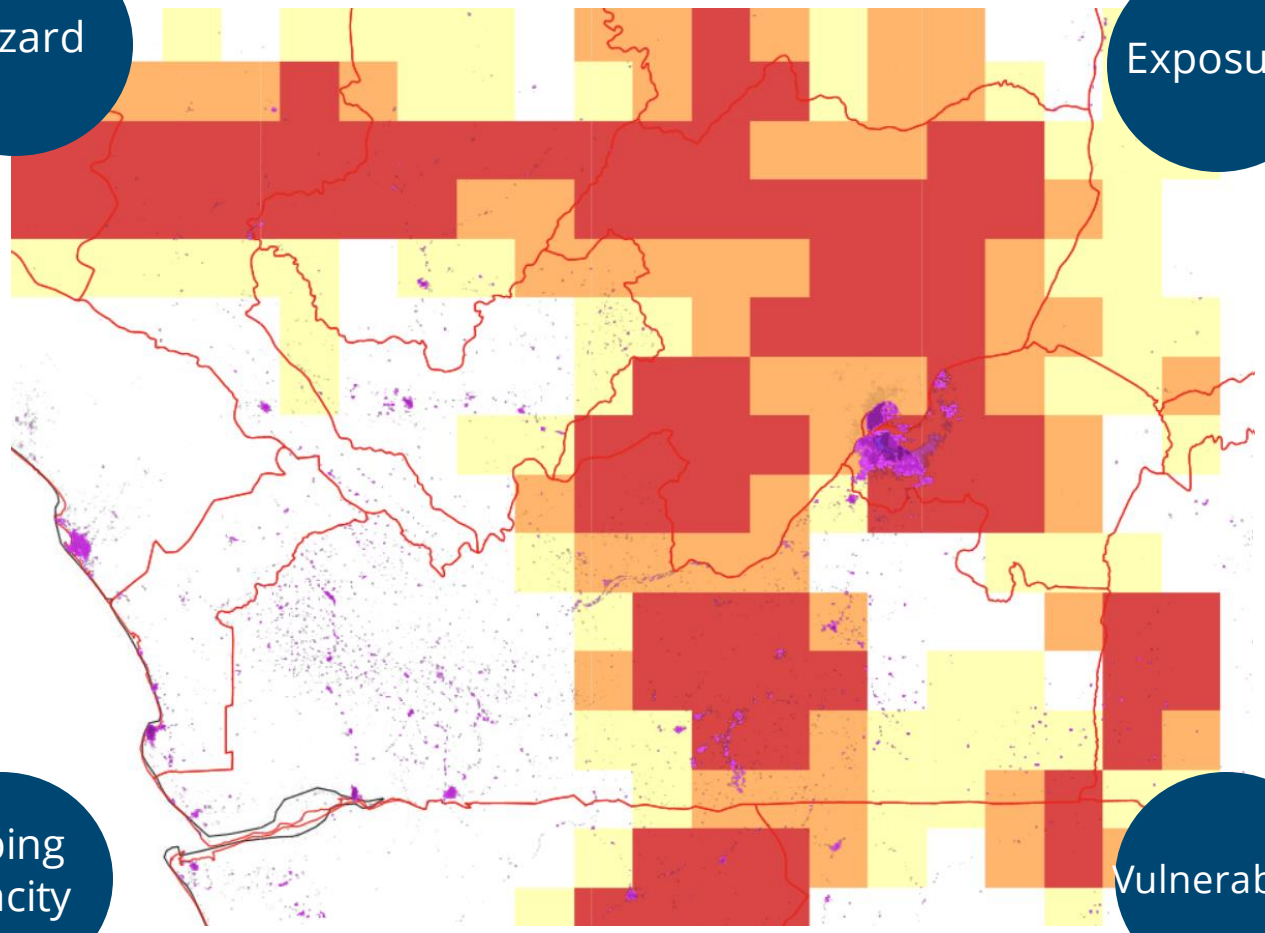
The impact-based classification

Hazard

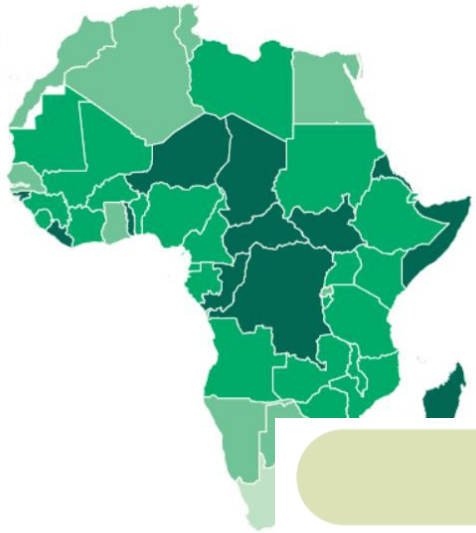
Exposure



Coping Capacity

Vulnerability

https://drmkc.jrc.ec.europa.eu/



INFORM
INDEX FOR RISK MANAGEMENT

INDEX FOR RISK MANAGEMENT

- DRR
- Governance
- Communication
- Phyisical Infrastructures
- Access to health system

