WaterSENSE Making SENSE of the water value chain in Australia

Operational Hydrological Models for Water Management: Case Studies from Australia, Brazil, and Portugal

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Hidromod

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Twitter: @MakeWaterSENSE

This project has received funding from the Horizon 2020 research and innovation programme under grant agreement No 870344

Introduction

- Operational hydrological models have great importance in water management
- AQUASAFE is a user-friendly platform for integrated water management including operational hydrological models
- SWAT model is one of the operational hydrological models in AQUASAFE

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Currently available models

Coastal	Inland	Urban water	Generic model
• MOHID • DELFT3D • SWAN • WWIII	• MOHID Land • **SWAT** • Daisy • AquaCrop • HydroAquafarm	• SWMM • EPANET • Bentley WG SG • GPSX	• R • Python • Fortran

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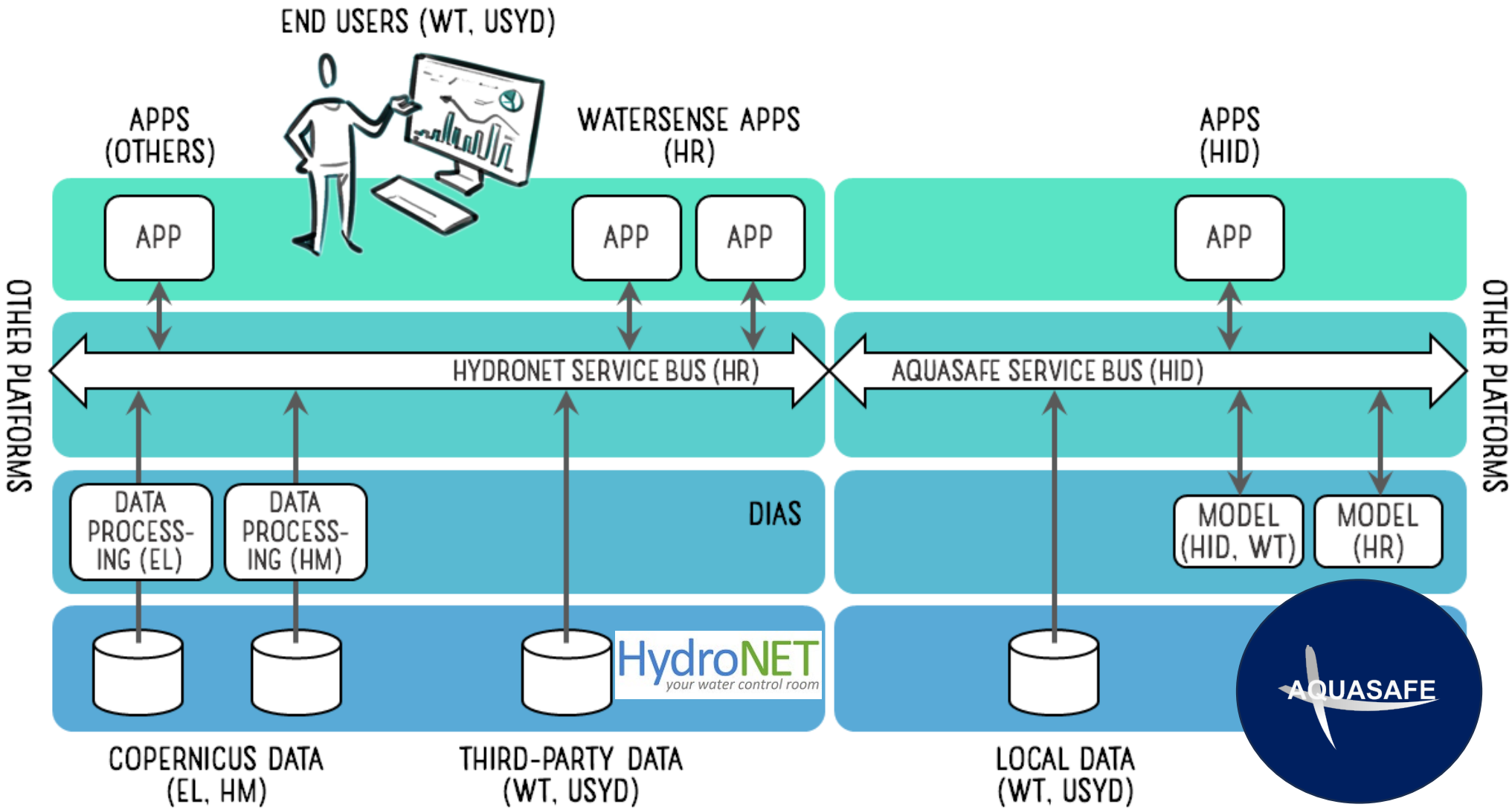

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Visualization in HydroNET

Visualization capabilities in HydroNET for real-time information

Many interfaces and features available for users

HydroNET
your water control room

AQUASAFE focus on operational hydrological modeling while HydroNET focus on visualization

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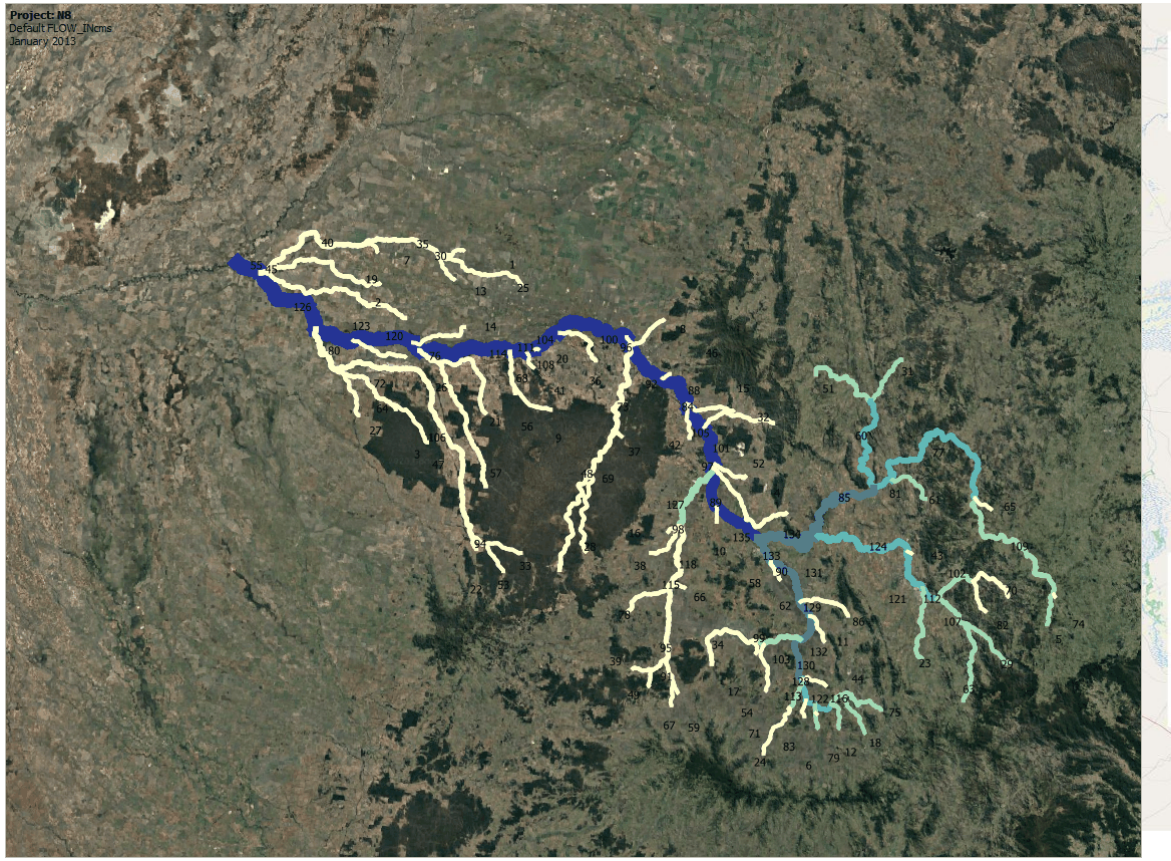
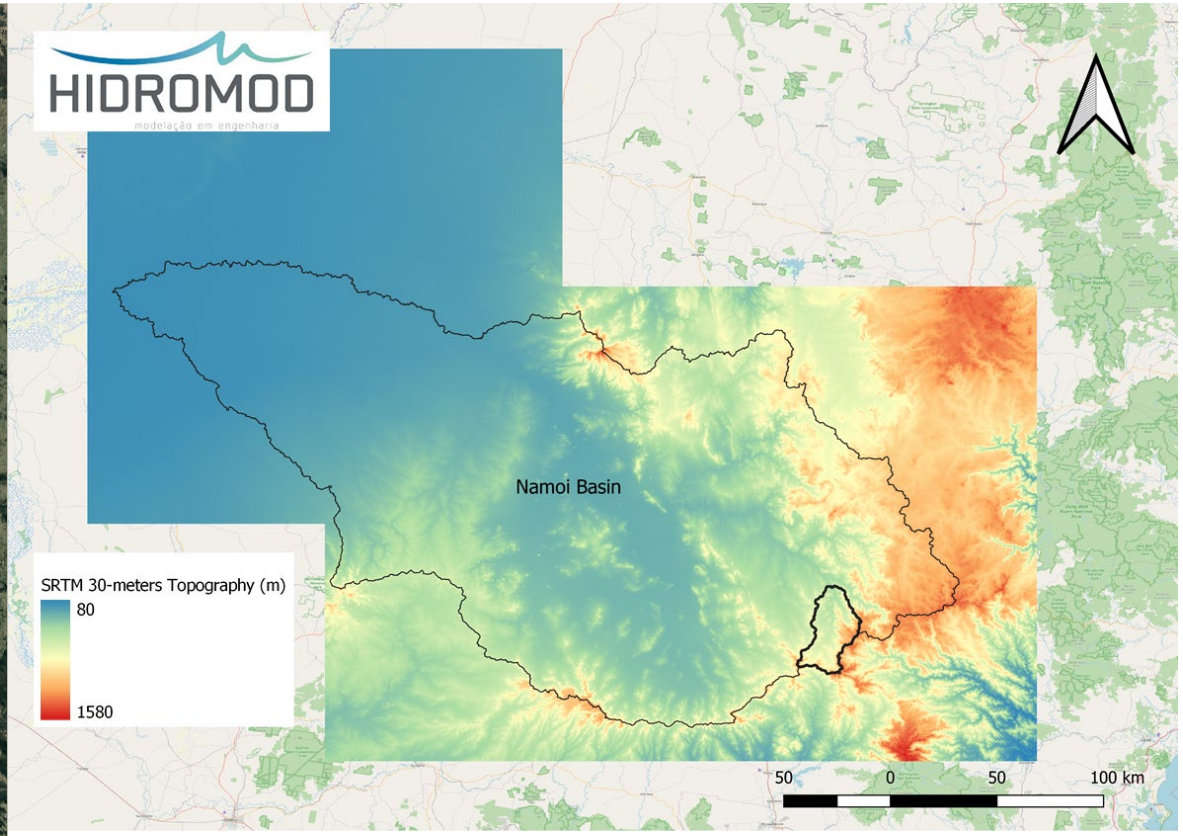
Case Study 1: Australia - Namoi Watershed

