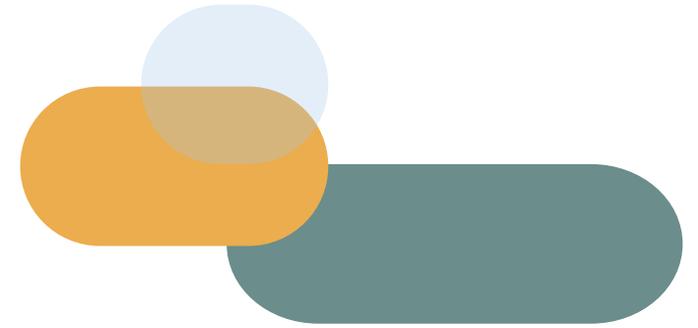# Operationalising EO & AI for Early Warning
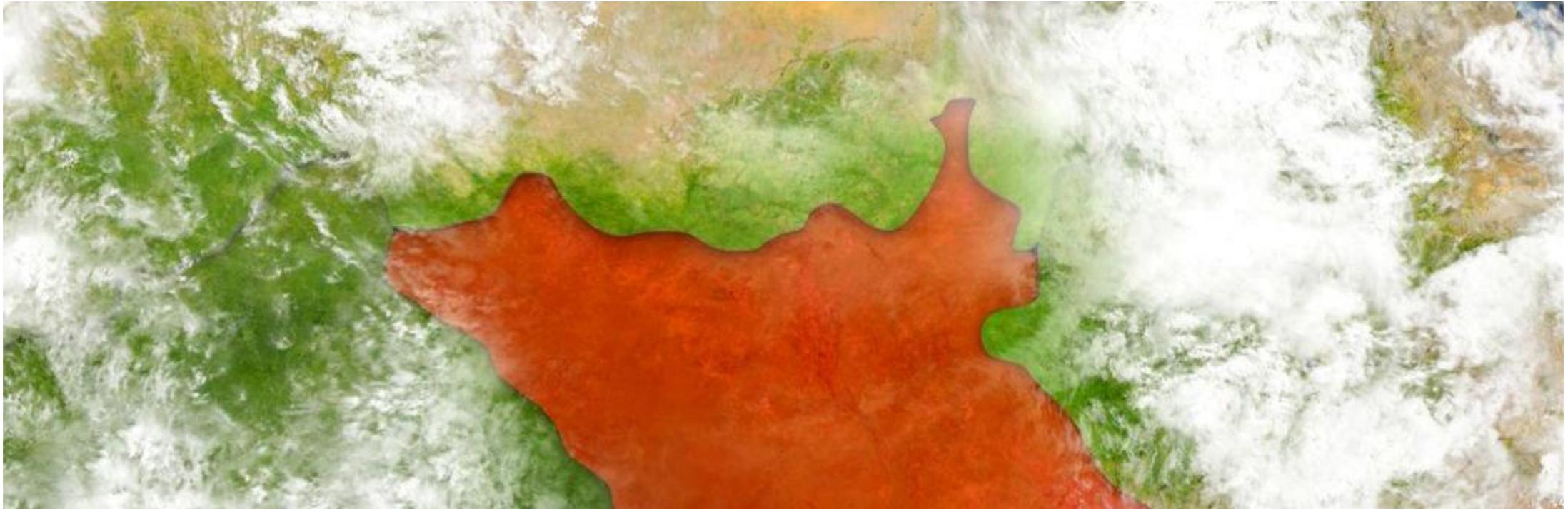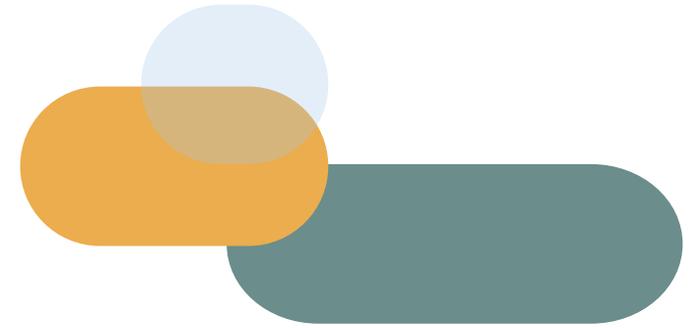
Danielle Monsef Abboud

Water Engineer Consultant at The World Bank

Eye in the Sky

Unlocking the Power of Earth Observation to forecasting floods in South Sudan

THE WORLD BANK

CENTAUR 2nd Workshop – 25 February 2026

South Sudan is one of the
most

vulnerable country to climate change and
**1st** for lack of coping capacity

💧 **Water is a source of risks and opportunities in South Sudan**

- **7th** in the world for share of total population exposed to floods
- **1 in 4** South Sudanese live in areas exposed to high flood hazard
- **7%** of South Sudan is covered by wetlands, with the Sudd covering **5%** making South Sudan's wetland management decisions regionally significant.
- Frequent cross-border floods highlight the need for South Sudan and neighboring countries to collaborate in improved flood forecasting and early warning systems to protect vulnerable populations.
- The potential of water resources to sustain and enhance livelihoods and food security remains unexploited
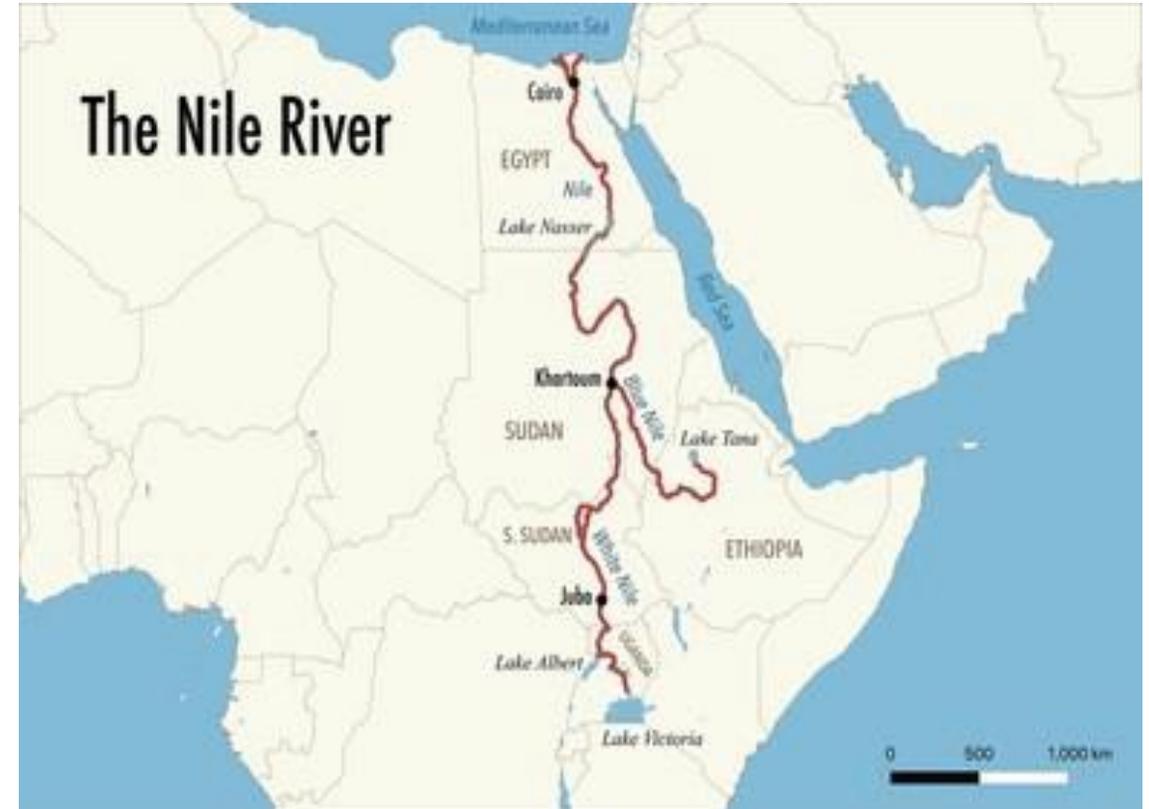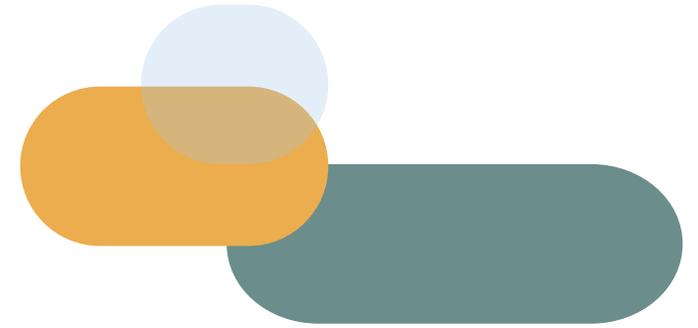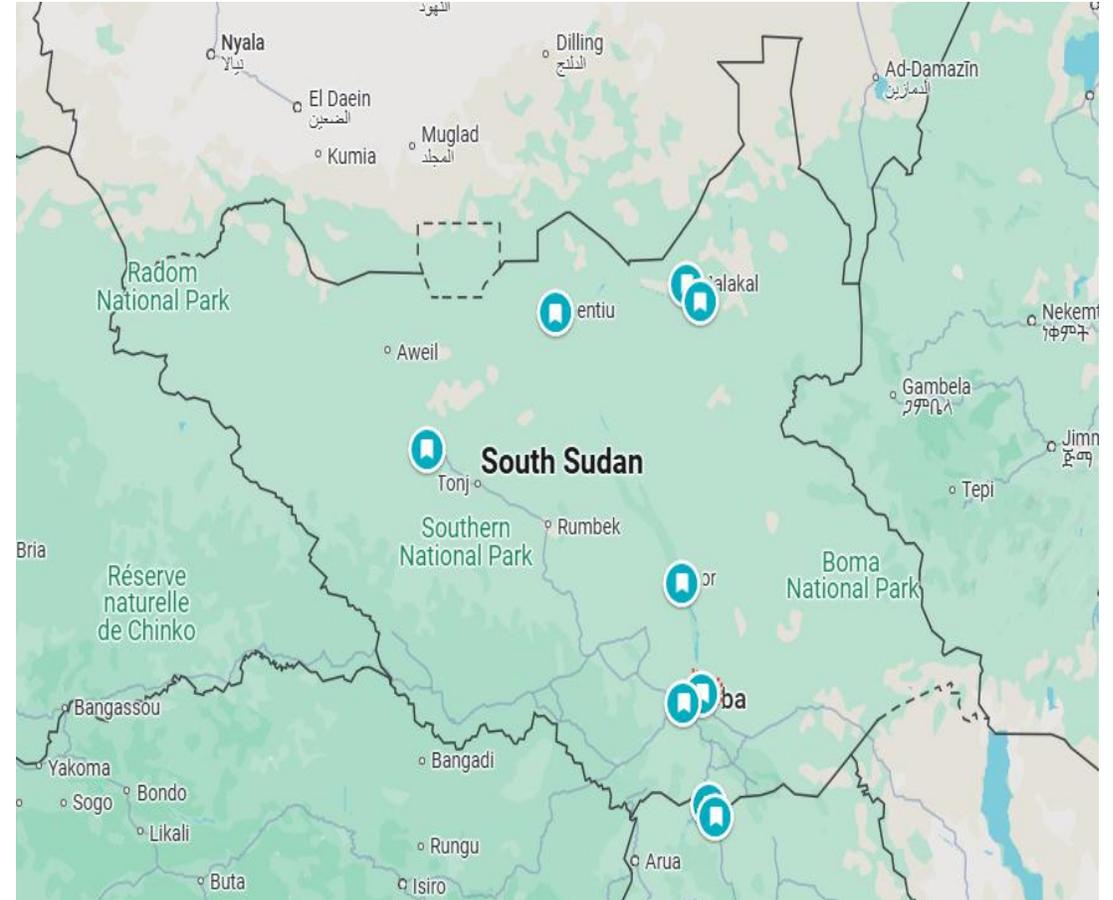