Institutional

Infrastructure

Lack of coping capacity

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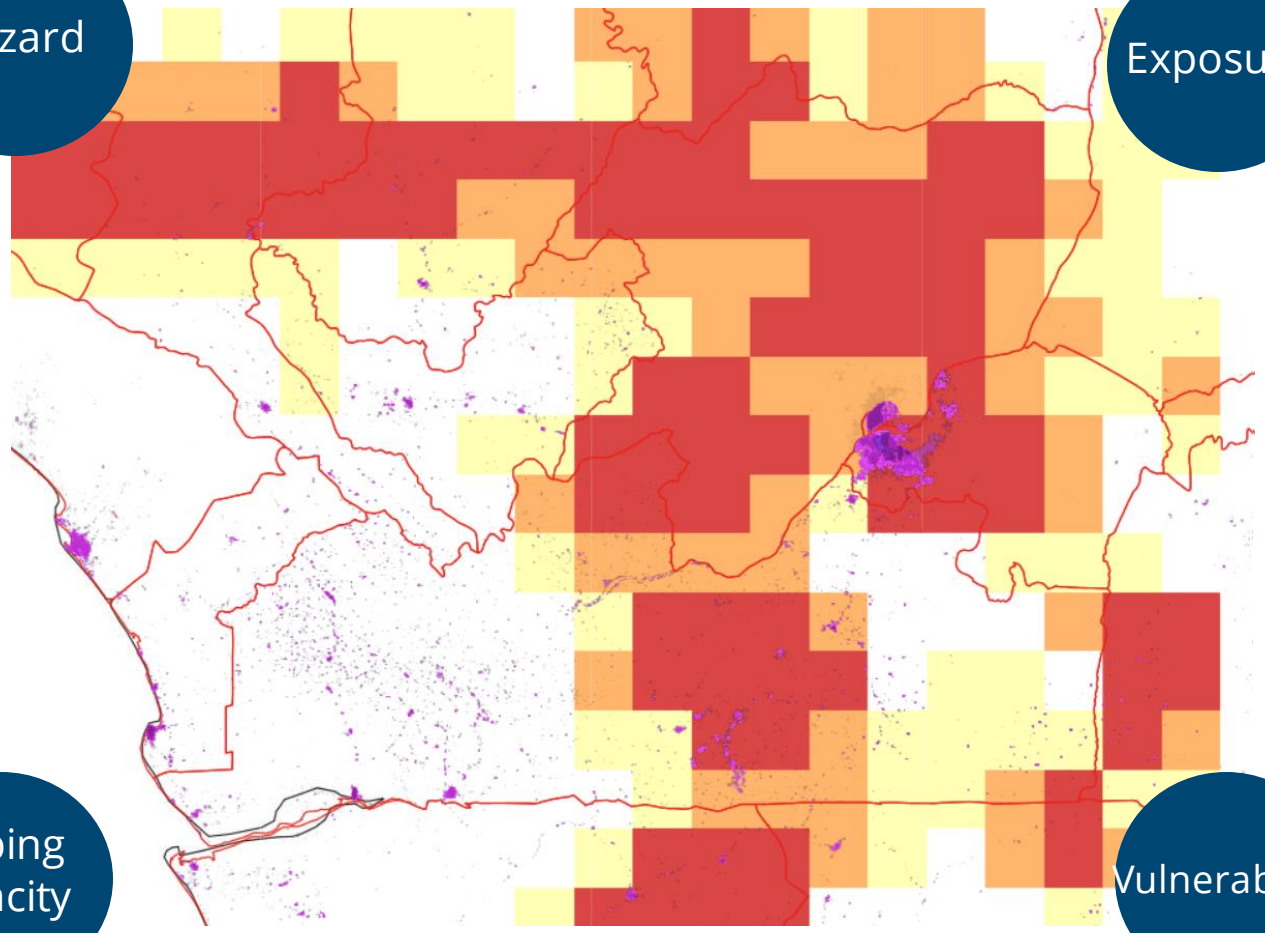
The impact-based classification

Hazard

Exposure

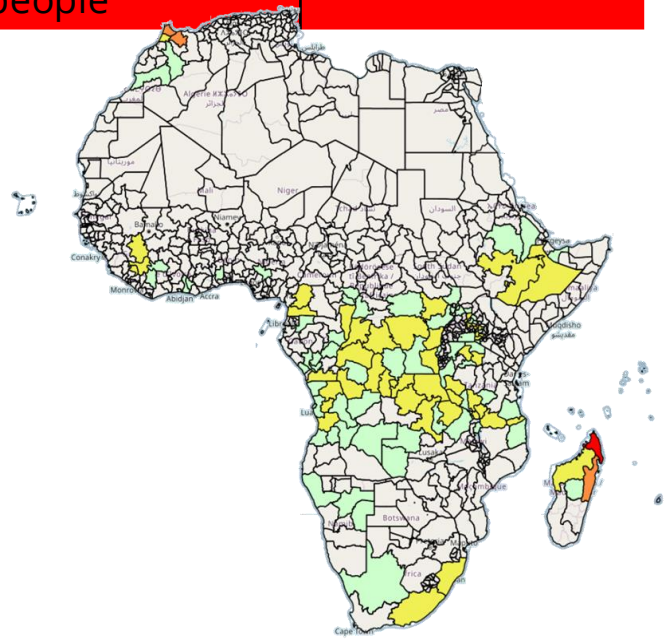
Coping Capacity

Vulnerability



Based on 5062 disasters occurred in 1990-21(EM-DAT)

