



IHE DUPC2 Webinar

# Tekeze-Atbara Research Project

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# Research team

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- **Project partners:**

- HRC ; EiWR-AAU; IHE Delft

- **Stakeholders:**

- Ministries of Water, Ethiopia and Sudan
- Ethiopia-Sudan Technical Advisory Committee (ESTAC)
- Embassy of Ethiopia in Khartoum; Embassy of Sudan in Addis Ababa

- **Resource persons:**

- Prof. Jacob Arsano, AAU; Prof. Atta Elbethani, UoK; Prof. Pieter van der Zaag, IHE Delft

- **Advisory committee:**

- Representatives from HRC, EiWR, Water Ministries and ESTAC

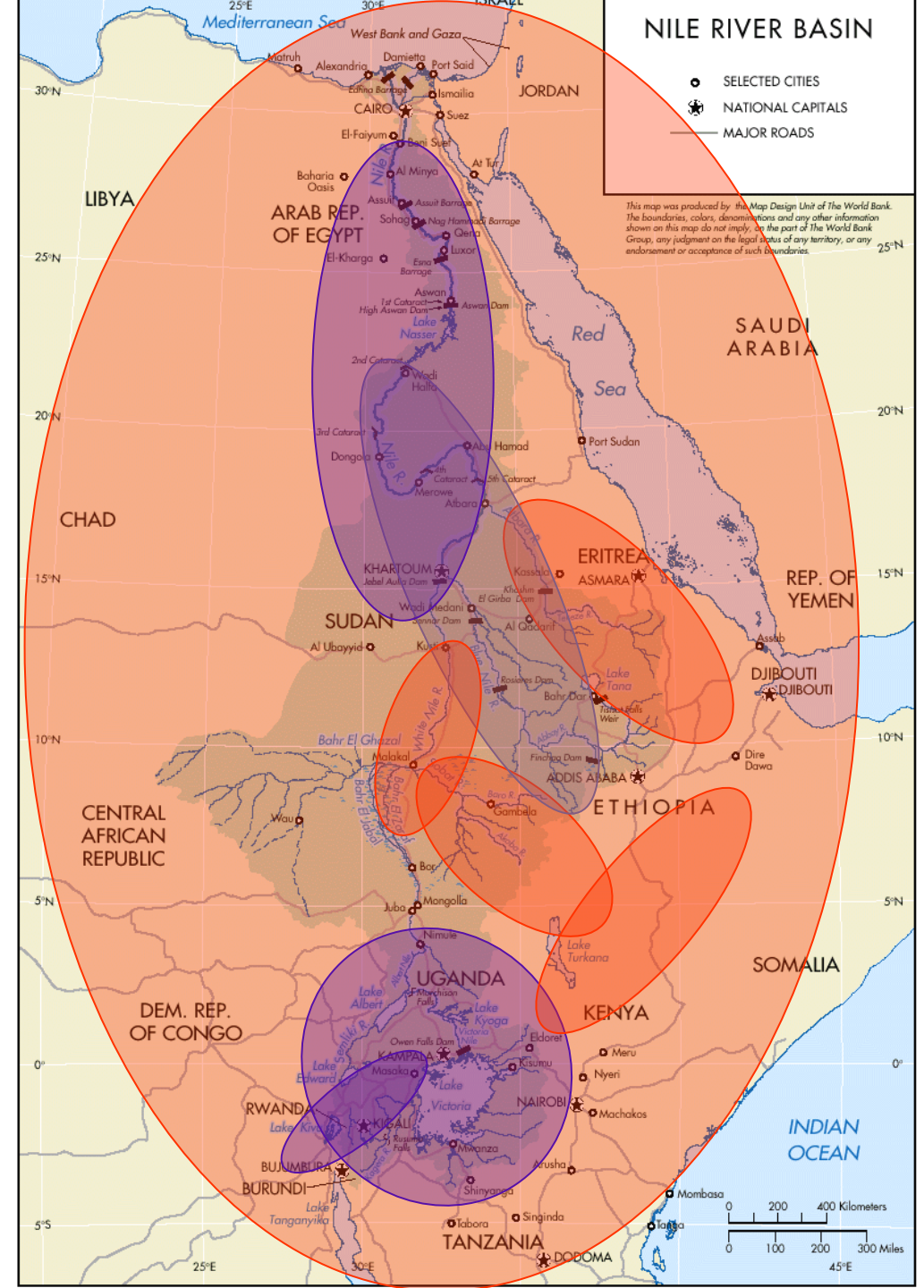




# Hypothesis

- Reaching consensus is relatively easier at sub-basin level
- Riparian countries are willing to cooperate on transboundary water management if benefits outweigh cost of cooperation

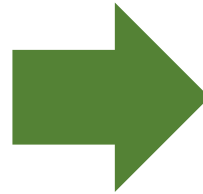
Source: (World Bank 1980)