- Namoi watershed has many water management challenges
- AQUASAFE used to make SWAT operational to predict flow and soil moisture
- Different sources of meteorological data for model input

Catchment hydrological modelling





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Steps for operational model execution

- Create consistent (gap filled, validate, etc.) boundary conditions
- Set Model execution interval
- Write Boundary conditions
- Write initial conditions
- Set Hotstart files
- Execute model (catch errors etc.)
- Read result files
- Store the results

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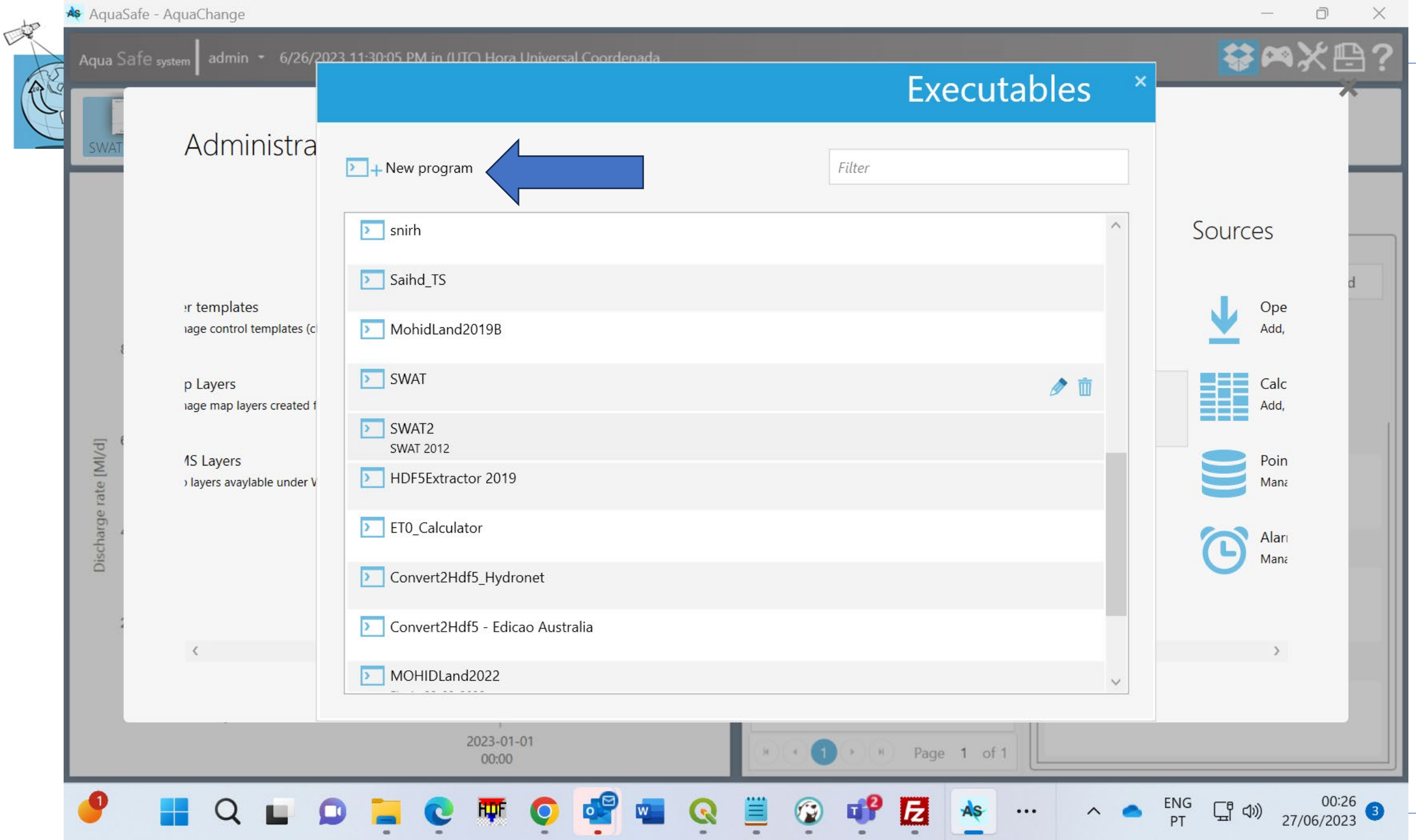
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SWAT
SWAT2
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Convert2Hdf5_Hydronet
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Page 1 of 1
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Mohid SWAT exe available in Aquasafe

Page | Discussion | View source | History

Mohid SWAT

Two modified versions of the SWAT model were developed, based on the three SWAT releases (SWAT2000, SWAT2005 and SWAT 2012). You can download the package with all the MOHID SWAT releases HERE. The functionalities described herein are equal in both versions. So we refer to this modified versions as SWAT-MOHID. This executable has to main functions: i)To help explore SWAT outputs; ii) To Couple SWAT and MRN. You can get the source code from MOHID download area in www.mohid.com. SWAT-MOHID uses the following MOHID modules:

- Module Time
- Module TimeSerie
- Module EnterData
- Module HDF5
- Module GlobalData

- SWAT Feb 9 2012 VER 2009/Rev 510
- http://wiki.mohid.com/index.php?title=Mohid_SWAT
- SWAT Apr 12 2013 VER 2012/Rev 591
- https://github.com/pedrochambel/SWAT-MOHID

