Global Gateway

PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

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AIG Autoridad Nacional para la Innovación Gubernamental

CopernicusLAC –Service Development

Flood frequency and impact mapping

Copernicus LAC Panamá

MASTER PRESENTATION

Users and Stakeholders

COLOMBIA

Users

- Fondo de Adaptación Nacional (FAN)
- National Unit for Disater Risk Management (UNGRD)
- Meteorological and Hydrological Institute (IDEAM)

Efforts executed by the users/stakeholders

- The ToR signatories generally attended regularly to the socialization and sprint demo meetings and provided feedback when were questioned
- Fondo de Adaptación Nacional (FAN) provided local input data and continuous feedback on the service.
- FAN hosted on-site socialization meeting with UNGRD and IDEAM.
- IDEAM hosted the CopernicusLAC training about Earth Observation for flood mapping, that some representatives of the institution attended.
- All the involved stakeholders accessed the data through the dedicated workspaces in the CopernicusLAC Processing Environment for floods.

Geoinformation Needs Addressed

📍 **Flooded Area Extent**

•Need for an **accurate and efficient** system to detect and report flooded areas capable of detecting floods in also urban environments

•Building and historical dataset of Flooded Areas to be used as reference

📍 **Water Depth estimates**

•Demand for **geospatial data** on flood intensity measure, useful to better understand the flood risk

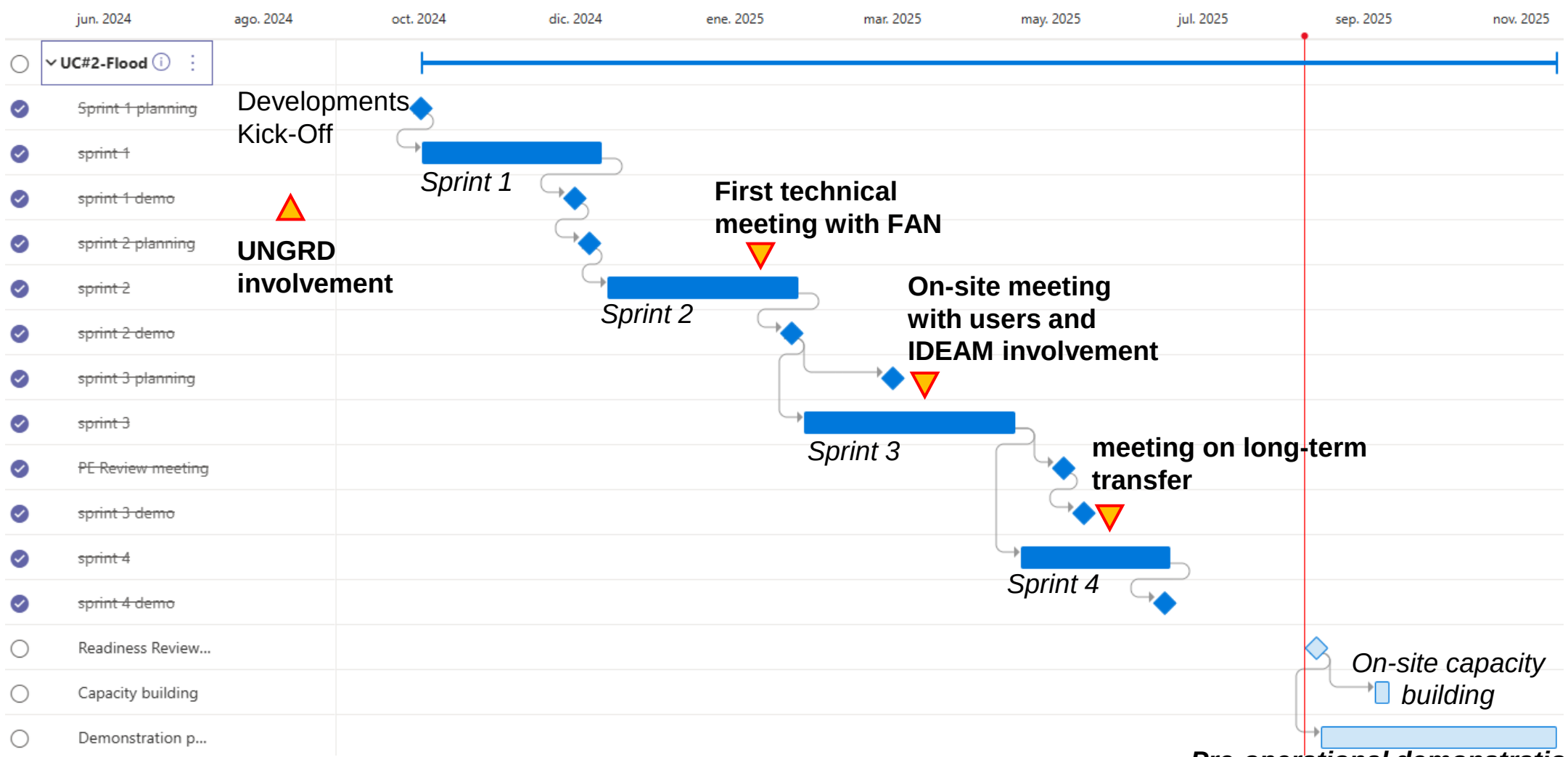
📍 **Flood Catalog/Frequency**

•Capability of a complete analysis of flood events in specific areas

•Empirical frequency estimates for planning purposes

•Strengthened collaboration between **scientific and disaster risk institutions** for better decision-making.