Index threshold	Impact forecast
<10 people	No event
<100 people	Sub-National
<0.5% of the population of an admin1	National
<5% of the population of an admin1 and >10k people	Regional
>5% of the population of an admin1 and > 50k people	Continental



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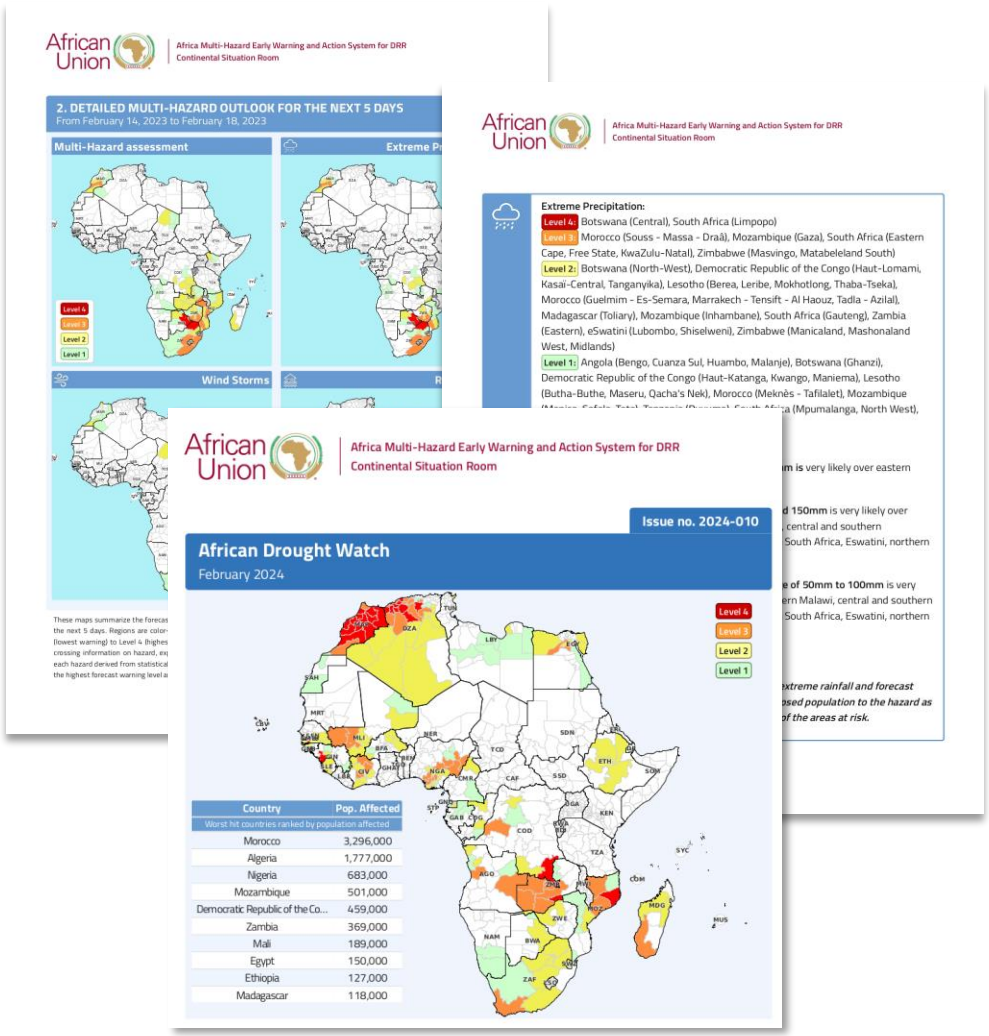
The AMHEWAS operational products



Continental Watch

- Issued twice per week (Tue and Fri)
- Impact-based forecast up to 5 days
- Hazards covered: Wind, extreme precipitation, river flooding
- Multi-language
- Includes a summary of recent disasters

Africa Drought Watch

- Issued one per month
- Impact-based current drought condition
- Hazards covered: drought
- Multi-language

Emergency Situation Report

- Variable frequency (event based)
- Reporting on ongoing / recent events and impacts
- Includes an outlook for the next days

The co-production paradigm

AUC SitRoom Officer

- Open the bulletin on myDewetra.world
- Check the presence of ongoing events

AUC SitRoom Officer

- Add advisories
- Disseminate

Experts from other Sit Rooms

CIMA and UNDRR staff

- Provide technical and scientific support

The co-production paradigm

AUC SitRoom Officer

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Training

Scaling

Experts from other Sit Rooms

CIMA and UNDRR staff

- Provide technical and scientific support

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UN Office for Disaster Risk Reduction