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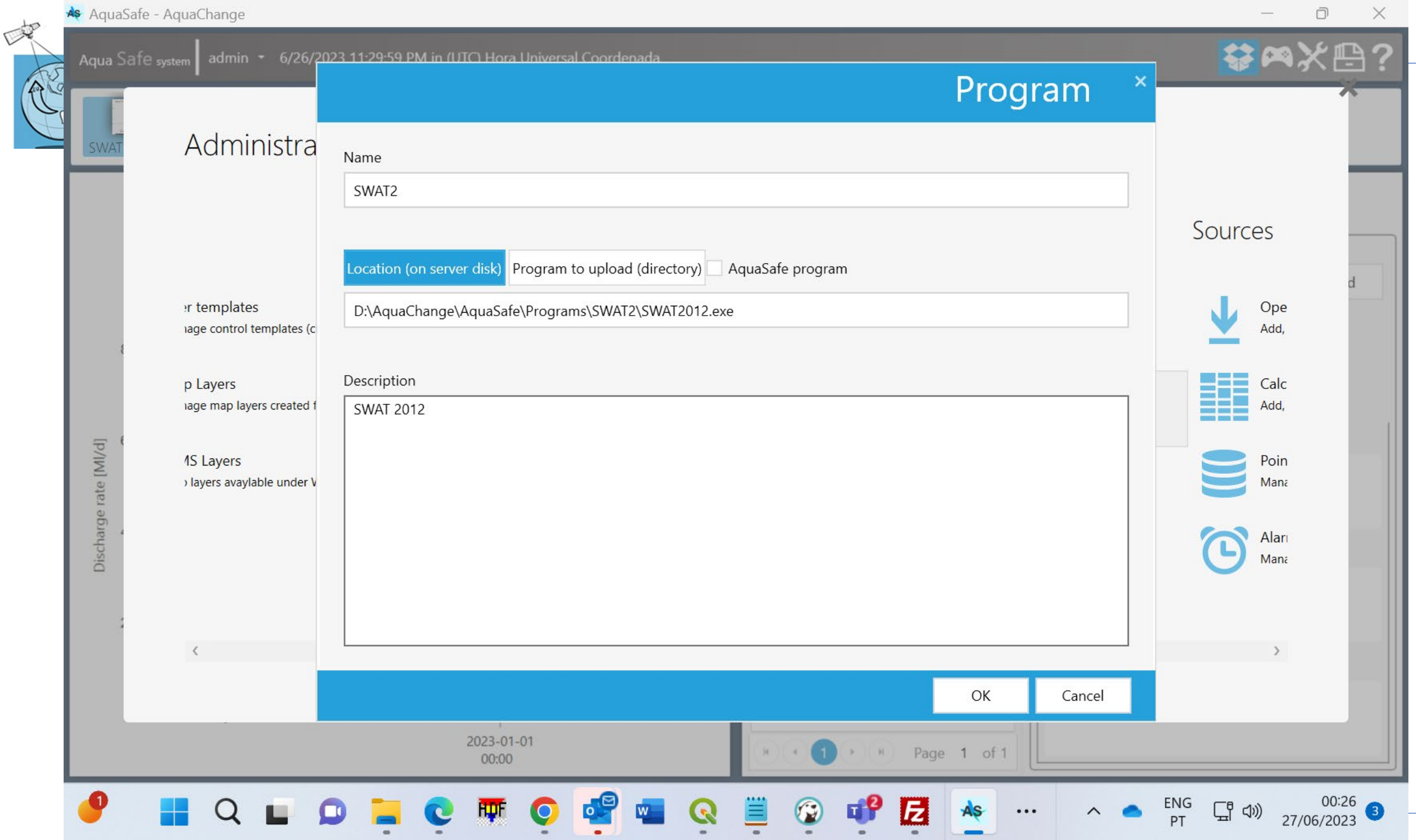
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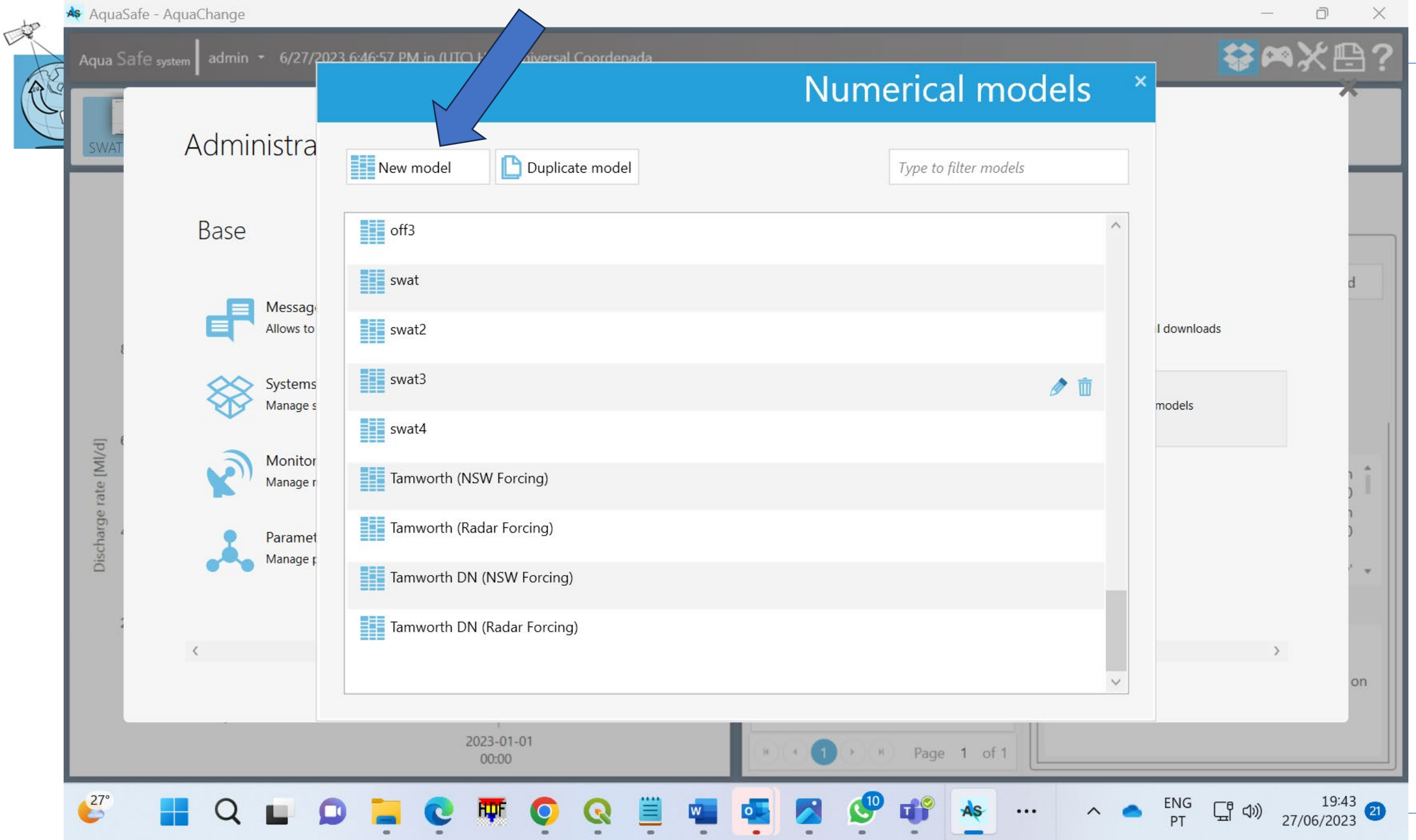
AquaSafe - AquaChange
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Tamworth DN (Radar Forcing)
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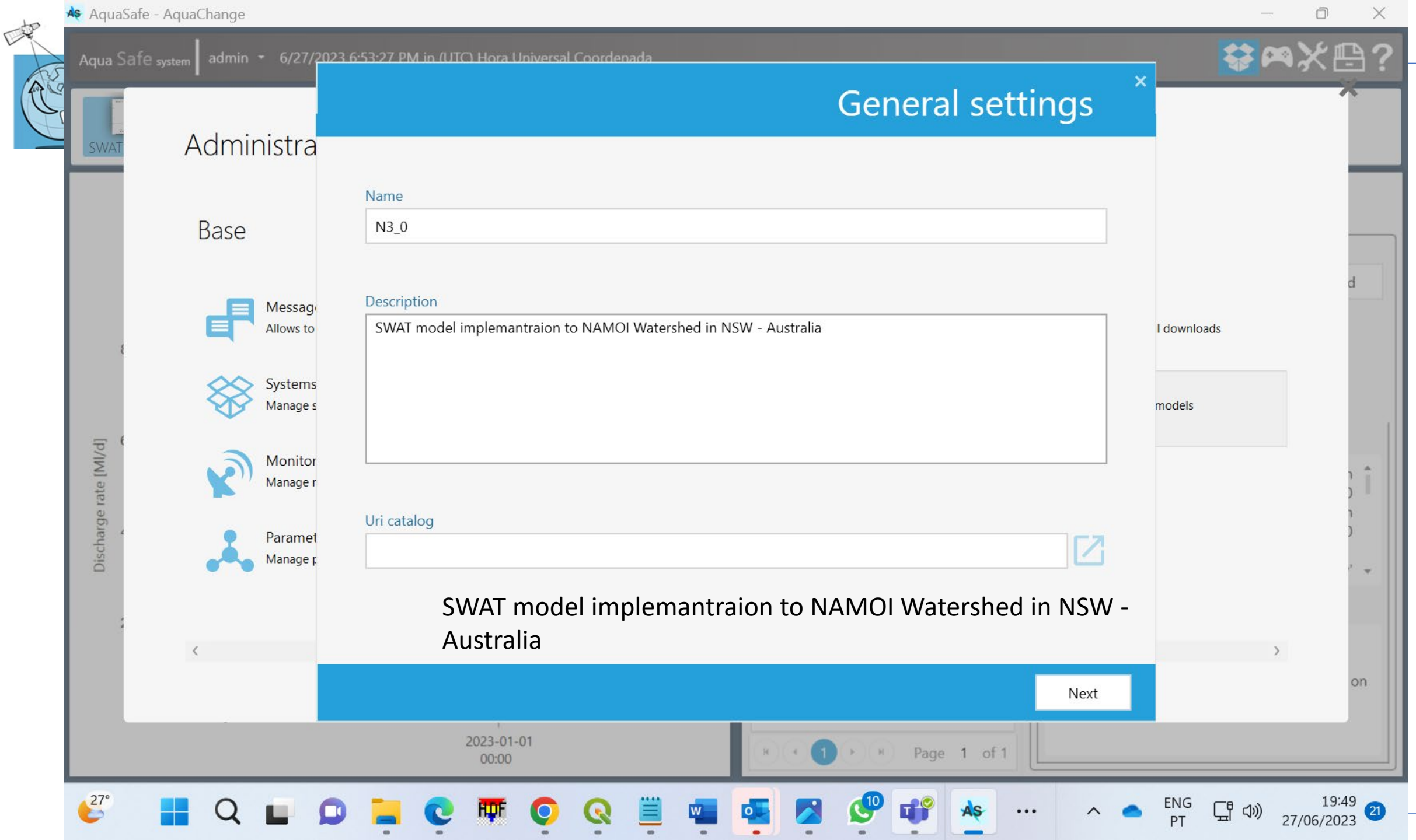
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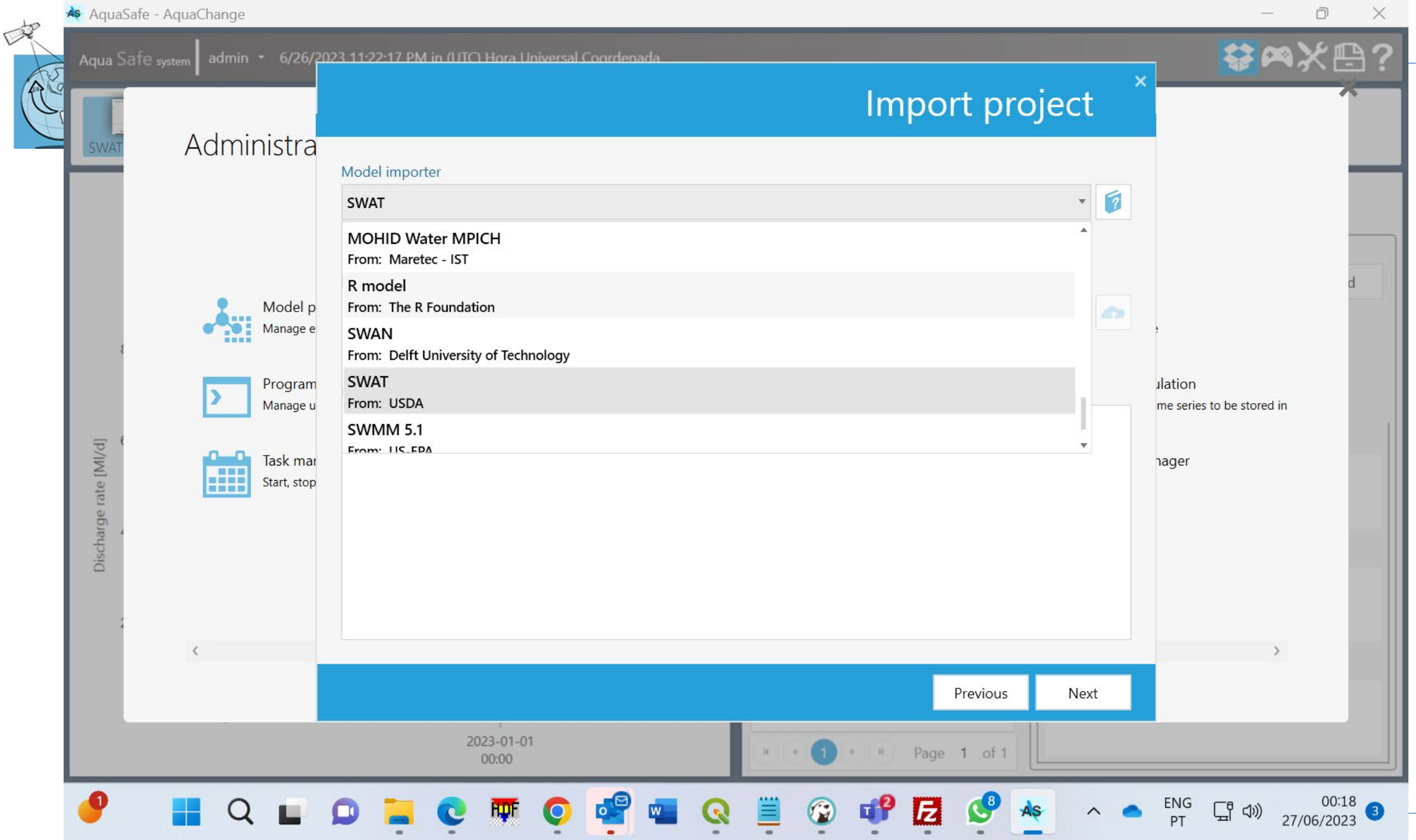
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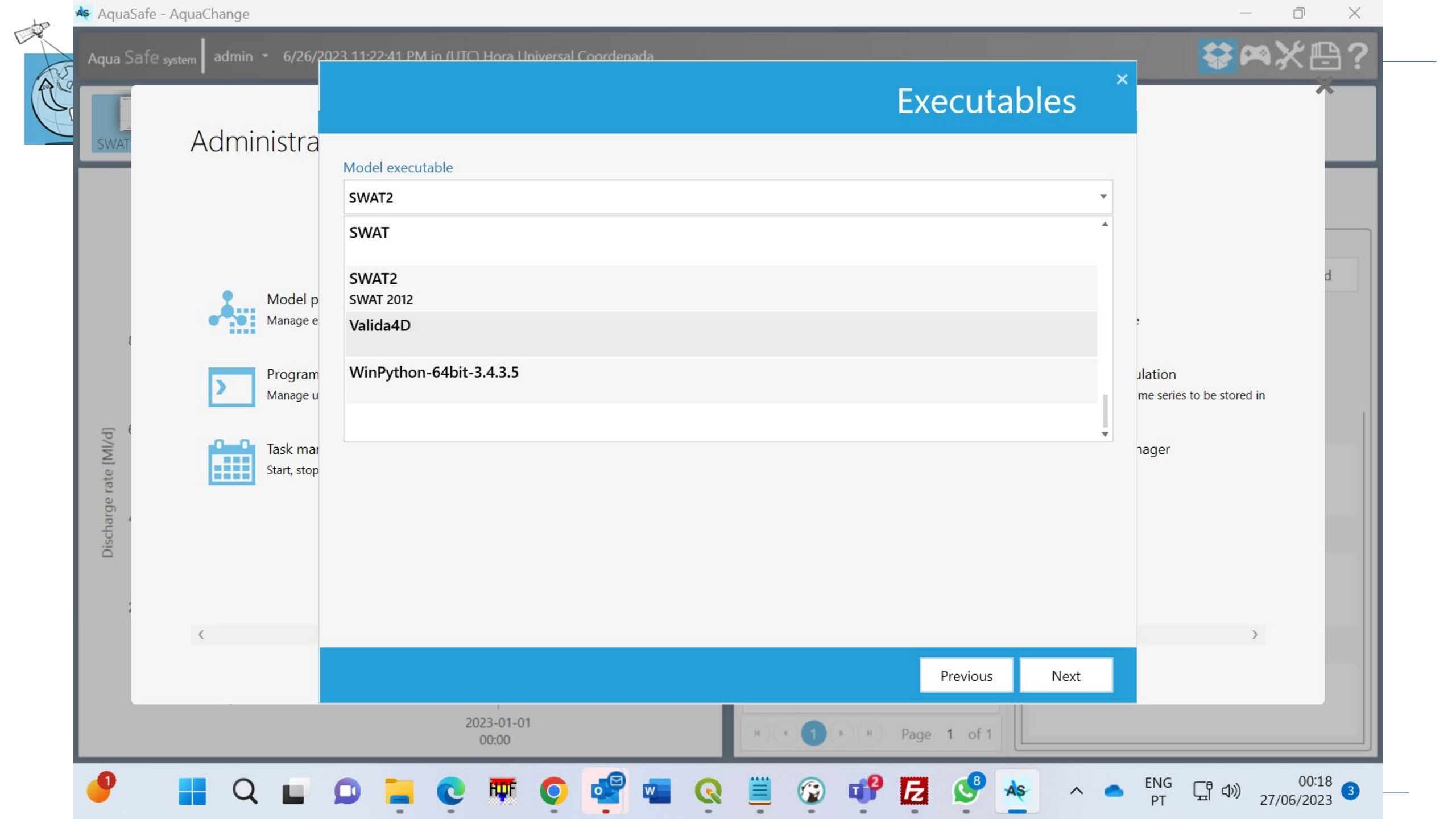
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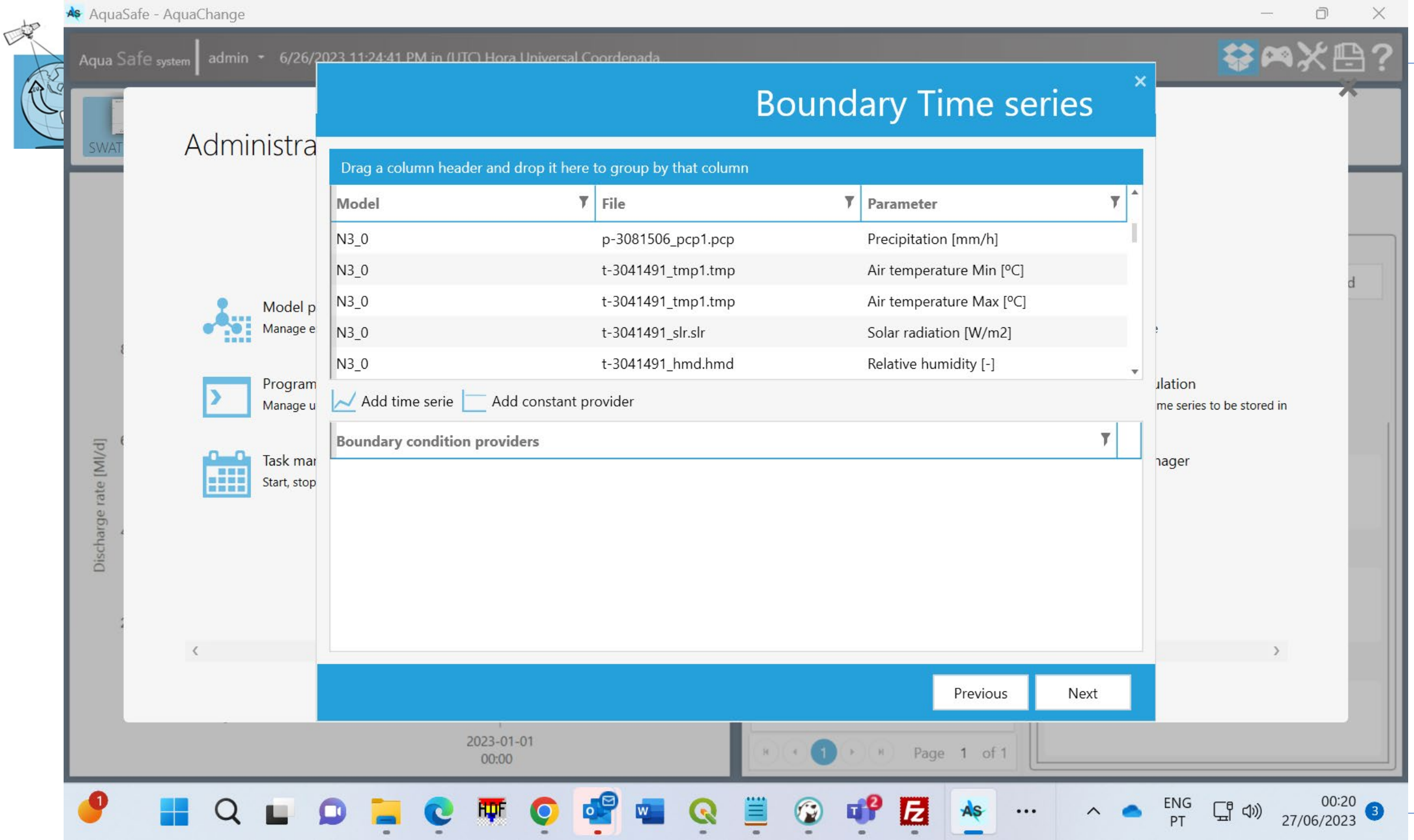
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p-3081506_pcp1.pcp
Precipitation [mm/h]
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t-3041491_tmp1.tmp
Air temperature Min [ºC]
N3_0
t-3041491_tmp1.tmp
Air temperature Max [ºC]
N3_0
t-3041491_slr.slr
Solar radiation [W/m2]
N3_0
t-3041491_hmd.hmd