Timeline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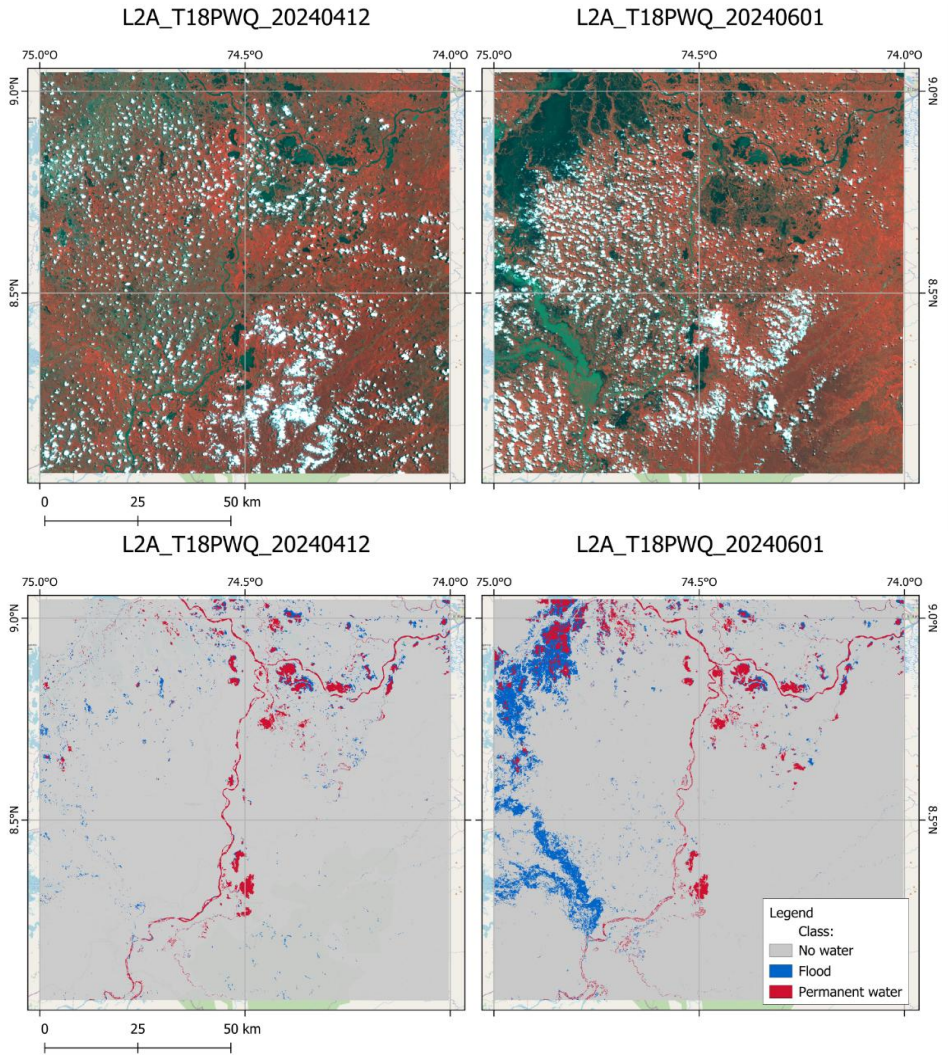
UC#2-Flood
Sprint 1 planning
sprint 1
sprint 1 demo
sprint 2 planning
sprint 2
sprint 2 demo
sprint 3 planning
sprint 3
PE Review meeting
sprint 3 demo
sprint 4
sprint 4 demo
Readiness Review...
Capacity building
Demonstration p...
Developments Kick-Off
Sprint 1
UNGRD involvement
First technical meeting with FAN
Sprint 2
On-site meeting with users and IDEAM involvement
Sprint 3
meeting on long-term transfer
Sprint 4
On-site capacity building
Pre-operational demonstration phase

COPERNICUS LAC - Service Development Activity

- Co-development with stakeholders of services based on Copernicus satellite products
- The services will be transferred entirely to the Copernicus Centre in Panama
- 18 open-source services, 8 related to flood risk (in two Processing Environments)
- Pilot case in La Mojana, developed with Fondo de Adaptación, UNGRD and IDEAM



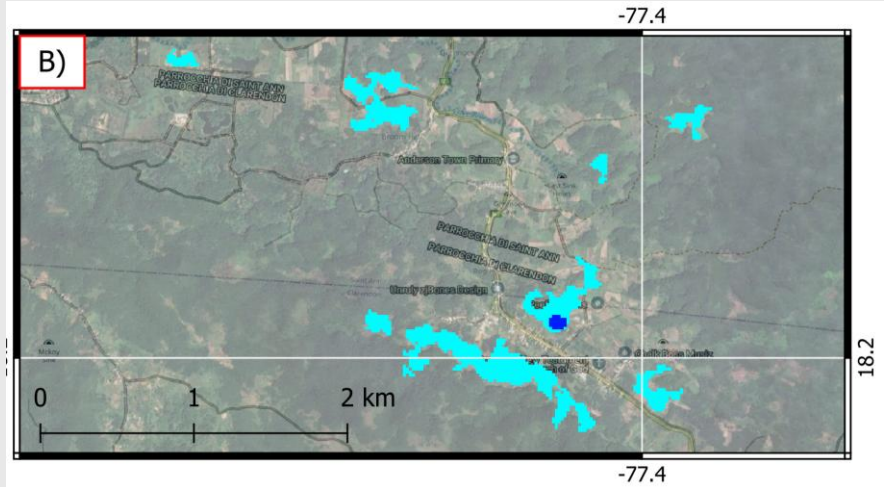
The services

To be transferred

Copernicus LAC Panamá

Flood Extent Mapping

The **Flood Extent Mapping (FEM)** service provides an Estimate of the cumulative extent of flood traces using both Sentinel-1 and Sentinel-2 for observation times over a period around the event start date, provided in the form of classified Geotiff (flooded, not flooded, permanent water body)



Frequency of production – Flood extent estimates for a specific observation time using EO data acquired before and after that time.

