TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Dam Reservoir Management

Overview

TEMBO Africa dam reservoir management utilises cutting edge monitoring and control technologies to optimise the management of water resources and to enable effective electricity generation in hydroelectric dams, while averting potential risks. Specifically, the service preserves the equilibrium between water release and storage, and facilitates the precise regulation of water levels. This ensures efficient operation of dams, strengthening their infrastructure resilience, and reducing the risk of floods.

Where?

The service is being piloted in Ghana and Zambia, and will later be available for any country in Sub-Saharan Africa.

For whom?

The service is suitable for governments, and parastatal and private organisations responsible for dam operation.

Smart Gains for Smart Dams

📊 Informed **decision making** and better timing of releases.

🚨 Avoidance of **dam failure** and **flash floods**.

💸 Avoidance of **dam spillage**, which may cost dam operators about €1M/day.

⚙️ **Cost reduction** and **low maintenance costs**.

⚡ More stable **hydroelectricity** production.

🌊 Precise monitoring of **flow rate** and **seepage** control between upstream and downstream dams.

💧 Improved **water allocation** and **irrigation management**.

🌿 Improved **environmental** management downstream of the reservoir.

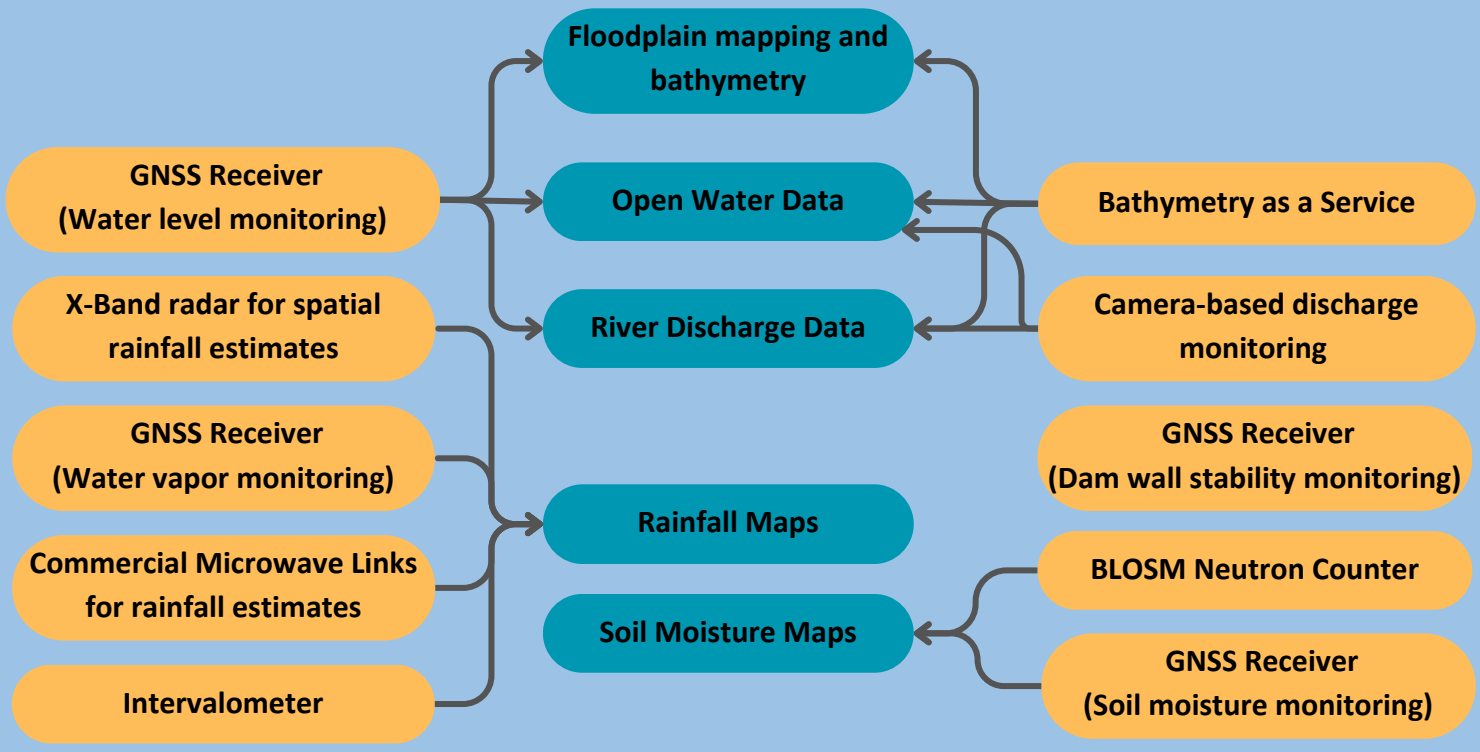
🕒 High temporal **resolution** (from seconds to minutes) of data measurements.

📈 Easy verification of data generated at dam sites and **simple visualisations** through customised dashboards.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

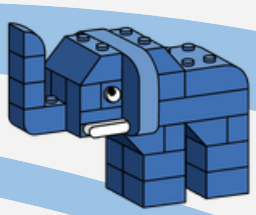
TEMBO Dam Reservoir Management is characterised by a "Lego®-ised" approach, leveraging a range of sensors and products, enabling its customisation and application under different conditions and needs.



Partners involved

TAHMO · TU Delft · GReD · MicroStep-MIS · SEBA Hydrometrie · AgroApps · Rainbow Sensing · University for Development Studies

Contact us and learn more!



temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Flood Early Warning Systems (FEWS)

Overview

TEMBO Africa FEWS leverage advanced forecasting technologies and data analysis to offer warnings to residents in flood-prone regions, enabling them to take proactive measures to protect themselves and their property. Involvement of representatives of the local population in operating the system helps create a community feeling in relation to the service. Alerts are sent via SMS, an app, or simpler methods like alarms and flags. The main advantage of this solution lies in its cost-effectiveness, as it uses alternatives to traditional, high-cost components like radar and stream gauges, making it suitable for mid-sized cities.

Where is it available?

The service is being piloted in Kenya and Ghana, and will later be available in any country of Sub-Saharan Africa.

To whom it refers?

TEMBO Africa FEWS are designed for urban areas in Africa with a population of less than 700,000 people.

Smart Solutions for safer communities

🚨Risk reduction for the population through localised and **real-time warnings**.

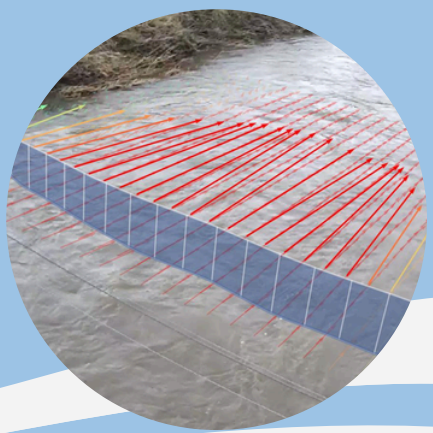
💸Provision of a **cost-effective** and innovative solution that is embedded in the local structure.

🧰Use of available resources (financial & human), setting up a service that ensure **sustainability**.

⚙️Easy sensor maintenance, repair, and operation by local staff, reducing costs and **eliminating the need for external experts**.

📈Improved ability to assess, monitor and manage financial and planning risks via **flood risk assessment**.