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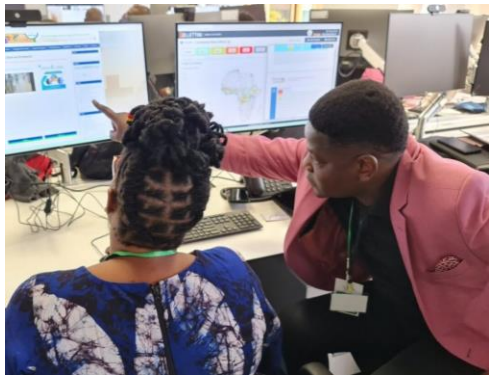
Capacity building

TRAIN THE TRAINERS

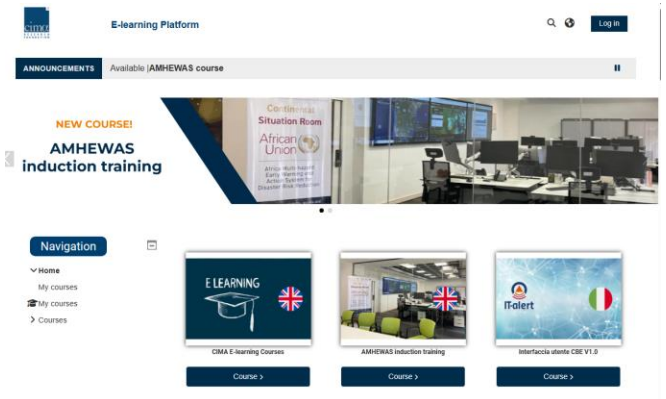
- **7 IGAD MS x 2**
- **ECOWAS MS x 2**
- **SADC MS x 2**
- **ECCAS MS**

- 12 agencies in **Namibia**
- 3 institutions in **Tanzania**



ONLINE TRAINING

edu.cimafoundation.org



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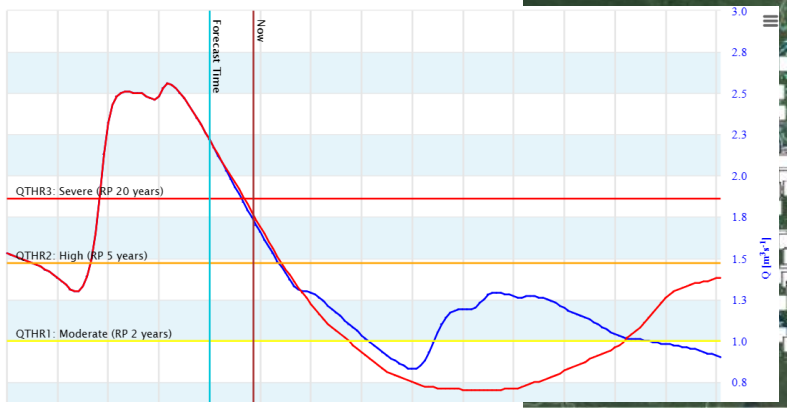
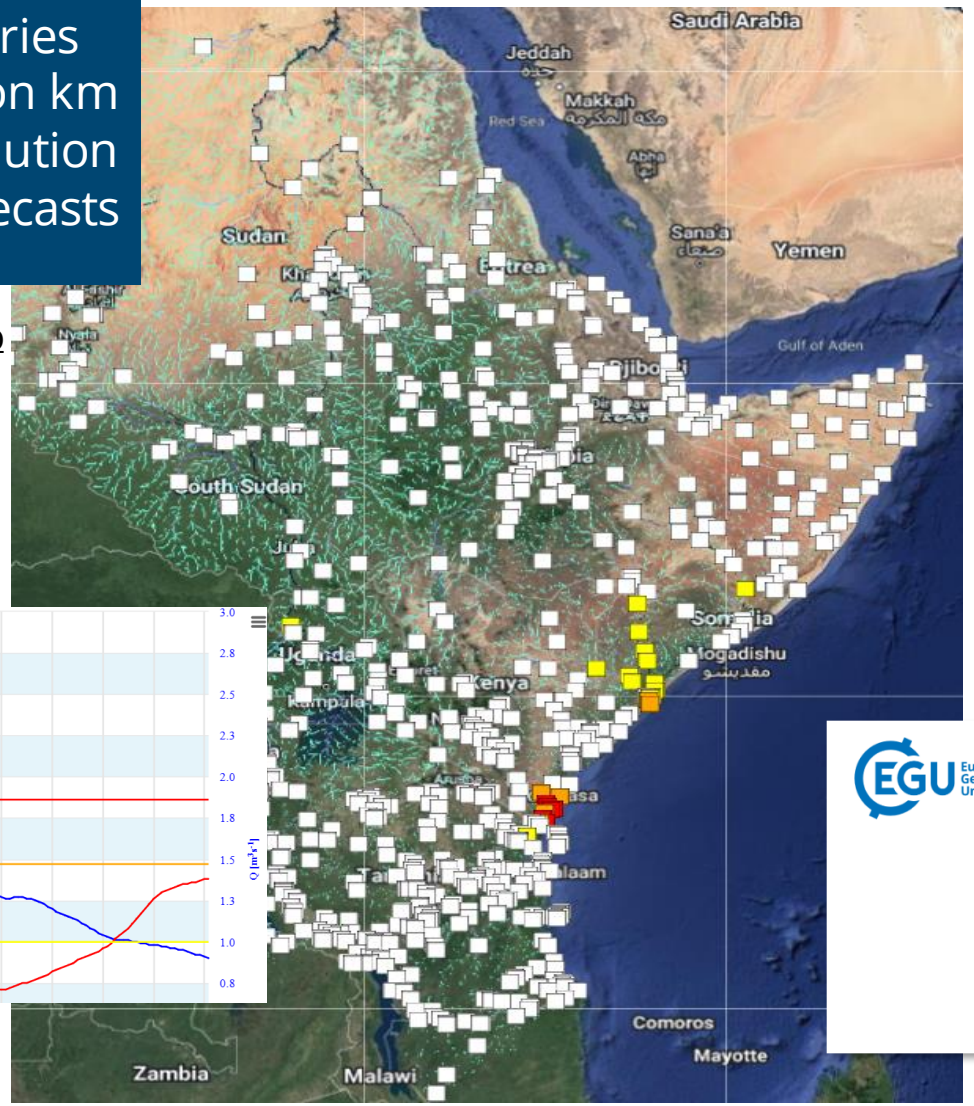
Scaling the system: FloodPROOFS East Africa