Spatial coverage - over a defined Area of Interest

Temporal coverage - NA

Constraints - availability of S1 and S2 acquisitions

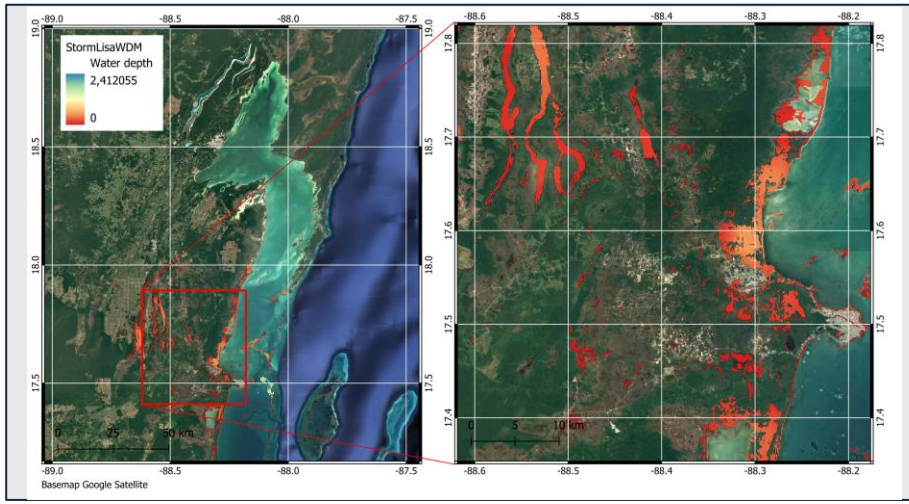
The **FEM** service tracks the extent of a flood both during an event and outside of emergency situations for prevention and risk assessment. It also provides critical input for the flood depth mapping service.

Service owner:

cima RESEARCH FOUNDATION

Flood Depth Mapping

The **Flood Depth Estimation (FlDM)** service provides high-resolution maps detailing the maximum water depth per pixel for specific flood extents, using as ancillary layer a Height Above Nearest Drainage (HAND) re-elaboration of the Copernicus Digital Elevation Model.



Frequency of production – provides flood depth estimates for a specific flood extent map

Spatial coverage – extent of the input flood extent map.

Temporal coverage - NA.

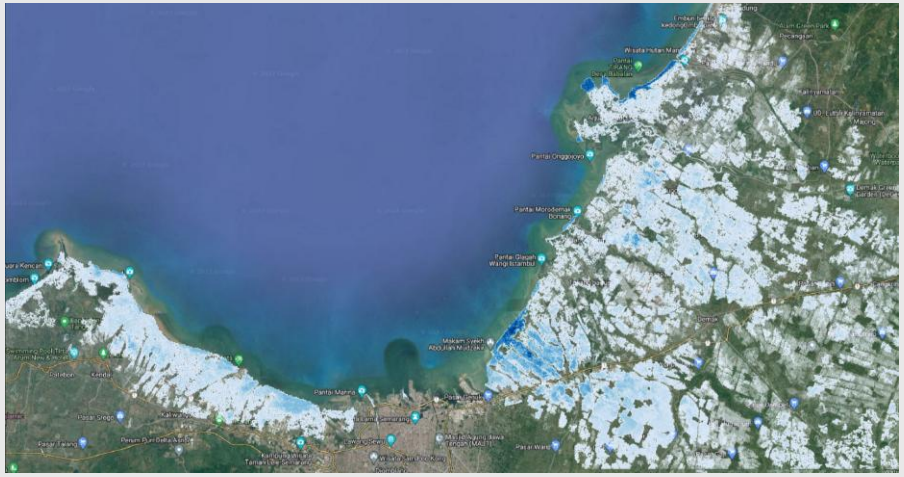
Constraints – Availability of Flood extent and HAND elaboration of a DEM over the area covered by the flood extent map

The **FlDM** service computes the maximum depth of flood water in each pixel. It can be used during a flood event and outside an emergency basis for prevention and risk assessment. Combined with vulnerability data provides a critical input for infering the flood impact.

Service owner: LIST

Flood Frequency Mapping service

The **Flood Frequency Mapping (FFM)** service provides estimates of a series of flood records for a user defined period, typically a season or multiple years, providing flood extent maps and the frequency map associated to these records.



Frequency of production - Can be updated every 6 months or on demand if a large event has been experienced

Spatial coverage – over a specified AOI

Temporal coverage – Scans the full catalog of Sentinel-1 & Sentinel-2 acquisitions

Constraints - availability of Sentinel-1 and Sentinel-2 data from the Copernicus Data Space Ecosystem.

The **FFM** service can be used in the risk reduction community in the broad sense to better understand the hazard, thus informing the risk assessment.

Service owner: cima RESEARCH FOUNDATION WASDI

The Use Case: pre-operational application in la Mojana (Colombia)

