Operational decision support system (ODSS) for integrated water resources management in Tanzania

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DHI

Outline of Presentation

- Background and Development Objectives of the ODSS
- Components of the ODSS
  - Water resources information system (WRIS)
  - Flood early warning system (FEWS)
  - Water use permitting analysis tool (WUPA)
  - Dam operation support tool for reservoir operations (DOS)
- Conclusion/Summary

Background

- Development of the ODSS is a component under the Water Sector Support Project Phase II (WSSP II) implemented 2017 – 2022.
- The project comprises the IWRM component of the WSSP II which includes development of an Operational Decision Support System (ODSS) linked to a modernised hydromet monitoring system.

Development Objectives (1/2)

To design, develop, install, and implement a comprehensive modern, modular, and customizable ODSS framework with:

- Water Resource Information System (WRIS) with hydro-met linkage, with integrated data management, analysis, and visualisation tools, as well as provisions for embedding models

Development Objectives (2/2)

To design, develop, install, and implement a comprehensive modern, modular, and customizable ODSS framework with:

- Prediction Tool for Water Resources Management for the Basin Water Boards
  - Flood Early Warning System (FEWS) (in Wami/Ruvu basin)
  - Water use permitting and water allocation (in Pangani and Rufiji basins)
  - DSS tools for Reservoir Operations (for Nyumba Ya Mungu Dam in Pangani basin and Mtera Dam and Kidatu Dam in Rufiji basin)


Uganda
KENYA
RWANDA
BURUNDI
THE UNITED REPUBLIC OF TANZANIA
DEMOCRATIC REPUBLIC OF CONGO
ZAMBIA
MALAWI
MOZAMBIQUE
Bukoba
Musoma
Lake Victoria
Mwanza
Lake Victoria
Arusha
Moshi
Shinyanga
Internal Drainage
Kigoma
Tabora
Lake Tanganyika
Singida
Tanga
Mkoani
Pangani
Dodoma
Wami / Ruvu
Zanzibar
Morogoro
Kibaha
Dar es salaam
Iringa
Rufiji
Sumbawanga
Rukwa
Lake Rukwa
Mbeya
Lake Nyasa
Songea
Lindi
Mtwara
Ruvuma Southern Coast

Purpose of the WRIS

- Enhance knowledge by sharing
  - water datasets
  - knowledge products
- Provide easy access to the latest relevant available datasets for water resources management and planning across Tanzania

Key Features of the WRIS

- The WRIS
  - is linked to diverse data sources
  - shows latest data from external and internal sources
    - from public domain
    - from affiliated institutions
    - from own data repositories
- State variables in the WRIS include
  - historical
  - near real-time
  - forecast datasets

WRIS (selected features)

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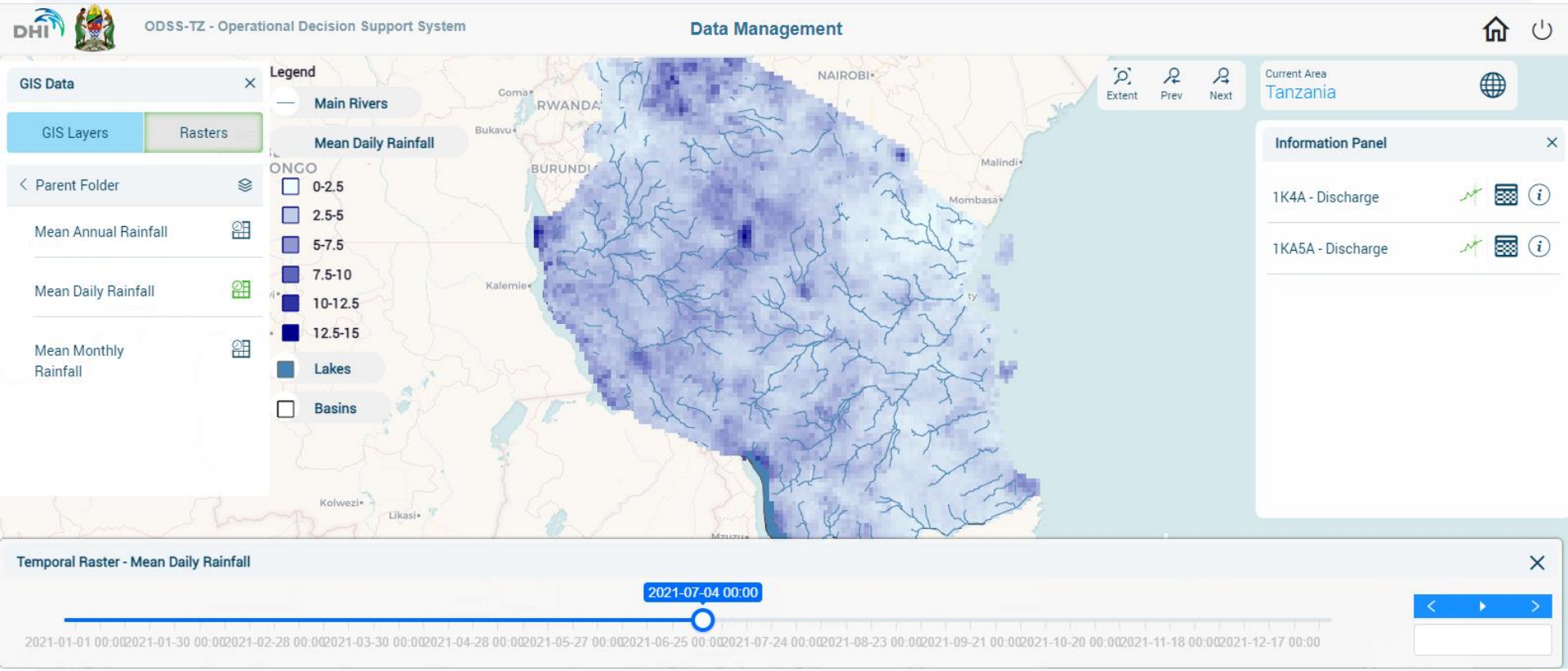
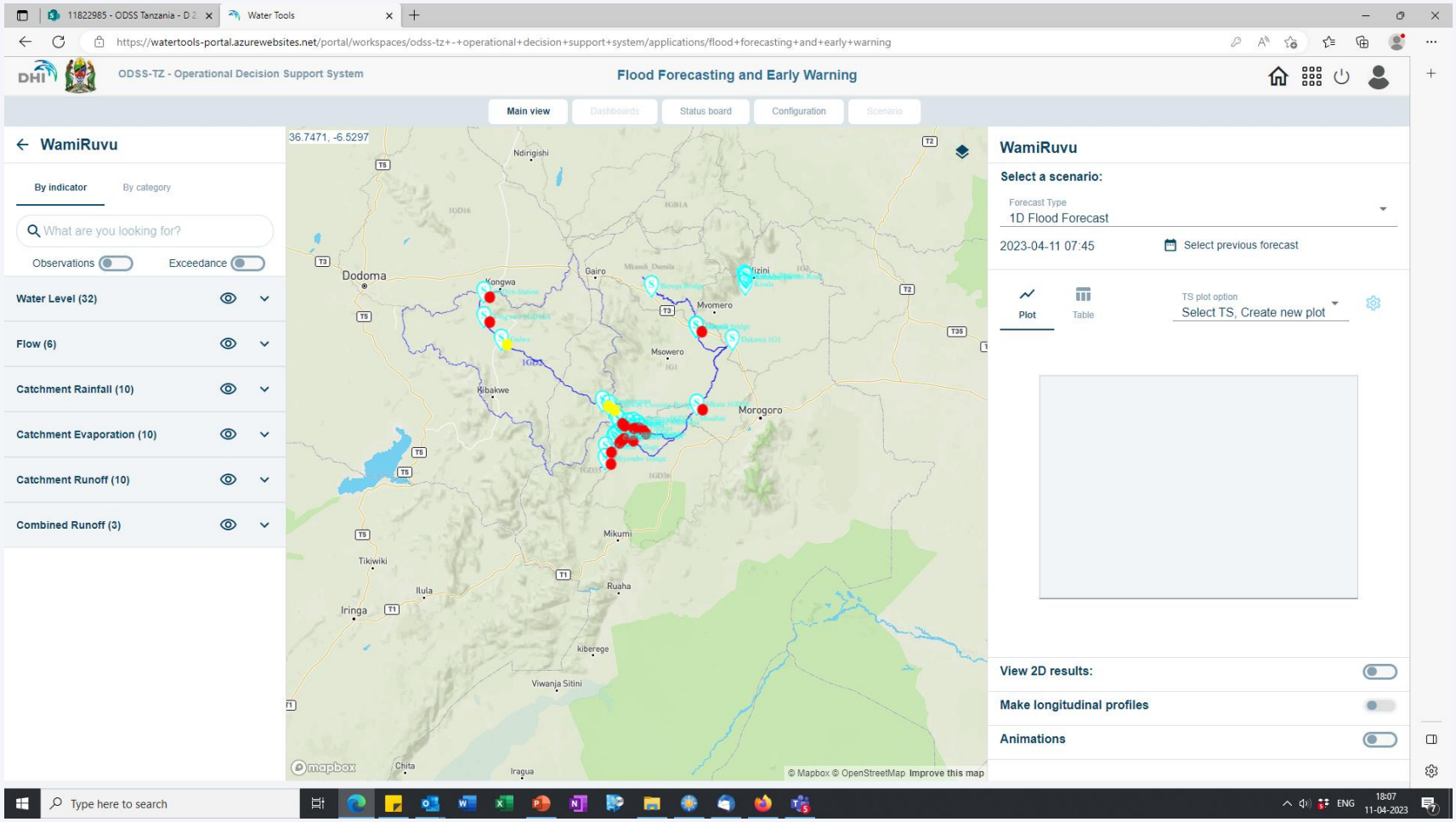