The Nile River Across Africa

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Hydromet Networks in France vs. South Sudan
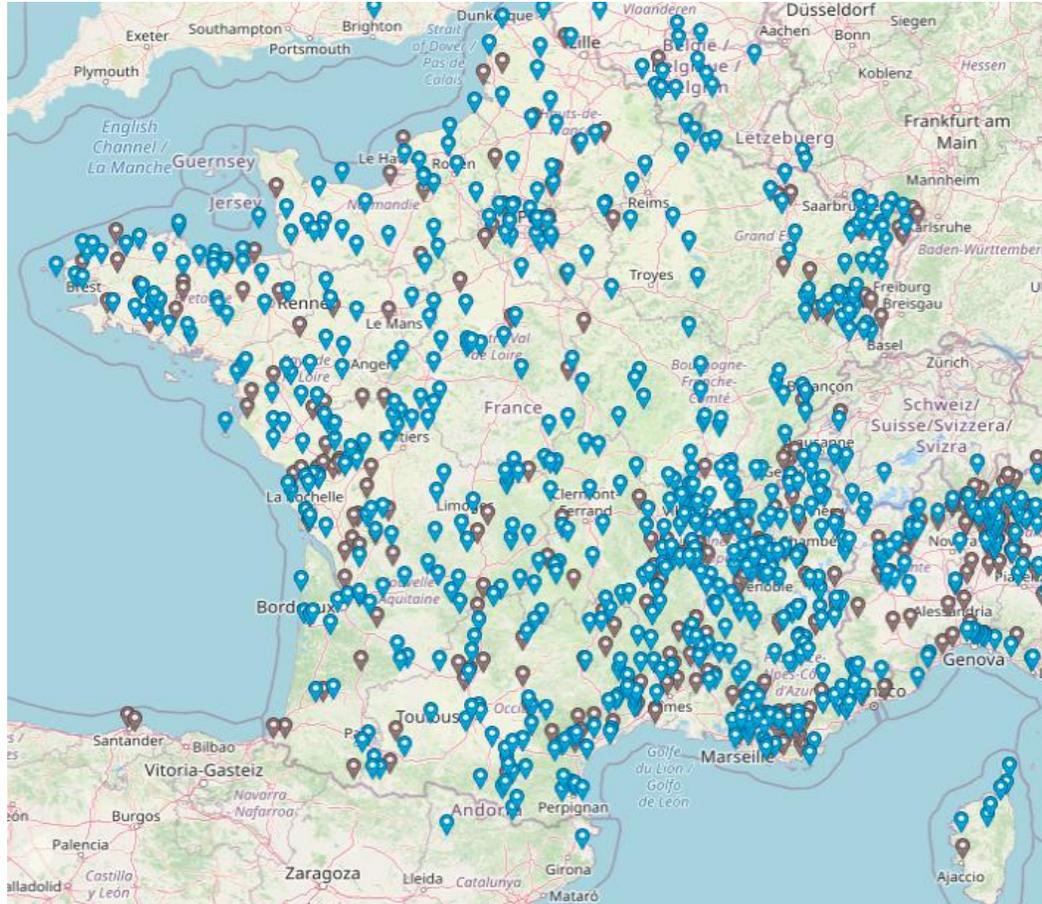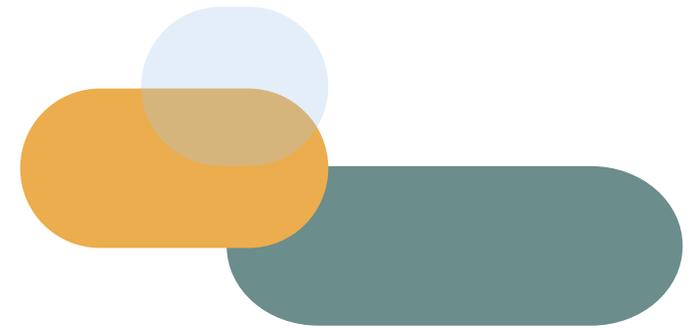
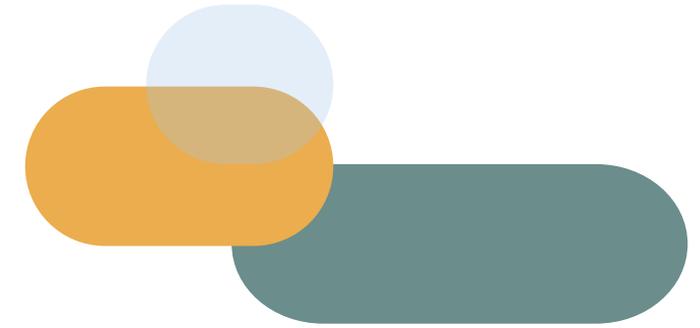4 588 Hydromet Stations   **551,695 km²**

9 Hydromet Stations   **619,745 km²**

World Bank Project Cycle

Earth Observation (EO) as a Tool for Flood Management

Bahr el Jebel

EO-Detected flooded areas

Seasonal flood frequency (S-1, 2017)