Execution modes, ad-hoc algorithms and examples

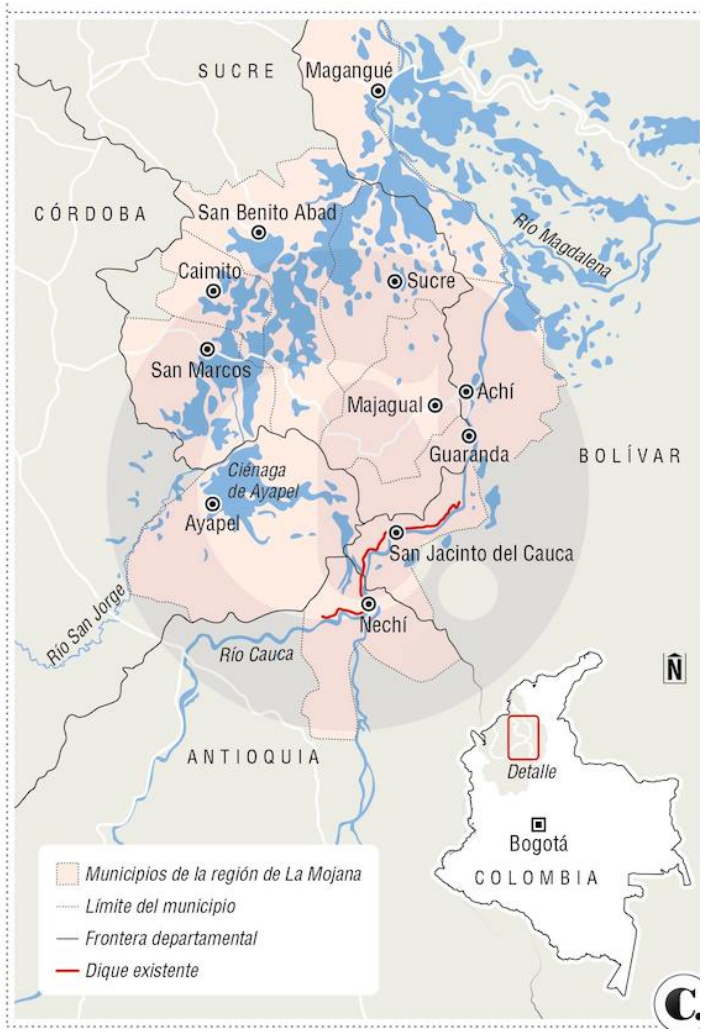
Copernicus LAC Panamá

Flooding in La Mojana - Colombia

The Use Case focuses on the automated flood delineation and frequency mapping service, providing accurate estimates based on satellite information.

This service aims to support flood management in La Mojana, providing crucial data for decision-making and disaster response planning.

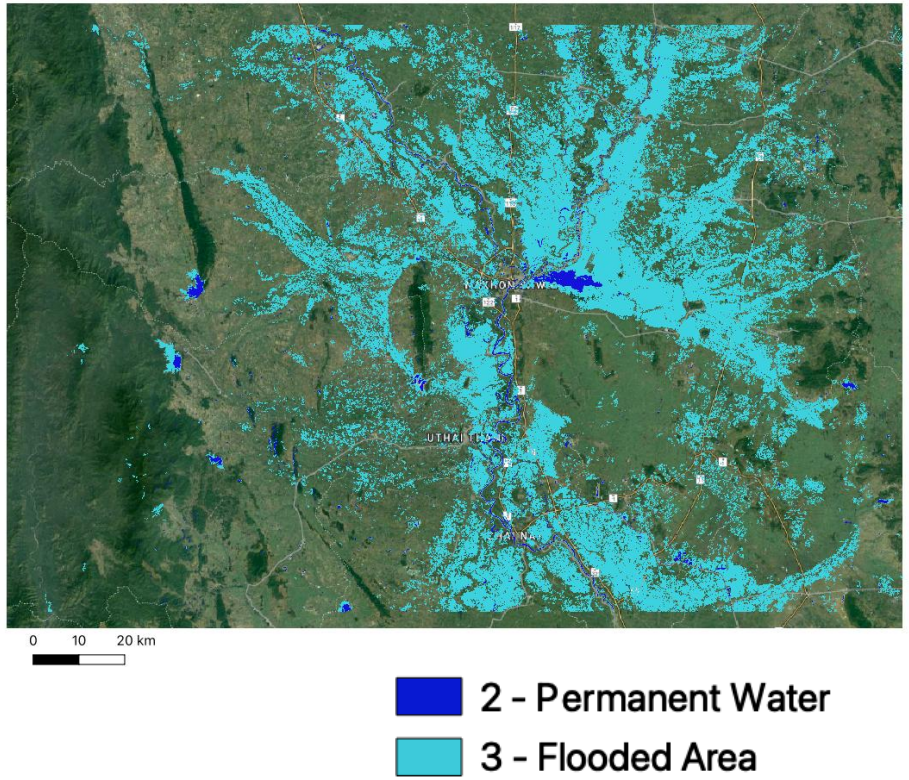
- Combination of:
- Continuous flood monitoring
- On-demand analysis of depth and impact



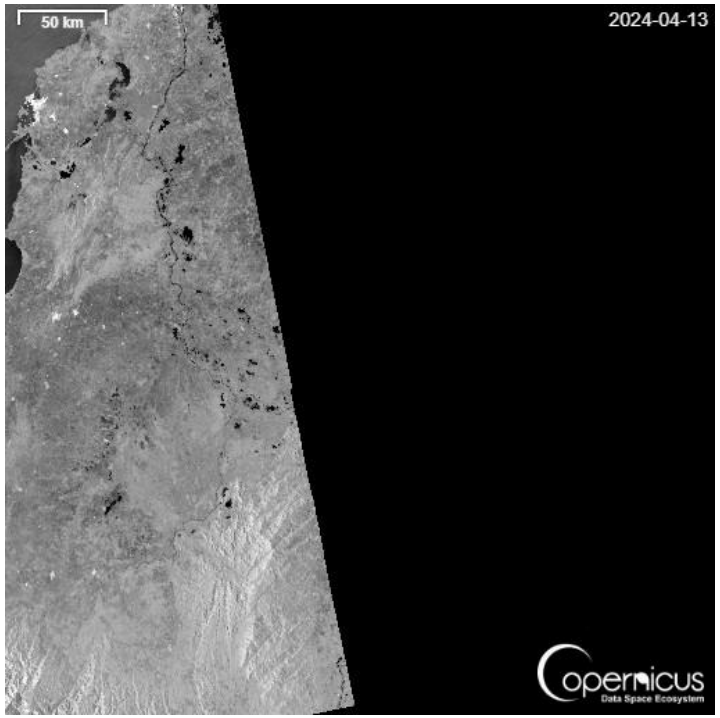
(Continuous) flood detection

The flood detection algorithm is based on the analysis of changes in intensity in satellite images. It uses optical data and SAR (Synthetic Aperture Radar) to identify flooded areas and distinguish them from permanent bodies of water.

The system is fully automatable and open source, allowing for easy deployment and adaptation.