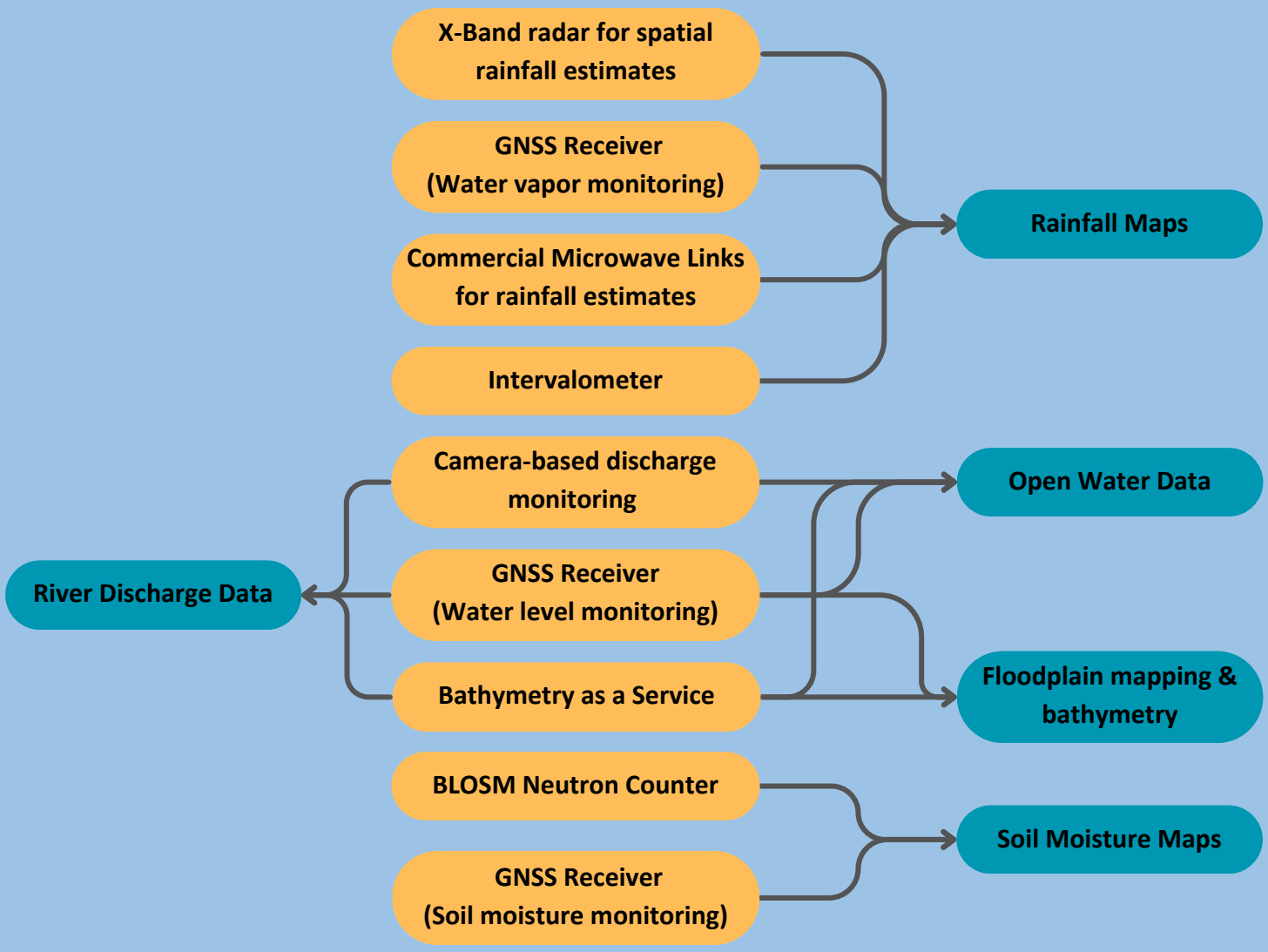
🏠Mitigation of **asset** damages.



This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

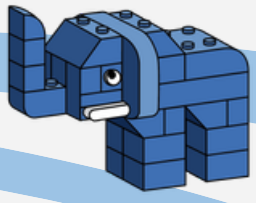
TEMBO FEWS are characterised by a "Lego®-ised" approach, leveraging a range of sensors and products, enabling their customisation and application under different conditions and needs.



Partners involved

TAHMO · TU Delft · GReD · SEBA Hydrometrie · AgroApps · MicroStep-MIS · Rainbow Sensing

Contact us and learn more!



temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Germination Insurance

Overview

TEMBO Africa germination insurance is an index insurance paying farmers if in the days after sowing there is insufficient precipitation, due to the delay of the onset of the rainy season or due to a prolonged dry spell within the season. It provides farmers financial security by guaranteeing they can replant without incurring substantial financial losses. Smallholder farmers, in particular, benefit greatly from this service, which helps stabilise their livelihoods and promote regional food security. This service can either be sold to farmers as a standalone service or it can be bundled with other products, like the provision of seeds, other types of insurances, etc.

Where?

The service will initially be provided in Kenya, Zambia, and Ghana, and will later be available in any country of Sub-Saharan Africa.

For whom?

Germination insurance can be sold in cooperation with governments, insurance providers, seed companies, input dealers, inclusive finance providers, etc.

Rooted in insights, ready for impact

☁️Use of meteorological data and models that trigger automatic and **efficient payouts** and **minimise false positives**.

📍 High accuracy due to **TAHMO stations'** local meteorological data.

📊Instantly accessible data in a **client-friendly** format for decision-making.

🗓️Consultancy on **optimal seeding times**, minimising germination failure and consequently the need for compensation payment.

⚠️Additional **information for farmers**, such as pests and diseases warnings.

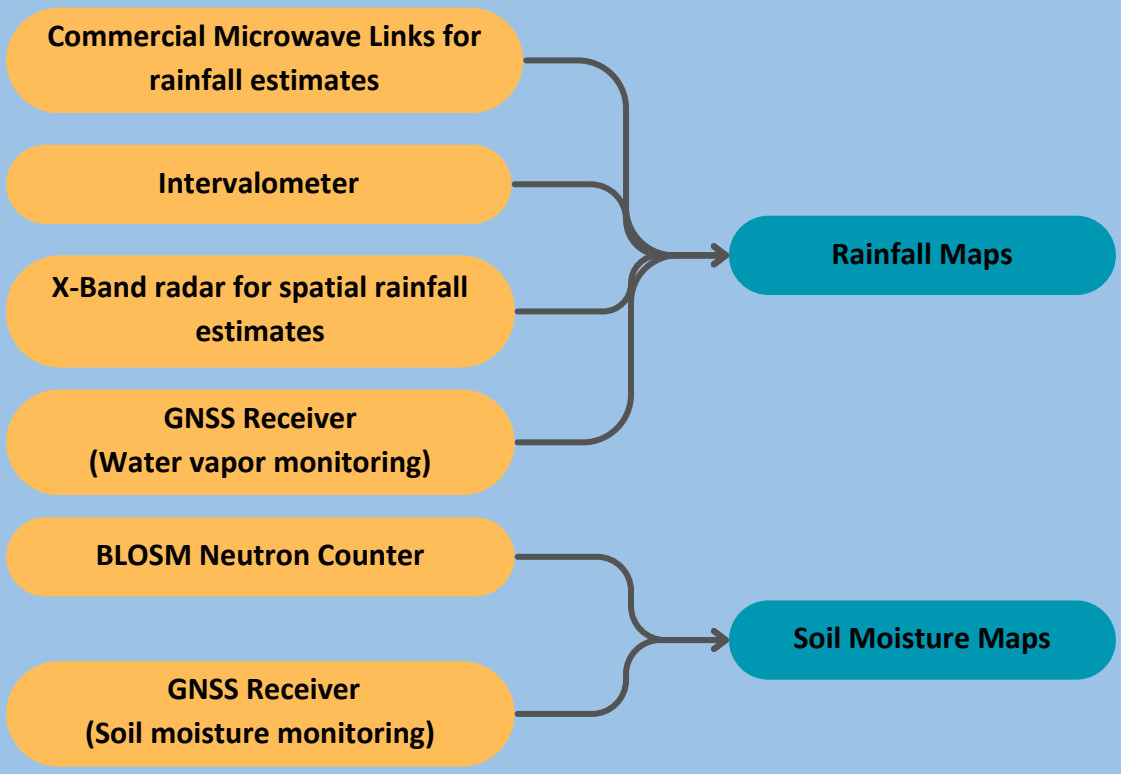
🤝Encouraging other parties to **invest** in farms using germination insurance and enables farmers to access additional **financial services**, such as loans.

🌱Assurance of germination success, stabilising supply chains and reducing production uncertainty for **aggregators** and **buyers**.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

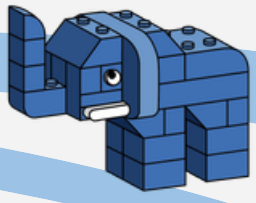
TEMBO Germination Insurance is characterised by a “Lego®-ised” approach, leveraging a range of **sensors** and **products**, enabling its customisation and application under different conditions and needs.



Partners involved

GHANA AGRICULTURAL INSURANCE POOL · TU Delft · AgroApps · TAHMO · MicroStep-MIS · GReD · UNIVERSITY FOR DEVELOPMENT STUDIES

Contact us and learn more!

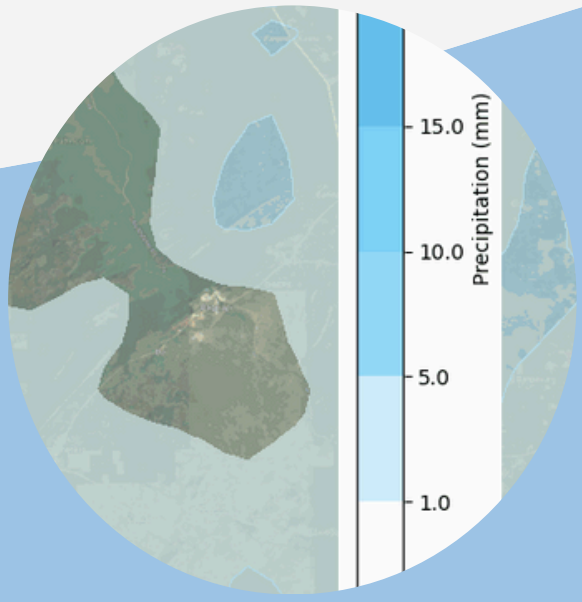


temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Rainfall Maps



Overview

TEMBO Africa Rainfall Maps provide information about precipitation height in mm, representing the depth of water that would accumulate on a flat surface, if all rain remained where it fell. They offer a spatial resolution of 5 km and update every 3 hours, and are produced at basin and (sub-)continental scale. For this purpose, they make use of data from TAHMO hydrometeorological stations, satellites, commercial microwave links, X-band radar, intervalometers and GNSS, where appropriate.

