Intra-ACP Climate Services and Related Applications Programme – ClimSA

WORKSHOP - SADC Region

WEFE NEXUS, Climate Variability, and Environmental Monitoring

South Africa, Johannesburg, June 10th – 13th 2024

OBJECTIVE OF THE SESSION

- To introduce key approaches and research areas for the current and following years in identified regions of potential interest also for SADC member partners

- To identify potential synergies and interests in the use of the approaches/tools and the identification of new needs to effectively support current and future water management challenges in Southern Africa region

- Start a dialogue with a focus on the identification of needs to effectively support current and future water management challenges in the SADC and Southern Africa context.

AGENDA

Thursday	
9:00 - 9:30	Research priorities and synergies
9.30 - 12:00	Exploring further research opportunities - Next Frame programme
12.00 - 12:30	Feedback on Research needs, tools and HCD activity
12:30 - 14:00	*Lunch break*

- A presentation from JRC to introduce current and future research priorities and methods in the SADC region
- Discussion working groups to explore further research opportunities and synergies
- Feedback from participants and survey

RESEARCH PRIORITIES

WEFE4Dev Team – Unit D2 Ocean and Water

South Africa, Johannesburg, June 13th 2024

WEFE4Dev Team

COLLABORATIONS

A multi-steps approach

Support the cooperation governance framework for planning

Addressing the needs (DGs, DGINTPA, UN family, AU, AMCOW, RECs, RBOs, AUDA-NEPAD CoEs, local stakeholders, International initiatives

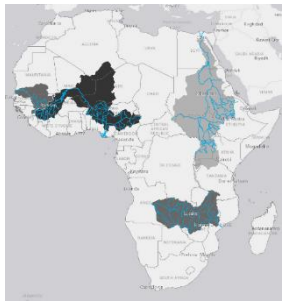
Global Europe

Feed the Nexus Dialogue

Identification of key priorities
Stakeholder involvement
High level publications, eg. :
- Position paper on the Nexus and SDGs)
- IWA publications on science and HCD

Geographic & thematic scopes

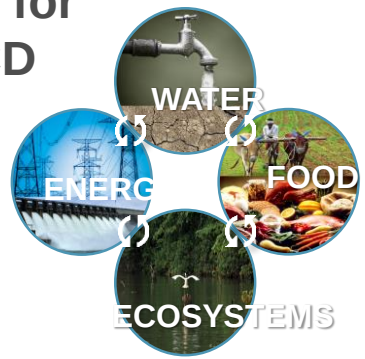
Ranging from world/continental to regional and transboundary river basins. Examples in Africa: Niger, Blue Nile, Lake Victoria, Zambezi (ACEWATER2), Mekrou, Senegal, WA regional



Climate | Energy | Hydrology | Agriculture | Water quality | Groundwater | Ecosystems

Support the scientific research for policy making and promote HCD activities

Data, methods and tools for water, energy, agriculture and land management
Water Resource Strategy for green growth
Science-based methodology going beyond sectors
Human Capacity Development (HCD)
Future scenarios analysis



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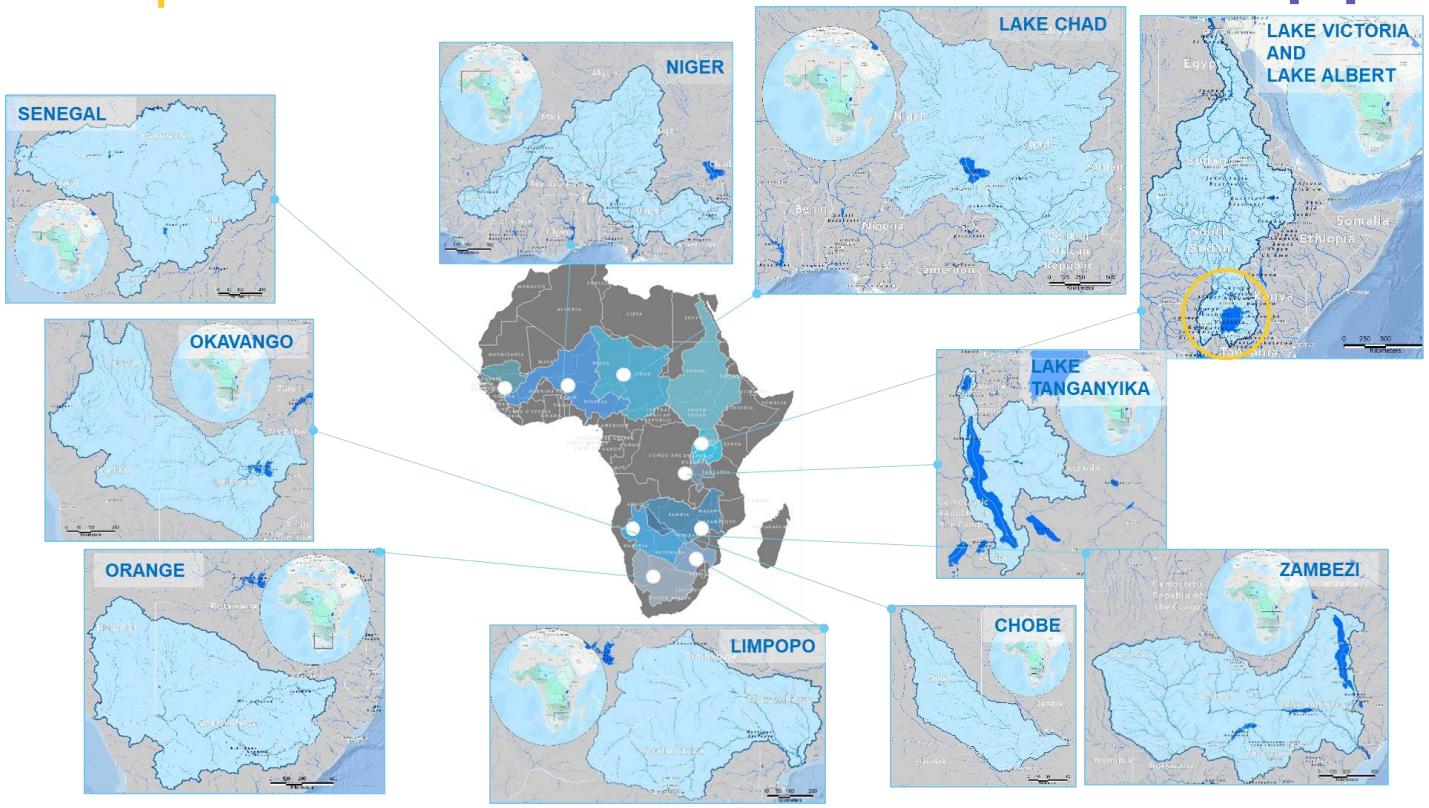
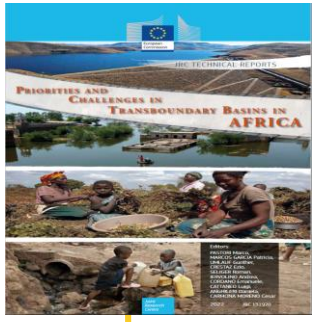
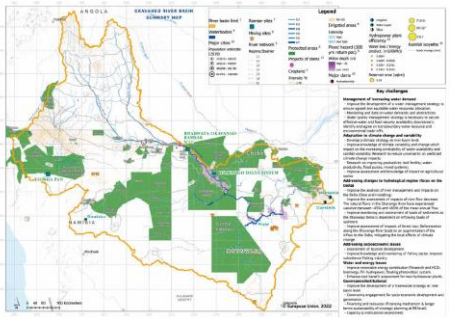
Scientific research to support policy making