## **Phase 1 (2017-2019)**

### **River Basin Simulation**

- River Basin Simulation model, *using MIKE Hydro basin*
- Developing scenarios of coordinated and non-coordinated operation
- Scenario analysis of operating policies of the reservoirs system
- Cost-benefits analysis



## **Phase 2**

### **Institutionalizing transboundary water management**

- Investigation of drivers/constraints
- Presentation of model outputs
- Literature review
- Analysis of existing institutions
- Design of institutional infrastructures
- Consultation with stakeholders

# Phase 1 [Jan2017-Apr2019]

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To evaluate costs and benefits of coordinated versus non-coordinated operation of the reservoirs system in T-A

## Specific Objectives

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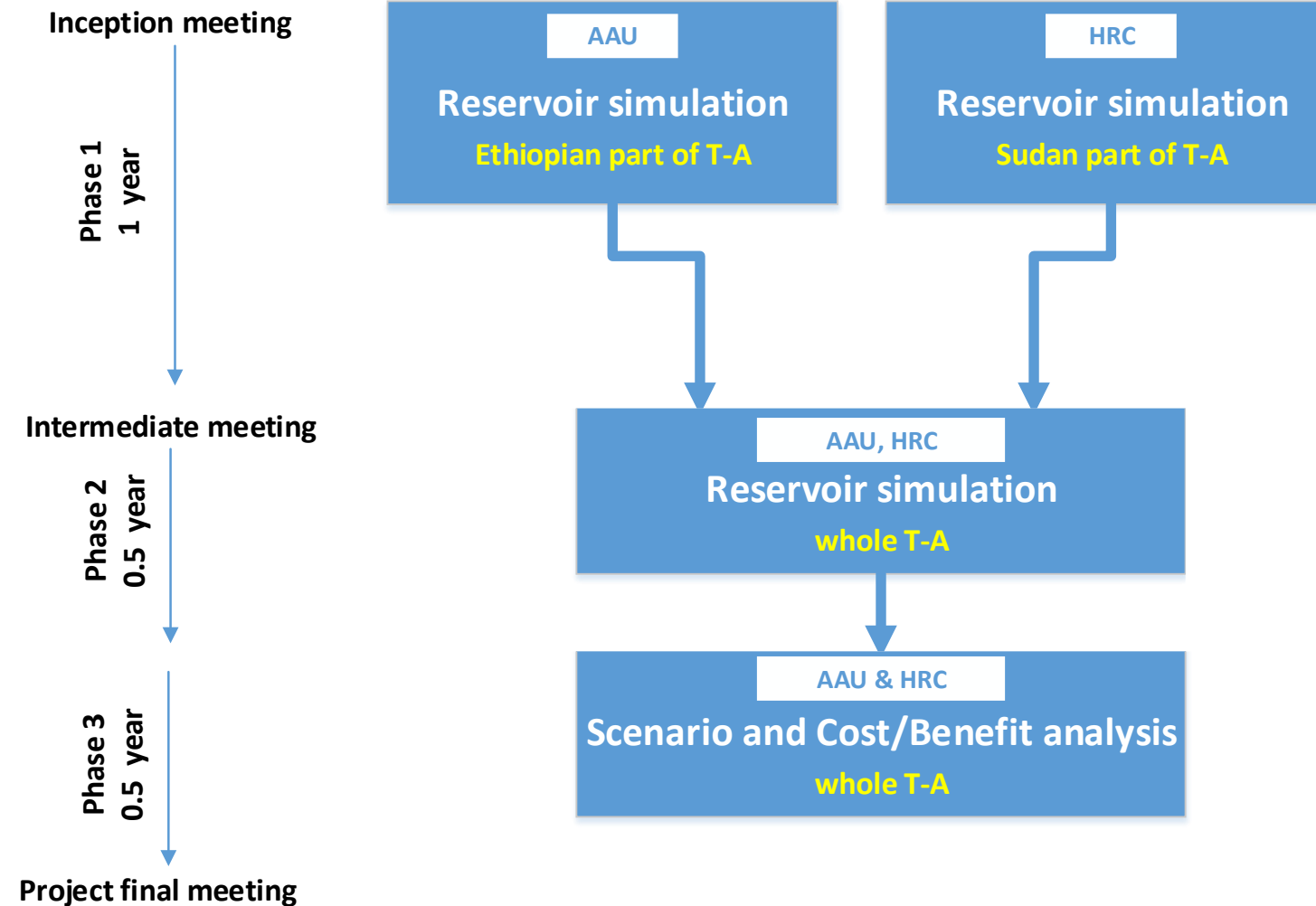
- ✓ To develop a river basin simulation model: to respond to demand of water supply, irrigation, hydro-power and environmental flow.
- ✓ Strengthen capacity and enhance trust among Ethiopian and Sudanese researchers through the joint development of models and analysis of operation scenarios
- ✓ Support the research agenda of Ethio-Sudan Technical Advisory Committee (ESTAC)

# Phase 1 Research questions

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- I. What is the performance of the present (and planned) reservoirs system in T-A basin, under current operating policies?
- II. What is the most optimal operating strategy(ies), for coordinated and non-coordinated scenarios?
- III. What are the costs & benefits of each scenario?
- IV. What is the impact at the sub-basin outlet (confluence with the main Nile?)