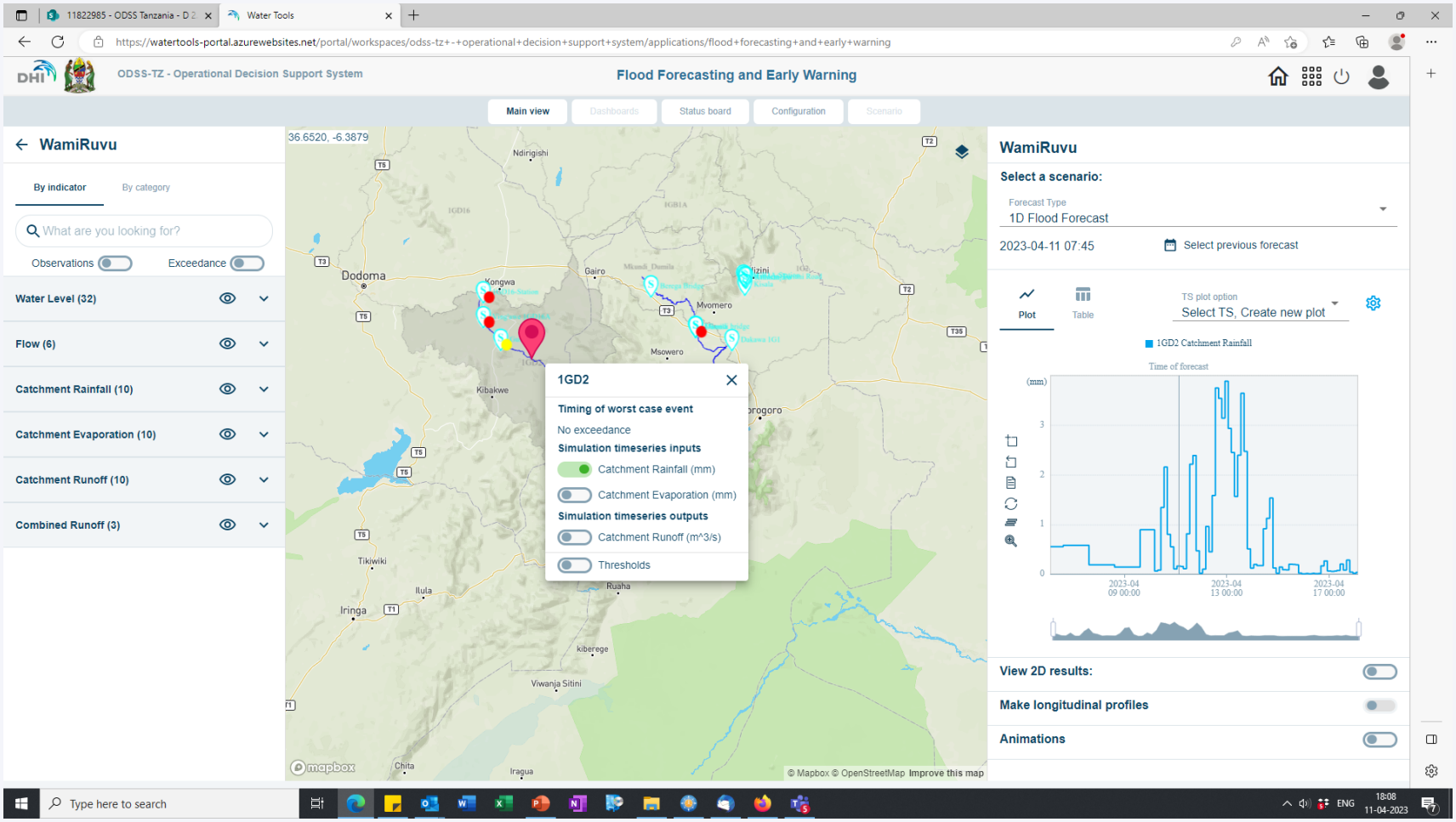
Components of the FEWS

- **Weather forecasting system** - using numerical weather prediction models (NWP) with quantitative precipitation forecasts (QPF) of the Tanzania Meteorological Authority (TMA)
- **Hydrologic forecasting system** - using rainfall-runoff models
- **Flood forecasting system** - with hydrodynamic modelling and data assimilation
- **Dissemination system** - to automatically alert stakeholders through different communication channels