- combine literature review, policy documents, and local experts' knowledge
- water priorities in policy documents and scientific literature sometimes do not match
- lack of data, data sharing and consensus on data quality are common and undermine cooperation
- science-policy-stakeholder collaboration can improve analysis by compensating for information gap

Water Management and Challenges in Transboundary River basins

Key principles:

- Sound knowledge to address the right questions (science + policy)
- Consensus on data and methods (among stakeholders and decision makers)
- Data collection, sharing, and literacy (from data to knowledge)
- Overcome policy inertia by promoting resilience (act now vs future)
- Value local knowledge (north and south perspectives)

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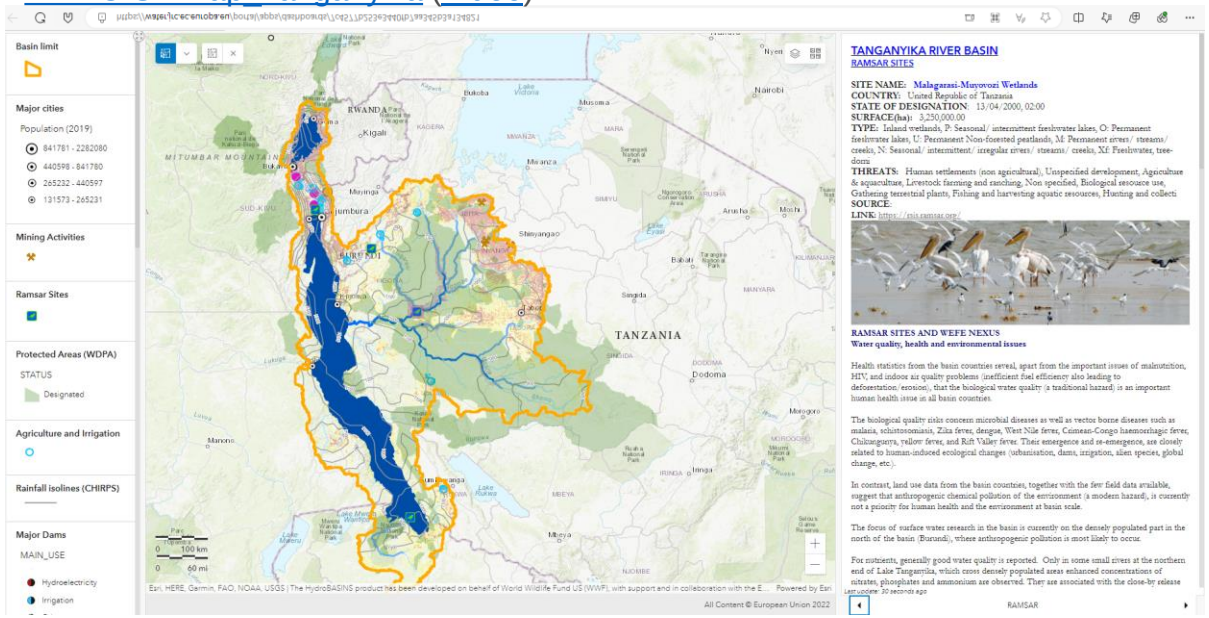
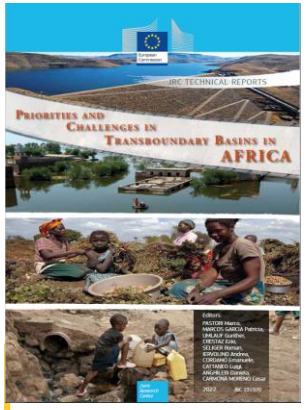
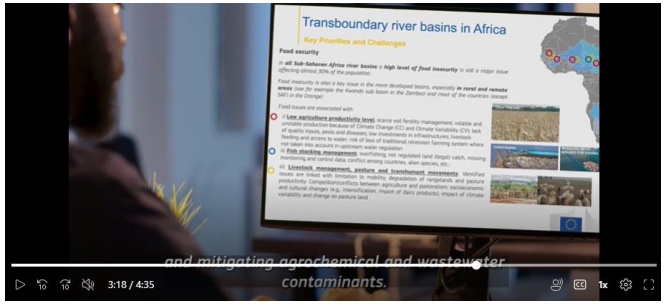
Scientific research to support policy making

WEBGIS - Map_Tanganyika (Video)



https://water.jrc.ec.europa.eu/portal/apps/dashboards/7c4577b253e3440fb7aa345b3a134821





Priorities and Challenges in Transboundary Basins in Africa (youtube.com)

Key outcomes:

- a first-level assessment based on currently available knowledge, data and information for a selected set of African transboundary river basins (selected by DG INTPA).

List of Transboundary River Basin Issues and Relevant STI areas

- some key factors have a clear and cross-cutting impact on all river basins, regardless of their specificities or levels of development: among these Climate Change and Climate Variability
- specifically Climate Variability in the short to medium term, must be taken into account (research and assessment at local scale) in future cooperation and development
- Other common drivers: increasing water demand (resulting from population and economic growth) and political instability

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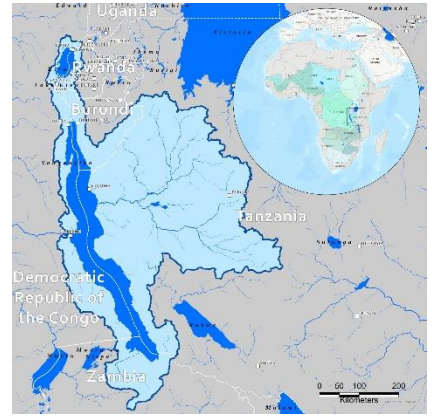
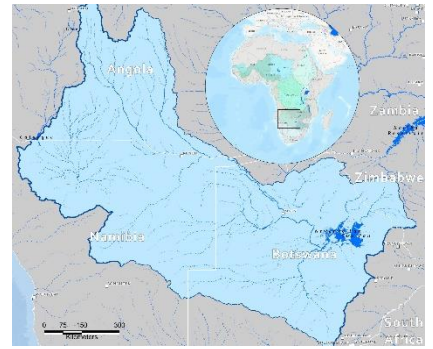
Scientific research
Issues, priorities and methods