# Phase 1 Approach

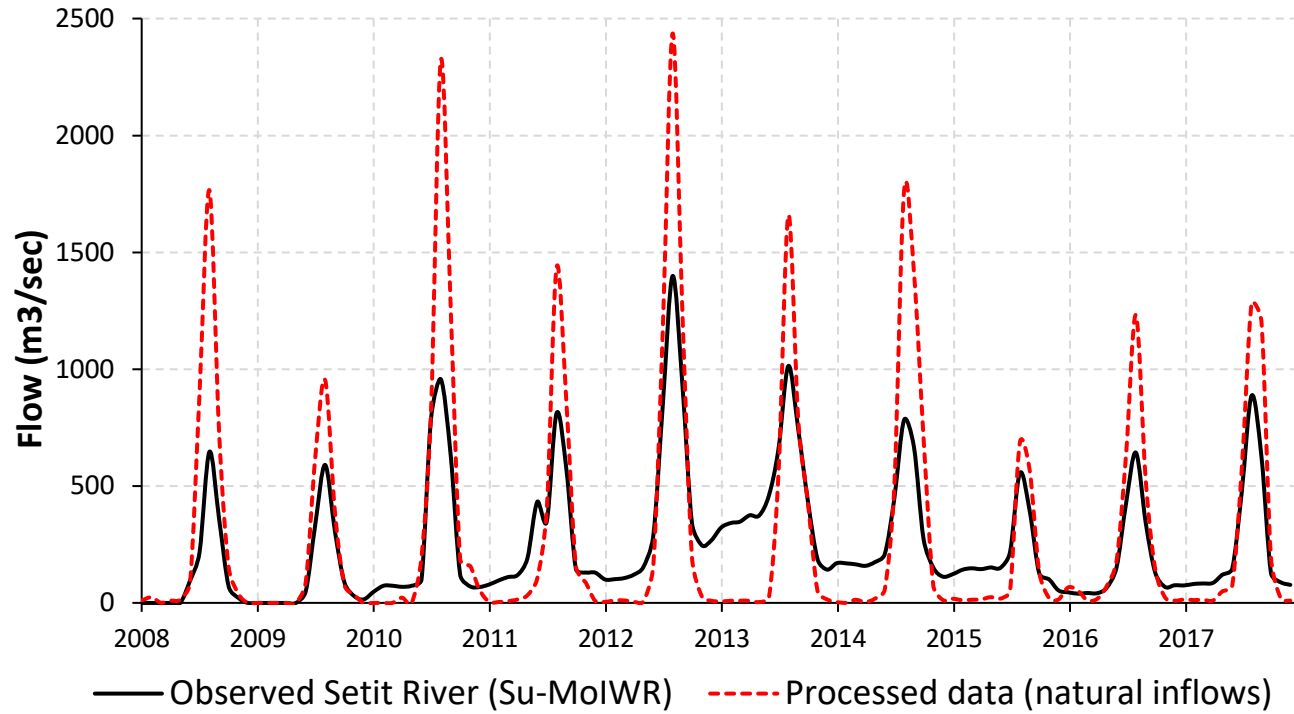




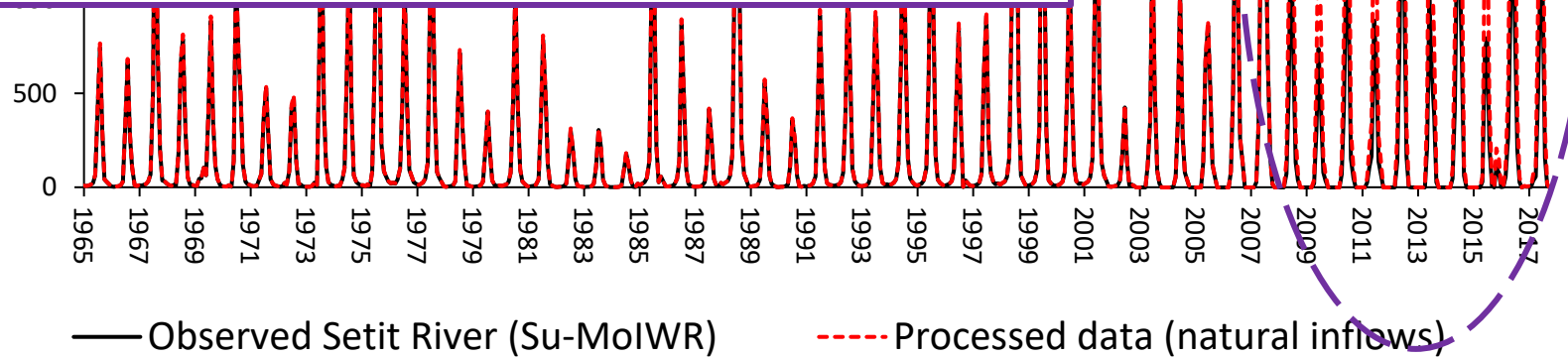
# Phase 1 Hydrology

- **Linear regression** was applied between monthly flow series at a tributary inflow and the near station.
- Records have been extended to cover period from **1965** to 2017 using Linear regression.
- For U/s TK5, observed data from MoWIE was used in conjunction with regression analysis.