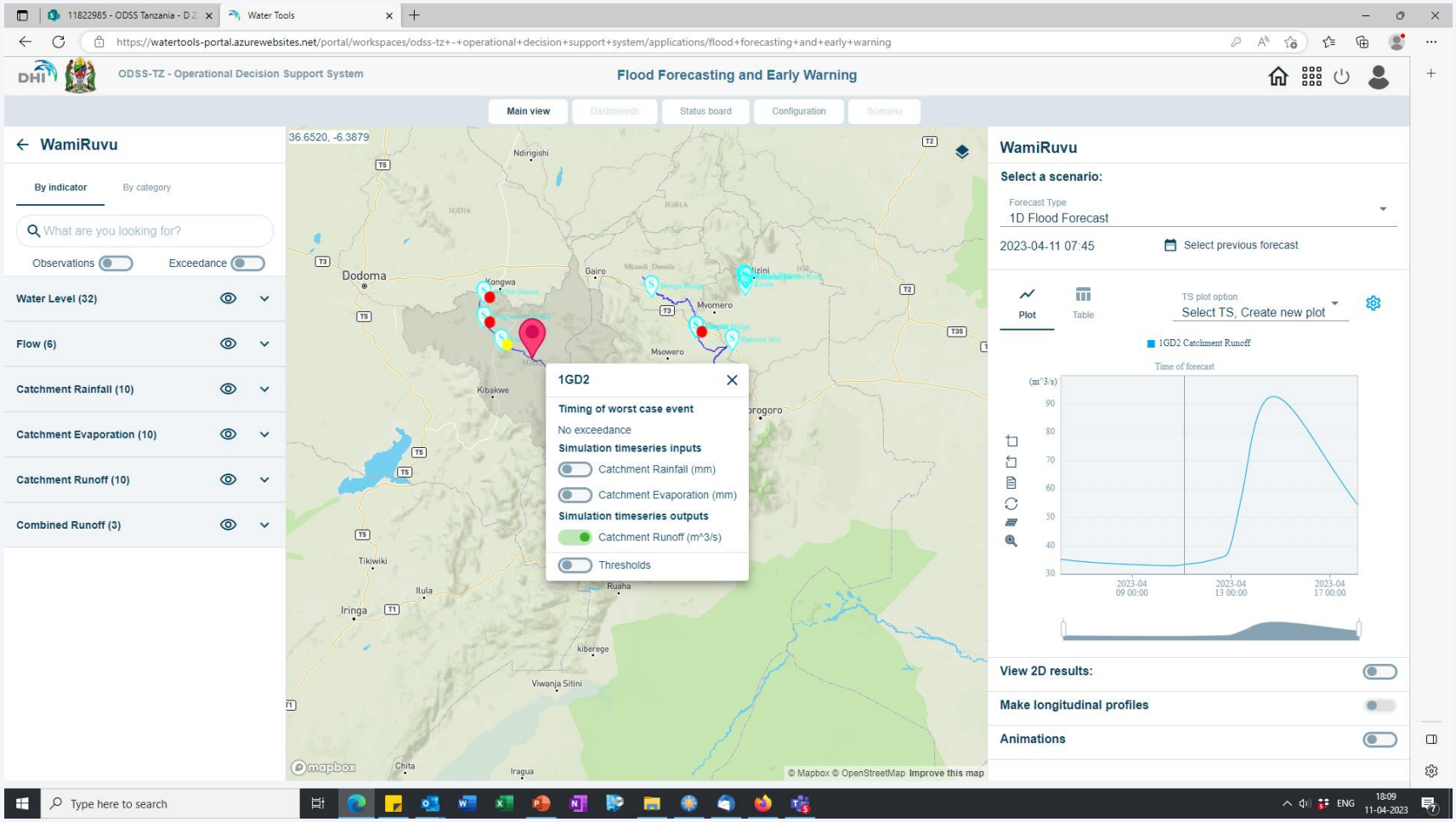
FEWS – explore



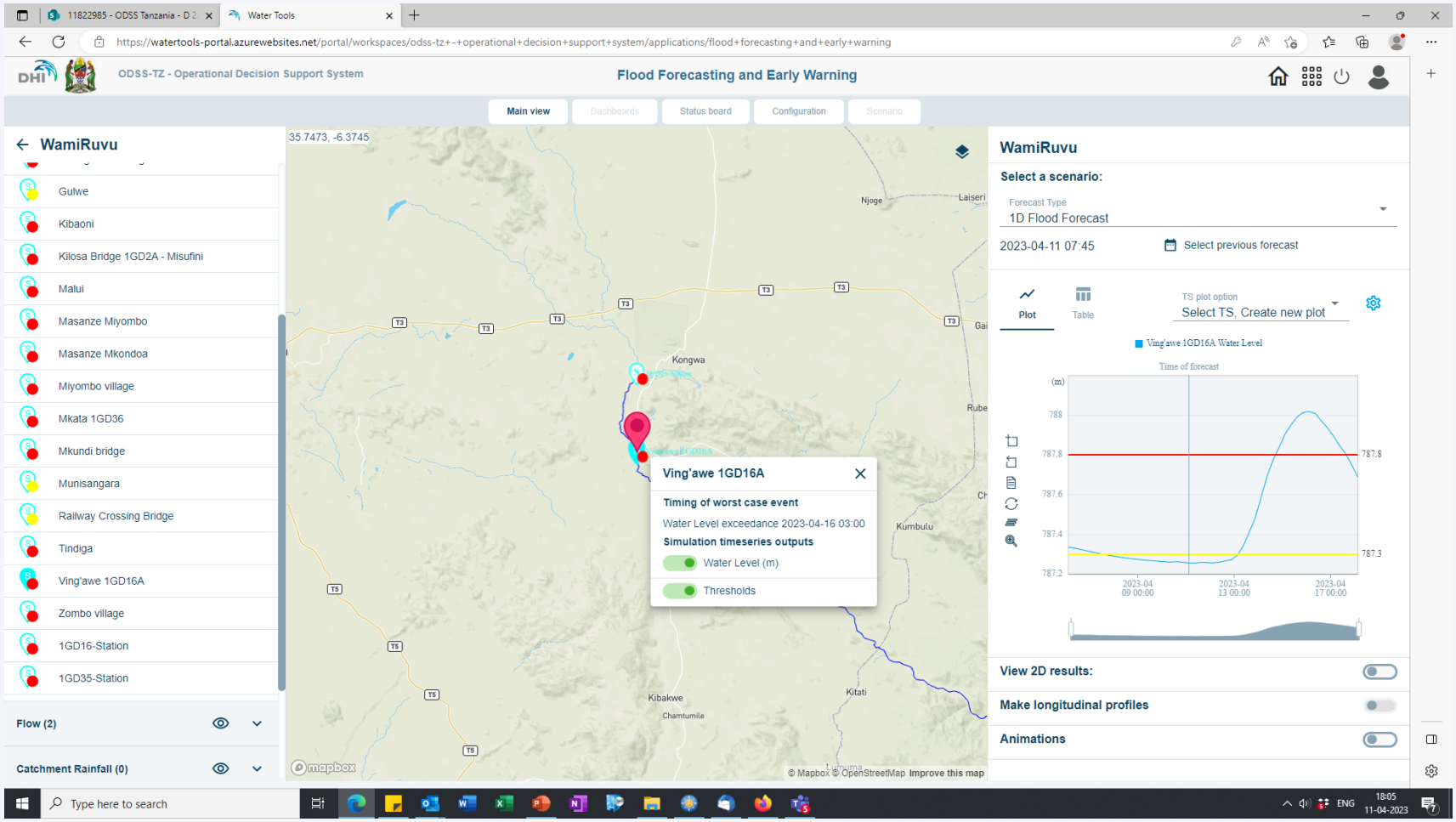
FEWS – explore HYD forecast



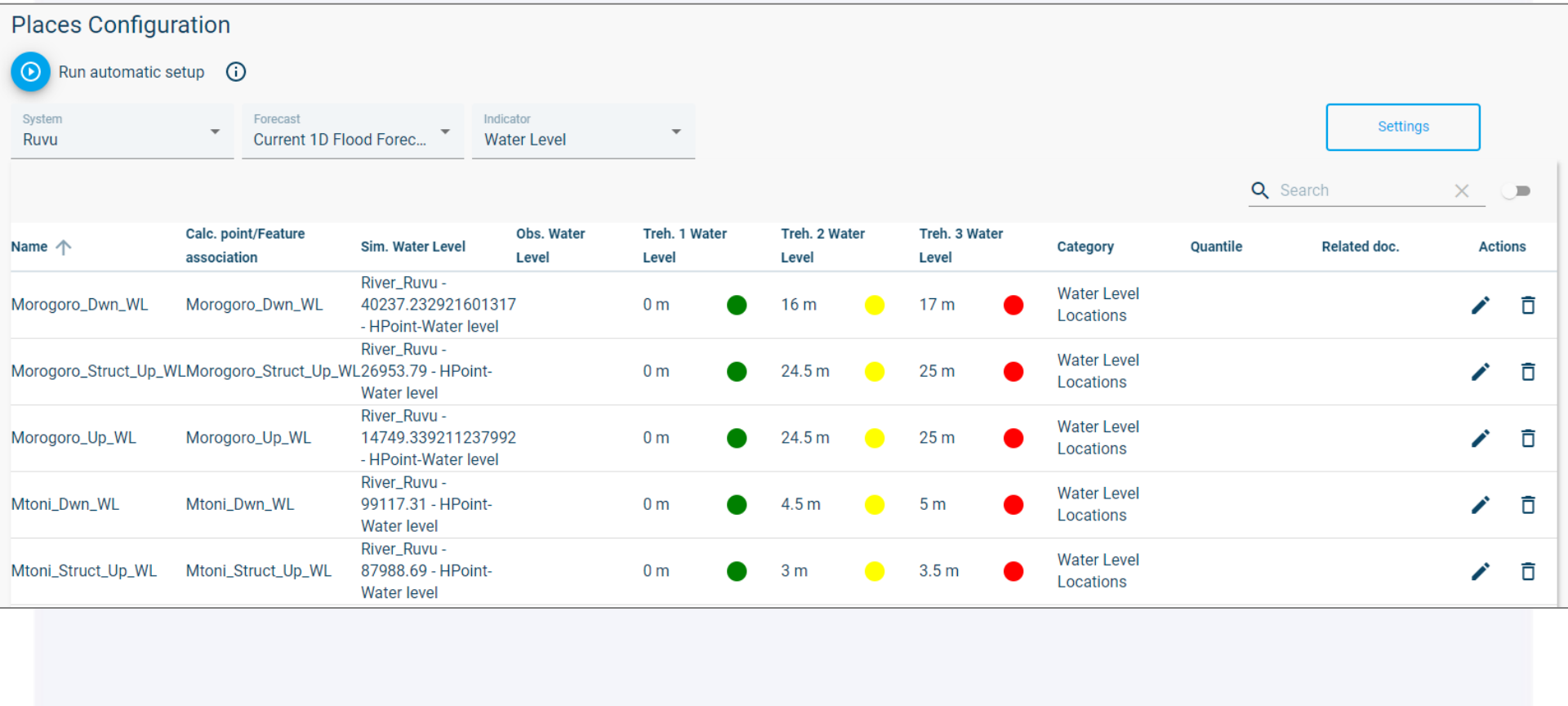
FEWS – explore HYD forecast



FEWS – explore HD forecast



FEWS – configure thresholds



Places Configuration

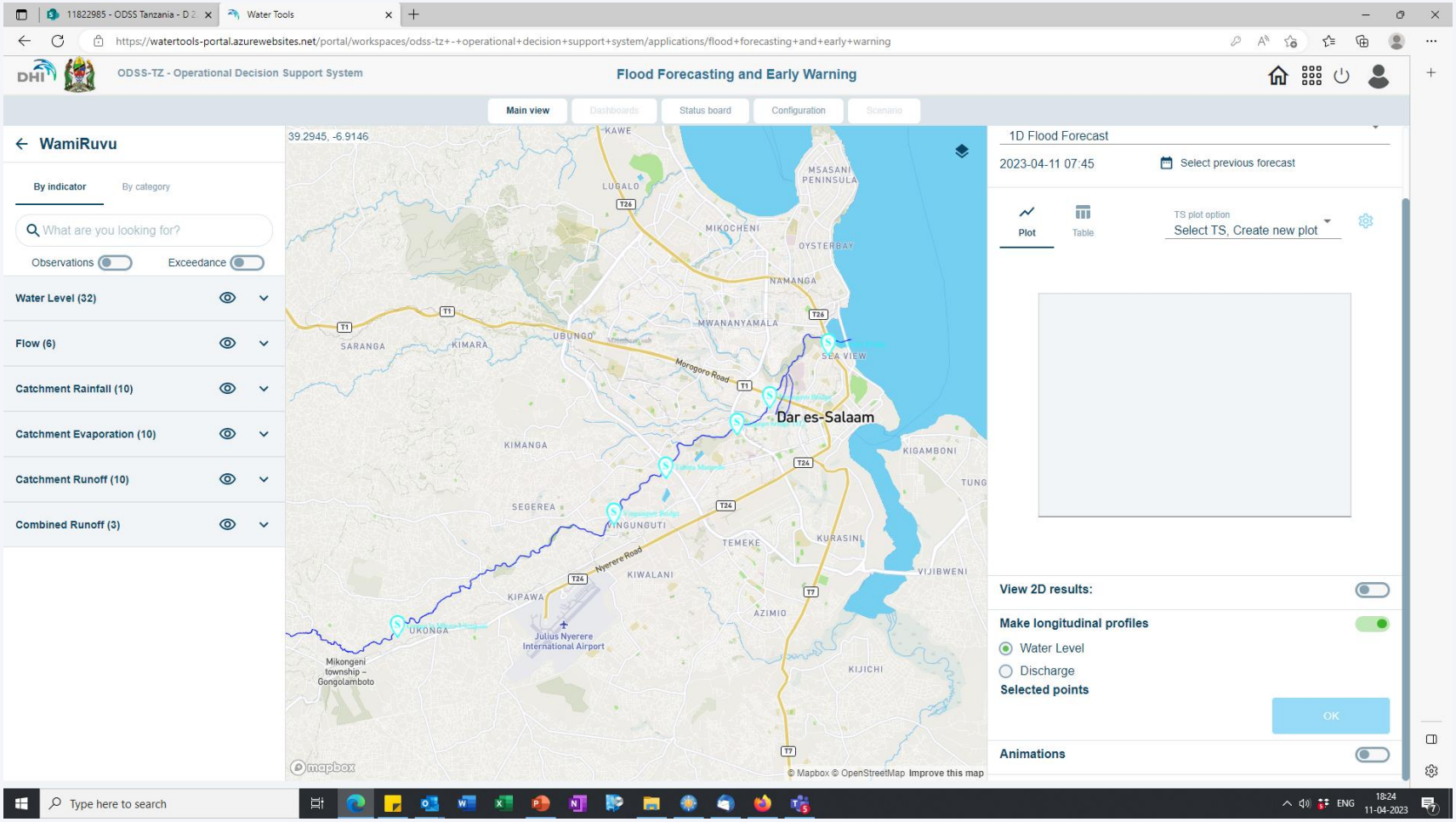
Run automatic setup

System: Ruvu | Forecast: Current 1D Flood Forec... | Indicator: Water Level | Settings