0   25   50   75   100%

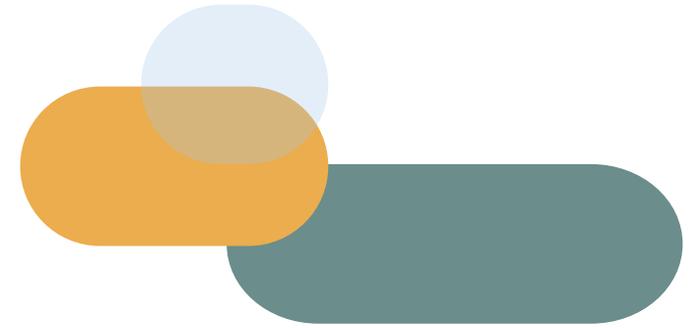— Jonglei Dike
● Major cities

500 km

South Sudan
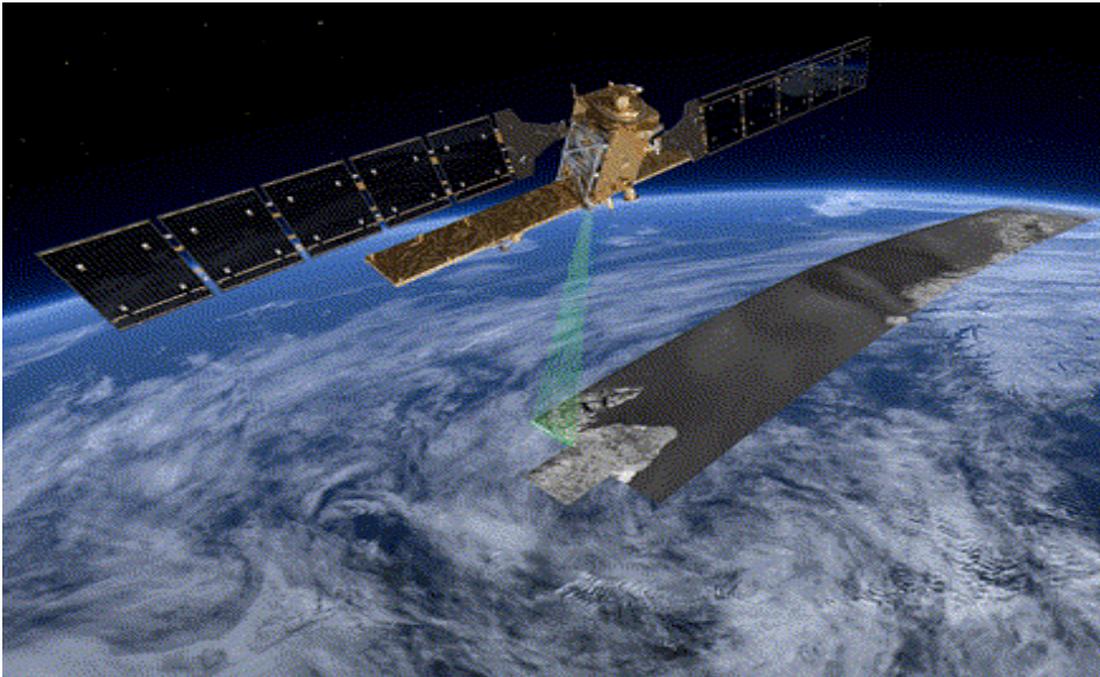
The **seasonal flood extent delineation** conducted is based on the constellation of two polar-orbiting satellites operating day and night performing C-band synthetic aperture radar (SAR) imaging, enabling them to acquire 10 m imagery regardless of the weather and illumination conditions.
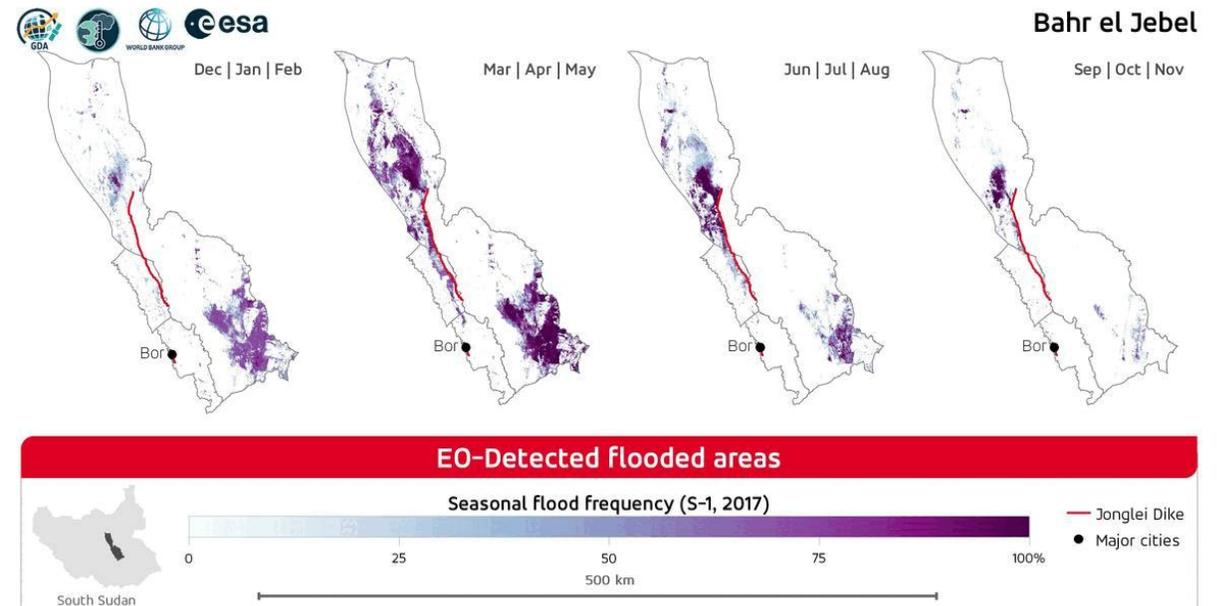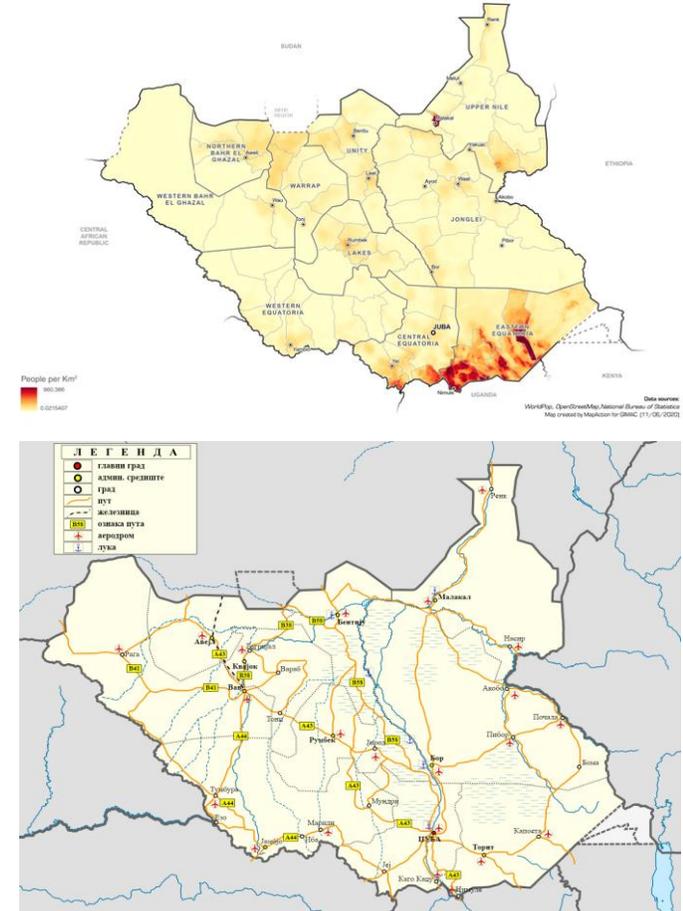
This method is based on the comparison of two images composites one on dry conditions, and another during a flood event.
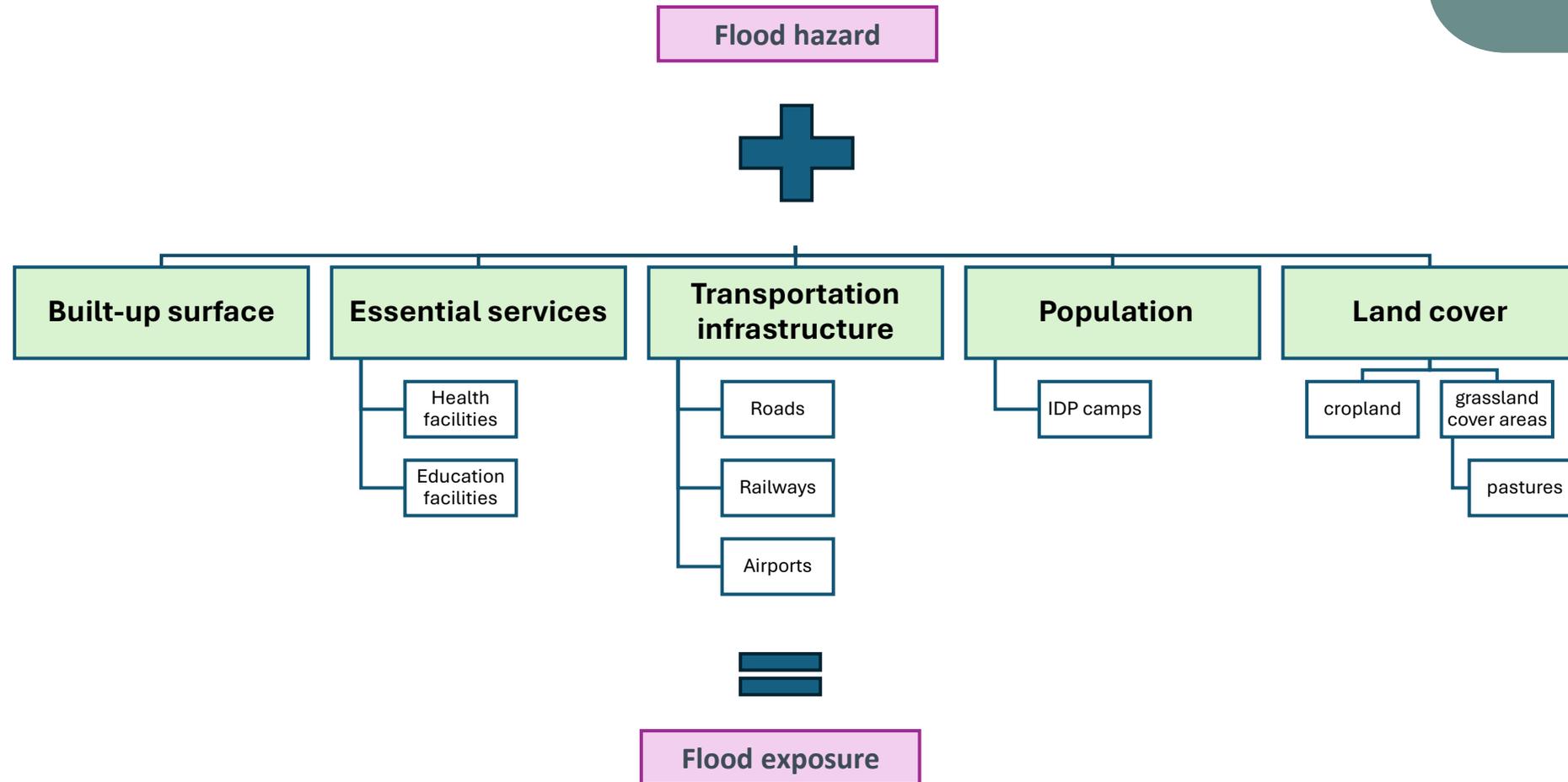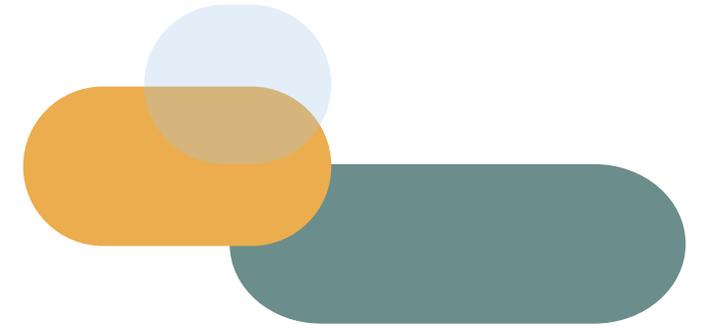
Identification And Organization Of Global Datasets