CURRENT AND FUTURE RESEARCH AREAS

Key selected areas

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches (depending on specific priorities)





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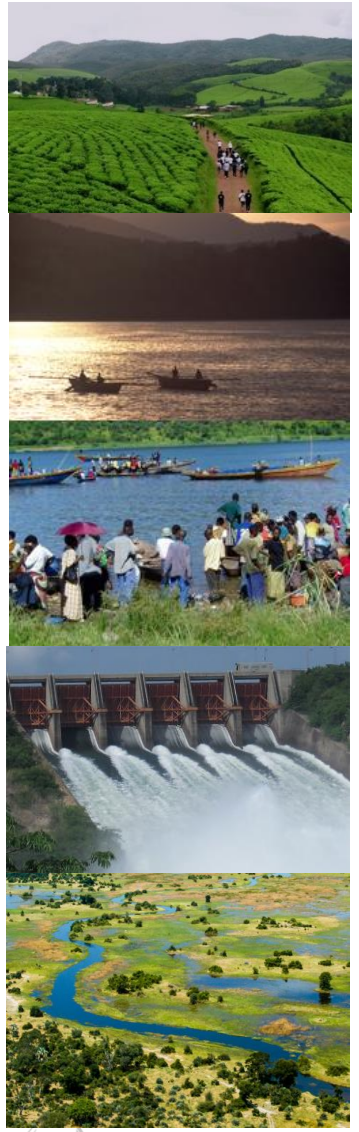
Issues, priorities and methods

Example of some key challenges

- **Insufficient resilience to the impacts of climate change**: Drought, severe storms, flooding, analyse flow dynamics and the implications of different hydrological and flow regimes, CV impact on lake /small reservoir, flooded areas. Increased erosion and sedimentation, Decrease in fish yields. Loss of biodiversity. land use planning, forest restoration, agricultural practices, alternative energy sources. identification of potential drought hotspots and interventions to mitigate their impacts
- **Insufficient monitoring and data collection programmes**: DATA on water demand and abstractions**.** Knowledge should be improved in terms of surface and groundwater interactions. (Even if no major issues affecting groundwater supply can be reported, a great and growing demand for groundwater exists, especially in areas not serviced by perennial streams). Lack of data, data sharing and consensus on data quality are common.
- **Unsustainable land management**: Habitat degradation. Loss of biodiversity. Loss of ecosystem services. Alteration of critical habitats. Invasive species management. Stabilise watershed and reduce coastal erosion and sedimentation in the lake and river Ruzizi. Focus on the Delta: flood pulse prediction and support to subsistence agriculture
- **Unsustainable fishing**: Weakly enforced and non-harmonized laws and regulations. Insufficient operational monitoring and control capacity. Loss of aquatic biodiversity. Further develop a sustainable fishing industry.
- **Increasing environmental and water pollution**: Decrease in water quality, air quality. Health risks, Waste management. There is an imminent increase in water consumption in the basins, which can result in the degrading quality of water. The potential impacts of these water quantity and quality changes (surface and groundwater) in localised areas and at basin scale are very poorly understood.
- **Improve energy access**: improve feasibility assessment of new proposed potential hydropower projects, primarily to determine ecosystem and socio-economic development impacts and affordability. Hydrological regime analysis for hydropower. Explore solutions using renewable energy: bioenergy, PV–hydropower, floating photovoltaic system
- **Improve human capacity of management**: common regulations for the exploitation of resources risk management plan for methane gas and future oil production and volcanic risks. Developing the institutional and organisational capacities of the Basin Authority



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Scientific research
Issues, priorities and methods

Example of some key challenges

- **Validation, sharing and discussion of research priorities is Key**
- **Importance of dialogue with local experts stakeholders**
- **Science-policy-stakeholder collaboration can improve water management by compensating for data gap**

EXAMPLE OF VALIDATE RESEARCH PRIORITIES IN THE TANHANYIKA BASIN

Technical Workshop – River basin water balance methods approaches and key challenges in the Lake Tanganyika and Lake Kivu basins

P1. Enhance DATA MANAGEMENT: development of technical support for **harmonizing, validating, managing and sharing of data**. Create and design **technical training Human Capacity Development (HCD) strategies, and materials**, while also considering the significance of **involving local experts, universities, and research centres** as bot beneficiaries and providers of the training. Ensure **long term monitoring capacity** with a focus on drivers (climate, landuse, agriculture, fishing, etc.) and environment (lake water quality, so fertility, protected zones, humid areas, coast, etc.)

P2. Shared development of a transboundary environmental monitoring system for the qualitative, quantitative, and climatic aspects of the Tanganyika and Kivu lakes

P3. Enhance capacity to quantify the threats: lake and surface water balance and temporal-spatial dynamics; identification and **spatial and temporal quantification** of land management issues such as erosion of land and coastal areas, and coastal flooding.

P4. Improve risk assessment capacity by modelling and statistical analysis with a specific **focus on erosion and flooding**.

P5. Enhance Remote Sensing (RS) data analysis capacity to support both water quantity, water quality and land degradations issues. Importance of ready to use methods and approaches that can effectively support these and other quantifications

