USING HYDROPEDOLOGY AS SOFT DATA TO REFLECT HYDROLOGICAL PROCESSES USING SWAT+

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SWAT+ Conference
Strasbourg

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Soil & Water Assessment Tool | SWAT

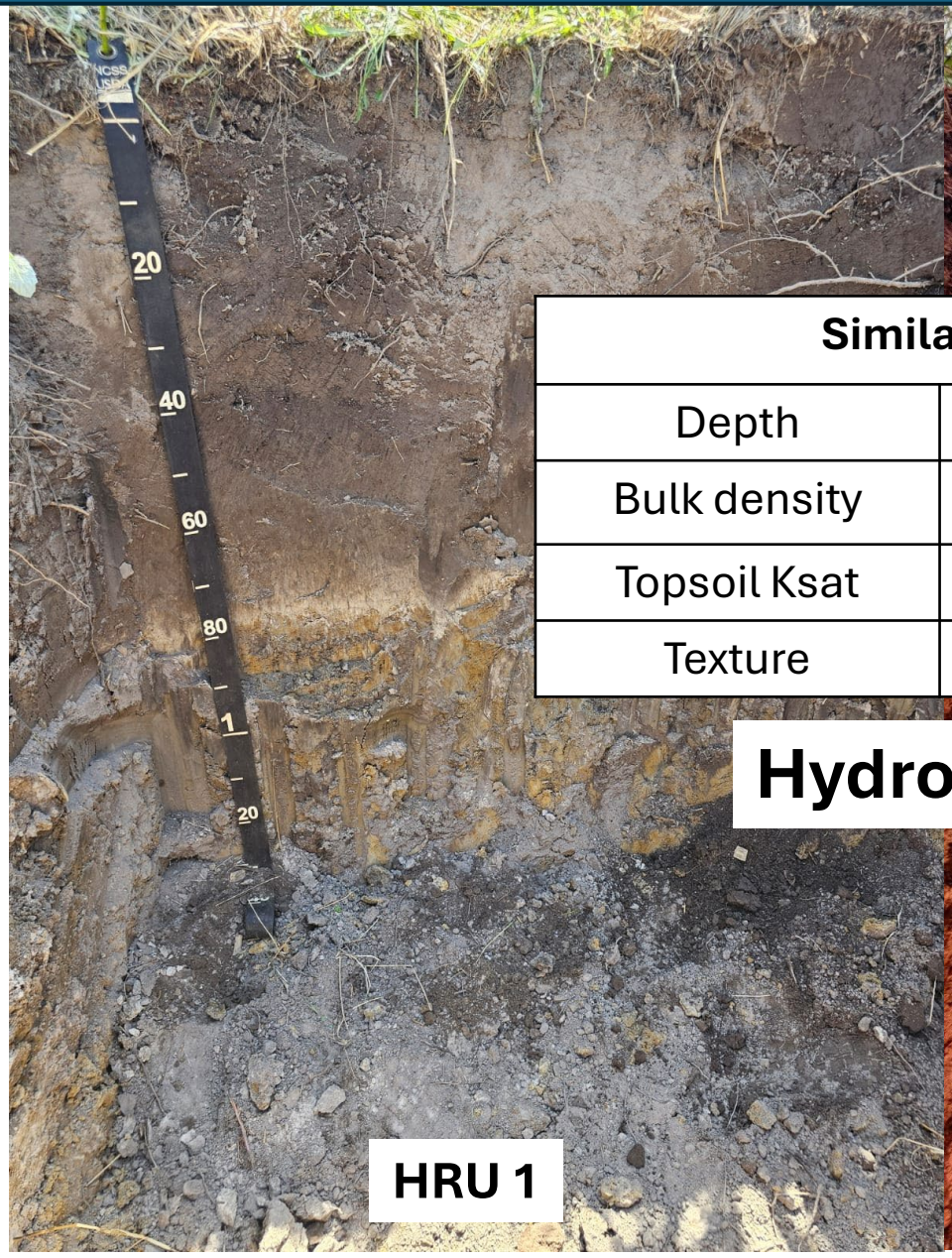
Introduction