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Boundary condition providers
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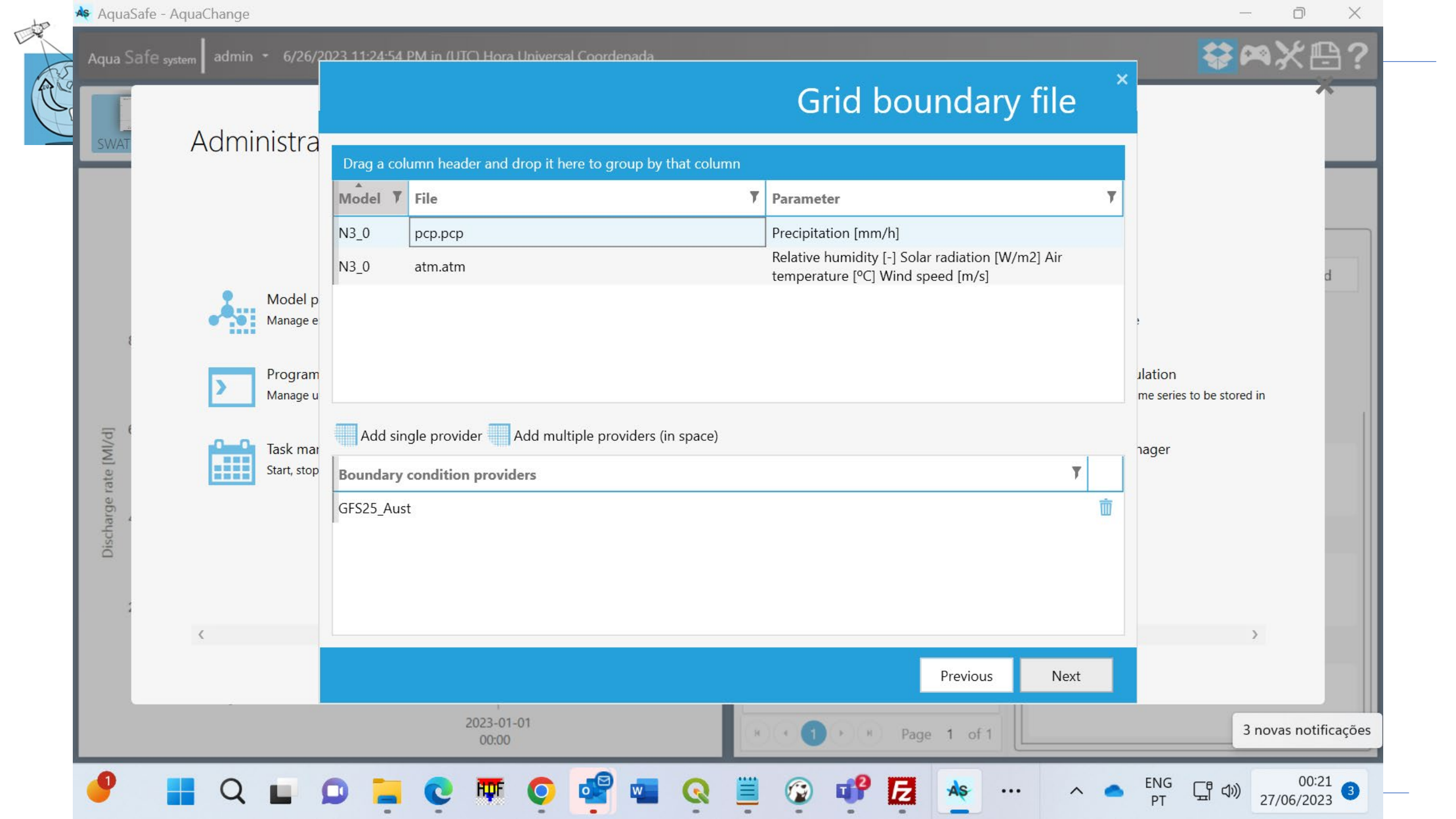
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N3_0
atm.atm
Relative humidity [-] Solar radiation [W/m2] Air temperature [ºC] Wind speed [m/s]
Add single provider
Add multiple providers (in space)
Boundary condition providers
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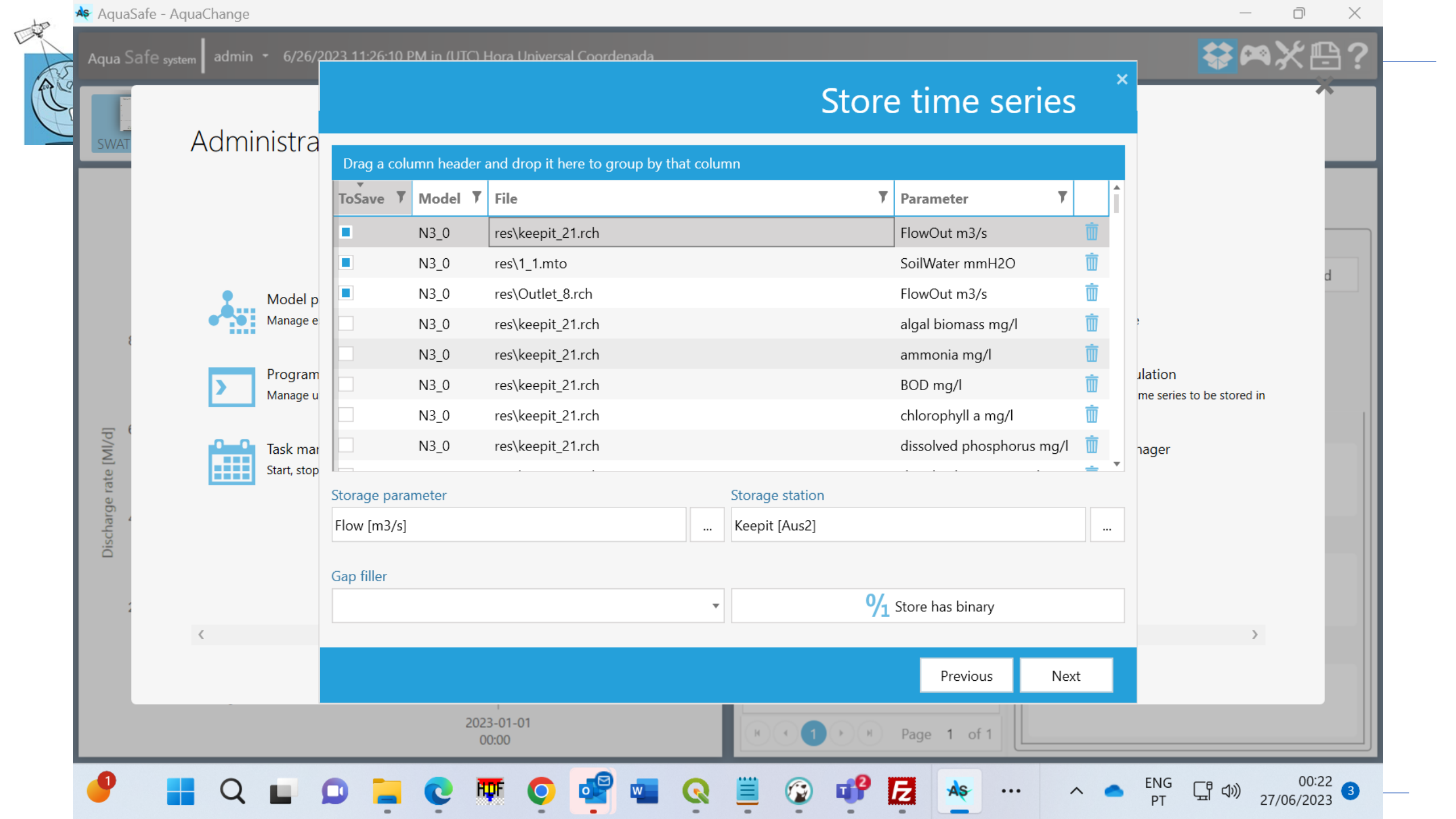
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N3_0 res\Outlet_8.rch FlowOut m3/s
N3_0 res\keepit_21.rch algal biomass mg/l
N3_0 res\keepit_21.rch ammonia mg/l
N3_0 res\keepit_21.rch BOD mg/l
N3_0 res\keepit_21.rch chlorophyll a mg/l
N3_0 res\keepit_21.rch dissolved phosphorus mg/l
Storage parameter
Flow [m3/s]
Storage station
Keepit [Aus2]
Gap filler
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Discharge rate [Ml/d]
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Page 1 of 1