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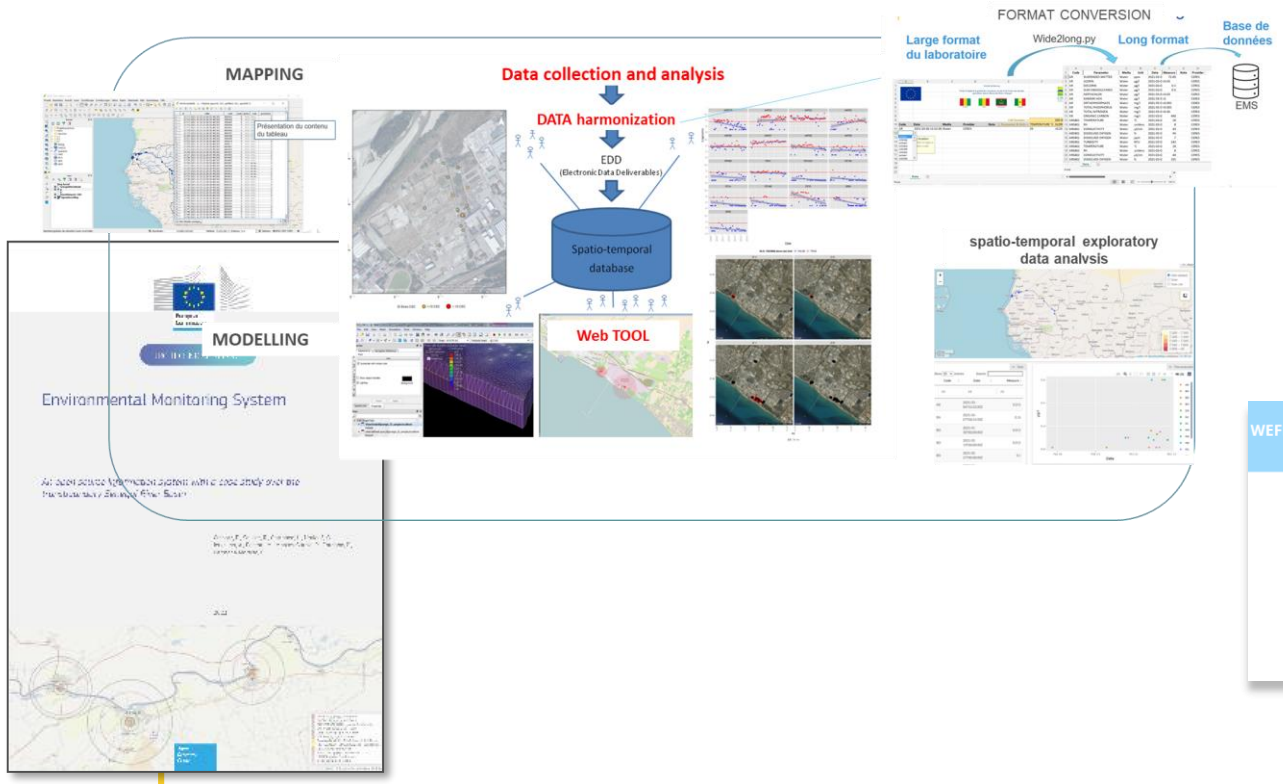
Scientific research
Issues, priorities and methods

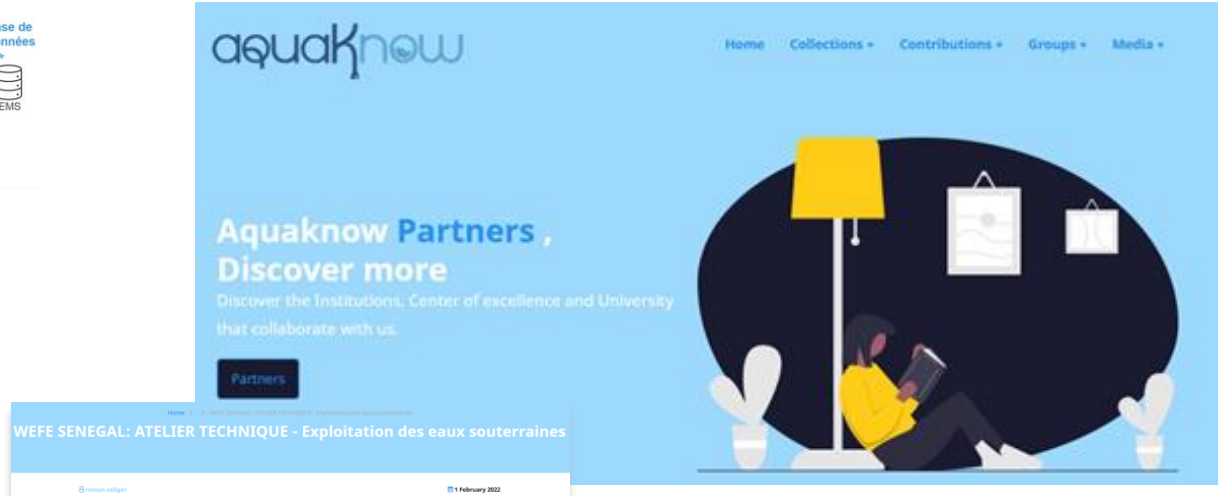
- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

Key research objective – JRC Water4Dev contribution

Development of data harmonisation, validation and management into an Open Source (OS) Environmental Monitoring System (Geospatial relational database). Setup of framework of methodological approaches.

Development of technical training, the design of training and HCD strategies and materials.





Sharing Data and Information with Partners
Training material
Events / News promotion

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Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

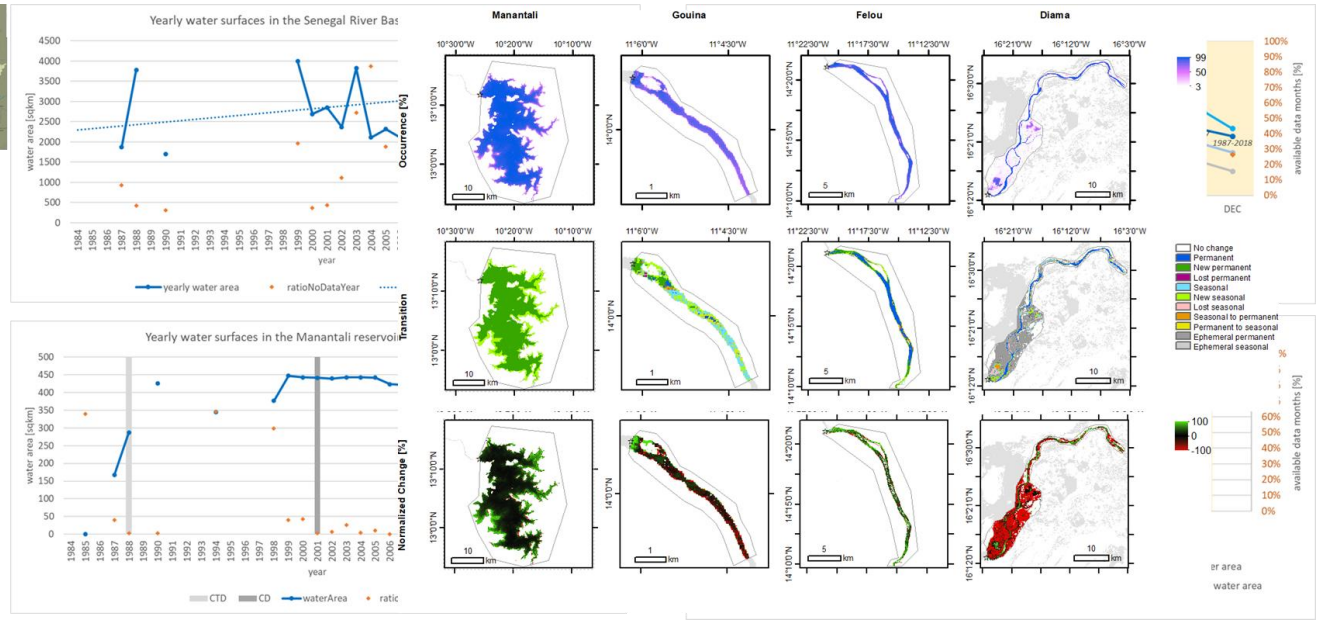
Key research objective – JRC Water4Dev contribution

Water accounting system to identify significant water demands across the basin. The temporal and spatial variability of water availability in the basin is characterized through the use of remote sensing (RS), geospatial data and modelling.