11 countries
6.8 million km
250 m to 3 km grid resolution
5days impact-based forecasts

https://github.com/c-hydro

FLOOD-PROOFS
FLOOD PROBABILISTIC OPERATIVE FORECASTING SYSTEM





- Model calibrated at 56 river gauges using years of data
- Model validated at 78 river gauges using up to 20 years of data
- Dedicated modelisation of 20 dams and 20 lakes, including the Sudd swamp
- Exposure data provided by local stakeholders

EGU European Geosciences Union

Natural Hazards and Earth System Sciences

Impact-based flood forecasting in the Greater Horn of Africa

Lorenzo Alfieri, Andrea Libertino, Lorenzo Campo, Francesco Dottori, Simone Gabellani, Tatiana Ghizzoni, Alessandro Masoero, Lauro Rossi, Roberto Rudari, Nicola Testa, Eva Trasforini, Ahmed Amdihun, Jully Ouma, Luca Rossi, Yves Tramblay, Huan Wu, and Marco Massabò

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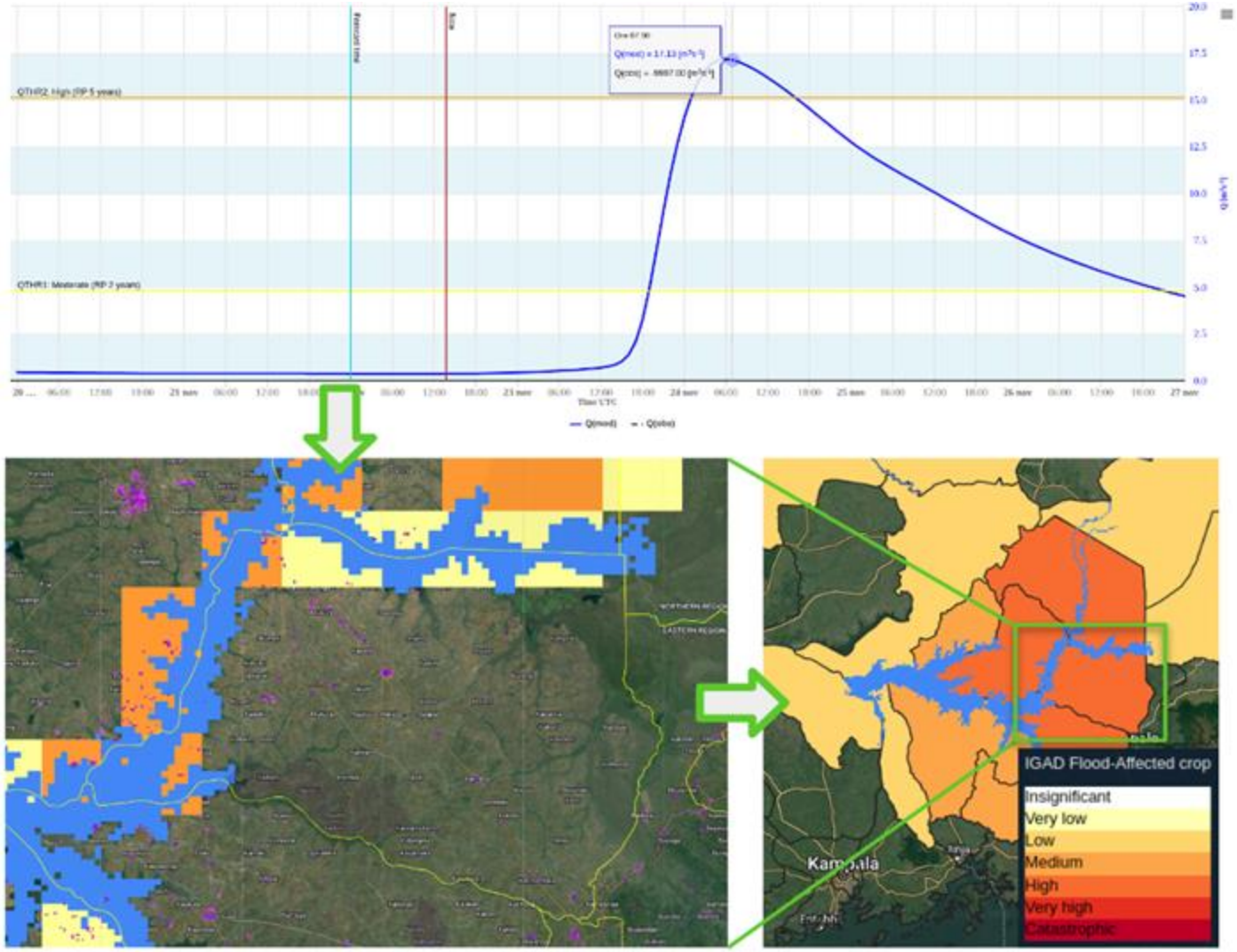
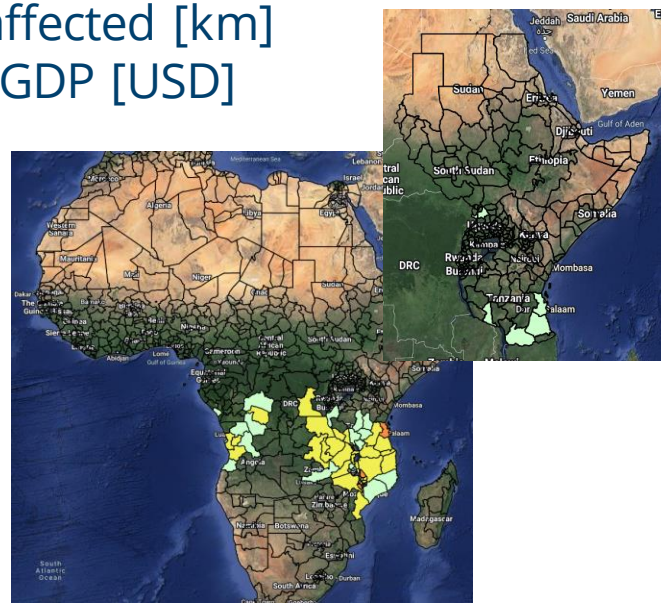
Impact-based forecast to the local scale