TK5 Operation (2008-2017)

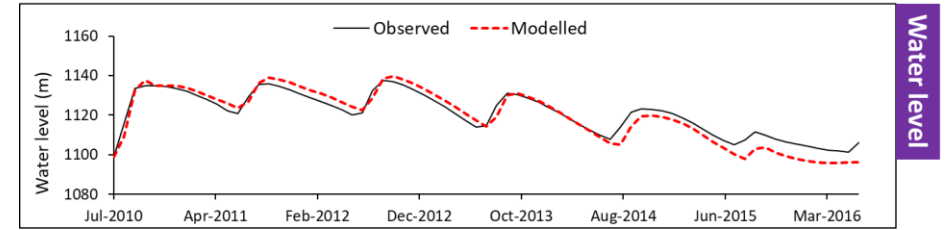


Water balance 1965

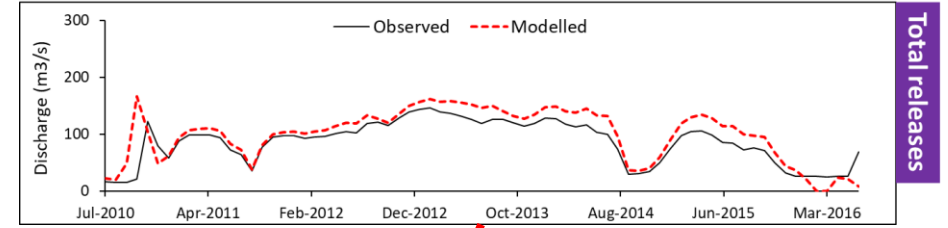


# Phase 1 Model setup

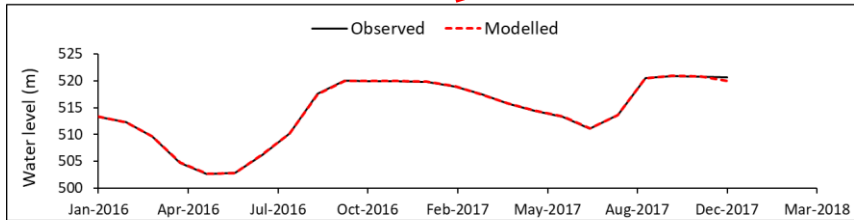
- 15 sub-catchments.
- Monthly time step,
- Running period from 1965 to 2017
- Simulating demand pattern
- Simulating reservoir operation