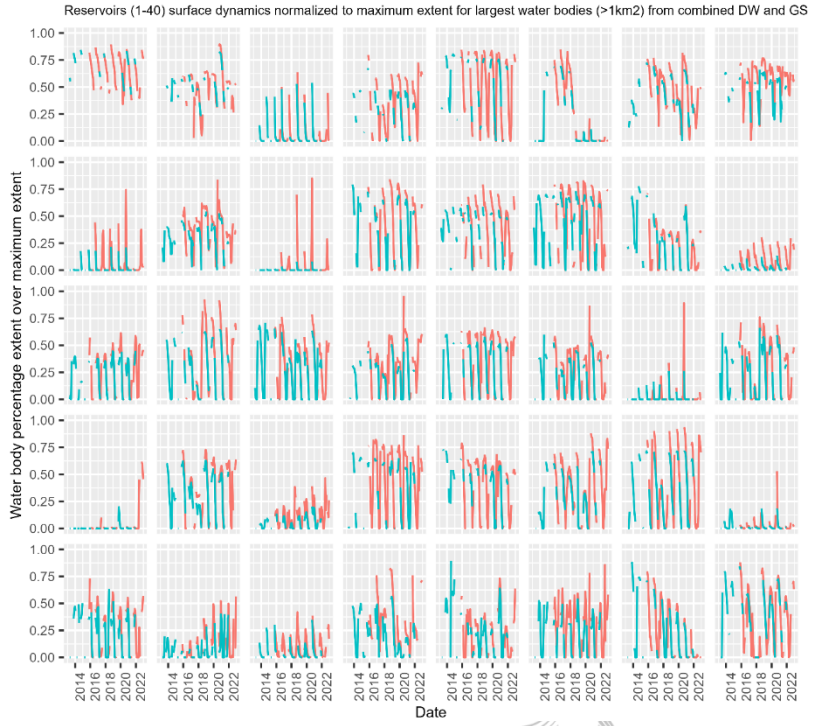
Time series analysis of water surfaces <u>at River Basin</u>, country, regional and <u>reservoir scale</u>

(1) Senegal River Basin

(2) Manantali reservoir



https://global-surface-water.appspot.com/



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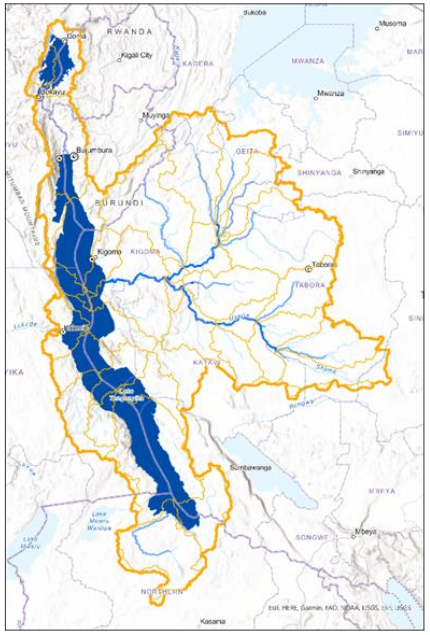
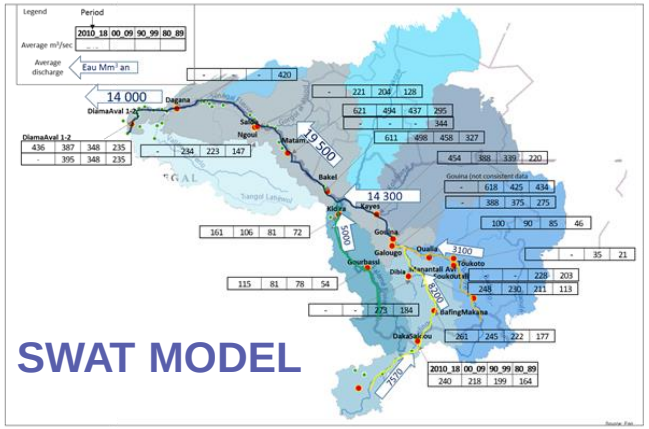
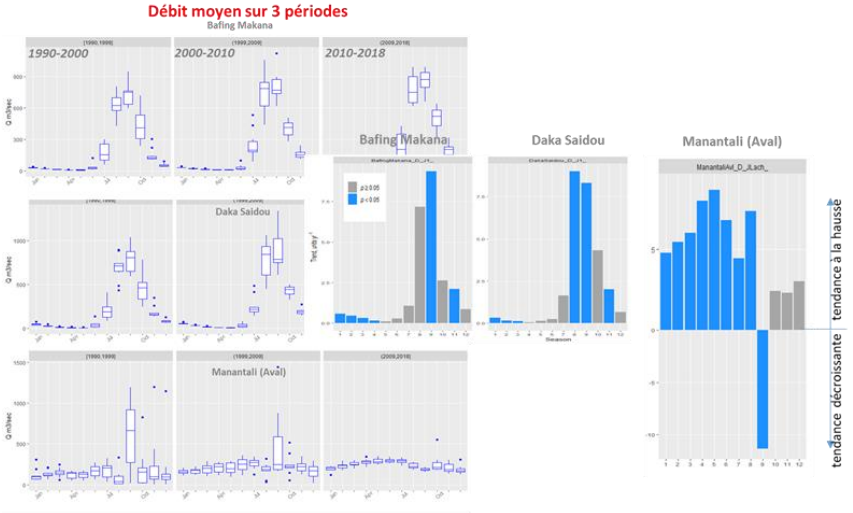
Hydrological basin analysis and hydro economic modelling