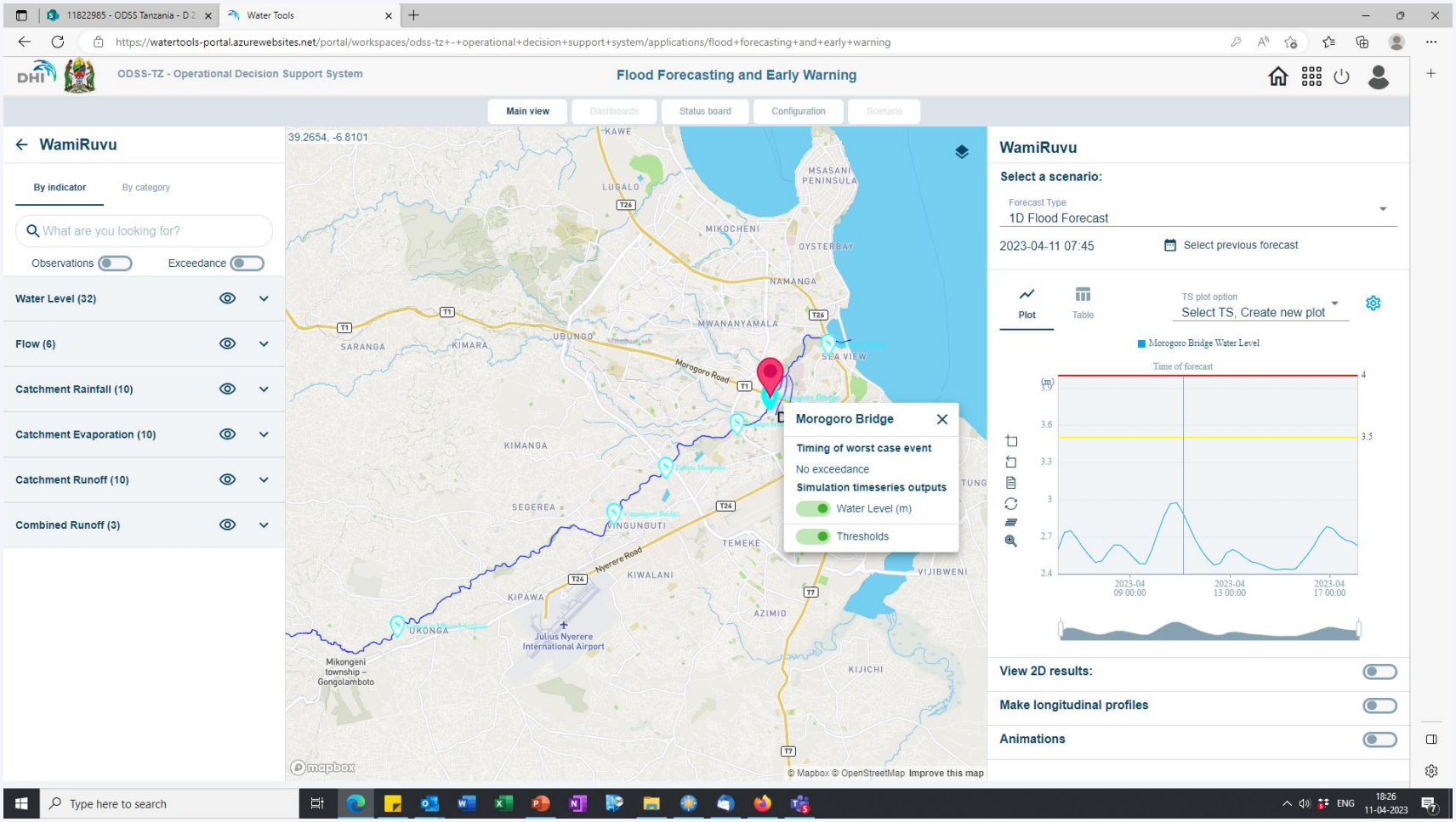
Search

Name	Calc. point/Feature association	Sim. Water Level	Obs. Water Level	Treh. 1 Water Level	Treh. 2 Water Level	Treh. 3 Water Level	Category	Quantile	Related doc.	Actions
Morogoro_Dwn_WL	Morogoro_Dwn_WL	River_Ruvu - 40237.232921601317 - HPoint-Water level		0 m	16 m	17 m	Water Level Locations			
Morogoro_Struct_Up_WL	Morogoro_Struct_Up_WL	River_Ruvu - 26953.79 - HPoint-Water level		0 m	24.5 m	25 m	Water Level Locations			
Morogoro_Up_WL	Morogoro_Up_WL	River_Ruvu - 14749.339211237992 - HPoint-Water level		0 m	24.5 m	25 m	Water Level Locations			
Mtoni_Dwn_WL	Mtoni_Dwn_WL	River_Ruvu - 99117.31 - HPoint-Water level		0 m	4.5 m	5 m	Water Level Locations			
Mtoni_Struct_Up_WL	Mtoni_Struct_Up_WL	River_Ruvu - 87988.69 - HPoint-Water level		0 m	3 m	3.5 m	Water Level Locations			