Where?

Rainfall maps can be applied anywhere in Sub-Saharan Africa under the condition that sufficient TAHMO stations are present in the area of interest.

For whom?

Ideal for flood early warning providers, dam managers, agriculture insurance providers, water authorities, agri-finance providers, and meteorological agencies.

Smart Rainfall Data for smarter decisions

🌧️**Timely** and **precise** information for decision-making related to water management, agricultural insurance and hydropower provision.

🔍High **resolution**.

🔁Frequent **updates**.

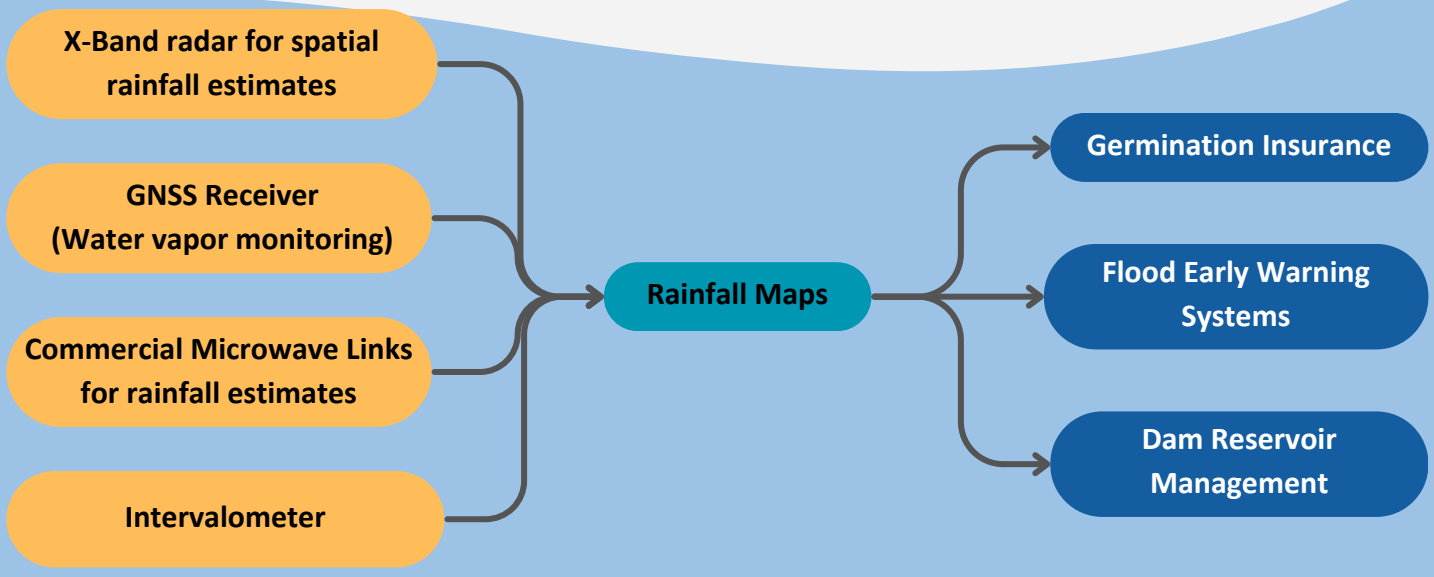
💸**Cost-effective** generation of the desired information.

📊Combination of **different data sources**.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

TEMBO Rainfall Maps are characterised by a "Lego®-ised" approach, integrating a range of **sensors** and enabling customisation and application under different conditions and needs, while can be leveraged by all **TEMBO services**.



Specifically:

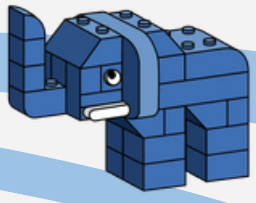
- X-Band Radar provides fine-scale spatial rainfall estimates with fast update rates.
- GNSS Receivers monitor atmospheric water vapor, improving rainfall prediction accuracy.
- Commercial Microwave Links offer cost-effective, real-time rainfall measurements by analyzing signal attenuation between mobile towers.
- Intervalometers deliver ground-truth rainfall intensity and type data at key locations.

All these inputs are assimilated, and combined with data from the GFS Global Model for the selected area, utilising a weather forecasting model. Following, a post-processing step refines the forecasts to produce Rainfall Maps.

Partners involved in Rainfall Maps

TU Delft · MicroStep-MIS · TAHMO · AgroApps

Contact us and learn more!



temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Soil Moisture Maps

Overview

TEMBO Africa Soil Moisture Maps provide information about how much of the rainfall runs off over the surface, how much is stored in the rootzone to feed crops and vegetation, and how much seeps down to replenish the groundwater. For this purpose, a combination of data from TAHMO hydrometeorological stations, satellites and the BLOSM sensors is leveraged, while the same procedure as the Copernicus European Flood Awareness System is used. These maps are scalable across the entire continent and feature a low latency of two days.

Where?

The soil moisture maps are first made for the Volta basin in Ghana and the Luangwa basin in Zambia, with a resolution of 1 km. They can then be scaled up for the whole continent, with a low latency of 2 days.

For whom?

Ideal for stakeholders interested in providing Flood Early Warnings, dam reservoir managers, and agriculture and feedstock insurance providers.

Precision soil data for smarter decisions

🌱Information on **root zone** water balance, essential for crop health and water resource planning.

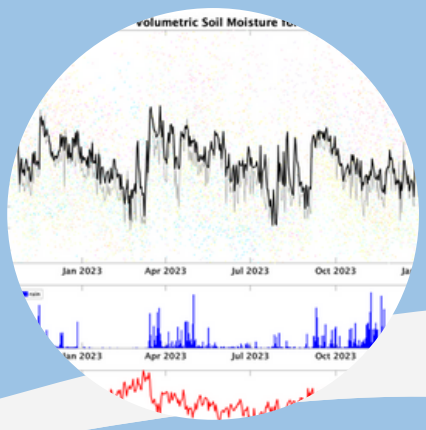
📊**Fair** and **data-driven** insurance schemes with high-resolution data (down to 1 ha) minimizing disputes and enhancing trust between farmers and insurers.

💧Insights into how much water the land can **absorb** before runoff occurs, supporting flood early warnings and dam reservoir management.

📈**Bias removal**, ensuring accurate and timely data for various applications.

💸**Cost-effective** generation of the desired information.

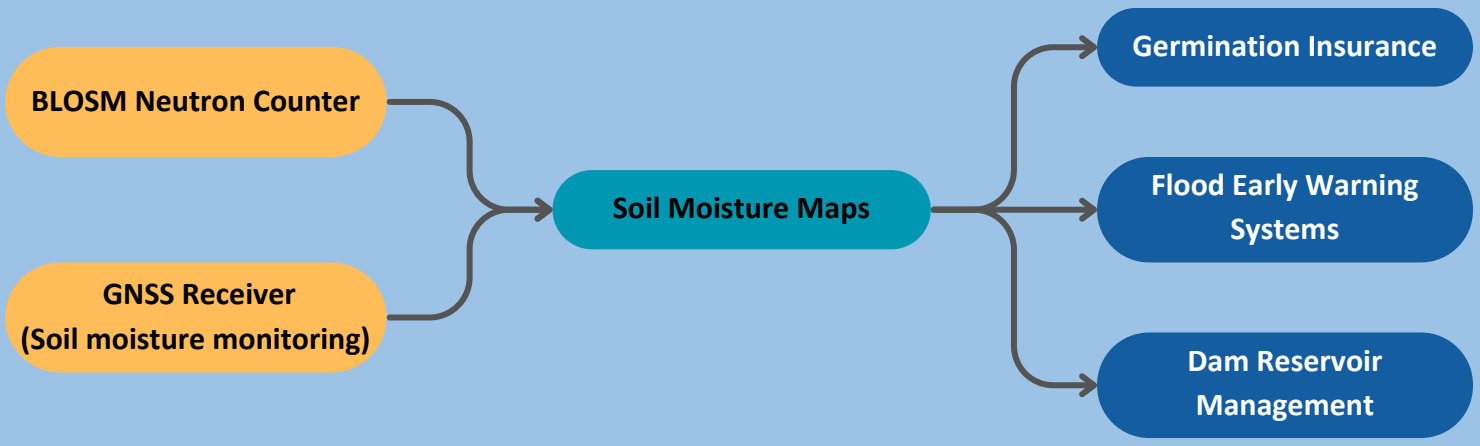
🔍Improvement of the **accuracy** of existing satellite-based soil moisture products, e.g. RZSM-ASCAT-NRT-10.



This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

TEMBO Soil Moisture Maps can combine two different **sensors**, while can be leveraged by all **TEMBO services**, under a "Lego®-ised" approach.



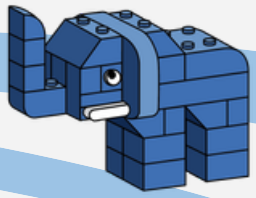
Specifically:

- The BLOSM Neutron Counter captures soil moisture variations across wide areas and at root-zone depth, offering continuous, reliable data at the scale of satellite pixels.
- The GNSS Receiver supports soil moisture monitoring by collecting additional environmental parameters and ensuring high-precision geolocation of measurements.