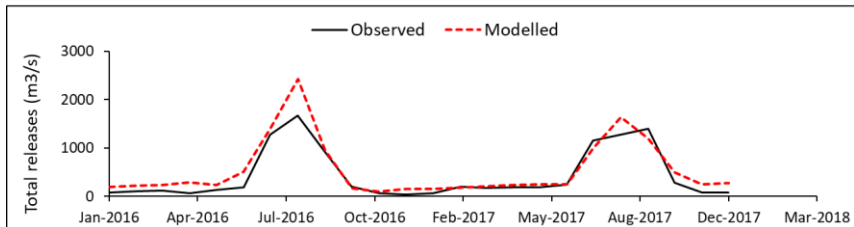
Water level



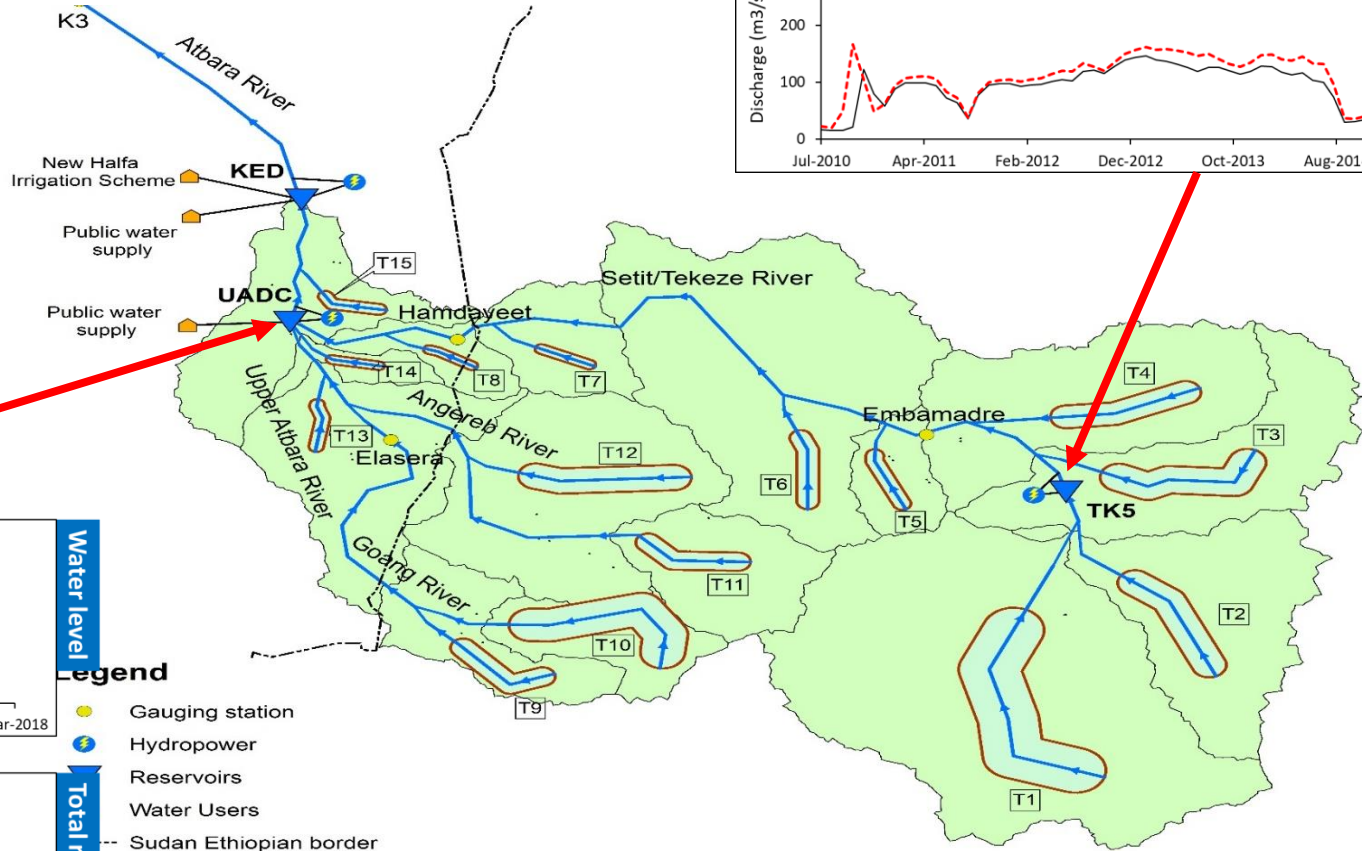
Total releases



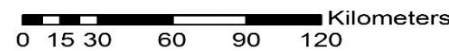
Water level



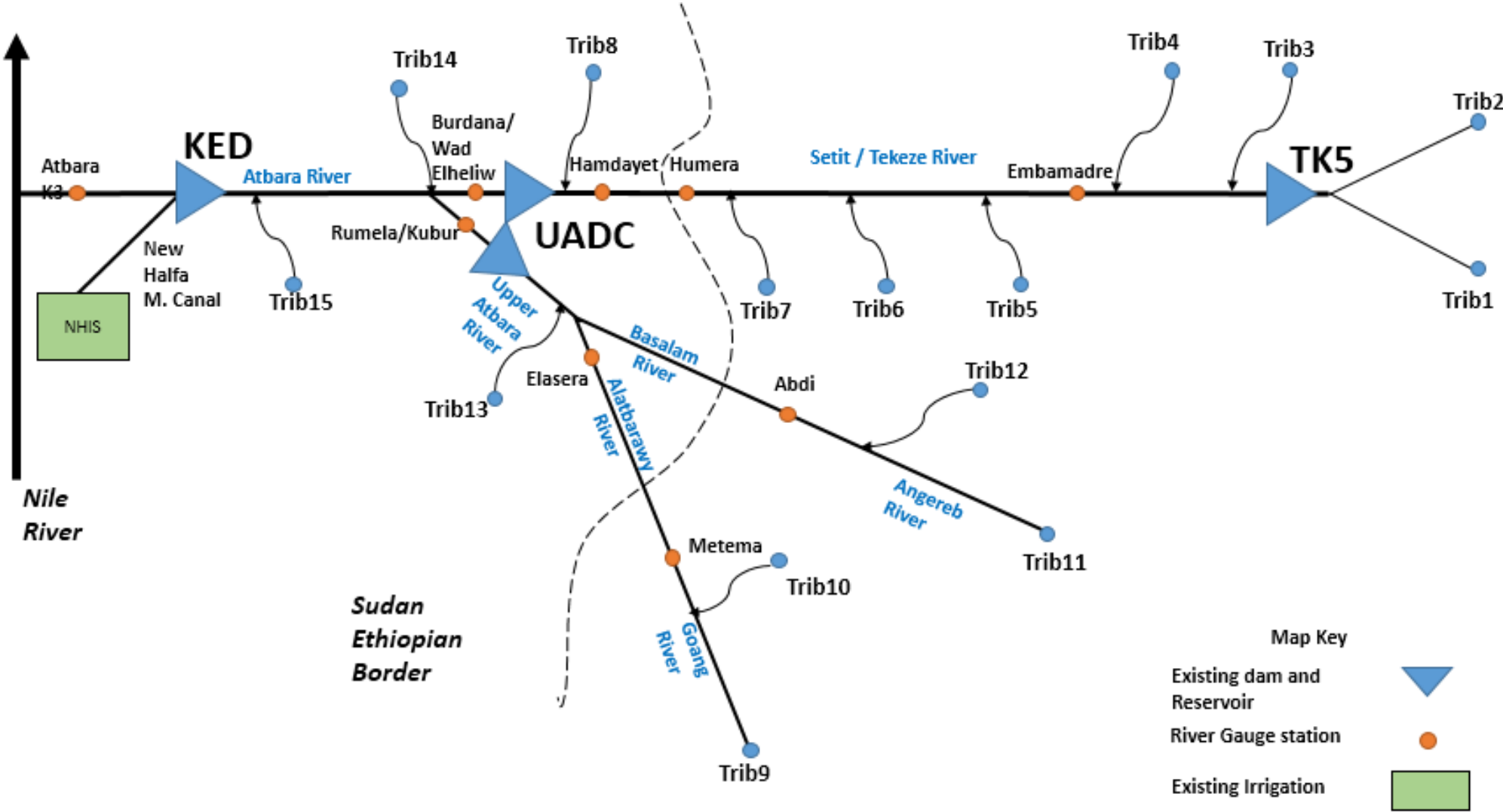