| Population	
Dataset name	GHS-POP - R2023A
Source	European Commission – Joint Research Center
Website	https://human-settlement.emergency.copernicus.eu/ghs_pop2023.php
Data type	Combination of Observations, Model output (model used in GPWv4.11) and data reprocessing.
Dataset description	The GHS-POP spatial raster product (GHS-POP_GLOBE_R2023) depicts the distribution of human population distributed by grid cells. It uses a raw global census data harmonized by CIESIN for the Gridded Population of the World version 4.11 (GPWv4.11) at polygon level and disaggregated from census or administrative units to grid cells.
Main applications	•Risk assessment for different threads: floods, hurricanes, landslides, tornados, etcetera. •Support for global demographic trends analysis and future projections.
Temporal resolution	Every 5-years
Temporal coverage	Latest data: 2023 (Available from 1975 every 5 years, to future: 2030)
Spatial resolution	100m (other resolutions available: 1km, 3 arcsec, 30 arcsec)
Spatial coverage	Global
Units	Number of people estimated per cell
Projection	WGS 84
Format	Raster (GeoTIFF)
Validation	Quality checked for format and mapping specifications following ISO-conform QC/QA procedures and cluster requirements.
Processing performed	No additional processing was required

36 Global Datasets

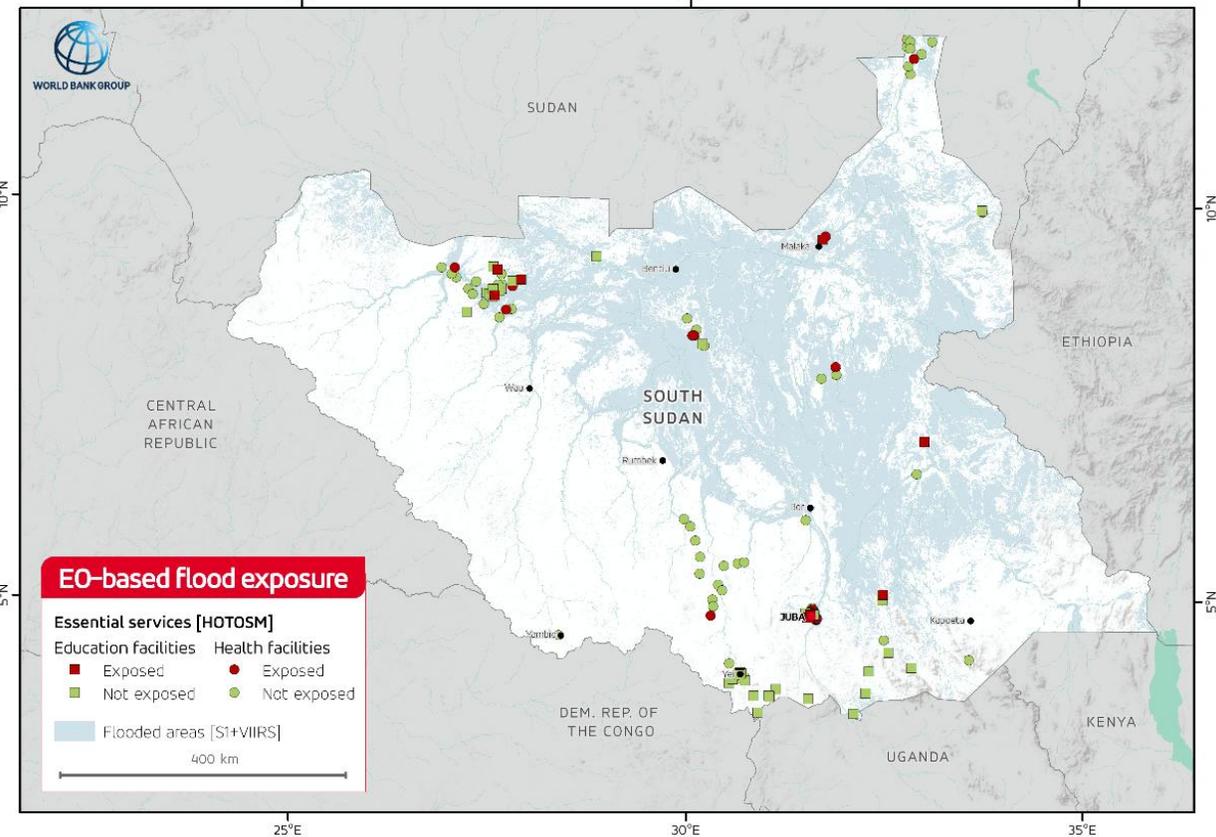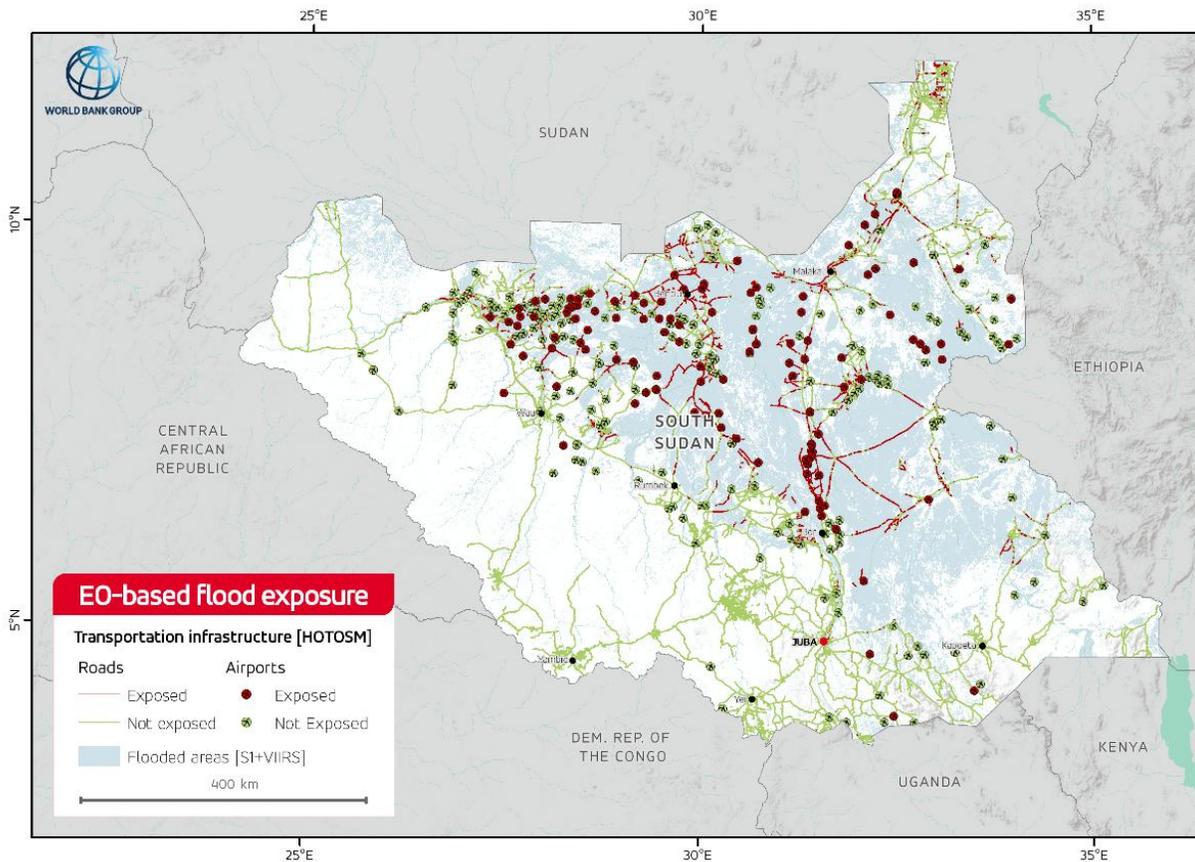Exposed Elements Maps

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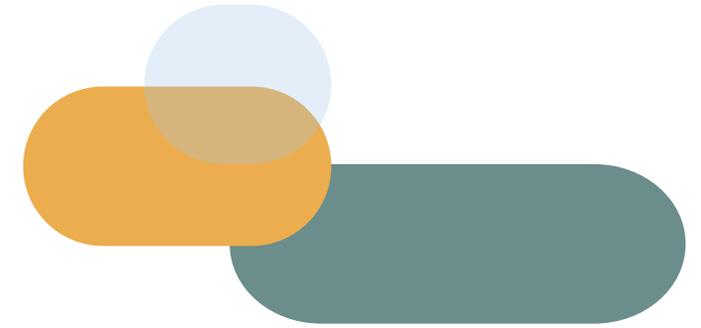
Flood Exposure Assessment
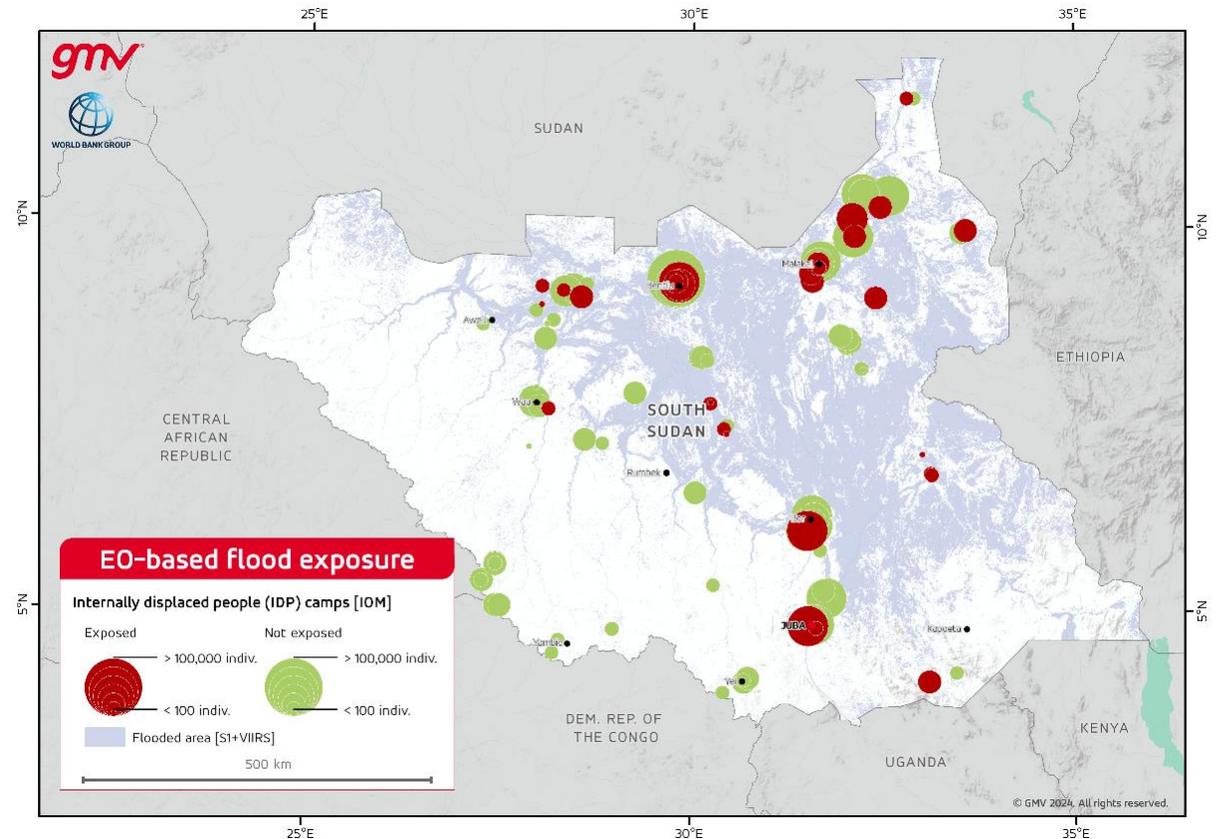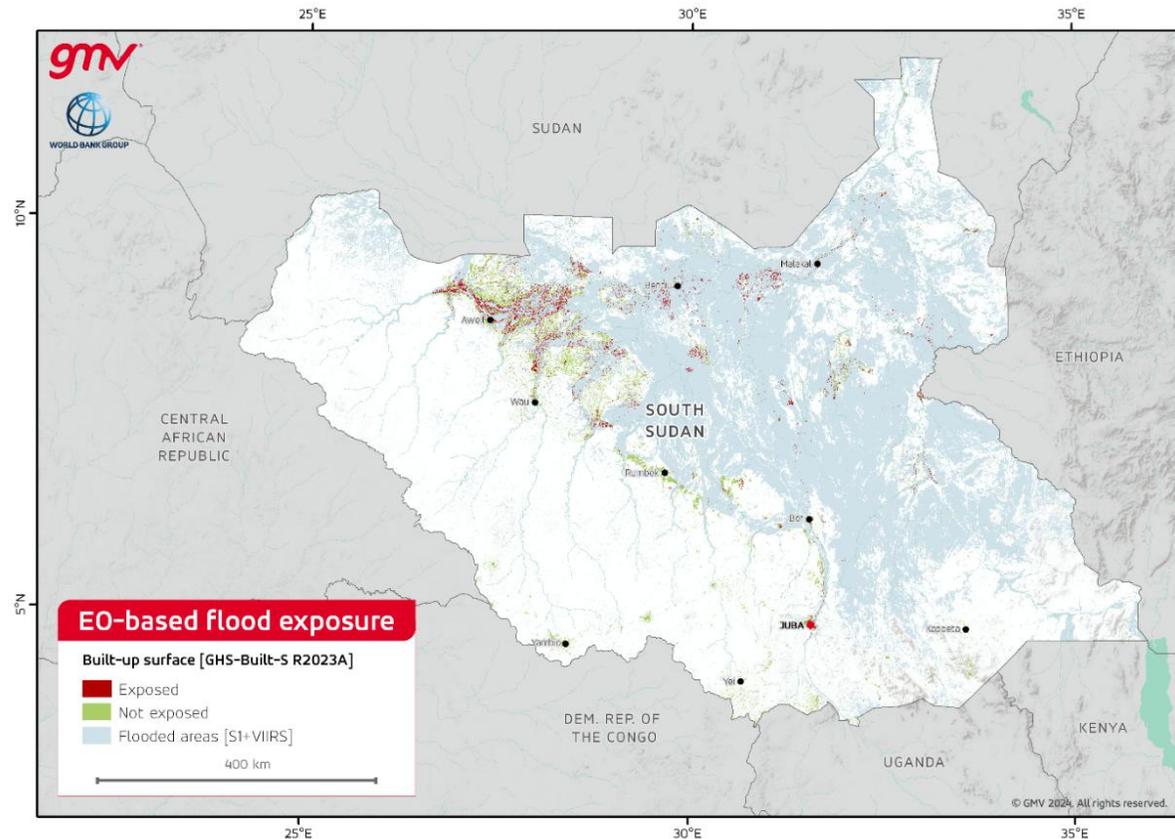
Flood Exposure: Earth Observation (2017-2022)
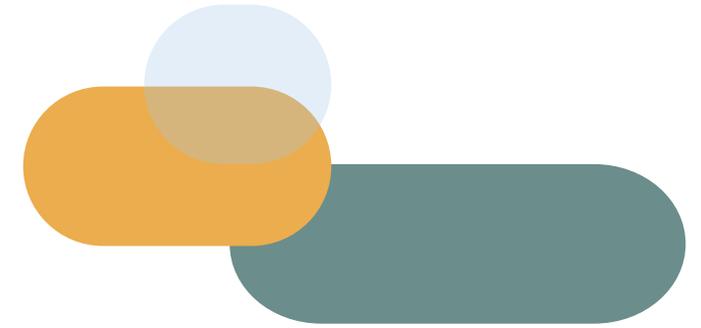
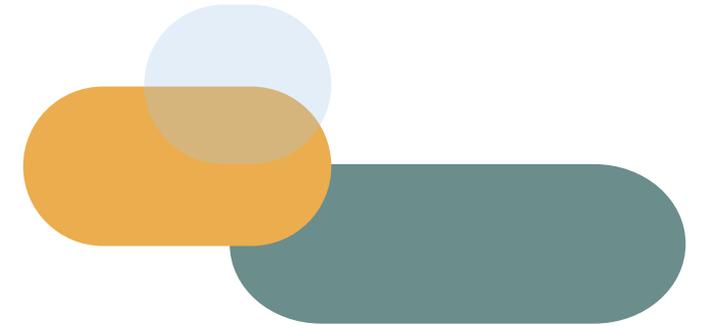## Transportation infrastructure & Essential services