Partners involved in Soil moisture Maps

UNIVERSITY FOR DEVELOPMENT STUDIES
TU Delft
TAHMO
MicroStep-MIS
GReD

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Open Water Data

Overview

TEMBO Africa Open Water Data delivers critical information about water bodies (rivers, floodplains, lakes and reservoirs) generating:

- **River discharge time-series**, recording the volume of water flows.
- **Operational Maps**, illustrating the extent of open water surfaces.
- **Bathymetry Maps**, indicating the underwater depth variations.

These outputs are enabled by the use of low-cost cameras and other affordable technologies, eliminating the need for repeated site visits to measure different water levels.

Where?

Open Water Data is piloted in Ghana and Zambia (dam reservoir management) and Kenya (flood early warning), and is available anywhere in Sub-Saharan Africa, subject to availability of the required sensors.

For whom?

Ideal for stakeholders interested in providing Flood Early Warnings and dam reservoir managers.

Smarter and faster monitoring of water

💸**Cost reduction**.

👷**No need** to construct a stage-discharge curve by revisiting the site at different water levels many times.

📡Determination of **area-discharge curves**, whereby areas can be determined by satellites.

🌊On site recording of flow velocity and discharge data in **real time** including proof-images.

💧Better management of the **volume** of water that is stored and released from dams.

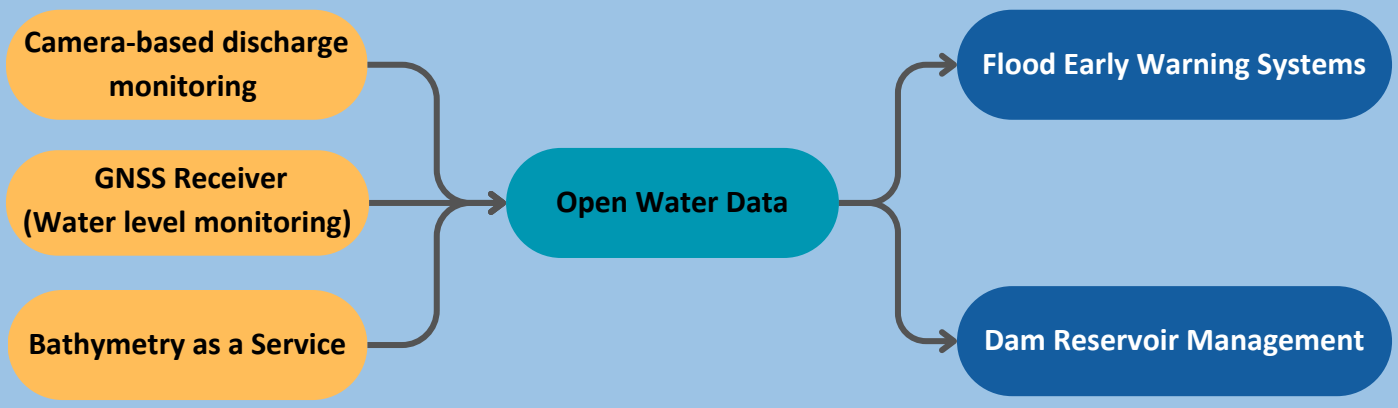
🚨Early **alerts** and better preparedness in the case of floods.

⚙️**Scalability**.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

TEMBO Open Water Data are characterised by a "Lego®-ised" approach, combining different **sensors** to customise solutions based on the needs of each water body, supporting two **services**.



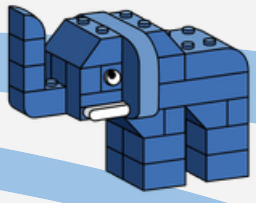
Specifically:

- Camera-based monitoring tracks surface changes like water extent and level. When combined with bathymetry and GNSS, it can also support accurate volume and flow estimations.
- GNSS water level monitoring measures real-time water height. Together with bathymetry, it helps estimate how much water is stored or flowing.
- Bathymetry as a Service maps the underwater shape of rivers, lakes, and reservoirs, improving the understanding of volume, capacity, and flood risks.

Partners involved in Open Water Data

TU Delft · TAHMO · GReD · Rainbow Sensing · SEBA Hydrometrie

Contact us and learn more!

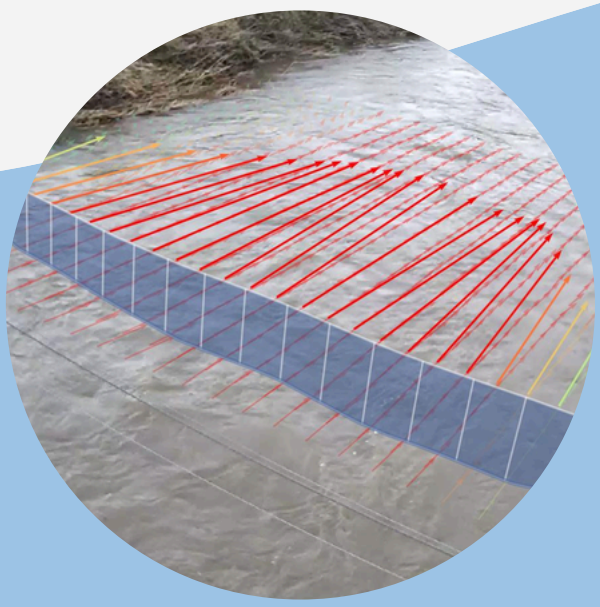


temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

River Discharge Data



Overview

River discharge refers to the volume of water flowing through a river channel over a given period, typically expressed in cubic meters per second (m^3/s). Monitoring river discharge is essential for understanding water availability, flood forecasting, hydropower management, irrigation planning, etc. TEMBO provides an innovative approach for monitoring river discharge, eliminating the need for traditional repetitive and costly field measurements.

Where?

River Discharge data can be offered in Ghana (through TAHMO Ghana), Kenya (through TAHMO Kenya), and Zambia (through LocalDevices Technologies Zambia Ltd.)

For whom?

Ideal for stakeholders interested in providing Flood Early Warnings, dam reservoir managers, water management authorities and hydro-meteorological agencies.

Better monitoring for safer rivers and smarter water management

⚙️Suitable for both **small** and **large** rivers.

🚨 Improved flood forecasting, detecting changes quickly to **protect** communities and infrastructure.

⚡Better planning and operation of dams and **hydroelectric** facilities.

🌊 Accurate water availability insights, supporting **sustainable** management of water resources.

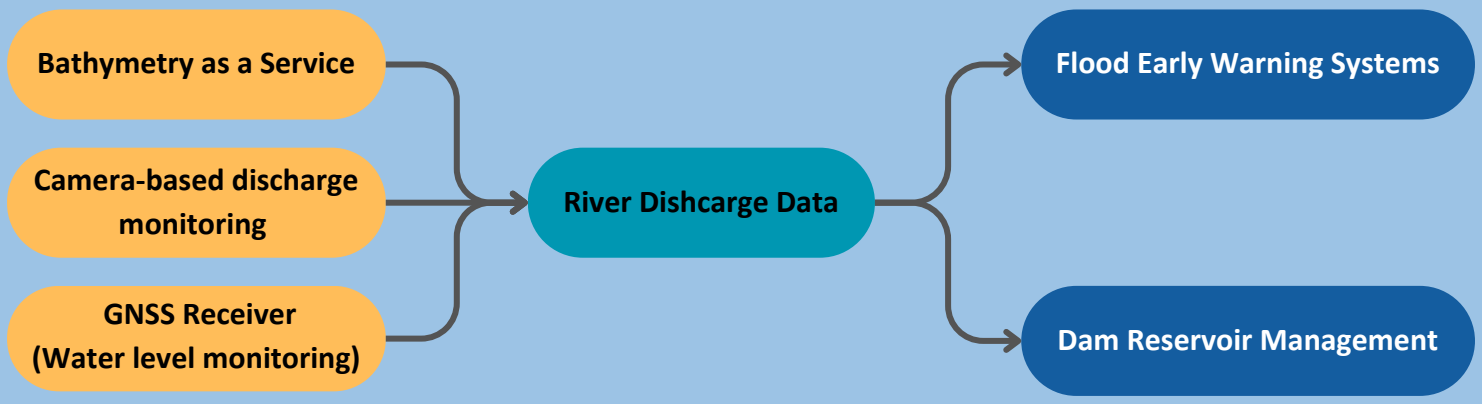
💸Reduced costs.

👷**Reduced labour-intensive** field efforts.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

TEMBO River Discharge Data are characterised by a "Lego®-ised" approach, integrating a range of sensors and enabling customisation and application under different conditions and needs, supporting two services.