Fully operational forecasting chain providing 5-days **impact-based flood forecasts** for the following categories:

- Population affected [-]
- Population displaced [-]
- Crop land affected [ha]
- Grazing land affected [ha]
- Livestock affected [-]
- Roads affected [km]
- Loss of GDP [USD]



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Thank you for your attention!

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EGU General Assembly

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AGRHYMET

ECOWAS

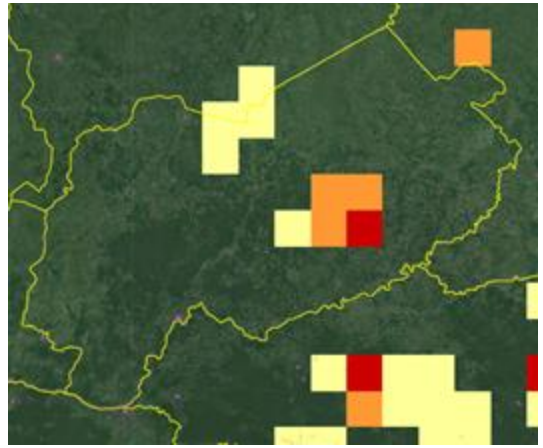
IGAD ICPAC

SADC

The impact-based classification: details

Absolute impacts for each pixel of the forecast grid:

$$Impacts_{pixel} = \Sigma(Hc \times Exp_{pixel} \times V) \times (Lcc/10)$$



Total impacts at the admin level, through aggregation at admin level:

$$Impacts_{admin} = \Sigma(Impacts_{pixel_in})$$

Relative impact obtained by dividing by the total exposure of the admin level:

$$Relative\ Impacts_{admin} = \frac{\Sigma(Impacts_{pixel_in})}{ExpTot}$$

Warning classes are defined by combinations of thresholds of absolute and relative impacts