Flood Exposure: Earth Observation (2017-2022)

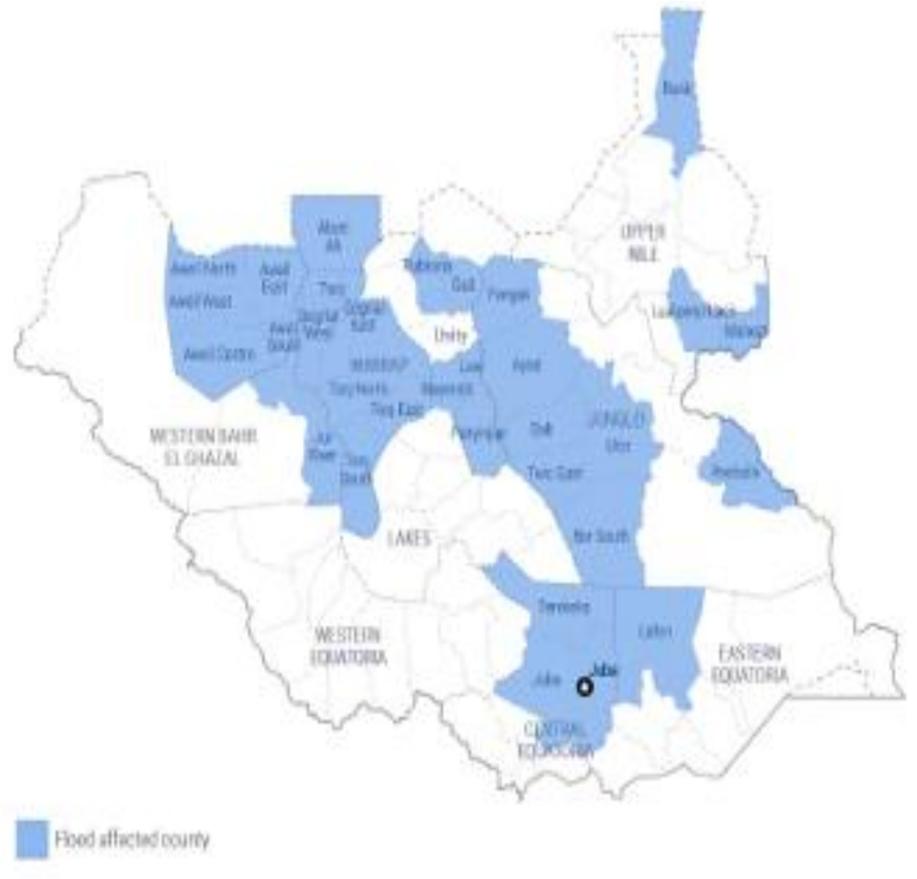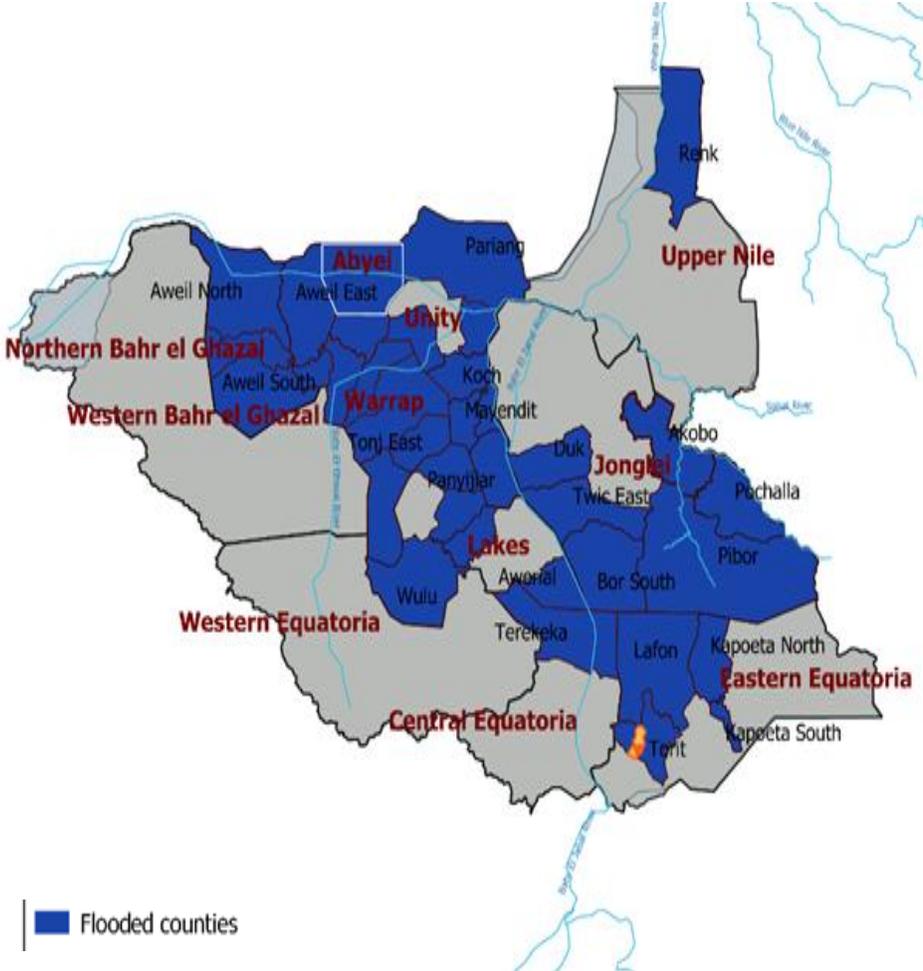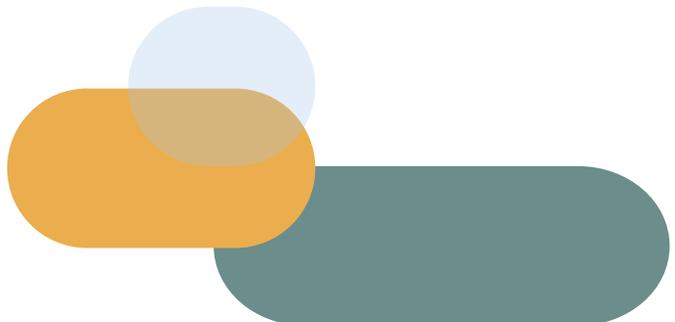## Built-up & IDPs flood exposure