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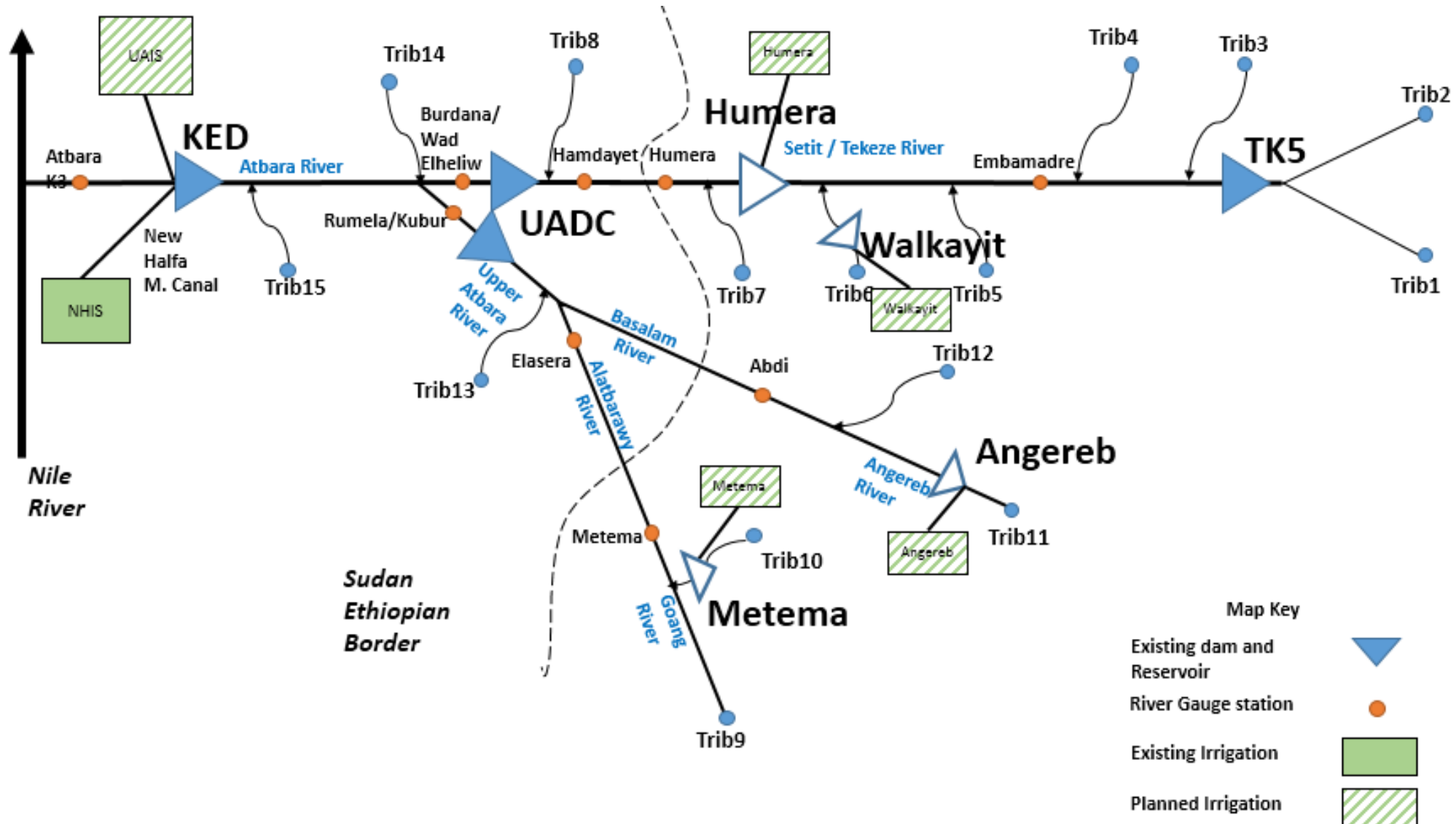
- Legend**
- Gauging station
  - Hydropower
  - Reservoirs
  - Water Users
  - Sudan Ethiopian border
  - Branch Connections
  - River
  - Water User Connections
  - Catchments