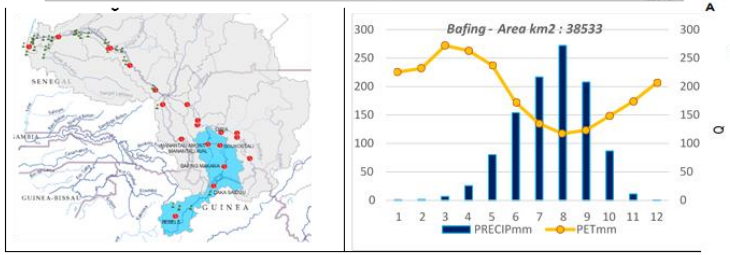
- Hydrological subbasins and River Network analysis (water accounting at subbasin level)

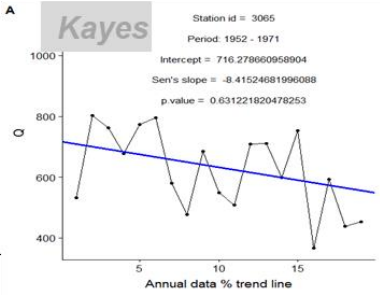


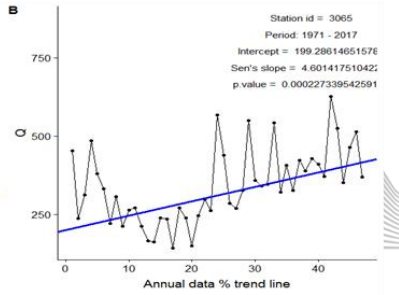
- Hydrological data (flows) analysis: summary, water accounting, trend analysis











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Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
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Key research objective – JRC Water4Dev contribution

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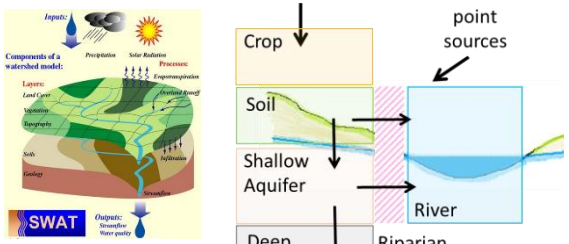
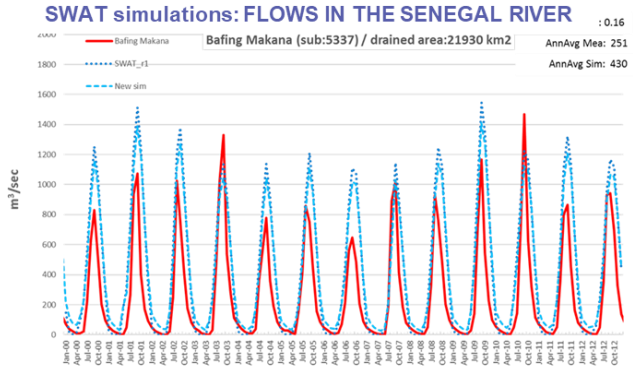
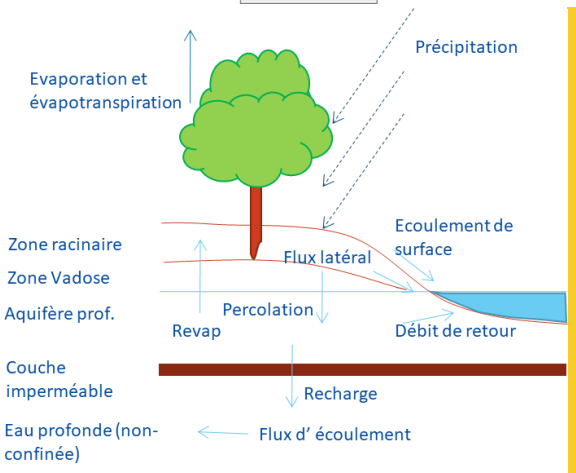


Hydrological modelling: different approach available depending on objectives and needs, data availability, and resources

The SWAT model is a **physically based** hydrological **model** that is capable of simulating the hydrological processes that occur in a catchment. **SWAT** is used for a variety of applications, including nutrient flows and accounting, water process simulation and accounting (infiltration, leaching, runoff, evapotranspiration, etc.), water quality assessment (N and P, sediments, pesticides, etc.), water purification and point sources, dams management, scenario analysis.





OBESERVATIONS / LESSONS

- Model setup available for several RBs in Africa (meaning basin input already included and harmonized)
- DATA availability at local scale is a common limiting factor: river flows/discharge measured data for long time series, measure water quality, sediment etc.)
- When local models available is suggested to improve their reliability as the outputs of models will be more acceptable
- Time and resources constraints
- **HCD and training is key aspect**

Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

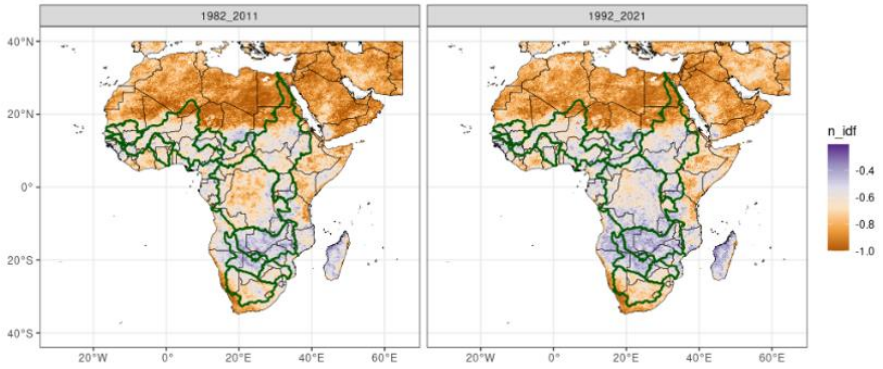
Key research objective – JRC Water4Dev contribution

Assessment and mapping of risk associated with water extreme events (coastal change and flooding, past flooding events and identification of main causes (rainfall-wind) (activity to be developed in collaboration with VITO, CNES, ESA, … and local experts or RCoEs to be identified).

Storm Rainfall Analysisis

THE RETURN PERIOD AND THE INTESITY DURATION CURVE (6)

n exponent : source CHIRPS dataset (reference period 1982-2011) and CHIRPS dataset (reference period 1992-2021) . The lower is the value of ***n*** (towards ***-1***), in a shorter time heavy rainfall intensity tend to concentrate. Where ***n> -0.6*** , heavy rainfall with a duration longer than 3 days are important to study.



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Example 4: Remote Sensing

ANALYSIS OF THE IMPACTS OF CV AND CC ON WATER BODIES

The support of SAR analysis for changes detection

Synthetic Aperture Radar (SAR) images from **Sentinel 1** have a great potential for detecting land cover changes.

These products do not depend on cloud cover and day/night alternation. This results in a **high availability of information** (2-3 images per month).