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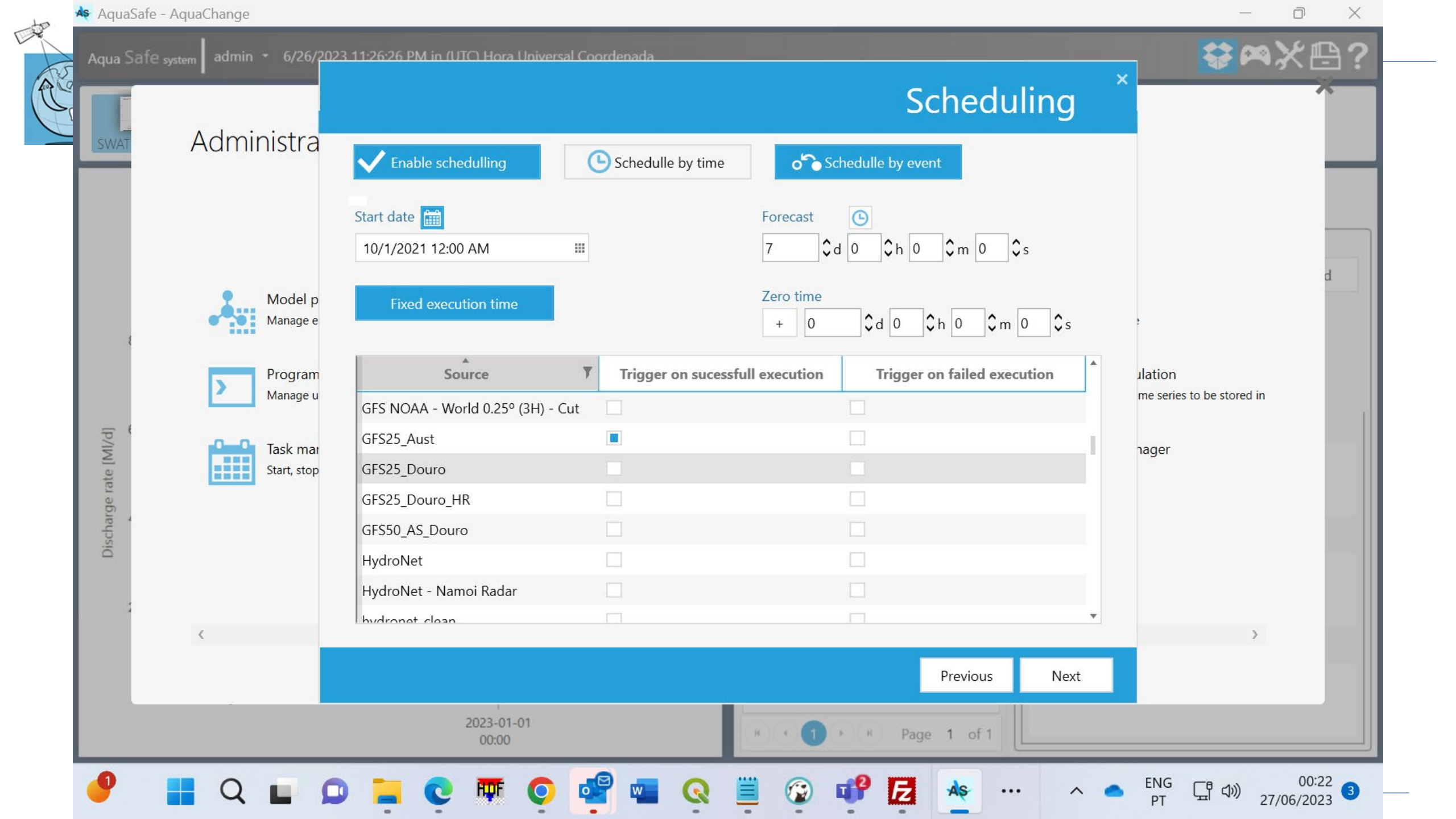
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Trigger on failed execution
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GFS25_Douro
GFS25_Douro_HR
GFS50_AS_Douro
HydroNet
HydroNet - Namoi Radar
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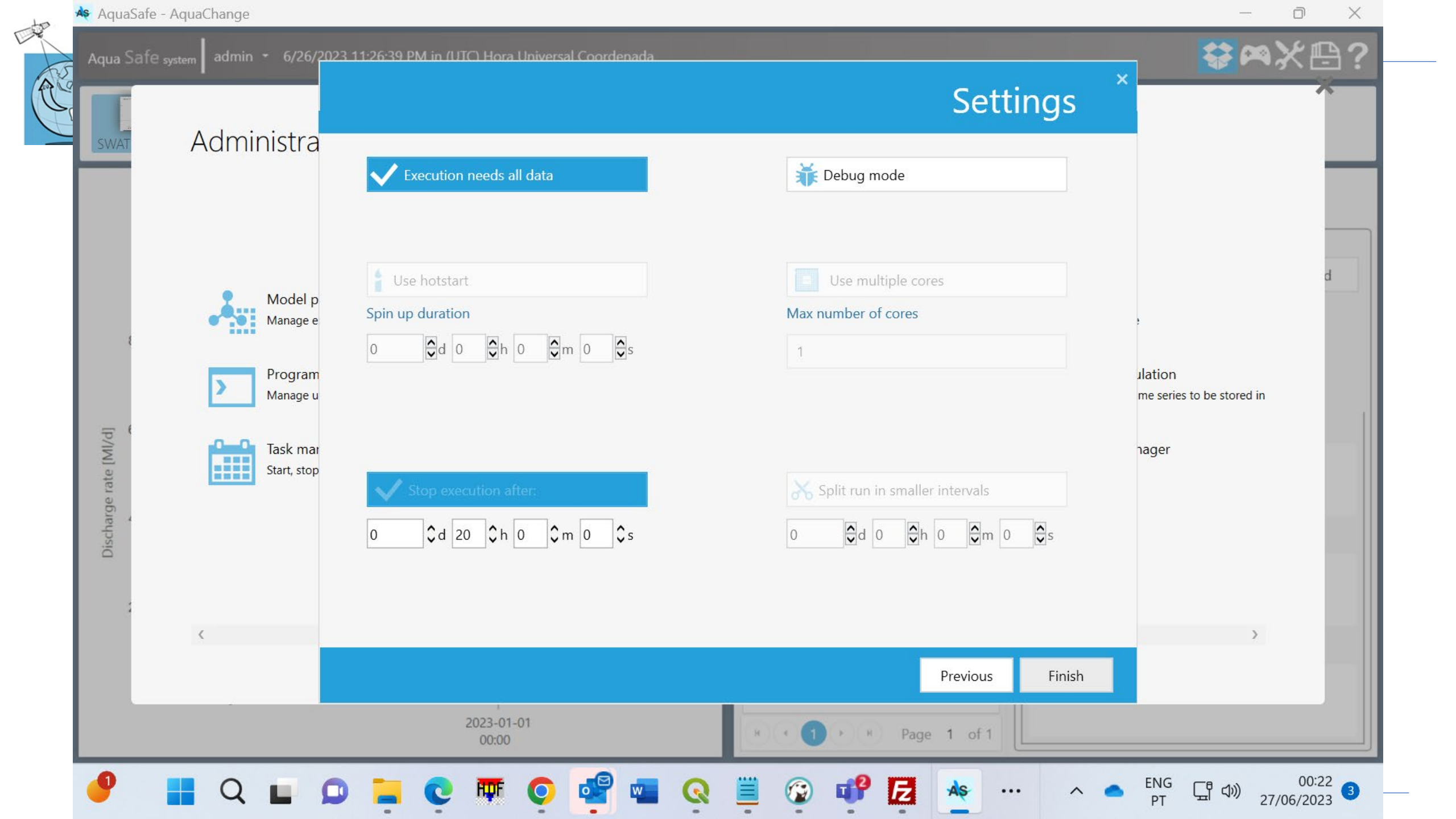
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Debug mode
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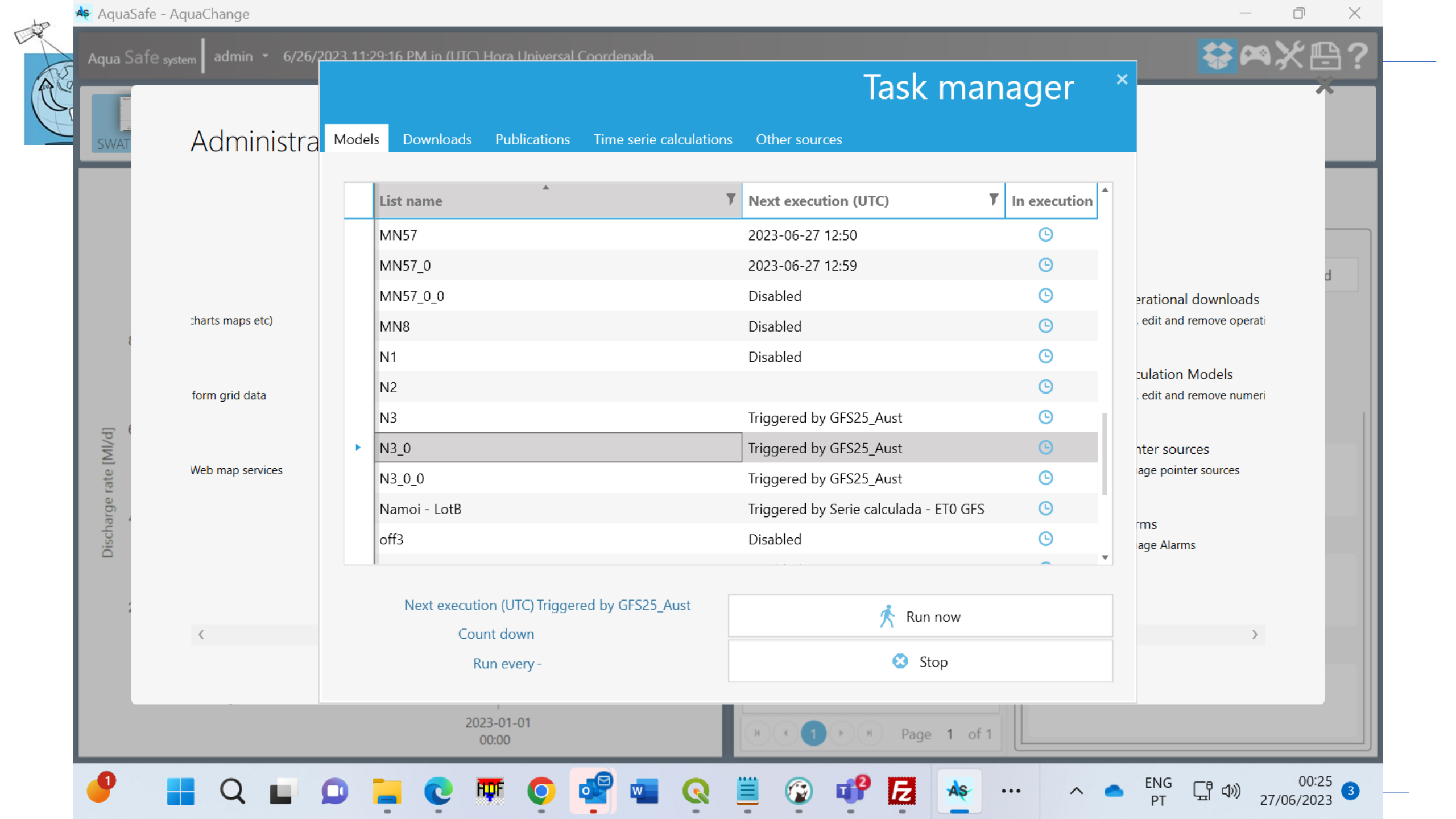
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MN57_0
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MN57_0_0
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MN8
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N1
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N2
N3
Triggered by GFS25_Aust
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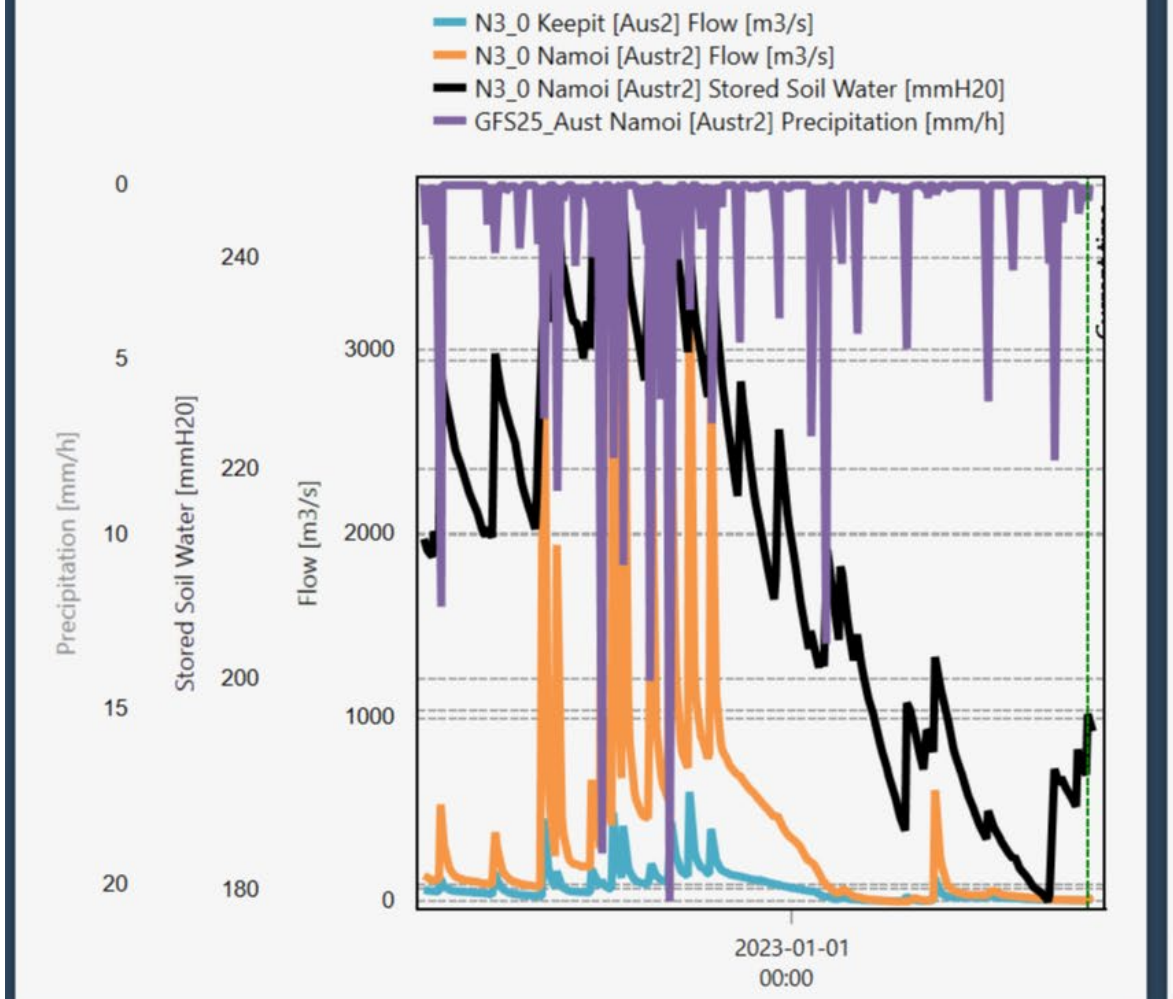
SWAT vs NSW | Monte Novo2 | WaterNSW