# Existing system



# Future situation



**Nile River**

**Sudan Ethiopian Border**

**KED** (Existing dam and Reservoir)

**UADC** (Existing dam and Reservoir)

**Humera** (Existing dam and Reservoir)

**Walkayit** (Existing dam and Reservoir)

**Angereb** (Existing dam and Reservoir)

**TK5** (Existing dam and Reservoir)

**Atbara River**

**Upper Atbara River**

**Basalam River**

**Alabarawy River**

**Goang River**

**Setit / Tekeze River**

**Atbara** (Gauge station)

**New Halfa M. Canal**

**NHIS** (Existing Irrigation)

**UAS** (Planned Irrigation)

**Burdana/ Wad Elheliw** (Gauge station)

**Rumela/Kubur** (Gauge station)

**Elasera** (Gauge station)

**Metema** (Gauge station)

**Hamdayet/ Humera** (Gauge station)

**Abdi** (Gauge station)

**Embamadre** (Gauge station)

**Humera** (Planned Irrigation)

**Walkayit** (Existing Irrigation)

**Angereb** (Existing Irrigation)

**Metema** (Existing Irrigation)

**Trib1** through **Trib15**

# Scenario development

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- S0: Existing non coordinated (Baseline scenario)
- S1: Existing coordinated system
- S2: S0 + planned water resources projects
- S3: S2, but coordinated system

# Coordination (Cost/benefit)

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Comparison between S2 and S3: coordinated vs (non-coordinated)

Country	Hydropower GW-hr/yr	Irrigation withdrawal Mm <sup>3</sup> /yr
Ethiopia	-199 (-9%)	+30 (+4%)
Sudan	-68 (-8%)	+194 (+3%)
T-A basin	-267 (-9%)	+224 (+3%)

# Follow-up research [Phase 2]

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- To identify and recommend designs of (potential) institutional set-ups for regional cooperation for the operation of the T-A reservoir system
- The design is based on information from the first project, and in close consultation with policy makers from the two countries.

## Phase 2 Development outcome?

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- The buy-in of the idea of institutionalizing the operation of the reservoir system in the T-A sub-basin for the benefit of the two riparian states.
- Riparian countries start negotiations to think of an institutional mechanism to serve this purpose.
- If this approach prove viable, it can be replicated at other sub-basins