SAR images can be used to investigate the changes occurred around water bodies to determine:

(1) Eventual hotspots of changes,
(2) Type of change,
(3) Temporal evolution of changes,
(4) Support water modelling development

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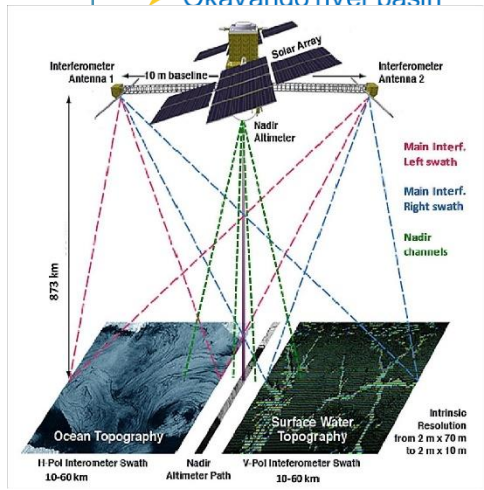
Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin

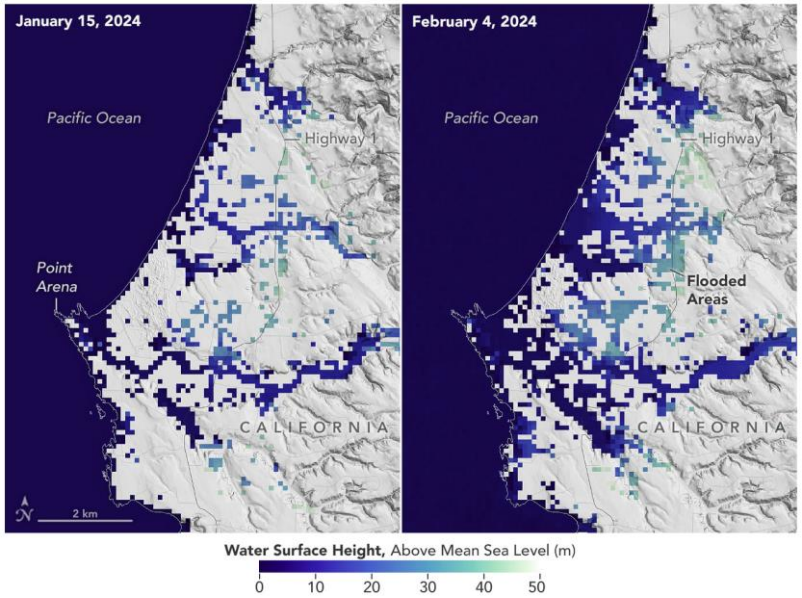
Key research objective – JRC Water4Dev contribution

Assessment and mapping of risk associated with water extreme events

Surface Water and Ocean Topography (SWOT)



- Designed to make the **first-ever global survey of Earth's surface water**.
- The radar altimetry satellite mission will survey **at least 90% of the globe**, studying Earth's lakes, rivers, reservoirs, and ocean **at least once every 21 days**.
- SWOT will provide **measurements of water storage changes** (surface water area and water depth) and support derived estimates of river discharge –for rivers wider than 100 m and lake area > 250 m x 250 m.
- JRC proposal to **characterize water volume variability in transboundary endorheic basins** (Lake Tanganyika, Lake Chad, Okavango) –TENBAWAS- accepted for the renewal of the **International SWOT Science Team (2024-2027)**



Source: NASA, CNES

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Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
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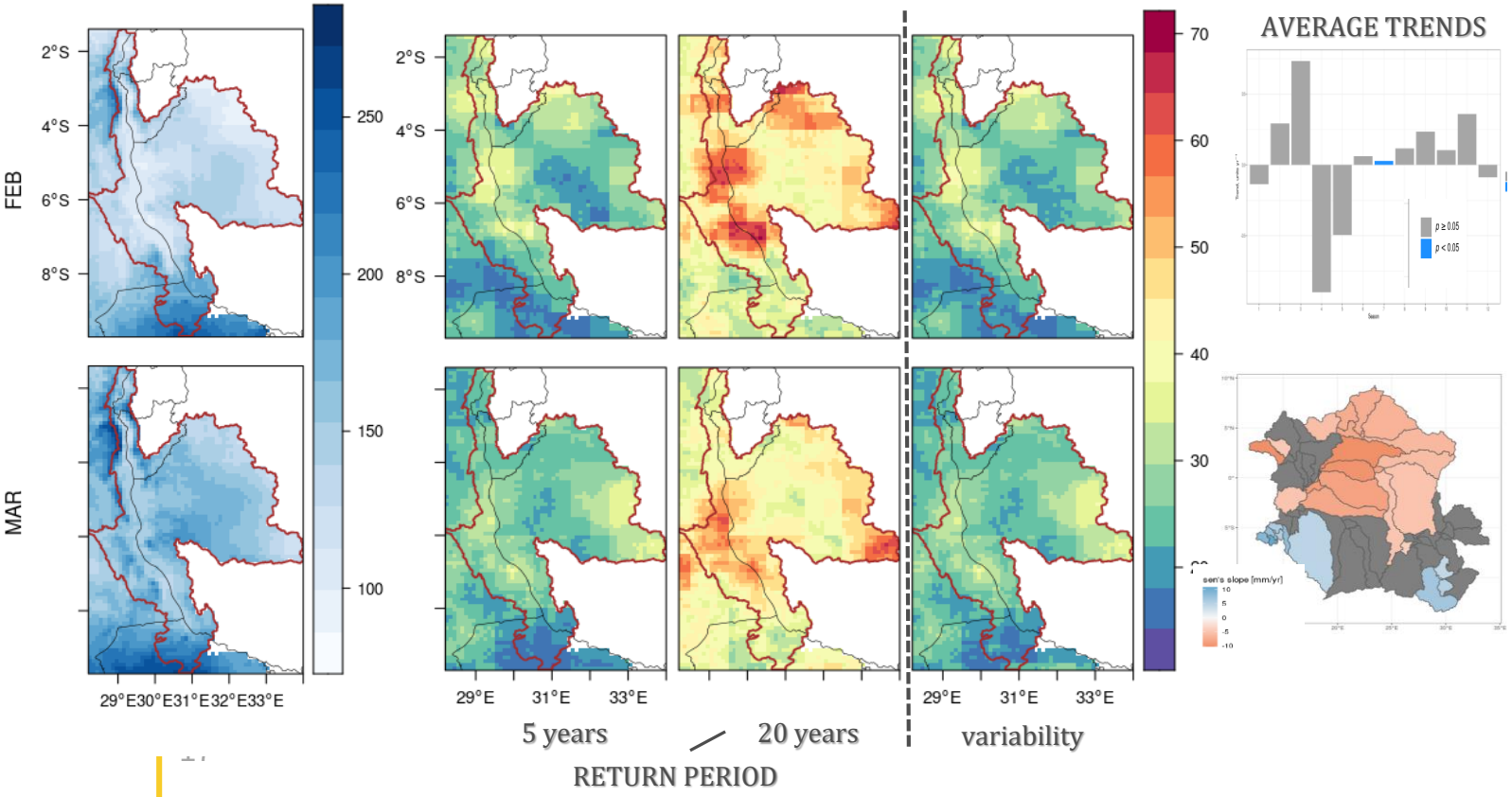
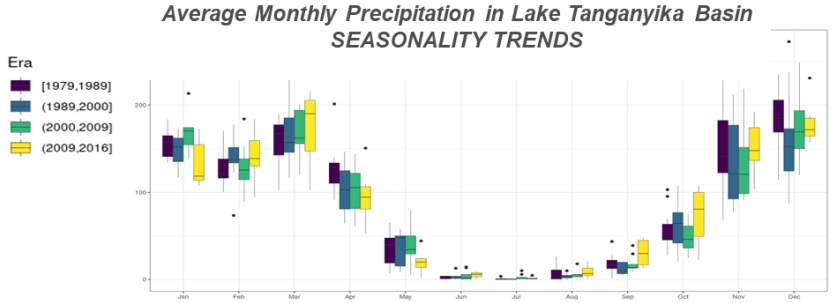
- Regional approaches