Sentinel 1 + Sentinel 2

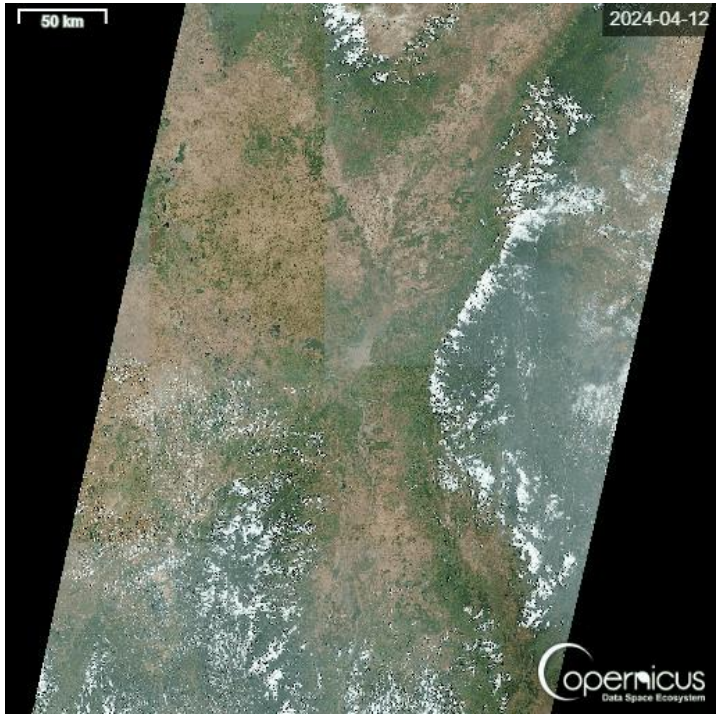


Sentinel 1

Day and night, in all weather conditions

Limited passing frequency (~12 days, now... will improve with S1-C)

Analysis requires more processing

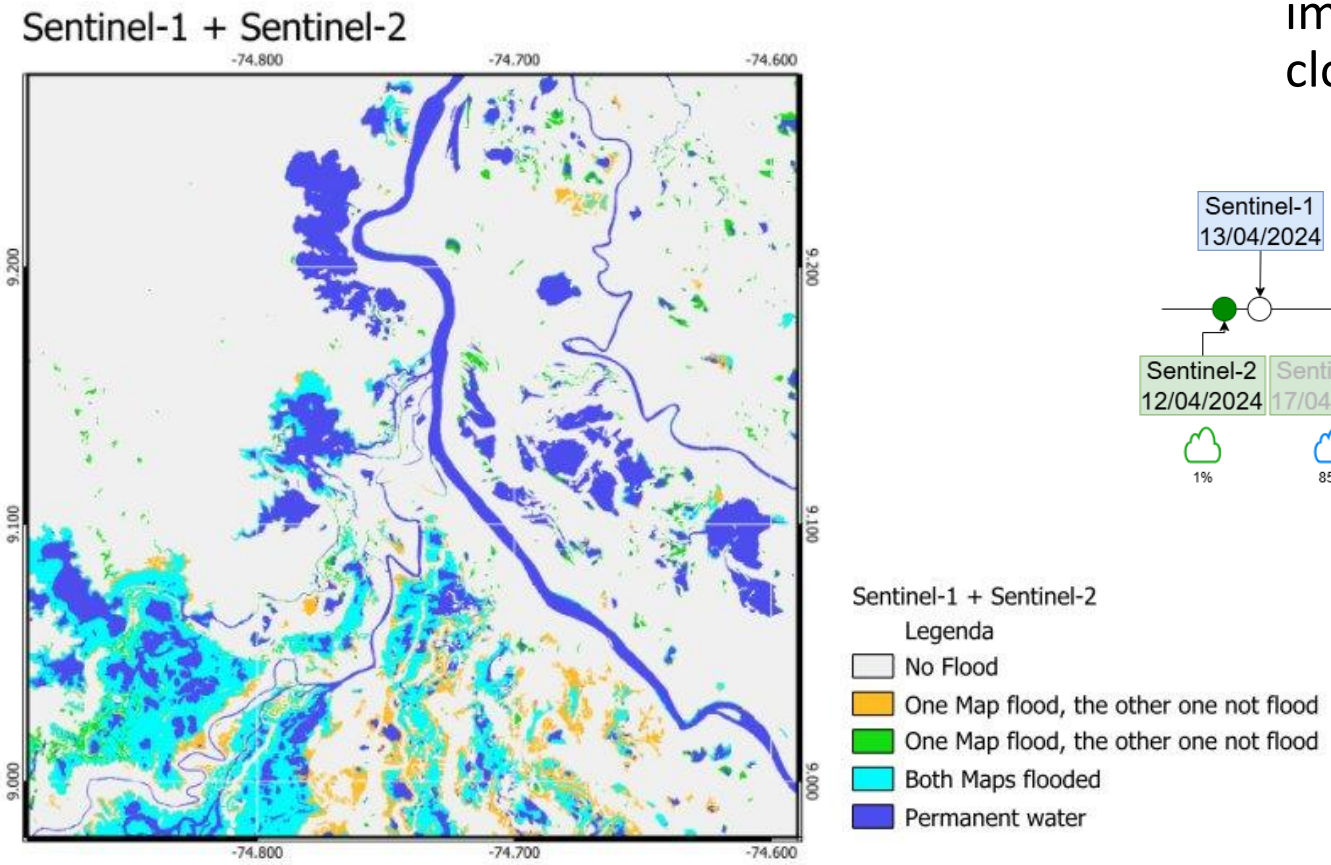


Sentinel 2

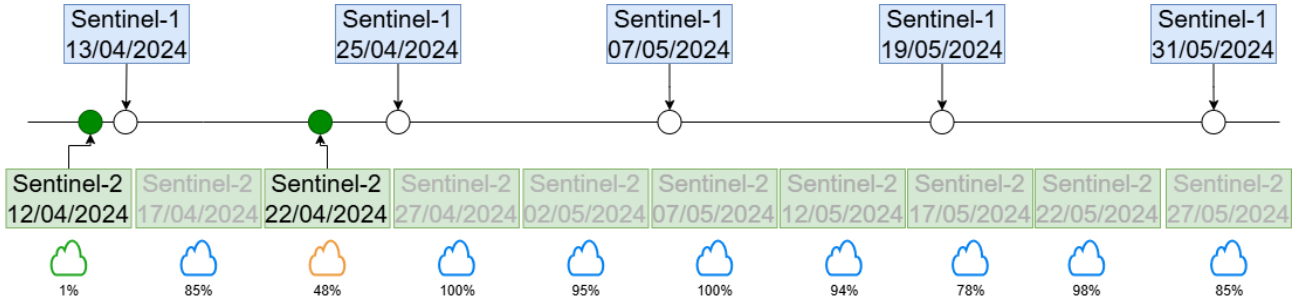
Good frequency of passage (~5 days)

Poor availability due to cloud cover during the event

Sentinel 1 + Sentinel 2



The combination of optical and SAR data improves detection accuracy, especially in cloudy conditions.