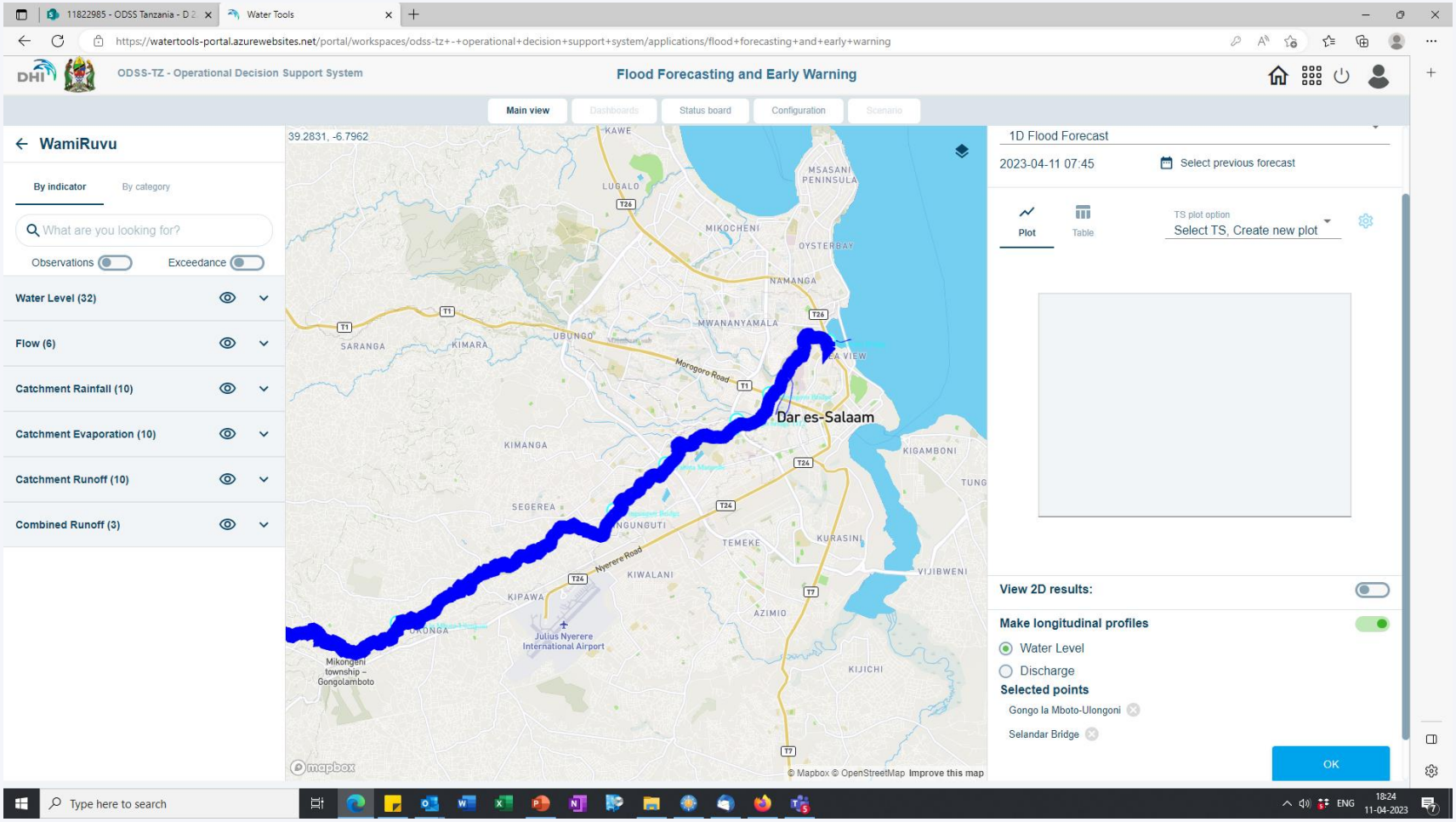
FEWS – explore flood forecast



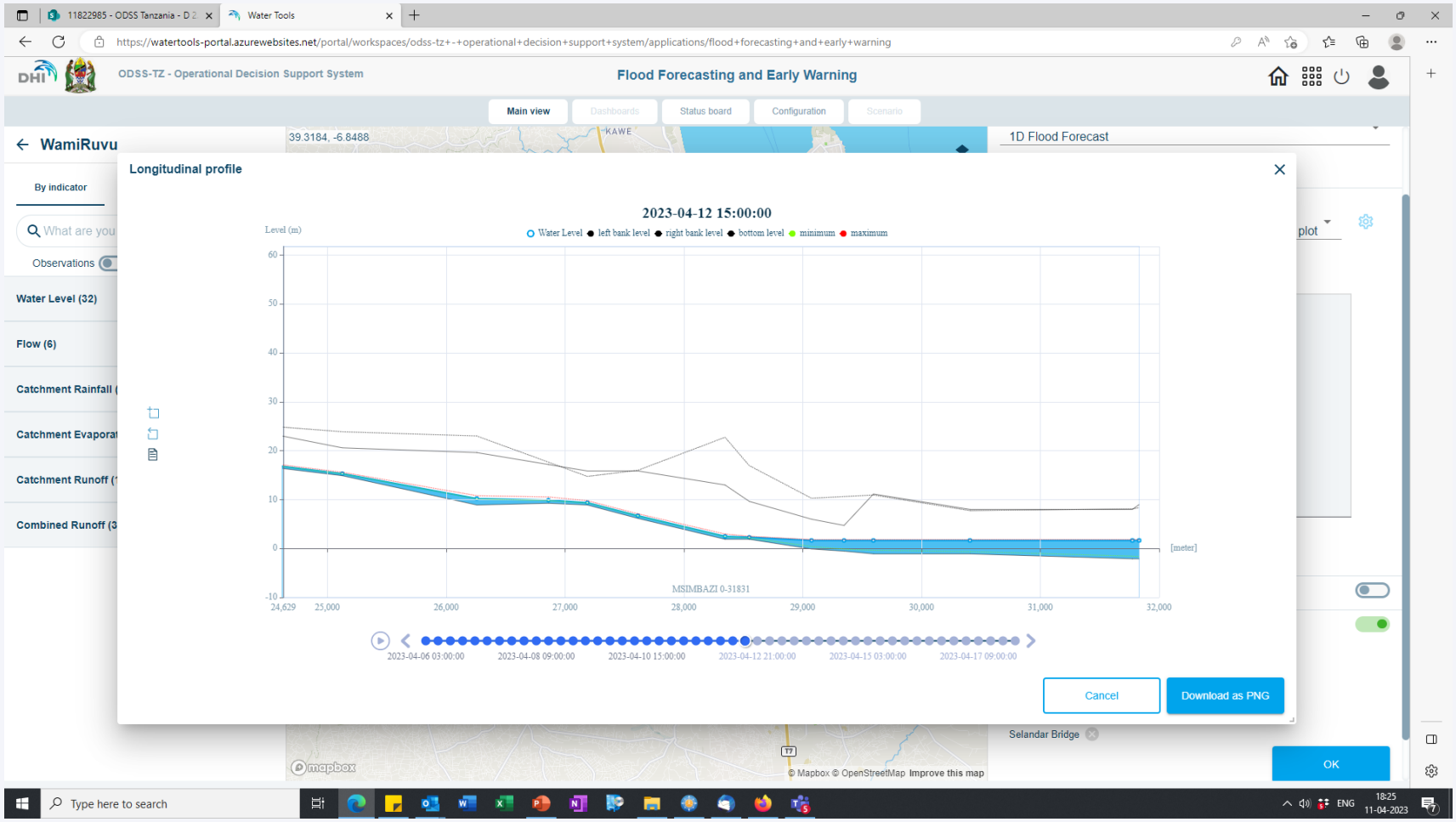
FEWS – explore flood forecast



FEWS – explore flood forecast



FEWS – explore flood forecast



FEWS – disseminate alerts

Flood Alerts and Warnings 2023-01-01 @ ODSS-TZ FFEWS

odsstz@gmail.com

Reply | Reply All | Forw

To Jakob Luchner; Mekuria Beyene; bertha.tarimo@maji.go.tz; edward@wemaconsult.com; elijommassy@gmail.com; Elise Usai; erasmostarimo@yahoo.com; fatuma.mambomlimbila@maji.go.tz; fmambo@rocketmail.com; george.lugomelo@maji.go.tz; hoseasanga@gmail.com; hoseasanga@yahoo.com; jknobert@gmail.com; jkwitiga@gmail.com; joseph.kwitiga@maji.go.tz;

generated: 2023-01-01 07:53
simulation: Simulation of Scenario of WamiRuvu_FFEWS_HD at 2023-01-01 07:46:14
start of simulation: 2022-12-27 12:00
time of forecast: 2023-01-01 12:00
end of simulation: 2023-01-08 12:00

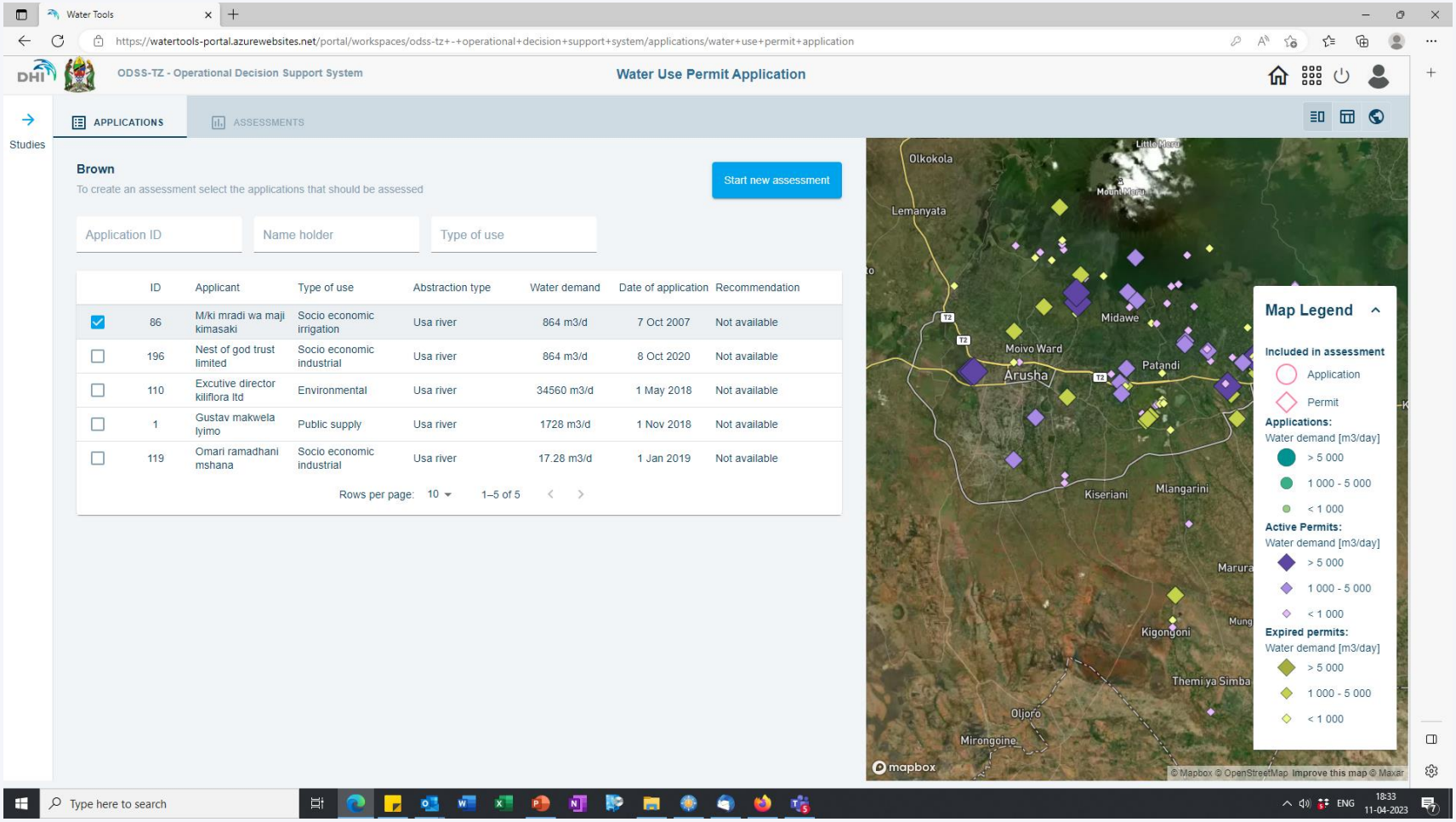
Flood Forecast - forecasted Water Level (max. 168 hours)

Status	Location	Alert	Water Level [m]	Warning Threshold [m]	Danger Threshold [m]
	Miyombo - 27170	Danger	469.09	468	469
	Kinyasungwe - 17818	Warning	788.29	788	789
	Miyombo - 17103	Warning	491.53	491	492
	Miyombo - 29430	Warning	464.85	464	465
	Miyombo - 32554	Warning	461.58	461	462
	Mkondoa - 35570	Warning	476.03	476	477
	Mkondoa - 98931	Warning	380.76	380	381
	Diwale - 34270	Ok	358.74	361	362
	Kinyasungwe - 37048	Ok	761.14	762	763
	Miyombo - 8537	Ok	509.28	515	516
	Mkondoa - 26059	Ok	498.11	500	501
	Mkundi - 10470	Ok	763.12	772	773