N3_0
Start execution 2023-06-27 10:35:22
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N3_0
Start execution 2023-06-26 10:35:41
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N3_0
Start execution 2023-06-25 10:36:23
End execution 2023-06-25 10:52:30

N3_0
Start execution 2023-06-24 10:35:27
End execution 2023-06-24 10:51:43

N3_0
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End execution 2023-06-23 10:51:36

N3_0
Start execution 2023-06-22 10:35:20
End execution 2023-06-22 10:51:36

N3_0

1 2 3 4 Page 1 of 4

Start | End | Download

Mod | Mod | Hotstart

Messages | Logs

Boundary Files Generation

Creating grid file for 'precipitation' between 2021-10-01 00:00:00 and 2023-07-04 00:00:00
'GFS25_Aust' provided data between 2021-10-01

Execution Log

Execution log file is too large (16MB), read on server.

Mostrar o ambiente de trabalho

27° | ENG PT | 19:58 27/06/2023 | 21

AquaSafe - AquaChange

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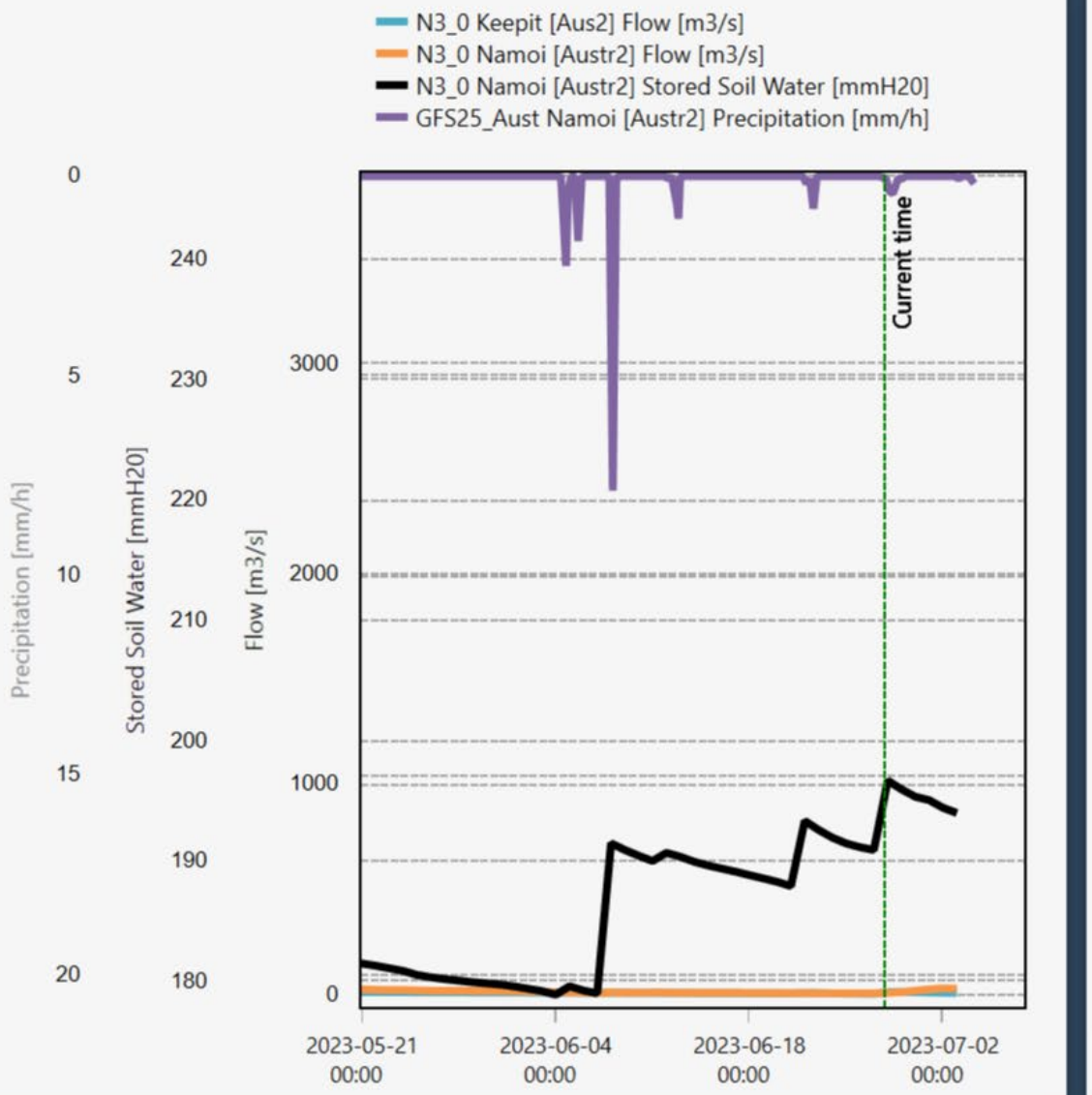