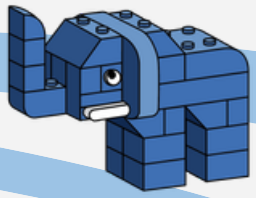
Specifically:

- Camera-based discharge monitoring can function independently to estimate river discharge by analysing surface velocity, but the estimates are stronger if calibrated with water level and cross-section bathymetry data.
- GNSS water level monitoring can also operate independently to track changes in water height, but when combined with bathymetry, it can also provide full discharge (volume) data.
- Bathymetry as a Service delivers essential riverbed maps that help improve discharge calculations by accurately measuring the river's shape and size.

Partners involved in River Discharge Data

Rainbow Sensing · TAHMO · TU Delft · SEBA Hydrometrie · GReD

Contact us and learn more!



temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Floodplain Mapping & Bathymetry

Overview

Bathymetric data of floodplains is essential to establish river discharge from either in-situ or satellite remote sensing. TEMBO Africa Floodplain Mapping & Bathymetry service produces seamless bathymetry/topography maps of floodplains, converting existing remote sensing data on surface area and river width into wetted profiles and reservoir volumes. This is done on a regular basis to keep the bathymetry for discharge estimates and hydraulic simulations up-to-date. The service is based on the use of UAVs and fish-finders, while the depth range is up to 100 meters.

Where?

So far, input is provided for dam reservoir management in Ghana and Zambia and for flood early waring in Kenya, while the product will be made available for any part of Sub-Saharan Africa.

For whom?

Flood Mapping & Bathymetry can be used by dam reservoir managers, water authorities and stakeholders interested in providing Flood Early Warnings.

Mapping made simple

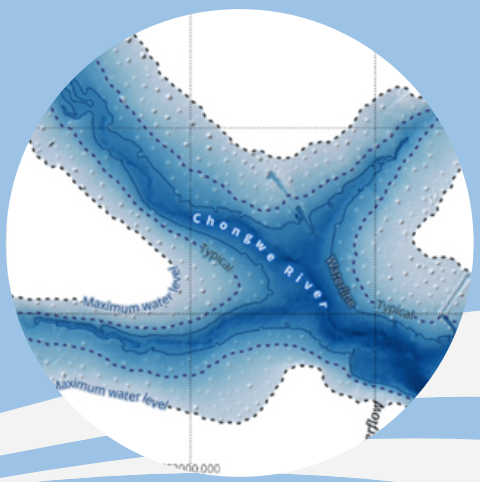
🔁 Keeps the bathymetric data for discharge estimates and hydraulic simulations **up-to-date** (essential for floodplains).

💡 Allows monitoring of **sedimentation** processes and planning of **sediment flushes**, (important for dam reservoirs).

⚙️ Can be made with **local**, easy to source materials.

👷 Can be operated by **local entities**, eliminating the need for costly international contractors.

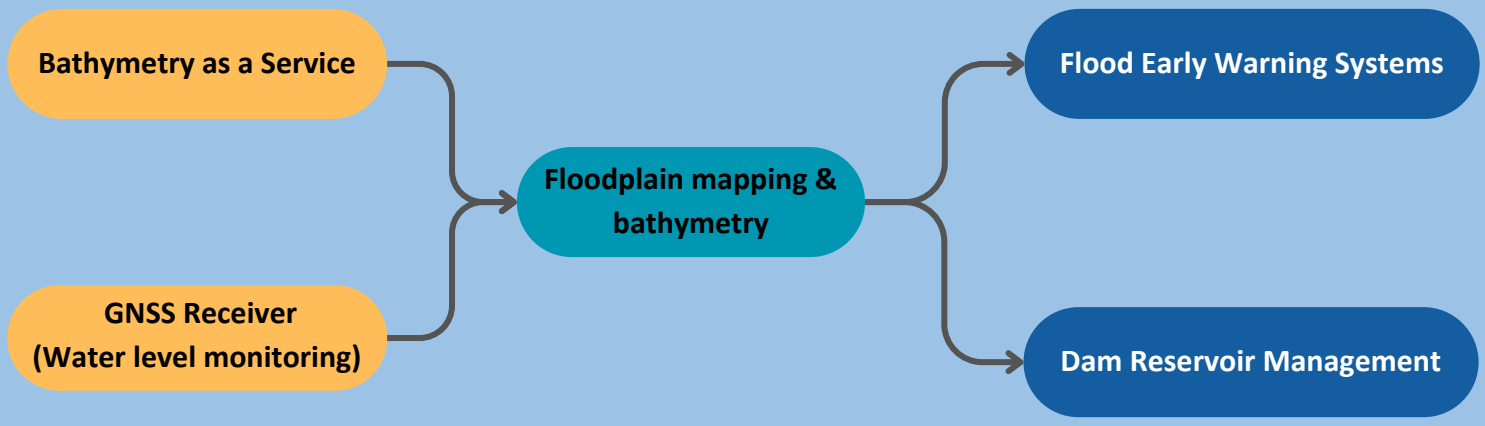
💸 Up to **90%** cost reduction compared to traditional survey methods, without compromising data quality.



This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

Flexible, customizable, and adaptable!

TEMBO Floodplain Mapping & Bathymetry follows a “Lego®-ised” approach, combining different **sensors** and enabling customisation and application under different conditions and needs, supporting two **services**.



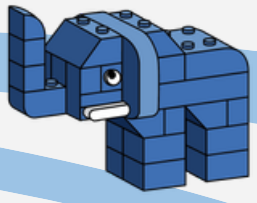
Specifically:

- Bathymetry as a Service provides detailed underwater topography, improving flood modelling, reservoir management, and flood risk assessments.
- GNSS water level monitoring tracks how water levels change over time, helping map floodplain extents more accurately.

Partners involved in Floodplain Mapping and Bathymetry

Rainbow Sensing · GReD · TU Delft · TAHMO

Contact us and learn more!



temboafrica.eu · info@temboafrica.eu · TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Commercial Microwave Links for rainfall estimates

Overview

TEMBO Africa Commercial Microwave Links use the signal between the cell towers of the mobile network to provide rainfall estimates. Specifically, when rain falls along the link, the signal is attenuated, and the companies adjust their power output accordingly. Thus, by monitoring these changes, it's possible to estimate rainfall in real time.

Where?

A mobile operator in Ghana is engaged, and an operational rainfall map is generated from CML data. After this pilot deployment, the initiative will be extended to cover not only Ghana, but also Zambia and Kenya.

For whom?

Ideal for dam reservoir managers, stakeholders interested in providing Flood Early Warnings, and crop insurance providers.

From CML towers to valuable insights

⚙️**Low complexity** hardware solutions, with easy to replace parts, that can be maintained locally, as much as possible.

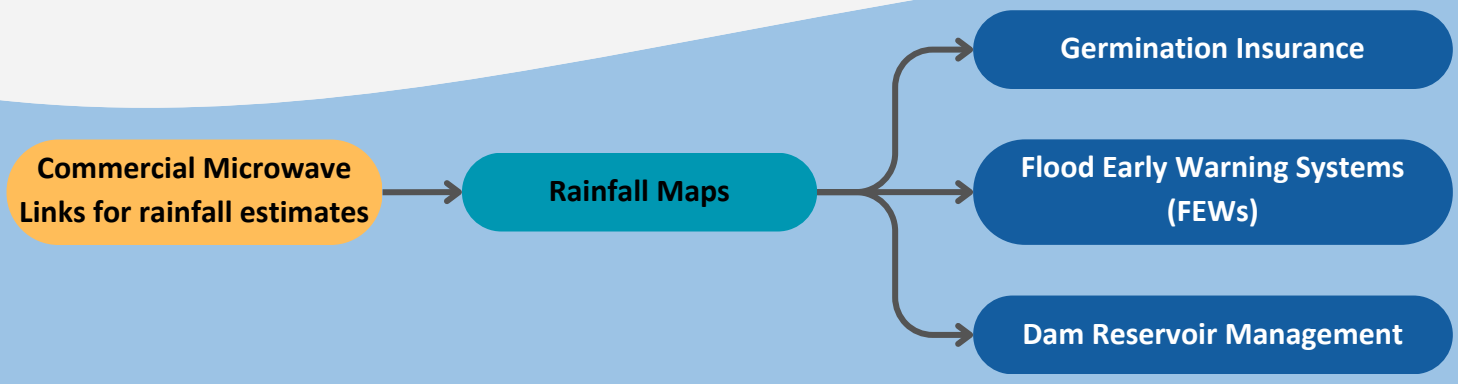
💧**Accurate** rainfall measurements, addressing the sparse coverage of meteorological networks in sub-Saharan Africa, where rainfall intensity and amounts can vary significantly over short distances.

💡**More accurate** and **cheaper** than rain gauges and satellite data.

📈Useful for **calibrating** rainfall maps (from satellite data) and hydrological models, leading to improved forecasts.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A sensor that can be used for one of the TEMBO products, while it can be leveraged by all services, thanks to a broader “Lego®-ised” approach!



How it works

Signal transmission between towers
Microwave signals are continuously transmitted between pairs of telecom antennas (cell towers).

Rainfall causes signal attenuation
When it rains along the signal path, raindrops weaken (attenuate) the signal strength.

Power adjustment by telecom operators
Telecom companies automatically adjust the signal power to maintain quality, responding to the rain-induced loss.