Key research objective – JRC Water4Dev contribution

Further enhance capability to analyse the impact of climate variability (CV) on water availability, landuse, agriculture, environment, etc.

CLIMATE VARIABILITY ANALYSIS





EXAMPLE OF REGIONAL ANALYSIS

✓ Respect to other areas of the Congo River Basin, precipitation deficit variability in the LTR is estimated to be around 30% or 50%, with a precipitation **deficit of 50%** (which may occur with a return period **of 20 years**)

✓ Areas in the **eastern and central parts** of the basin most **prone to precipitation deficit**: e.g. a **decrease** of **agricultural productivity in the Katavi** area

✓ socioeconomic impacts (in 2019, heavy rainfall triggered flash floods, mudslides and landslides in Burundi).

✓ The impacts on rainfed agriculture are not clear: wetter conditions could suggest a favorable environment for its development

Scientific research
Issues, priorities and methods

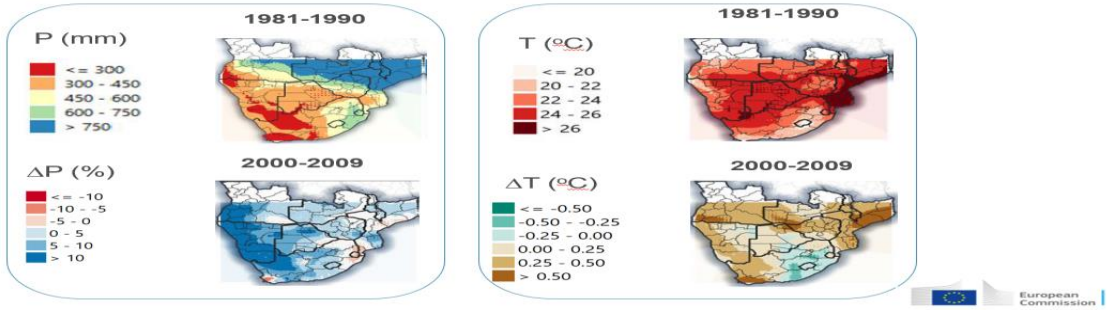
- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

Key research objective – JRC Water4Dev contribution

Further enhance capability to analyse the impact of climate variability (CV) on water availability, landuse, agriculture, environment, etc.

- **Development of a methodological approach tailored for large-scale analysis with limited data**
- **Generation of spatially-explicit information on the probability of occurrence of several climate conditions and their related impacts**
- **Characterisation of climate trends during the last decades**

Mean precipitation and temperature during the maize growing season. Changes.



- **Integration of sectoral perspectives**
- **Generation of climate information at appropriate spatio-temporal scales**
- **Need to evolve from “science-based” to “user-based and climate-informed”) climate services**

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Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

Key research objective – JRC Water4Dev contribution

AND OTHER KEY AREAS TO BE FURTHER DEVELOPED

- **Enhance the assessment of linkage between cv and energy access (electricity production):** Hydrological regime analysis and CV for hydropower. Explore solutions using renewable energy: bioenergy, PV–hydropower, floating photovoltaic system
- **Analyse land degradation as impacted by land use/land cover change**, particularly with a focus on the expansion of cropland in specific hotspots areas and erosion. This research will potentially contribute to the identification and characterization of the major stressors affecting degradation of natural areas and forest (deforestation).
- **Development of a comprehensive inventory of environmental open data and system**, both geospatial and non-geospatial, to be collected and harmonized at the river basin level. Establishing a comprehensive and interdisciplinary data collection and analysis.
- **Support the exchange of information, experiences, and knowledge about the basin** among regional and national authorities, stakeholders and scientific experts. Assist in **identifying reinforcement needs** in other environmental sectors, relevant at the river basin level, and in general for water resource management.

Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
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Summary and key messages for discussion

- **2 key RIVER BASINS IDENTIFIED**: interest, knowledge, research needs
- **Data management: issues, sharing and harmonization of data across sectors, ….**
- **Synergies with research areas: CV analysis, Water quantity and quality, Environment and land management**

Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
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Summary and key messages for discussion

Synergies

- **Common interest for those geographical and thematic areas:**
  - **Are you aware about key projects being developed in the region ?**
  - **Do you see any specific issue common with you region of interest**

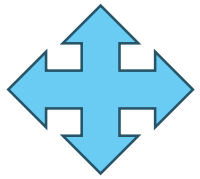
Scientific research
Issues, priorities and methods

- Lake Tanganyika and Lake Kivu basins
- Okavango river basin
- Regional approaches

Summary and key messages for discussion

- **Synergies with research areas: CV analysis, Water quantity and quality, Environment and land management**

CV AND CHANGE ADAPTATION



Climate prediction and Information services

Regional thematic products for Climate Services

Thank you

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AGENDA

Thursday	
9:00 - 9:30	Research priorities and synergies
9.30 - 12:00	Exploring further research opportunities - Next Frame programme
12.00 - 12:30	Feedback on Research needs, tools and HCD activity
12:30 - 14:00	*Lunch break*

- A presentation from JRC to introduce current and future research priorities and methods in the SADC region
- Discussion working groups to explore further research opportunities and synergies
- Feedback from participants and survey