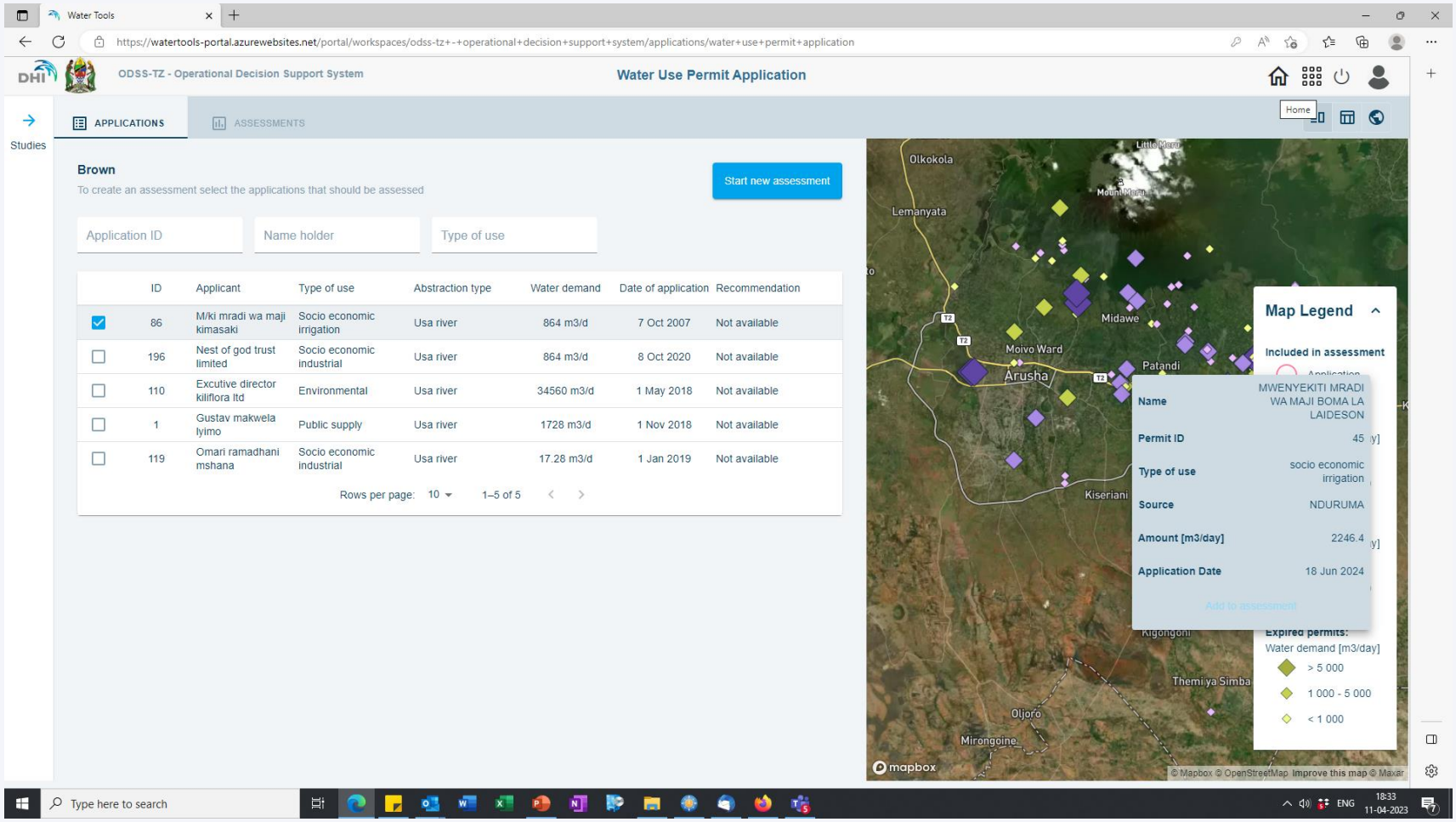
Purpose of the WUPA

- WUPA supports decision making for **granting new water use permits** and evaluating existing permits.
- WUPA includes **water balance and allocation** functionality based on a dynamic water resources system model.
- WUPA enables **analysing the effects** of existing and applied for water abstractions on the basin's water balance.
- Risk of water shortages may vary according to monthly variation in water availability and permits. Therefore, new permits may influence the area in which a permit is given and other areas in the basin (e.g., downstream abstractions in a river).