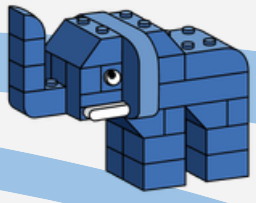
Data collection & monitoring
TEMBO Commercial Microwave Links sensor collects this power adjustment data and monitors how much the signal was attenuated.

Rainfall estimation
Using known relationships between signal attenuation and rainfall rate, the system estimates how much rain has fallen along a specific area.

Partners involved in Commercial Microwave Links

TU Delft TAHMO

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

X-Band radar for spatial rainfall estimates

Overview

TEMBO Africa X-Band radar is a small radar for spatial rainfall estimates, which scans its environment, using X-band rays with a frequency of 9410 MHz up to a distance of 200 km. It detects precipitation as low as 10 dBZ, reconstructing the wind field, and providing real-time insight into the weather.

Where?

The system can be applied all over Sub-Saharan Africa, while a pilot is being implemented in Ghana.

For whom?

Ideal for stakeholders interested in providing flood early warnings, dam reservoir managers, crop insurance providers, meteorological agencies, aviation, and farming and fishing sectors.

Small, smart and simple

💸 **5 times cheaper** than the traditional C-band radar.

⚡**40 times lower consumption** in contrast to C-band radar, being ideal for areas with limited power infrastructure.

⚙️ **Reduced installation** and **maintenance costs** compared to standard large meteorological radars, thanks to its smaller size and simpler construction.

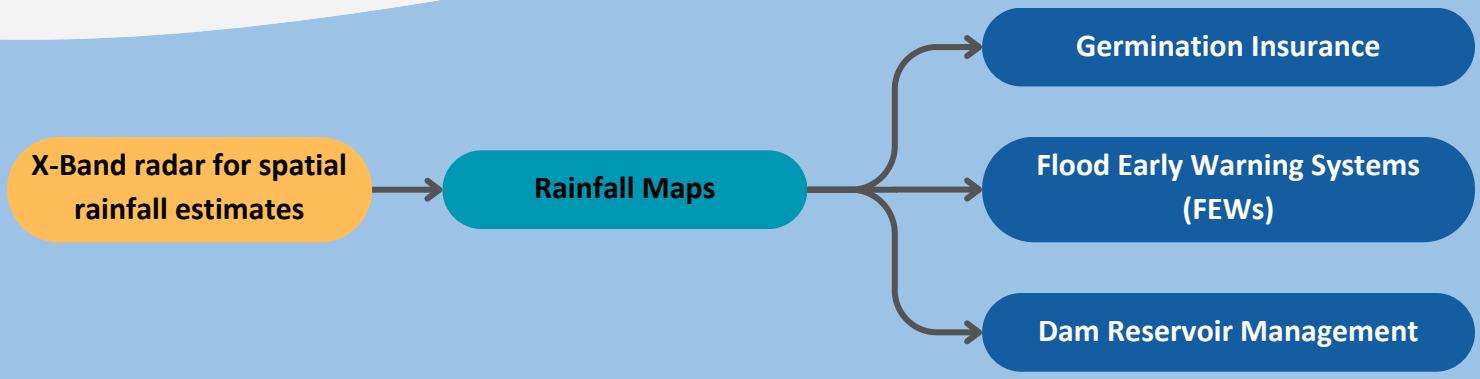
👷Can be supported and maintained by **local technicians**, reducing dependency on specialised external support.

🔁**Faster data update** rates, achieving a full 3D scan in 1 minute versus 5 minutes of the C-band, enhancing real-time weather monitoring and nowcasting.

💡Additional uses in FFG, aviation, fishing, and farming.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A sensor that can be used for one of the **TEMBO** products, while it can be leveraged by all services in the context of a "Lego®-ised" approach, which enables flexible integration with other systems!



How it works

Scanning of the atmosphere
The radar scans the surrounding atmosphere by emitting X-band microwave pulses (9410 MHz) up to a 200 km range.

Precipitation and wind detection
The radar identifies rainfall intensities as low as 10 dBZ and reconstructs wind movements in real time.

3D Data Generation
A full atmospheric scan is performed every minute, much faster than traditional systems.

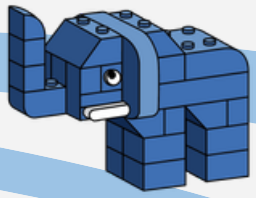
Edge data processing and transmission
The data of the scans are processed locally through edge computing and can be transmitted to external platforms at 2–3 Mbit/s.

Data integration
Transmitted data are integrated with other platforms for real time monitoring and decision support.

Responsible partner for the X-Band radar

MicroStep-MIS

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Intervalometer

Overview

TEMBO Africa Intervalometer provides insights in the structure of rainfall as it reaches the ground, measuring drop arrivals on a drum. By capturing when each drop hits, the device helps distinguish between different rainfall-producing mechanisms (like steady rain, showers, or storms), while the generation of such high-precision data can also be used to improve and calibrate satellite-based rainfall estimates.

Where?

50 intervalometers are planned to be placed at TAHMO stations in Ghana and Zambia.

For whom?

Intervalometers are ideal for agriculture insurance, flood early warnings and dam reservoir management.

From raindrops to insights

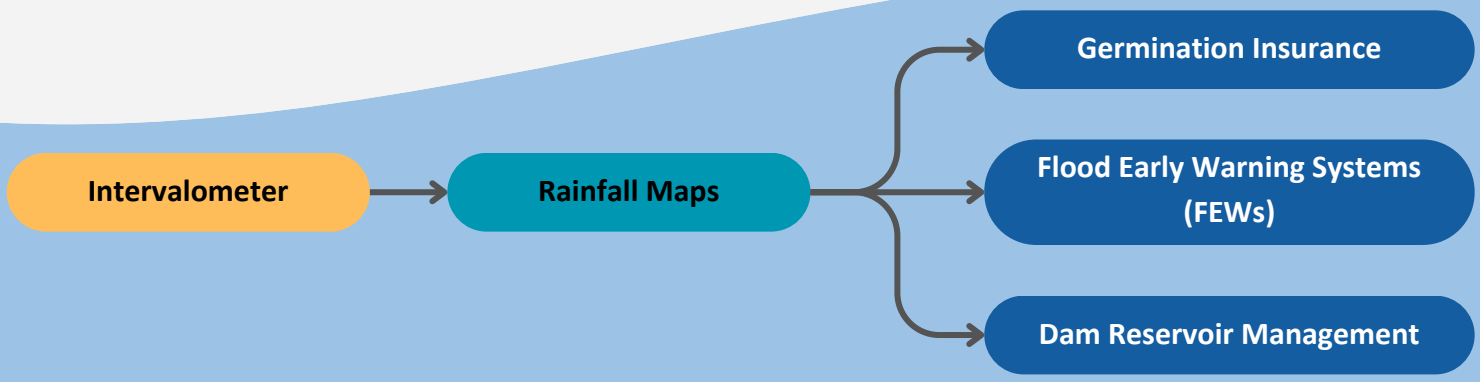
💸Very **low-cost** precipitation measurements (The current alternative is the use of laser disdrometers, which cost € 3,000 or more).

🌧**Additional rainfall info**, with real-time intensity measurements, which matters for run-off and water storage, as well as information about the type of rainfall.

🛡**Less affected** by dust and insects in contrast to the laser disdrometer.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A sensor that can be used for one of the TEMBO products, while it can be leveraged by all services, thanks to a broader 'Lego®-ised' approach!



How it works

Raindrop hits the drum
A raindrop falls onto a small 15 cm² drum surface, which contains a piezo-electric sensor underneath.

Signal generation
When a drop strikes the drum, the piezo element generates a tiny electrical pulse corresponding to that impact.

Signal processing
This signal is sent to a connected processing unit that records rainfall structure and intensity.

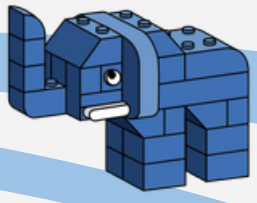
Data interpretation
The above records are analysed to distinguish different rainfall types (e.g., steady vs. convective storms), assess rainfall dynamics, and monitor rainfall intensity in real-time.

Improvement of satellite and radar data
The fine-grained arrival data supports real-time calibration and validation of satellite-based rainfall estimates and radar retrieval algorithms.

Responsible partner for the Intervalometer

TU Delft

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

BLOSM Neutron Counter

Overview

The TEMBO Africa BLOSM neutron counter is a device for measuring the thermal/fast ratio of neutrons in the atmosphere, which is representative of the soil moisture content in a 300 m radius area. The device is effective down to 50 cm below the surface, making it suitable for monitoring root-zone soil moisture.

Where?

BLOSMS will be placed in Ghana and Zambia.

For whom?

BLOSM is ideal for germination insurance providers, entities interested in providing flood early warnings, and dam reservoir managers.