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Start execution 2023-06-26 10:35:41
End execution 2023-06-26 10:51:13

N3_0
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N3_0
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End execution 2023-06-22 10:51:36

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1 2 3 4 Page 1 of 4

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Messages Logs

Boundary Files Generation

Creating grid file for 'precipitation' between 2021-10-01 00:00:00 and 2023-07-04 00:00:00
'GFS25_Aust' provided data between 2021-10-01 00:00:00 and 2023-07-04 00:00:00

Execution Log

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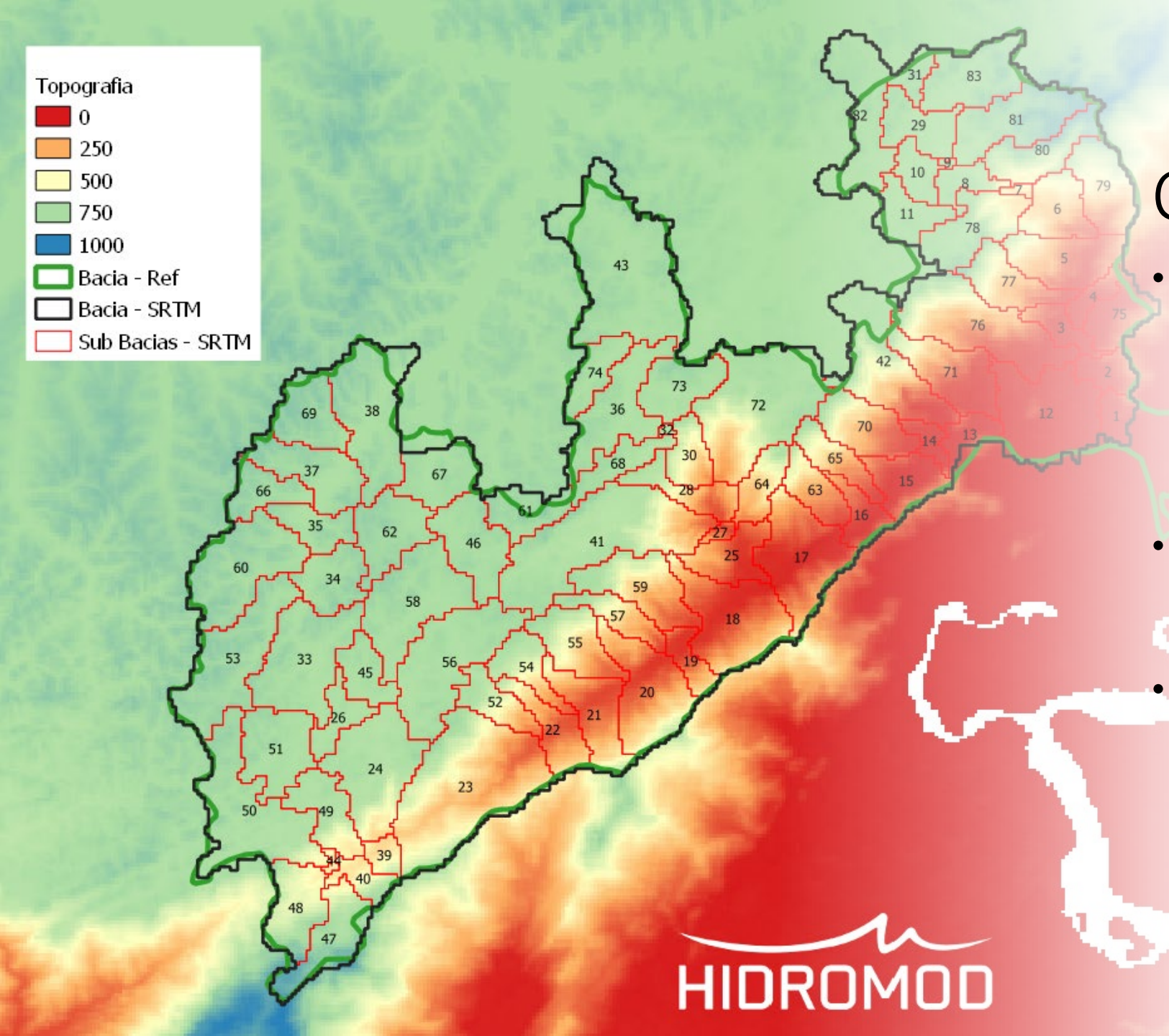
27° ENG PT 20:00 27/06/2023 21

Case Study 2: Brazil - Cubatão River Watershed

- Cubatão River Watershed has a urban water management context
- A operational platform was created for fluviometric and rainfall data monitoring
- Very few data available for calibration and validation
- Due to frequent flooding it is very important to have a operational platform for managing water resources

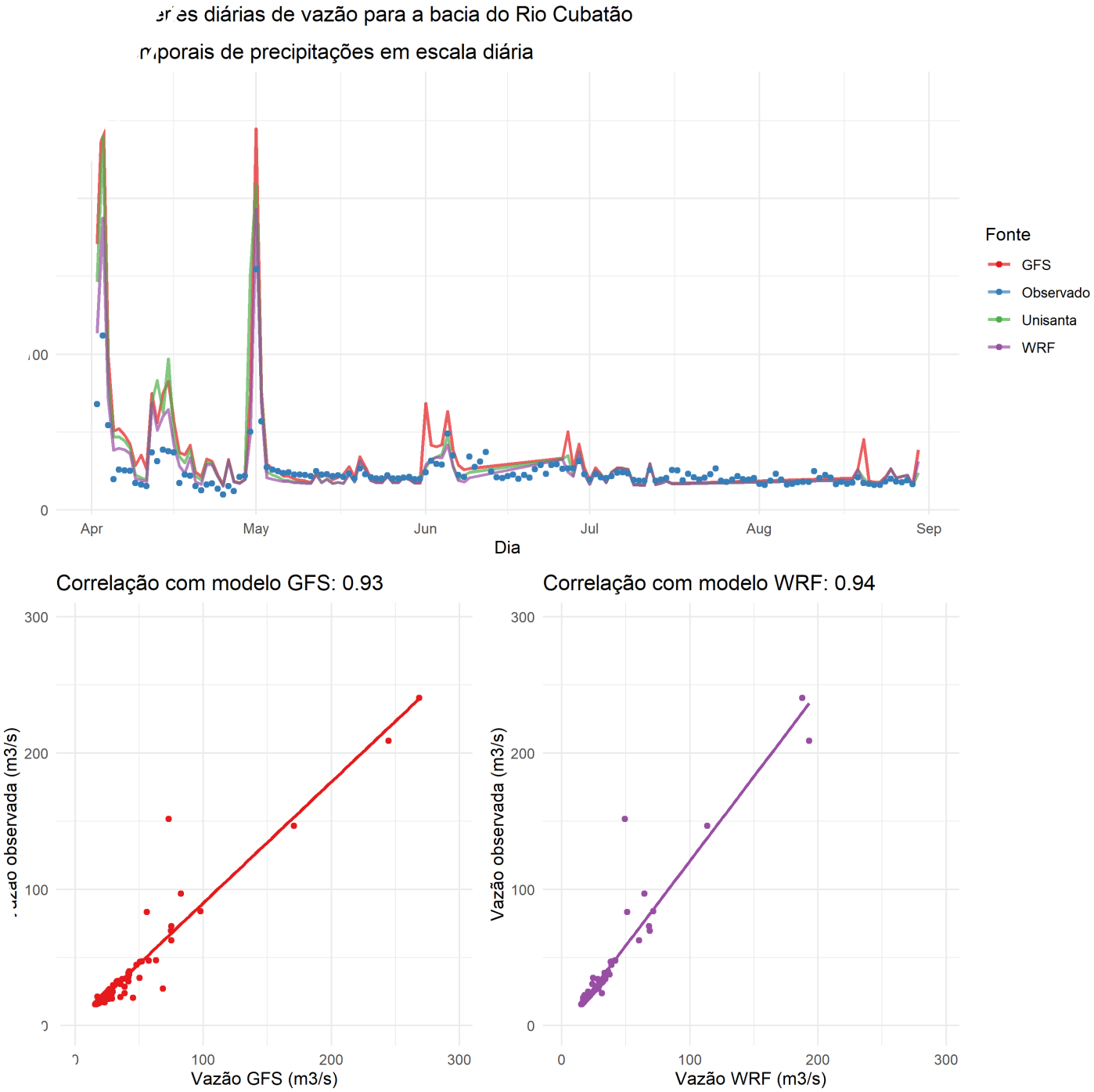


Cubatão

- Elevation: The watershed has a minimum elevation of 0 meter and a maximum elevation of 1167 meters, with an average (mean) elevation of 553.87 meters.
- Area of Watershed: The total area of the watershed is 18831 hectares (ha).
- Number of Subbasins: The watershed is divided into 83 subbasins, each corresponding to a distinct hydrologic response unit (HRU).