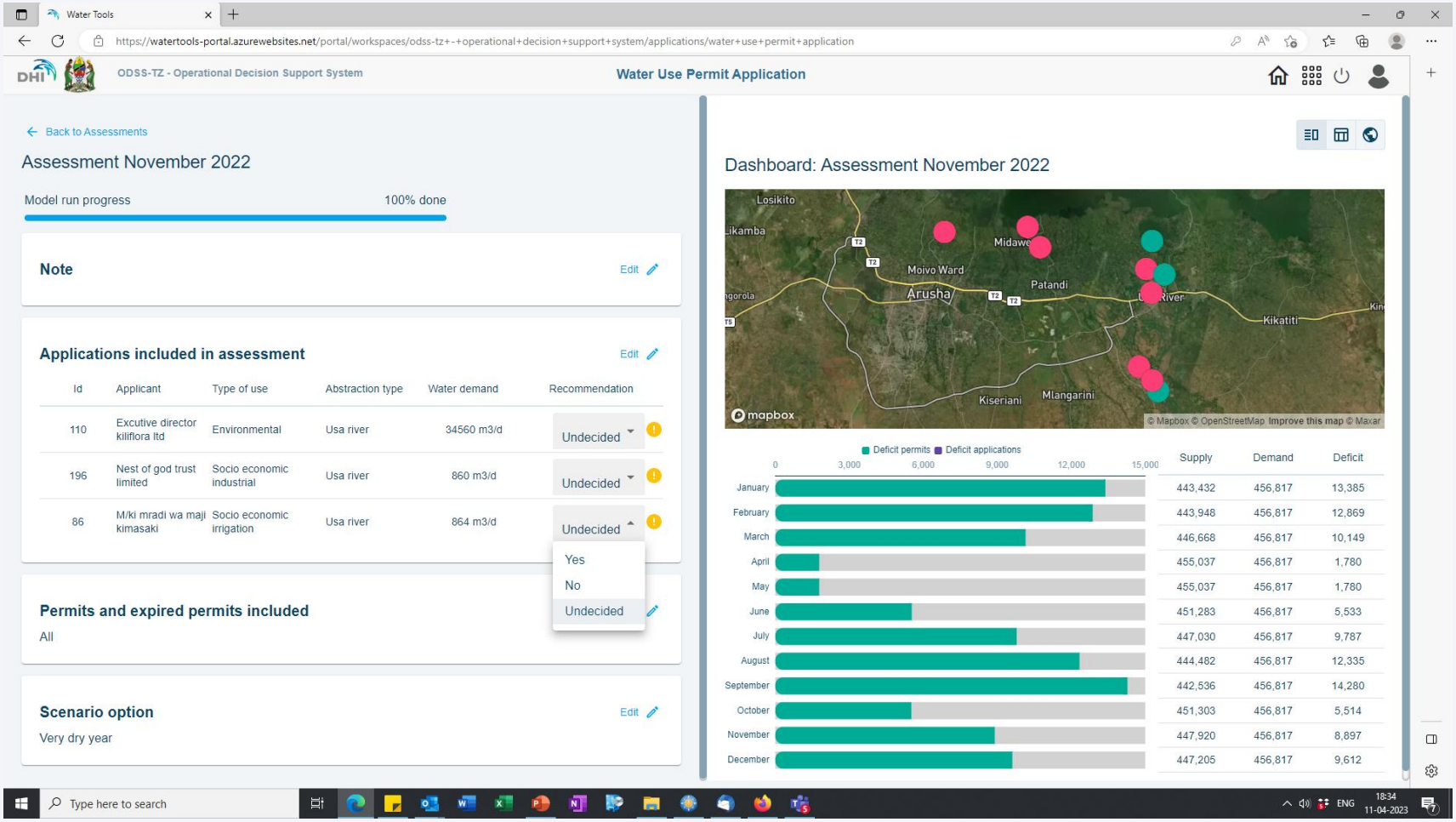
WUPA – applications & permits



WUPA – applications & permits



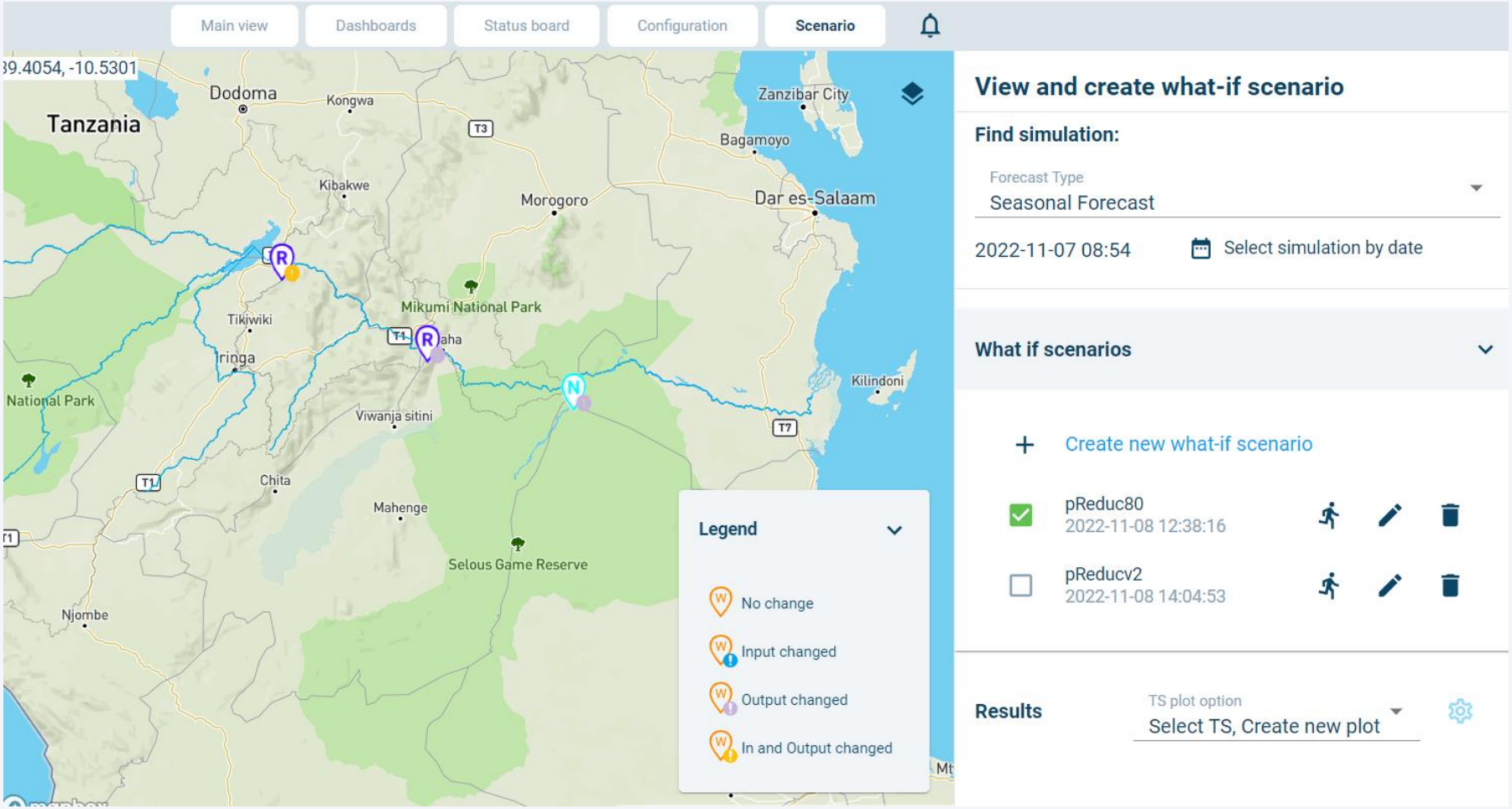
WUPA – analyse effects



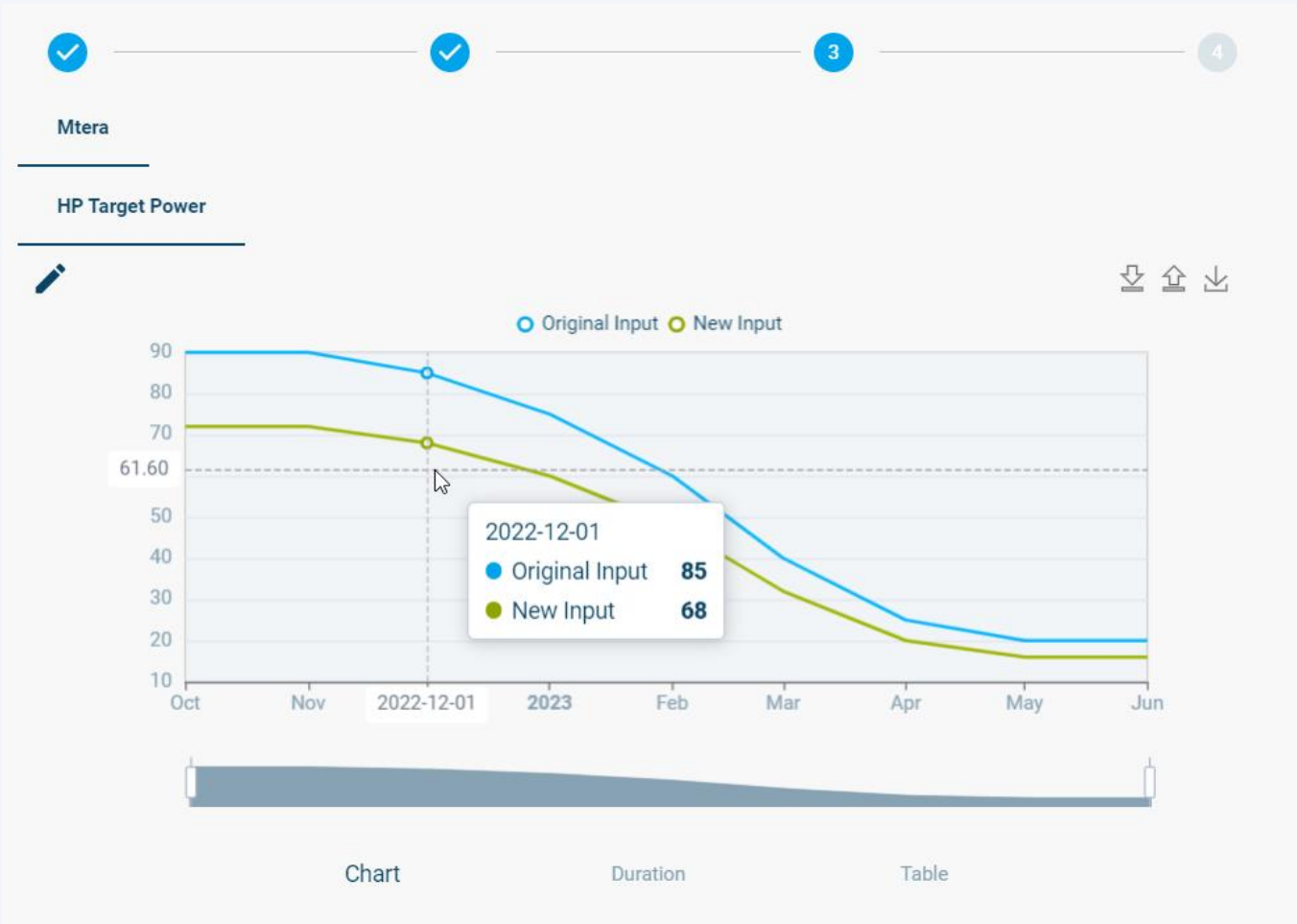
Purpose of the DOS

- Hydrological flow forecasting models based on **seasonal weather forecasts** and with **embedded operation rules** for reservoirs are used to support reservoir operations for improved and integrated water resources management.
- The tools support **decisions for efficient water allocation** from reservoirs in low flow periods: This allows minimising water shortages and optimising reservoir releases in high flow periods to reduce downstream floods.