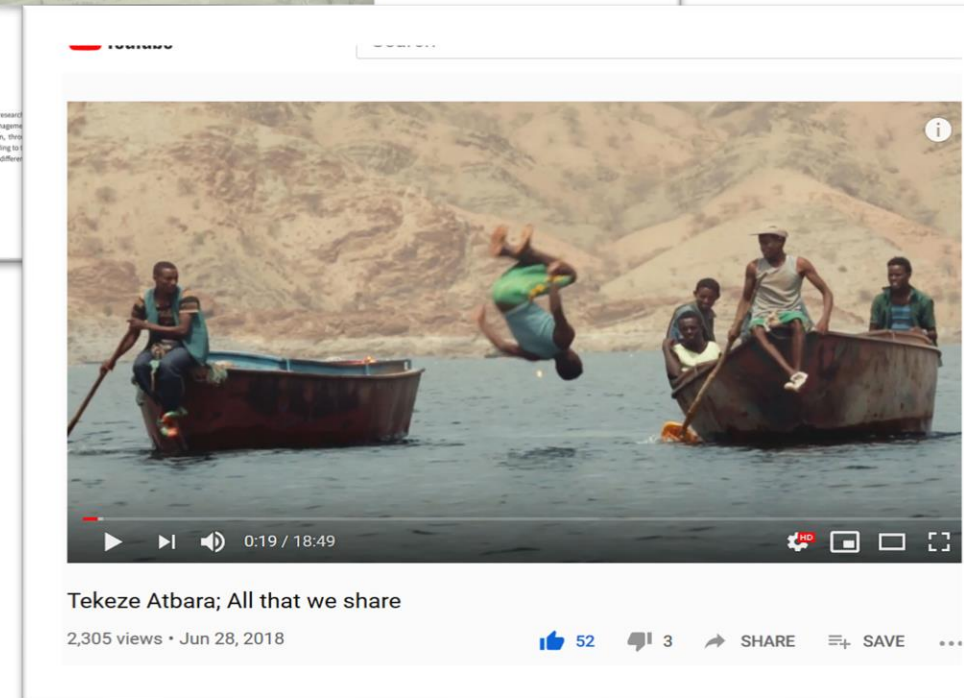
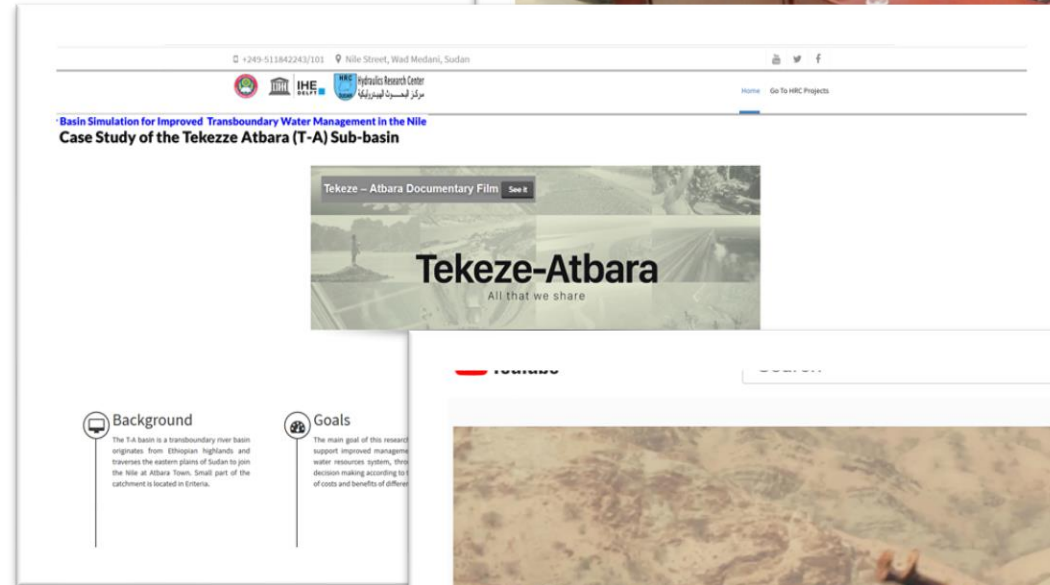
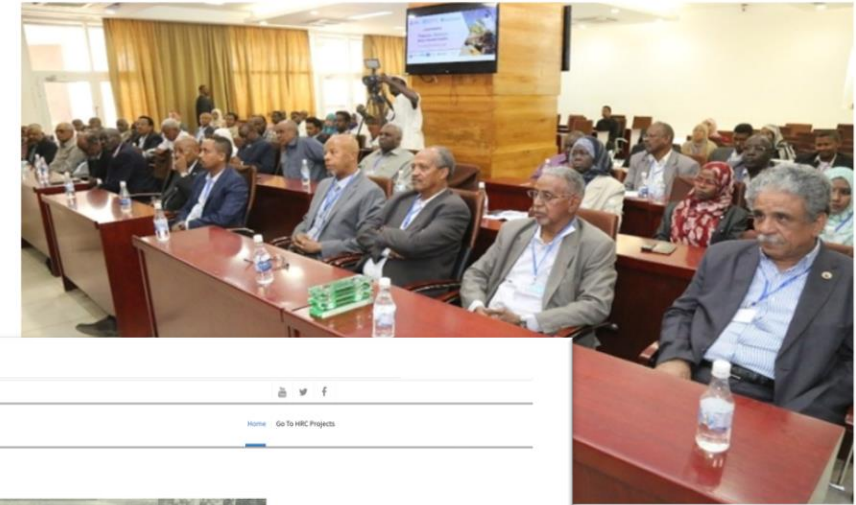
## Phase 2 Key research pillars

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- Clear analysis of motives and constraints for transboundary cooperation, including the costs and benefits analysis of reservoir operation scenarios,
- Review of global and regional experience of reservoir operation in transboundary context,
- Close consultation with policy makers in Ethiopia and Sudan

# The outreach

- Meetings with stakeholders (2 Workshops and 1 regional conference)
- Brochures, reports in TV and newspapers
- Active website: [www.t-abasin.hrc-sudan.sd](http://www.t-abasin.hrc-sudan.sd)
- 18 min documentary film



# Conclusions

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- The project avail robust information for policy making
- Valuable asset of the project: joint model; joint dataset, joint research team
- 5 MSc students associated to the project
- Outreach: enhances visibility of the T-A basin

# Thank You

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