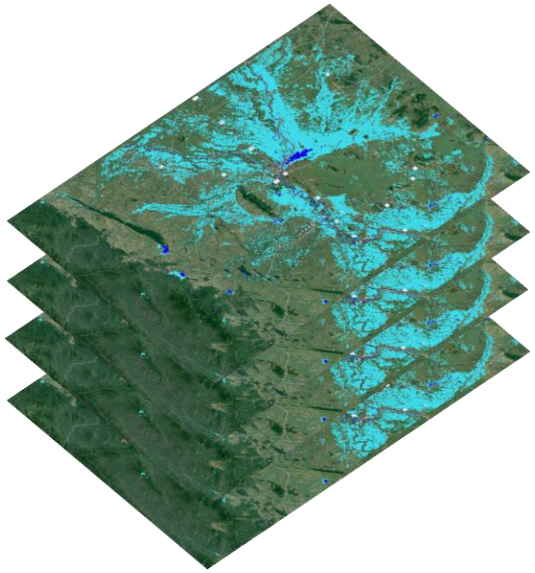


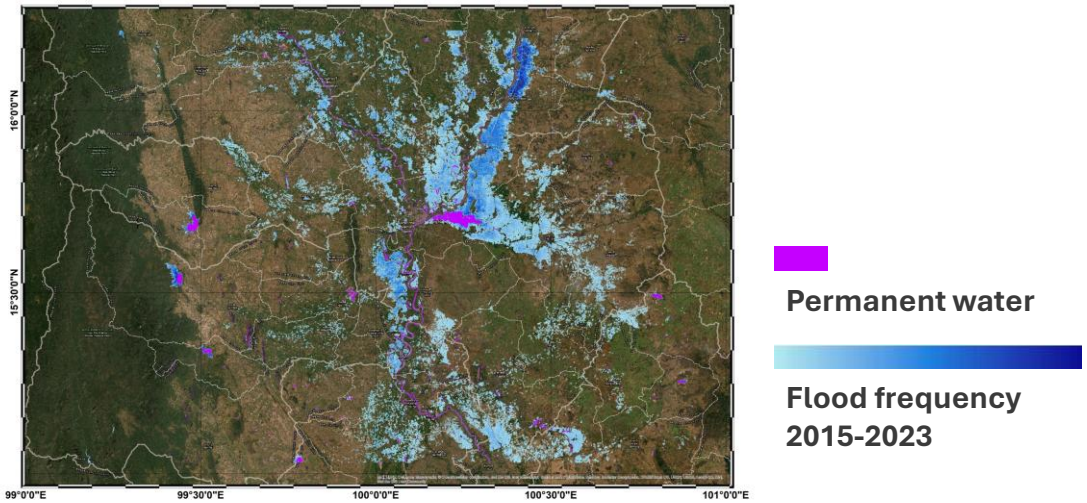
Frequency mapping

Using all the data from Sentinel 1 and 2 from 2015 to 2025, a detailed historical catalogue of flood events in La Mojana region will be generated.

The map distinguishes between permanent waters and areas of frequent flooding, providing a clear view of the locations most vulnerable to **recurrent flooding**.

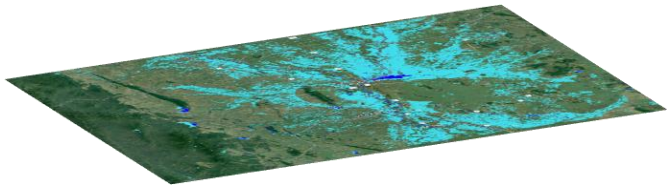
Frequency maps allow decision-makers and planners to identify **flood patterns**, and make a comparison between the magnitude of events