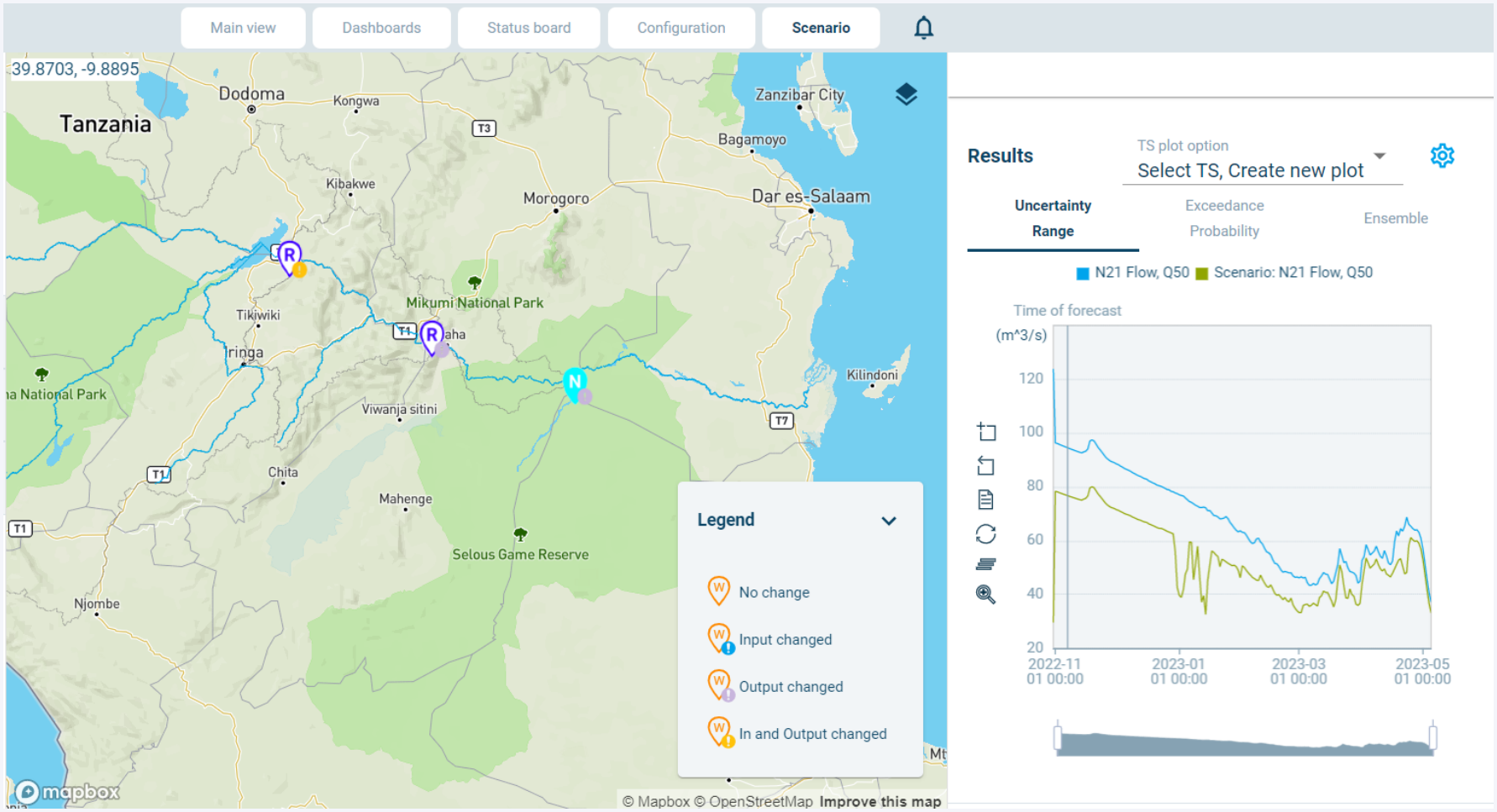
DOS – dam release effects



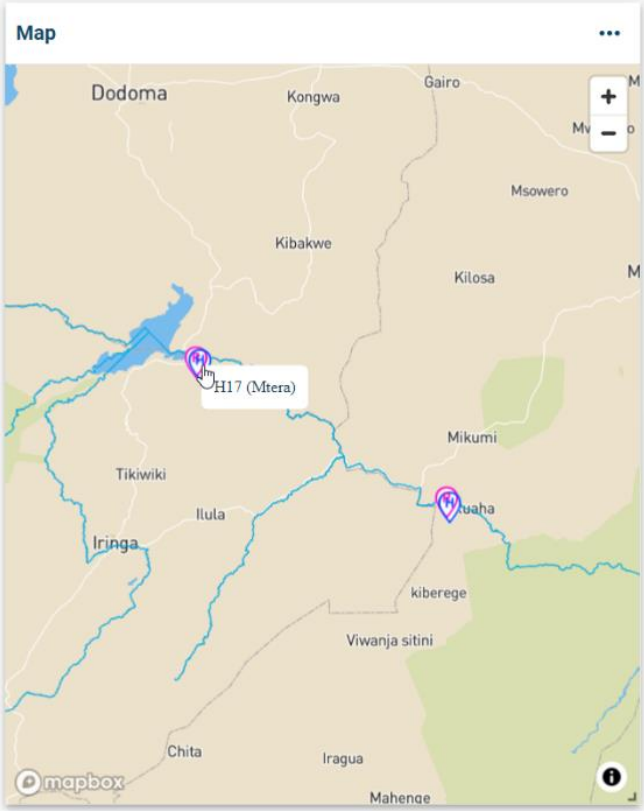
DOS – define scenario

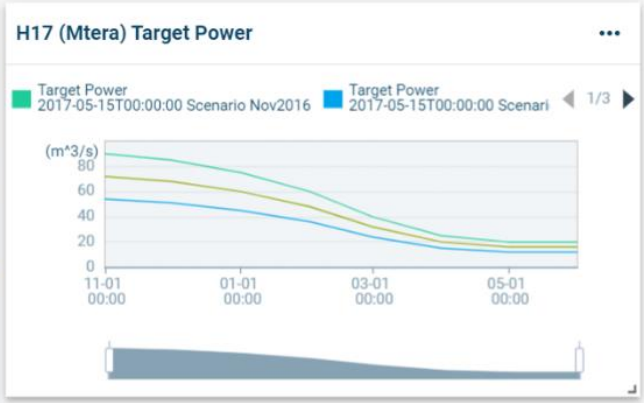


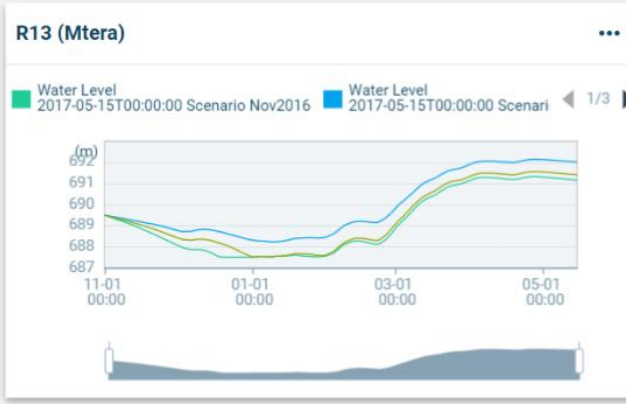
DOS – compare scenarios

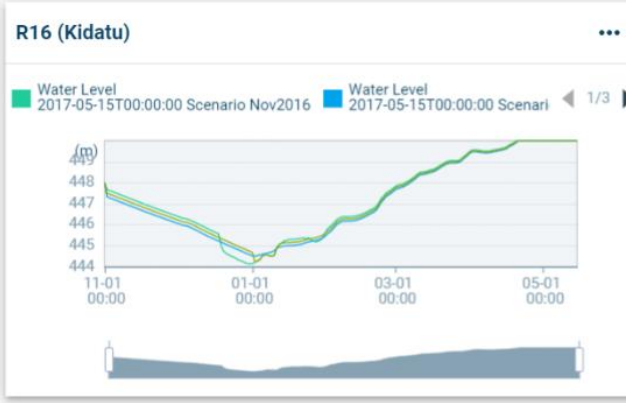


DOS – dashboard





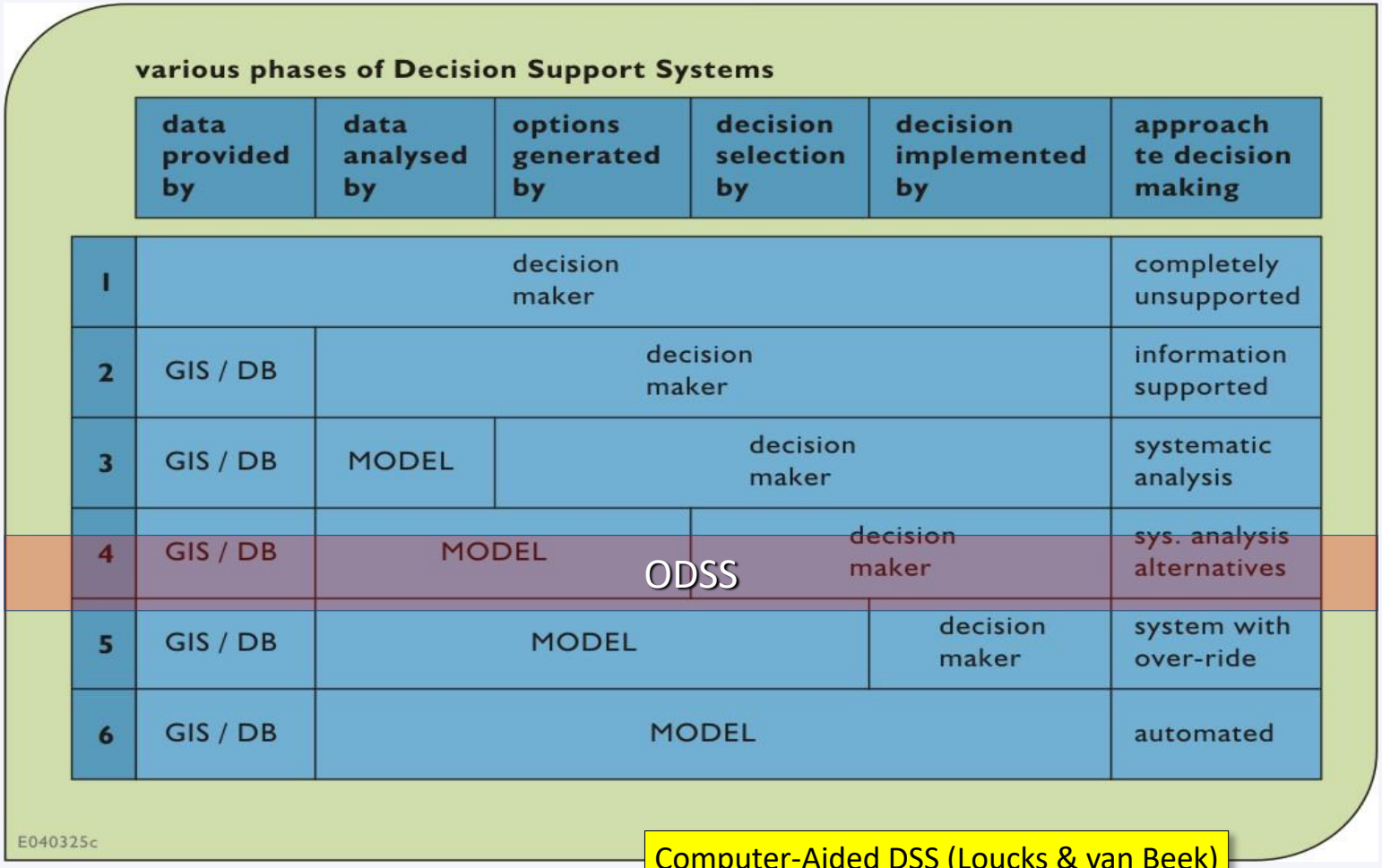




ODSS – integrated solution

- Water resources information system (WRIS)
- Flood early warning system (FEWS)
- Water use permitting analysis tool (WUPA)
- Dam operation support tool for reservoir operations (DOS)

Decision Support System



Computer-Aided DSS (Loucks & van Beek)


NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL
THANK
YOU!