The impact-based classification: details

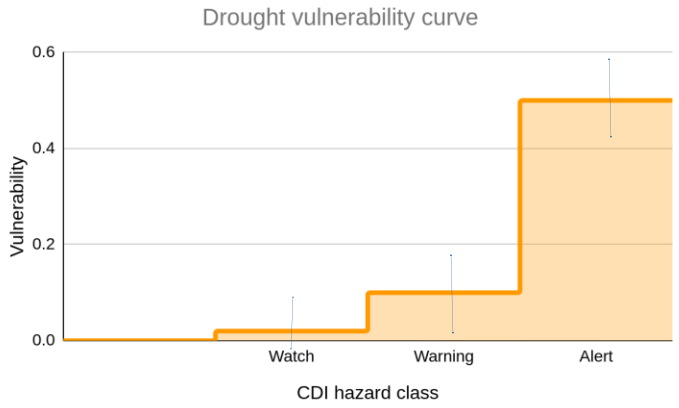
By defining the Exposed population (Ep_i) in each hazard class i as the product

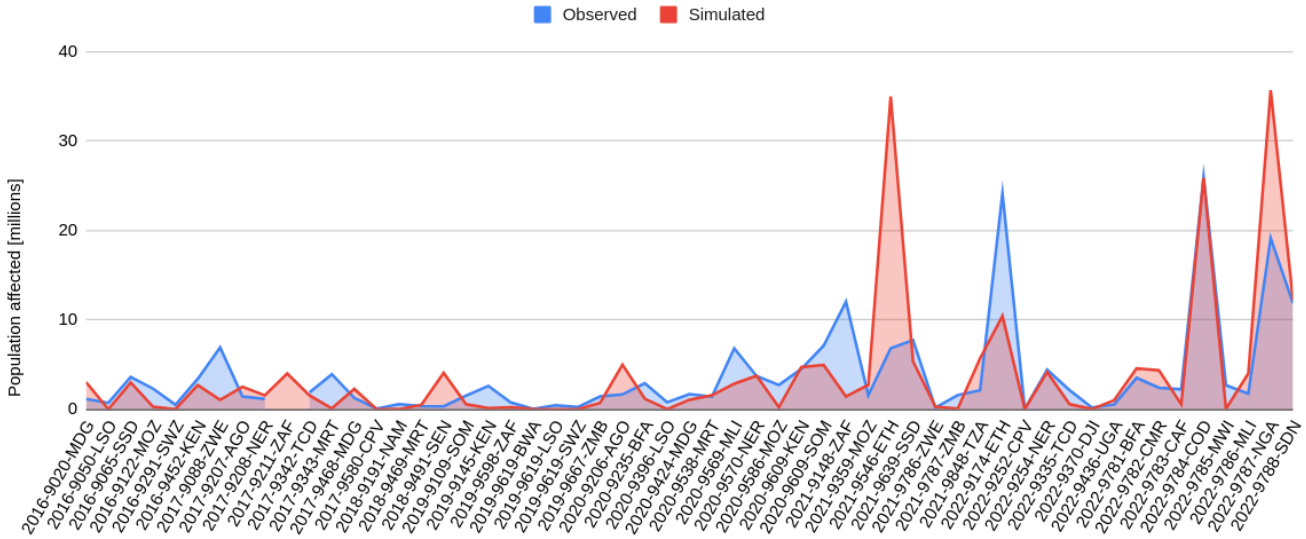
$$Ep_i = H_i * Pop_i * LCC$$

we can then write:

$$OI = V_1*Ep_1 + V_2*Ep_2 + V_3*Ep_3$$

Vulnerability curves were calibrated by matching simulated drought impacts with observed data taken from droughts recorded in Africa from 2016 to 2022 and with affected population available in the EM-DAT database