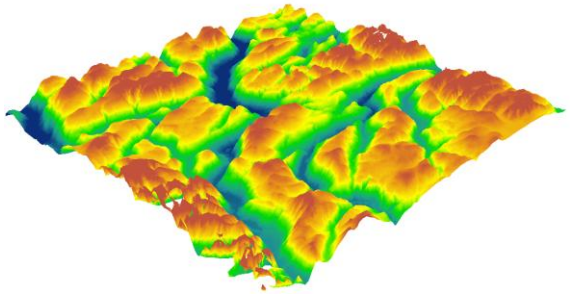




Flood depth map

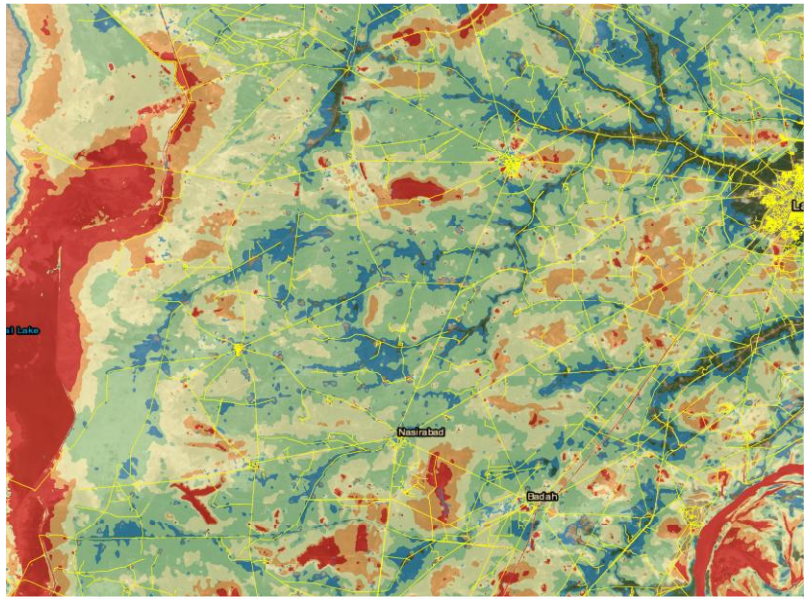
Flood extension map





Digital Elevation Model

Water Depth Map



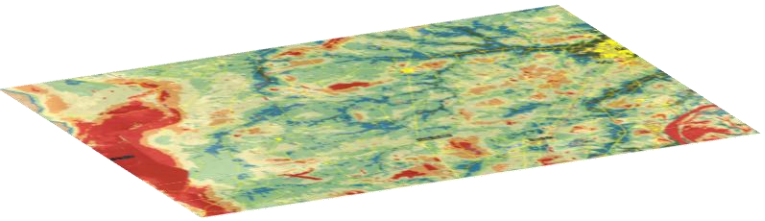
Water Depth [m]

- < 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- >2
- Roads

By selecting an area and at the user's request (on demand), it will be possible to extract the **water depth** for a given flood extent mapped by satellite, based on an algorithm that combines the flood extent with elevation information (from the DEM)

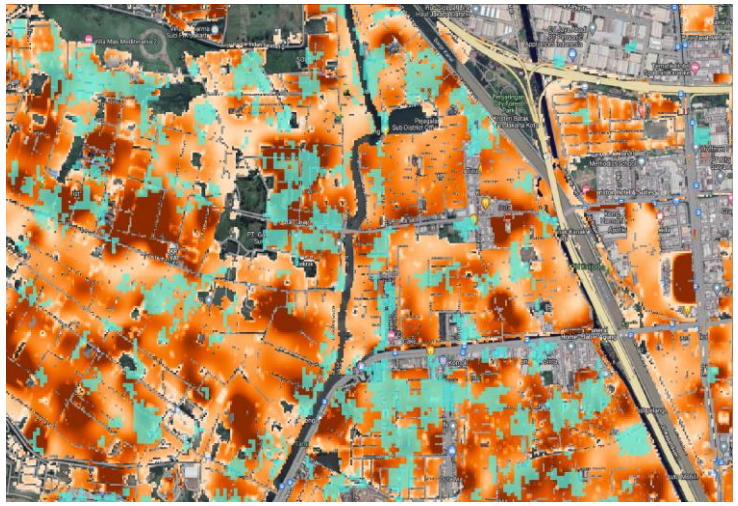
Simplified Flood Impact Assessment

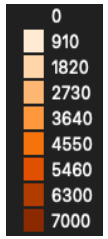
Water Depth Map



Exposed element map

Impact Map





To quickly assess the potential impact of the flood event, user will be able to overlay the flood extent map with the available geospatial information on the location of the **exposed elements** (population, crops, livestock).

The Platform

Processing Environments

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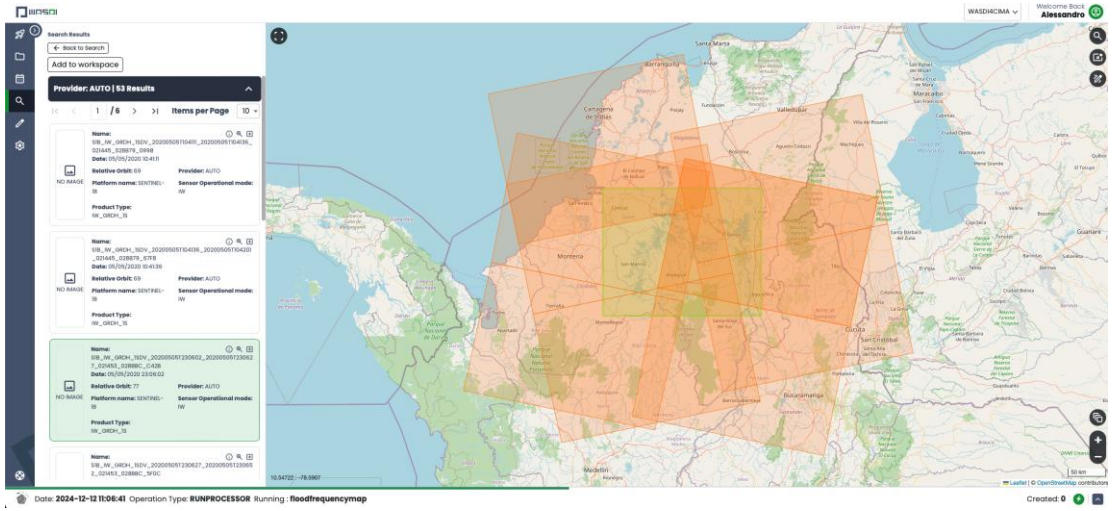
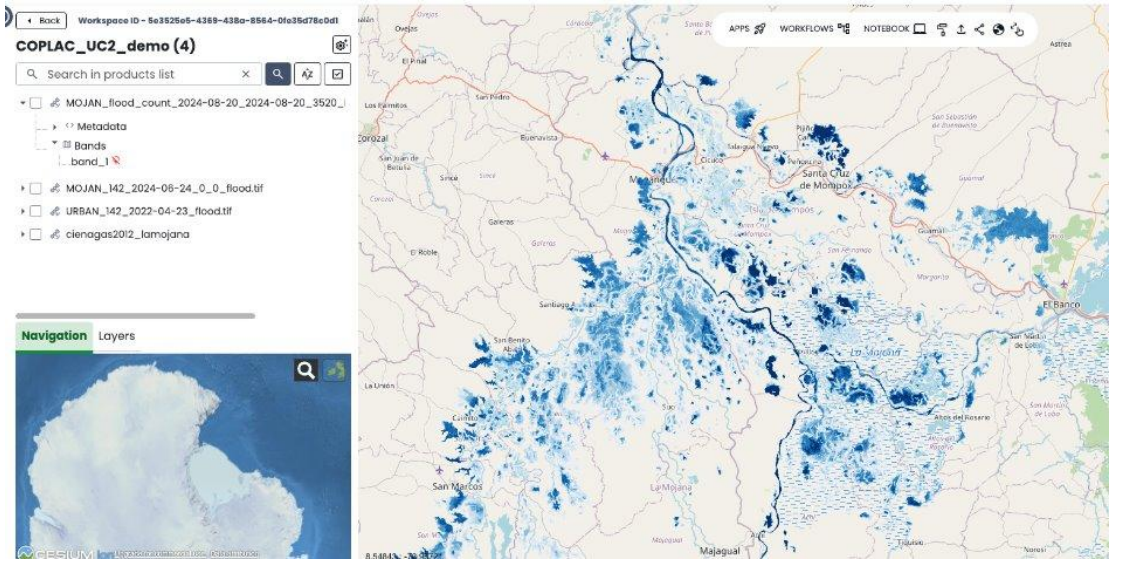
Panamá