From neutrons to insights

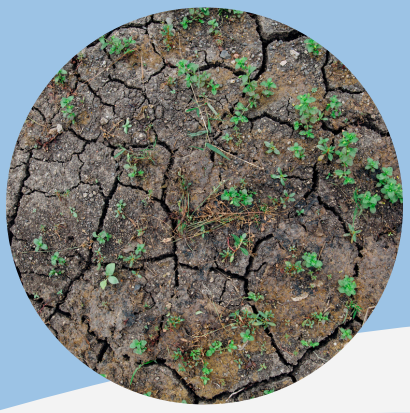
📍Information **over an area**, in contrast to traditional sensors that provide information only at the location of the sensor.

🕒**Real-time** information up to **50 cm** depth, capturing local variation, in contrast to satellite imagery which provides information once in 5 days and only about the topsoil.

💸**Cost-effective** alternative to neutron probes using Helium-3 (of which there are only five such instruments in Sub-Saharan Africa, because of the high price).

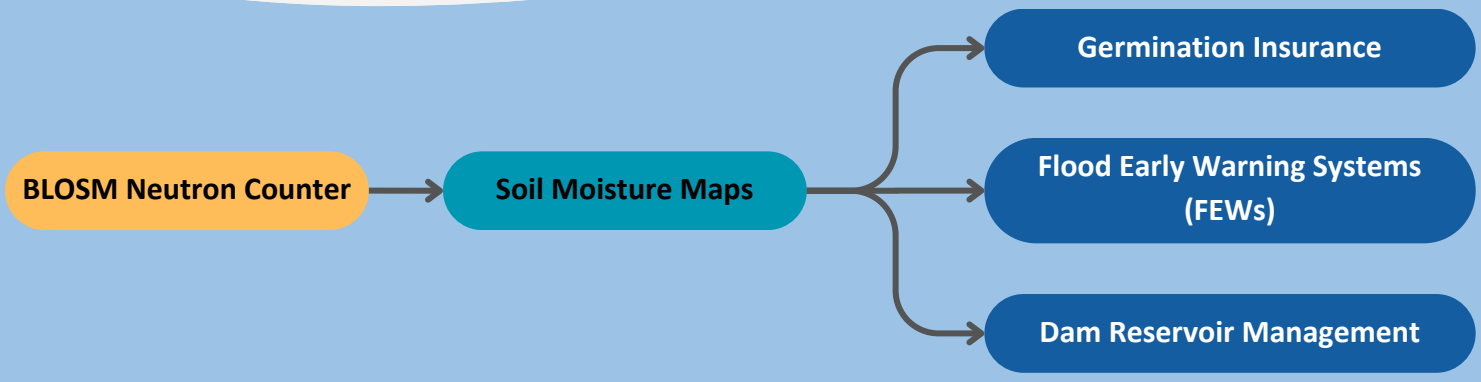
💡Ideal for **ground-truthing satellite** soil moisture calibration, providing real-time data at the scale of satellite pixels or model elements, and filling gaps between satellite overpasses.

📈Designed for **large-scale use**, with one single field device with SDI-12 and RS485 serial bus connectors for logging, unlike traditional sensors limited to specific locations.



This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A sensor, that can be used for one of the TEMBO products, while can be leveraged by all services, under a broader 'Lego®-ised' approach!



How it works

Neutron detection
The sensor contains two boron-based neutron detectors: One detects neutrons moderated by water, and the other detects fast neutrons.

Signal collection
The signals from the two detectors is fed to the evaluation electronics through pair of photo-multipliers.

Signal processing and filtering
The evaluation electronics processes the signals to distinguish signals from neutron from signals caused by other sources (gamma particles).

Neutron comparison
The system compares the count of moderated neutrons to fast neutrons.
(More moderated neutrons = higher soil moisture/Fewer moderated neutrons = drier soil)

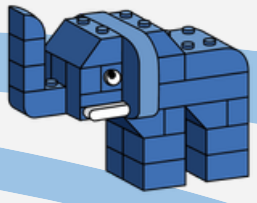
Data output
The output of the system is provided using meteorology standard SDI-12 interface and RS485 serial bus.

Partners involved in BLOSM Neutron Counter

TU Delft

MicroStep-MIS

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

GNSS Receivers

Overview

TEMBO's low-cost GNSS sensors are versatile tools for near-real-time monitoring. They measure ground and structural movements with sub-millimetre precision, water levels and soil moisture by analysing satellite signal reflections, and support weather forecasting by capturing atmospheric water vapor. Operating reliably in almost any weather, each station can fulfill multiple functions—offering a compact, cost-effective solution for high-precision environmental and structural monitoring.

Where?

The service will first launch in Kenya, Zambia, and Ghana, and then expand across Sub-Saharan Africa.

For whom?

GNSS receivers are ideal for entities interest in providing flood early warnings, dam reservoir managers, agriculture insurance providers, environmental services providers, and other entities managing critical infrastructure.

Real-Time Monitoring that matters

🛡️ **Enhanced safety** for dams, mines, bridges, slopes, and other critical infrastructure.

🔁 **Automated, continuous data** with near real-time updates.

📈 **Accurate 3D displacement** data, easy to visualise and interpret.

☁️ **All-weather reliability** for uninterrupted monitoring.

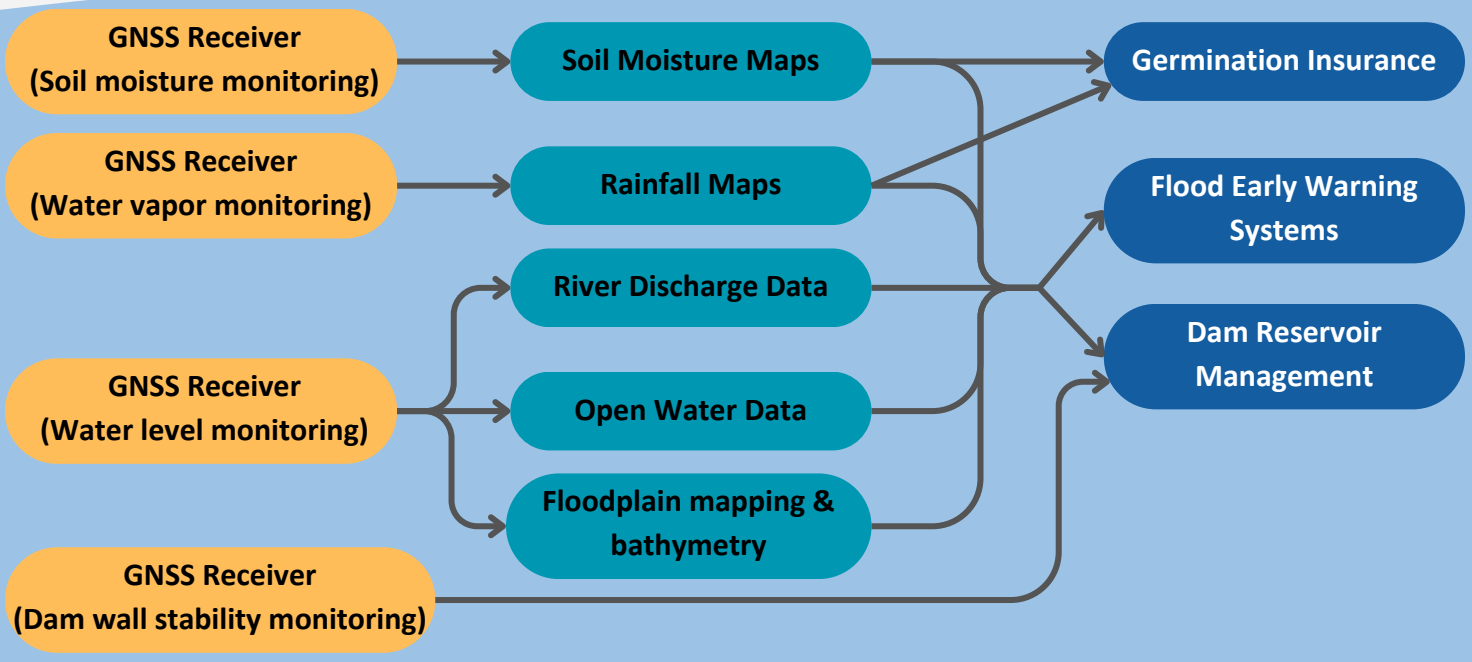
💡 **Multi-purpose stations** and cross-sector use (civil protection, water, agriculture, mining, geotech, climate projects, etc).

💸 **Cost-effective and scalable**, from single sites to full networks.

🚨 Enables smarter decisions and **early warnings**, boosting resilience.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

One sensor, multiple applications leveraged by all TEMBO products and services, thanks to a “Lego®-ised” approach!



How it works

Signal reception

The receiver collects signals from multiple GNSS satellites (like GPS, Galileo) and by calculating the time it takes each signal to arrive, it determines its exact position.

Soil moisture monitoring: Signals reflected from the soil surface are analysed to estimate soil moisture.

Water vapor monitoring: Signal delays caused by atmospheric water vapor are measured for weather forecasting.

Water level monitoring: Signals reflected off water are analysed to estimate water levels.

Dam wall stability monitoring: The relative positions of GNSS receivers installed on the dam wall and stable reference points, are analysed to detect millimetric-level displacements in near real-time.

Data transmission

Data are sent to the cloud to be processed.