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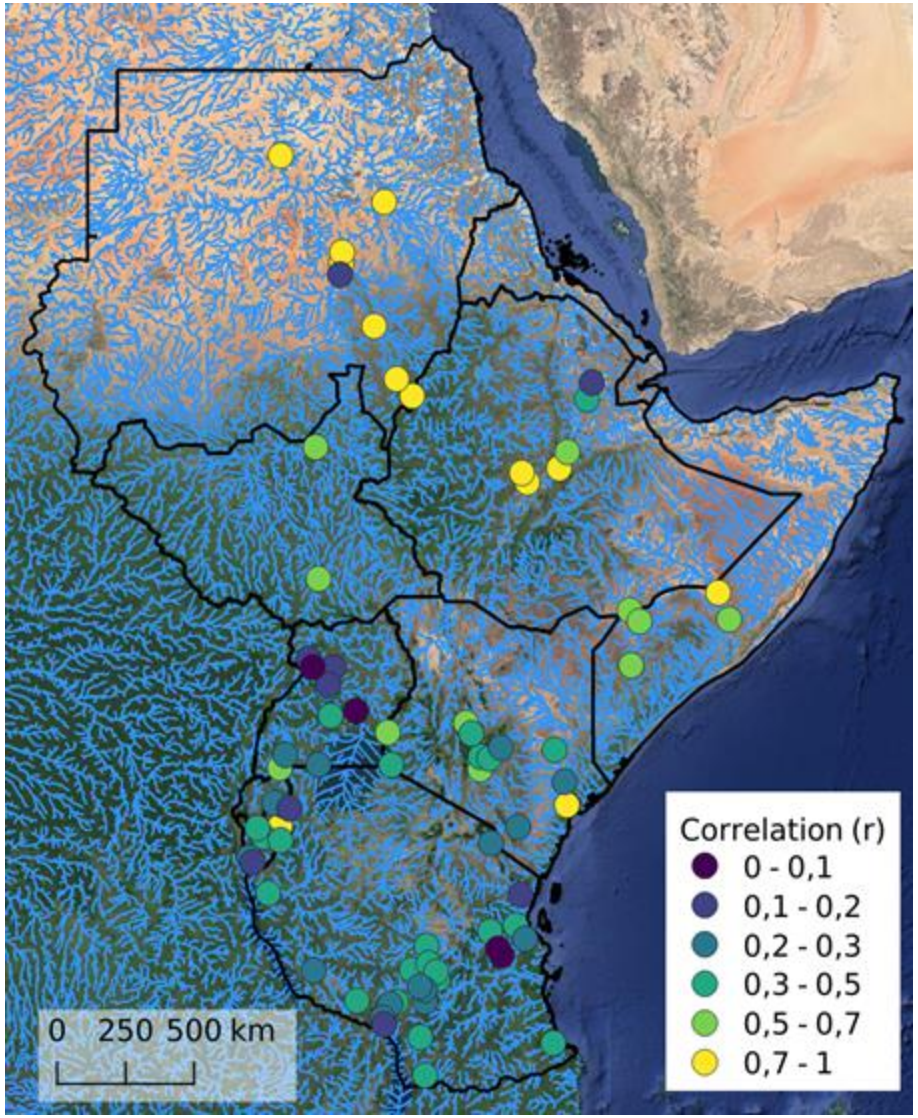
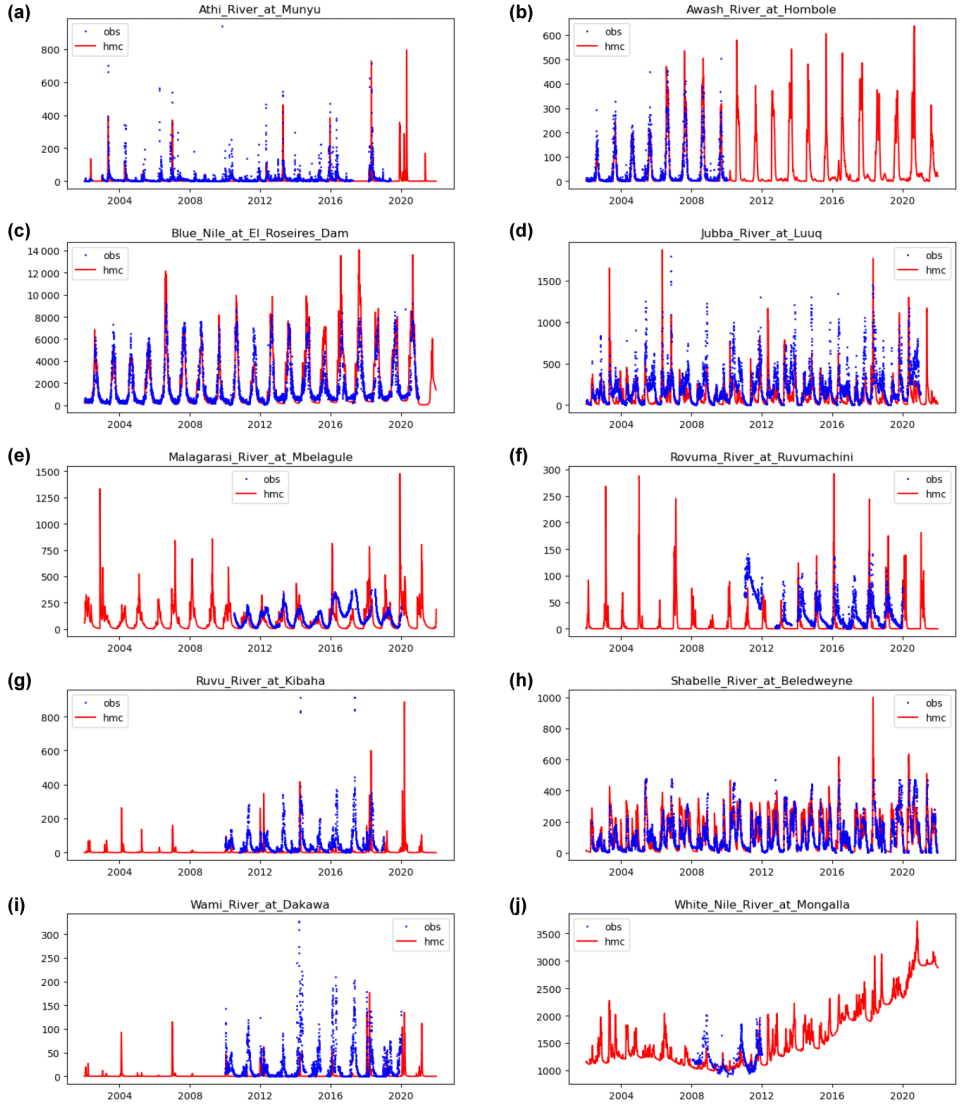
Performance of FPEA system





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