Where and when?

The services will be made available to accredited users through specific environments/platforms, hosted within the CopernicusLAC Panama Data Centre:

- Specialised Processing Environment
  - Platform/interface where the calculations and demonstrations of services will be carried out during the Development and Pre-Operational demonstration phases
  - Long-term operation of the services as from January 2026 and beyond the project.
- Baseline Processing Environment
  - It will host simplified versions of the services (extent, frequency, depth and hazard).
  - Long-term operation of the services beyond the project.





THE PRE-OPERATIONAL DEMONSTRATION PHASE

Set-up and challenges

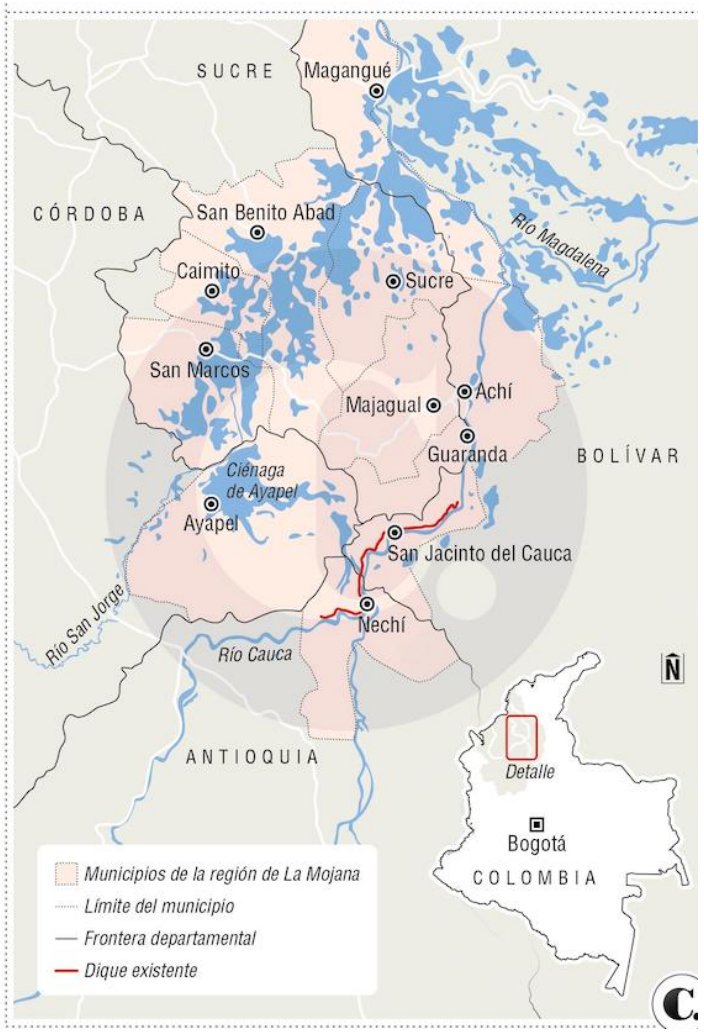
Copernicus LAC
Panamá

The pre-operational demonstration phase

Info on the demo phase:

- **Start date**: mid-end September 2025
- **End date**: mid-end December 2025
- ROI: Mojana (Colombia)

- Users will have access to two workspaces on the Processing Environment that will be automatically updated once new data are available:
  - The WASDI 2.0 - COPLAC_UC2_archivo: the workspace containing all the flood extent maps computed over the Region of Interest from 2015 to present and the flood frequency map.
  - WASDI 2.0 - COPLAC_UC2_operacional: the workspace containing only the latest flood frequency and flood extent maps computed.
- Starting from one of the available flood extent maps, users can compute flood depth maps by means of the Flood Depth Mapping Service via the App accessible at this LINK.
- Direct access to the Flood Extent Mapping App, to test the workflow in other locations in Colombia
- Expected outcome:
  - Users might include the services'products in their operational routines when there are flood events in La Mojana or elsewhere in Colombia (overlap with the rainy season)
  - Users integrate the frequency map in their platforms/reports/analyses



Challenges for pre-operational demonstration phase

- Long-term sustainability and maintenance of services after the demo phase (resources, institutional commitment).
- Concerns about data storage and “results property” when using external infrastructure outside Colombia.
- Technical and organizational complexity of interconnecting platforms (CopernicusLAC ↔ FAN’s own platform).

Opportunities for pre-operational demonstration phase

- FAN as a mature, proactive user and regional focal point, convening other institutions (IDEAM, UNGRD with mandate in flood monitoring).
- Integration of CopernicusLAC outputs (flood delineation, frequency maps, hazard maps) into FAN's platform and UNGDR, IDEAM protocols.
- Possibility to develop a simplified workspace for external LAC users → supports regional knowledge-sharing.
- Strong user interest in continued training (remote + in-person).
- Potential new uptake: Dominican Republic's Environment Ministry interested in Flood Frequency & Hazard Mapping.