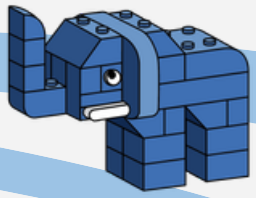
Data access

Cloud based platforms allow visualisation, management of alerts, and further analysis.

Partners involved in GNSS Receivers

GReD TU Delft

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Camera-based discharge monitoring

Overview

TEMBO Africa offers real-time water level and discharge data in rivers and canals, using a camera taking videos at regular intervals. For river up to 50 meters, a small camera system, the "PtBox" is available and can be paired with one of the following software:

1. DischargeKeeper Light, using the proprietary and patented SSIV software, with a Maintenance and Support from SEBA Hydrometrie.
2. OpenRiverCam, a fully scalable open-source solution with a local Maintenance and Support contract with our local vendors.

For wider rivers, a larger system, the DischargeKeeper is, is available from SEBA Hydrometrie.

Where?

Ghana - contact: TAHMO Ghana
Kenya - contact: TAHMO Kenya
Zambia - contact Local Devices Technologies Zambia Ltd.

For whom?

Ideal for organizations seeking to provide flood early warnings, enhance situational awareness, and monitor dam inflows/outflows and irrigation schemes.

Monitoring made smarter and safer

👷**Non-contact** discharge monitoring, avoiding dangerous and labour-intensive methods.

🌊**Real discharge** measurements rather than water level estimates, extremely useful for e.g. short-term flood forecasting.

⚙️**Flexible installation** on riverbanks, suitable for various locations

💸**Affordability** and **scalability**.

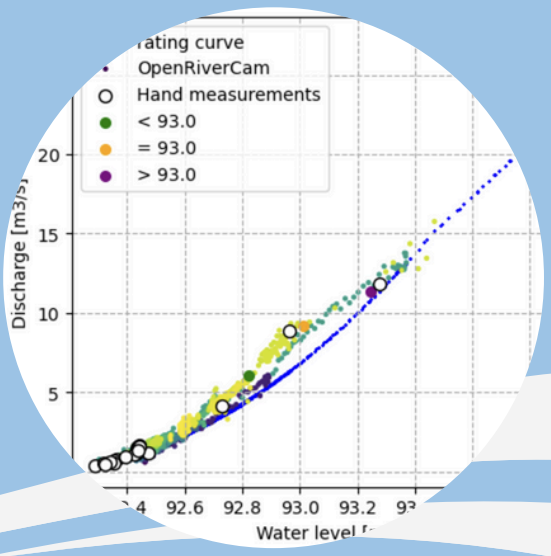
🔧**Low complexity** hardware, with easy to replace parts and little maintenance.

👷**Easy installation** by a hired professional or the user.

⚙️**No limitation on the water depth**.

🌐**Multiple software hosting options**: international, local, or on-premise.

🌐**Web-based platform** and **API** for data retrieval and integration.



This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A sensors solution, that supports one of the TEMBO products, while can be leveraged by two services thanks to a “Lego®-ised” approach!

Camera-based discharge monitoring

↓

River Discharge Data

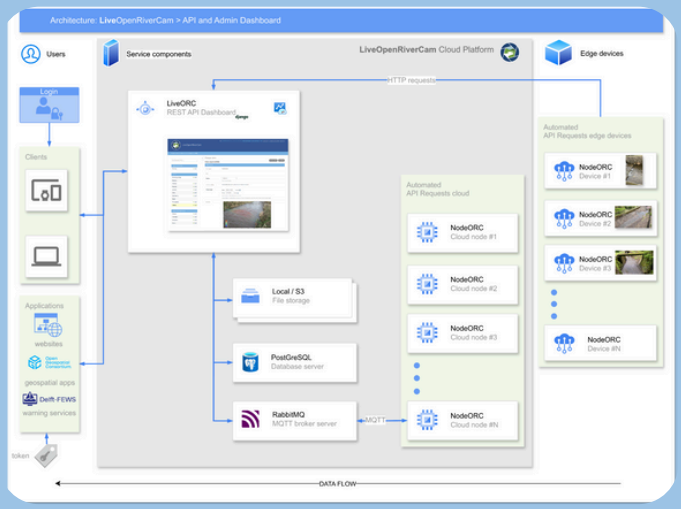
↓

Dam Reservoir Management

Flood Early Warning Systems

Your Sensor: PtBox, a Raspberry Pi-based system that records, processes and transmits videos, water level and discharge

Your Data: Time series views, downloads or scripted access through the Discharge App (proprietary) or LiveORC API (open-source).



How it works

Find a suitable site

↓

Set up a mast and power supply

↓

Install our camera system

↓

Measure some coordinates on both banks and a bottom profile

↓

Calibrate the camera with on-board OpenRiverCam (open-source) or SSIV (proprietary) software

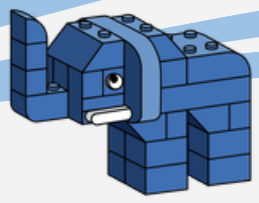
↓

Check if everything works and enjoy your data on dashboard or through scripting. **In-country specialists can assist with installation, operation and maintenance.**

Partners involved in Camera-based discharge monitoring

RAINBOW SENSING

SEBA HYDROMETRIE



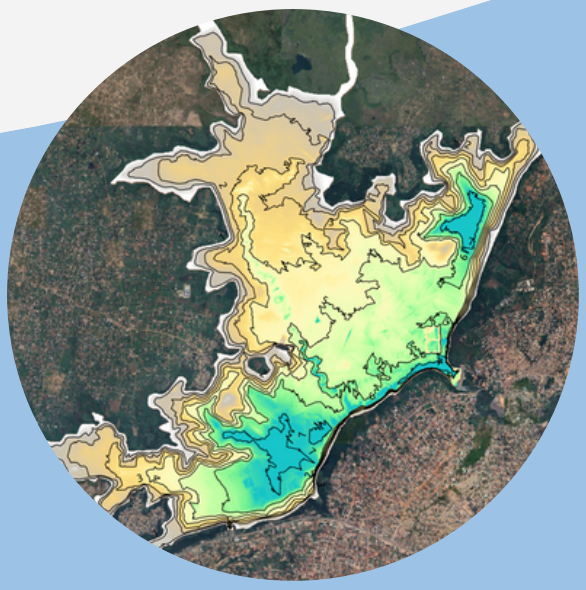
Contact us and learn more!

temboafrica.eu info@temboafrica.eu TEMBO Africa

TEMBO Africa

Transformative Environmental Monitoring to Boost Observations in Africa

Bathymetry as a Service



Overview

Floodplain mapping and bathymetry is expensive and therefore not carried out (regularly) in Sub-Saharan Africa, leading to inaccurate hydrological modelling, increasing the likelihood of disasters and economic losses. TEMBO Africa solution uses UAVs and fish-finders, to translate existing data (remote sensed surface area and river width estimates) into wetted profiles and reservoir volumes, and produce seamless bathymetry/topography maps of floodplains. It can be carried out regularly, keeping the bathymetry for discharge estimates and hydraulic simulations up-to-date, and allowing for monitoring of sedimentation processes and planning of sediment flushes (for reservoirs). The depth range is up to 100 meters.

Where?

The sensor constellation is initially tested on the Weija reservoir and a stretch of the Black Volta, both in Ghana, and it will be used for flood early warning in Kenya and for dam reservoir management in Zambia. Following, it will be available across the entire Sub-Saharan Africa.

For whom?

Bathymetry as a Service is ideal for dam reservoir management and entities interested in providing flood early warnings.

Mapping made simple

⚙️**Low complexity hardware** solutions, with easy to replace parts, that can be maintained locally, as much as possible.

💸**Cost-effective alternative** to international survey contracts, which can exceed €100,000.

📈Generation of a combined bathymetry and terrain dataset of a river section or reservoir with **local, easy to source materials**.

👷**Operable by local entities**, including entrepreneurs and NGOs.

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101086209). The Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither can the European Union nor the granting authority be held responsible for them.

A **sensors solution**, that supports one of the TEMBO **products**, while can be leveraged by two **services**, all within the context of a “Lego®-ised” approach!

How it works

Deployment of simple hardware
Local teams leverage simple solutions like Low-cost drones (UAVs) and fish-finders, to collect wet and dry bathymetric data in river sections, reservoirs, or floodplains.

Capture of surface and subsurface profiles
Surface and subsurface profiles are captured using sonar and high-accuracy GNSS positioning, with depth measurements reaching up to 100 meters.

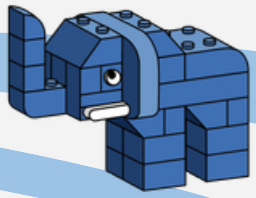
Data processing
The collected data are processed through OpenDroneMap to generate seamless combined bathymetry and topography maps.

Creation of wetted profiles
The above maps are translated into wetted profiles and reservoir volume estimates, supporting hydraulic modeling and sedimentation monitoring.

Partners involved in Bathymetry as a Service

Rainbow Sensing TAHMO TU Delft

Contact us and learn more!



temboafrica.eu info@temboafrica.eu TEMBO Africa