Flood Exposure: Earth Observation (2017-2022)

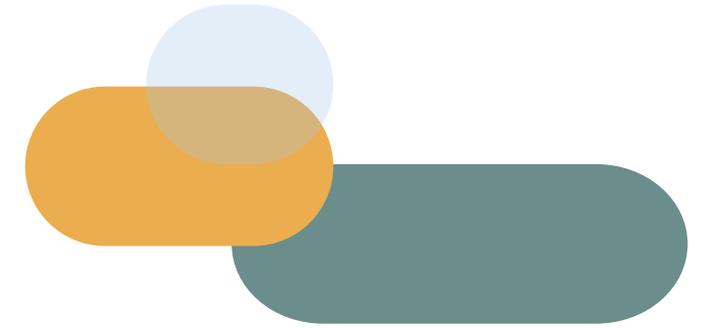## Cropland and grassland & Pasture flood exposure
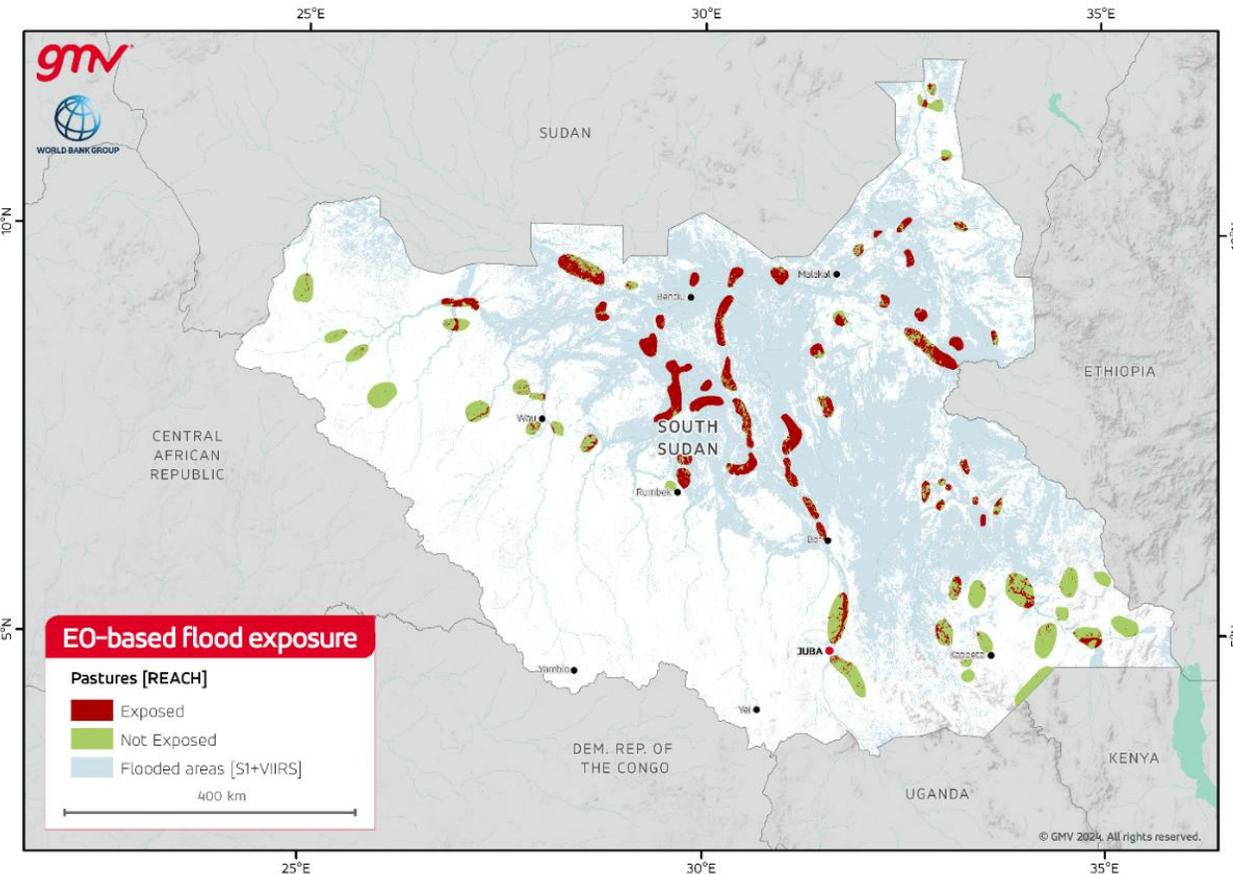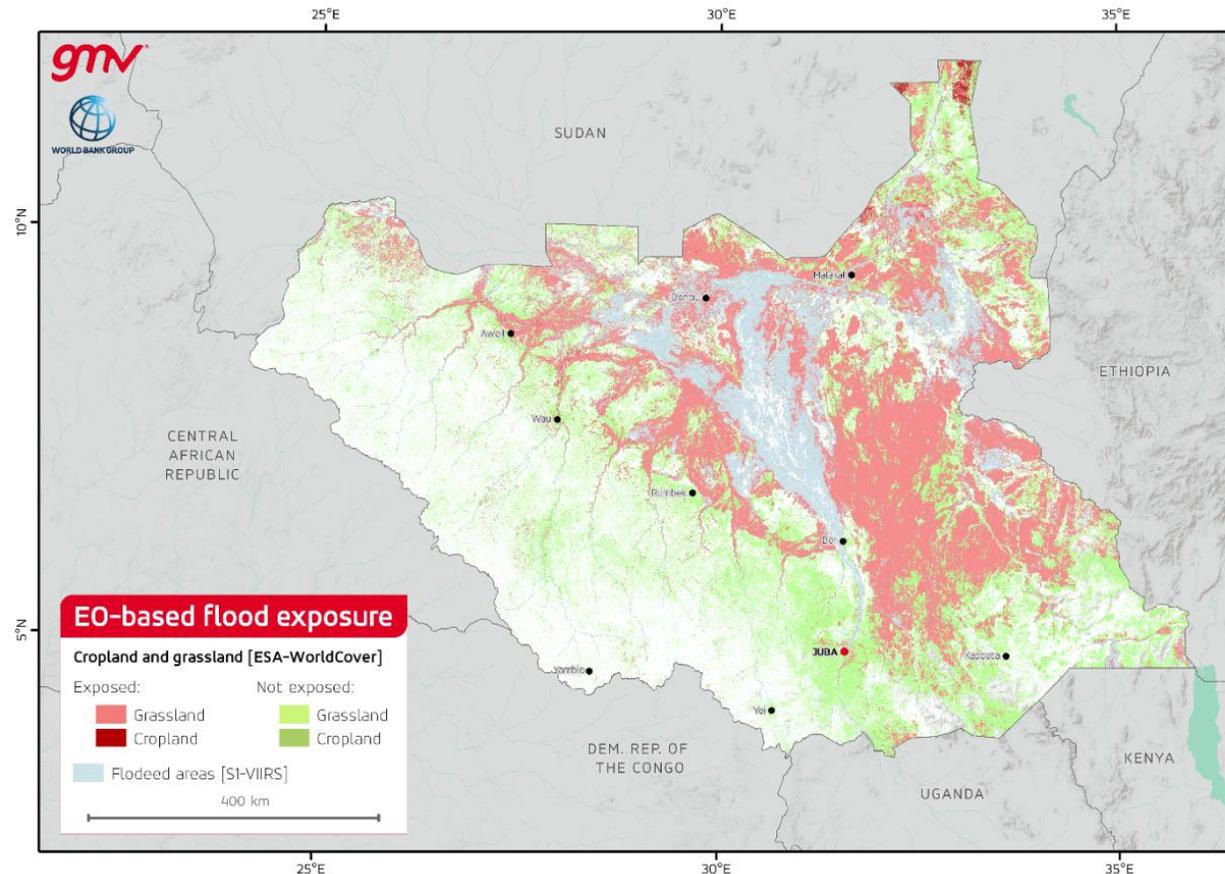
Comparing Flood Impacts 2020 vs 2024