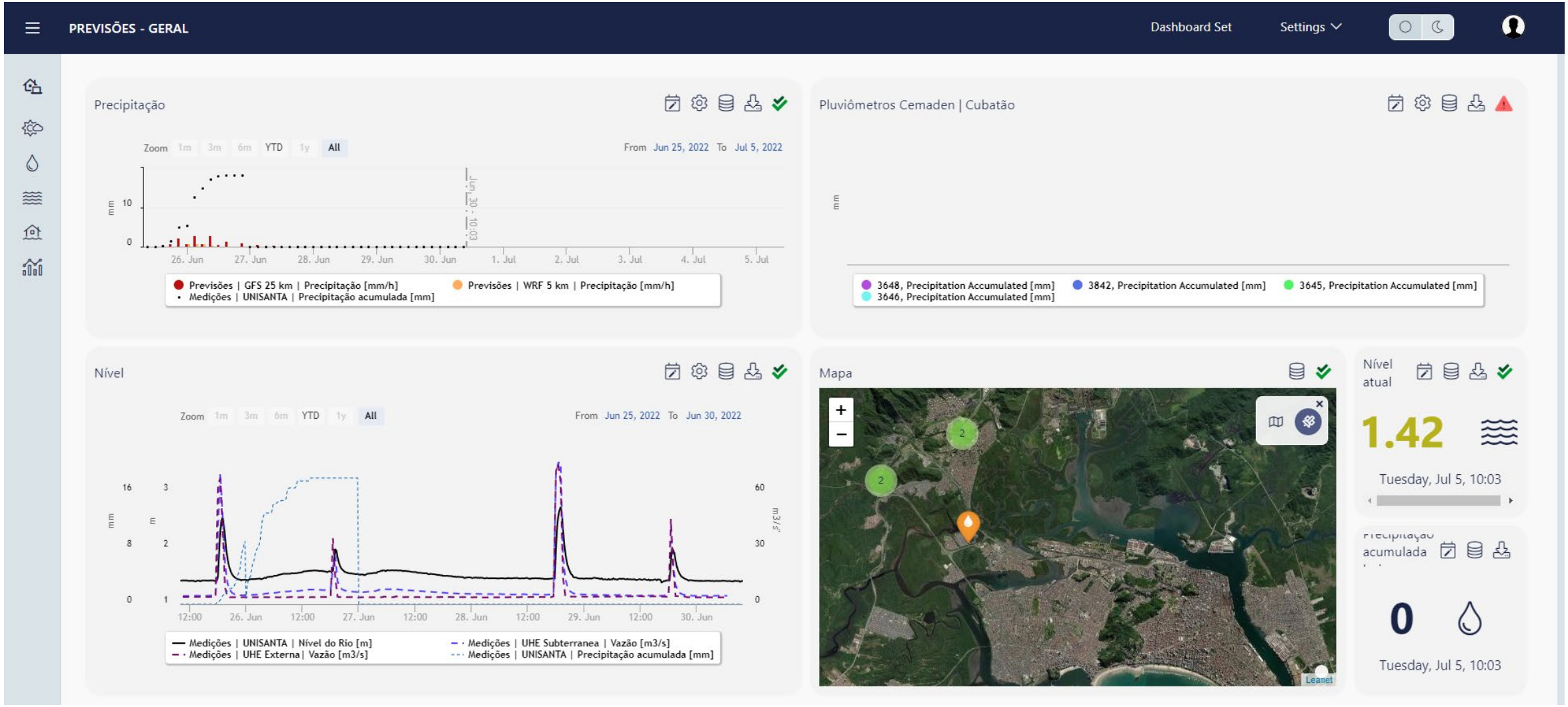
Calibration/Validation

- Very few data
- Model as some predition capacity
- Calibration period for 1972-1974
- Validation period between April and August 2022



Comapração com dados disponíveis no perído de 2022-04-01 a 2022-09-01

Operational information on the AQUASAFE



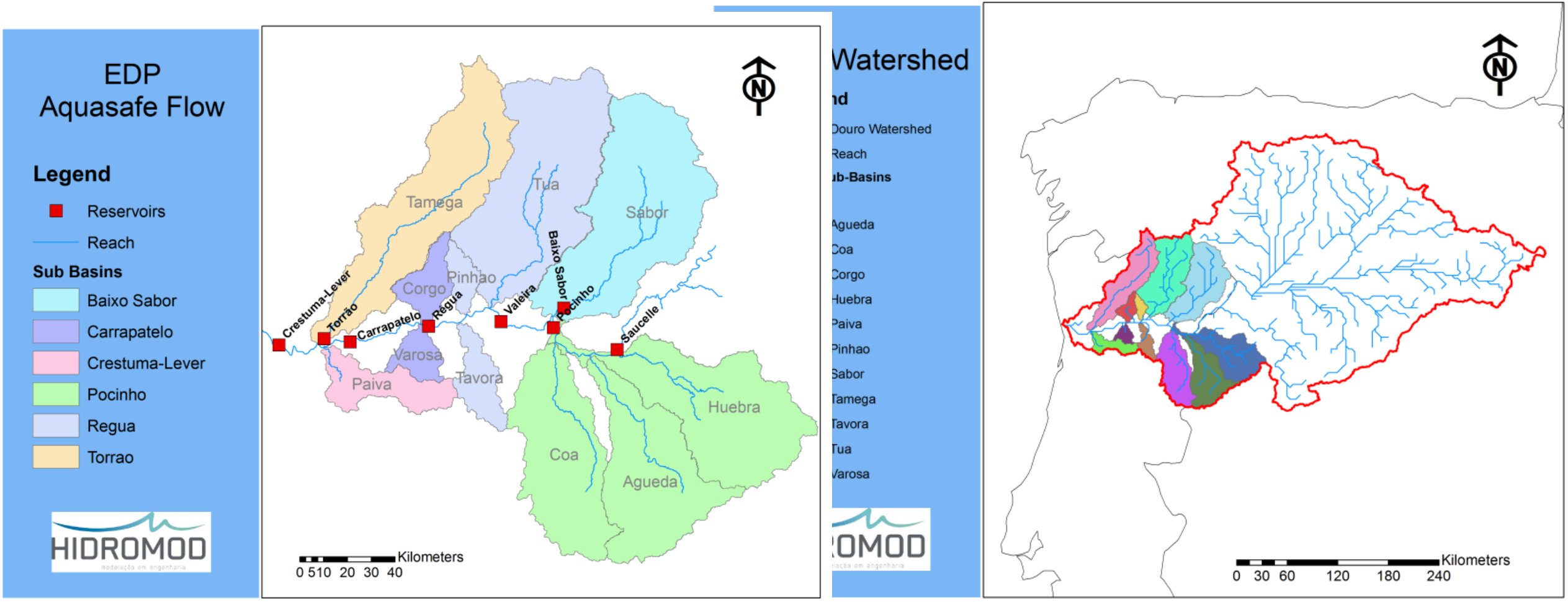
This project has received funding from the Horizon 2020 research and innovation programme under grant agreement No 870344

Case Study 3: Portugal - Douro River Hydropower Plant Cascades

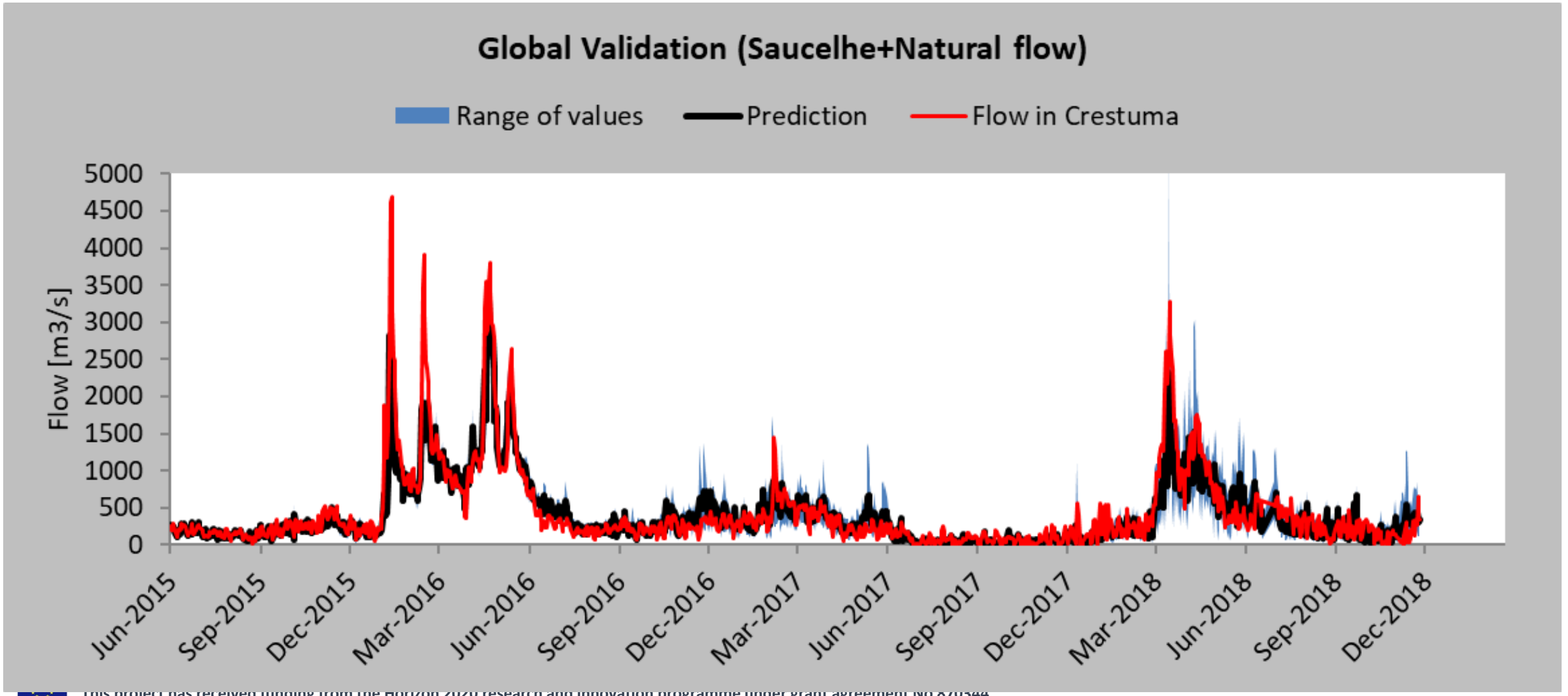
- Hydropower plant cascades on the Douro River and very significant electric production
- Operational system developed for streamflow forecasting
- Utilization of various sources of precipitation predictions in the model
- Operational system allows to improve hydropower plant management

This project has received funding from the Horizon 2020 research and innovation programme under grant agreement No 870344

Douro basin and sub-basins



Operational validation – 2015-2018



This project has received funding from the Horizon 2020 research and innovation programme under grant agreement No 870344

Uptime and availability

	Procedures	Success
Internal sources1	MOHID model runs forced by GFS 25km + IPMA pcp	99.4%
	MOHID model runs forced by IPMA pcp + WRF 5km + GFS 25km	100.0%
	MOHID model runs forced by WRF 36km + IPMA pcp + GFS 25km	100.0%
	Runs do modelo MOHID forçado por IPMA pcp + WRF 12km + GFS 25km + WRF 36km + WRF 5 km + GFS 50km	100.0%
	MOHID model runs forced by GFS 25km + IPMA pcp	99.4%
	SWAT model forced by WRF 5 km + WRF 12 km + GFS 25 km + WRF 36 km + GFS	99.4%
	SWAT model forced by WRF 12 km + WRF 5 km + GFS 25 km + WRF 36 km + GFS	99.4%
External sources1	Model WRF 12 km MeteoGalicia (availability plus download)	100.0%
	Model WRF 36 km MeteoGalicia (availability plus download)	100.0%
	Model WRF 5 km Ibermeteo (availability plus download)	100.0%
	Model GFS-50 km (availability plus download)	97.2%
	Model GFS-25 km (availability plus download)	99.4%

Conclusion

Constant model validation is crucial for an effective use of operational hydrological models in water management. Operational reporting is fundamental.

Uptime and availability of results is also very important in the presented case studies. Operational alert systems contribute to this.

Usability is paramount. A versatile and easy to use interface is key for success.

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Q&A Session

Get ready to fire away with your burning questions