MHADM Flood situational Mapping, September 2020

OCHA Flood snapshot, September 2024

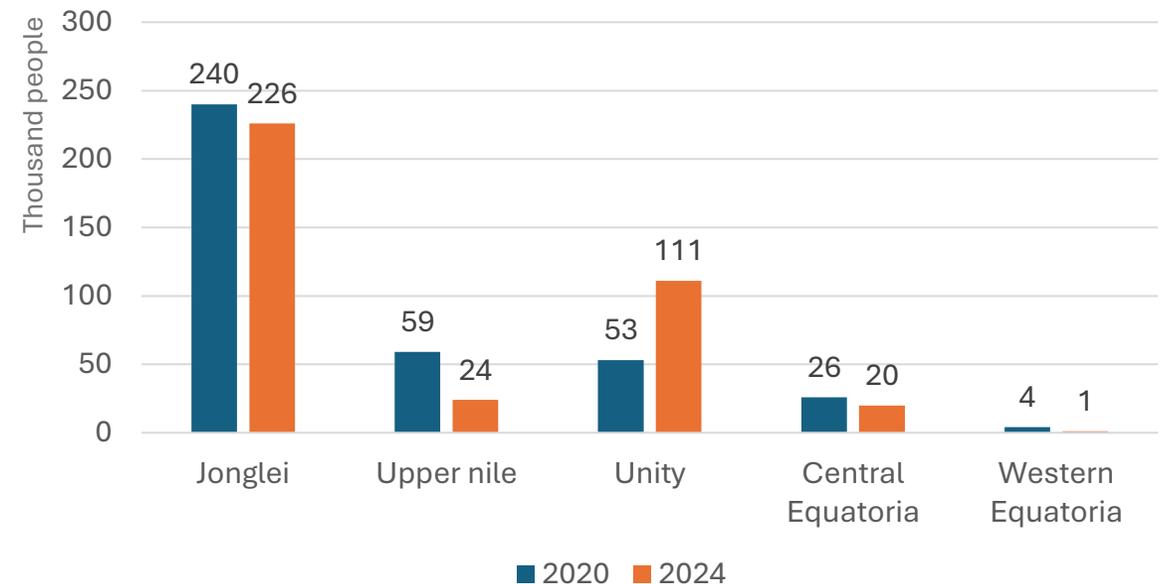# Empowering Communities Through Hydromet Stations

Awareness and informative campaigns were conducted effectively due to the availability of data from hydromet stations. These stations provided real-time and reliable weather and hydrological information, enabling communities to better understand flood risks and take proactive measures to mitigate their impacts.
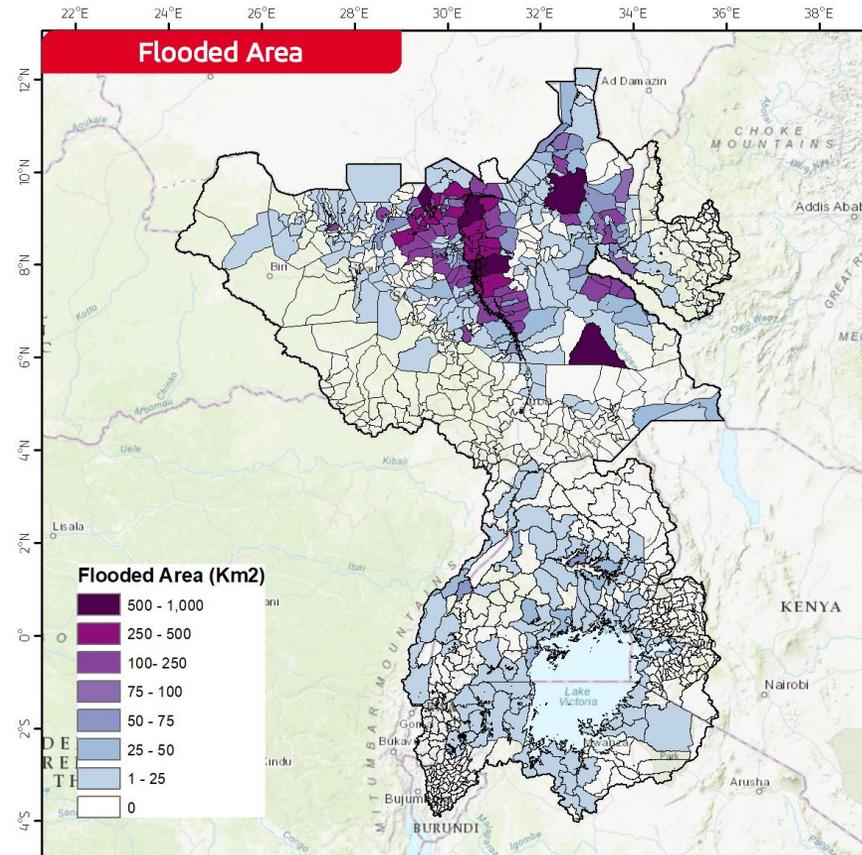
Awareness Initiatives:

- Engaging Jingles

- Interactive Radio Shows

- Timely Alert Messages

FLOOD-AFFECTED PEOPLE BY STATE

	2020	2024
Jonglei	240	226
Upper nile	59	24
Unity	53	111
Central Equatoria	26	20
Western Equatoria	4	1

Thousand people

Sources: OCHA, FEWS NET, humanitarian partners in South Sudan, 3 Sep 2020 – 18 Sep 2024

Relevance in the Short and Long Term

Flooded Area

Flooded Area (Km2)
- 500 - 1,000
- 250 - 500
- 100 - 250
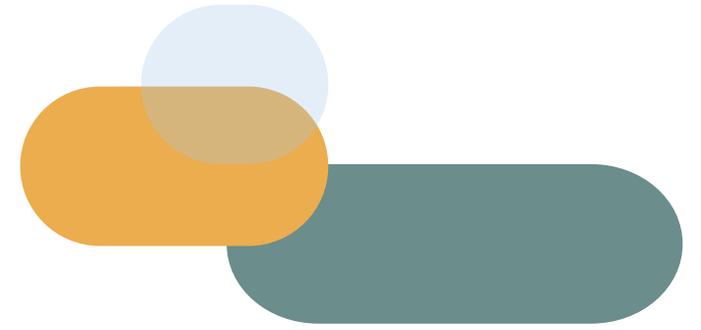- 75 - 100
- 50 - 75
- 25 - 50
- 1 - 25
- 0
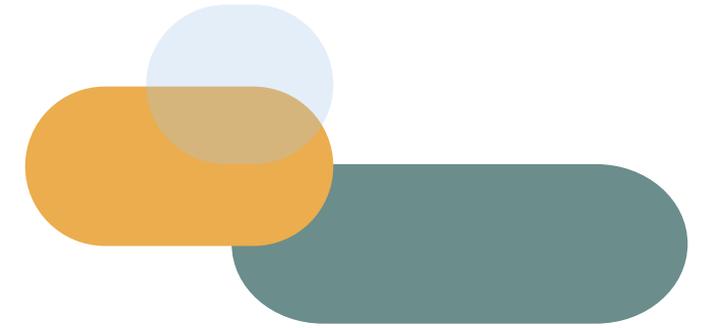
- **Rapid Deployment**: Scalable and cost-efficient for broad application.

- **Targeted Response**: Identifies and prioritizes imminent exposure risks.

- **Informed Decisions**: Enables proactive, data-driven upstream planning.

- **Efficient Decision-Making**: Supports quick action in high-risk zones.

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Thank you!