USA Taxonomy

Alfisol

WRB Groups

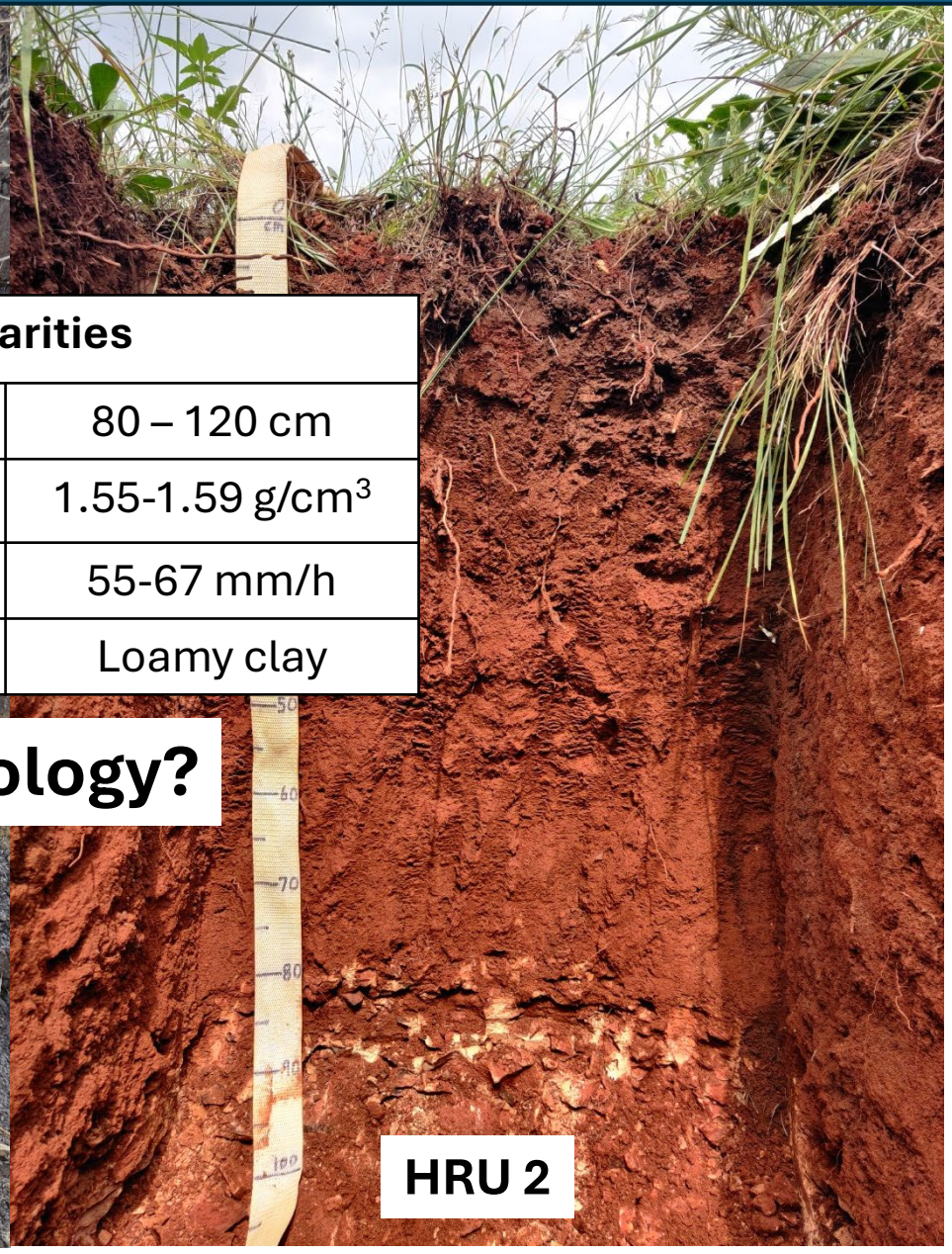
Luvisol



Similarities	
Depth	80 – 120 cm
Bulk density	1.55-1.59 g/cm^3
Topsoil Ksat	55-67 mm/h
Texture	Loamy clay

Hydrology?

HRU 1



HRU 2

USA Taxonomy

Oxisol

WRB Groups

Acrisol

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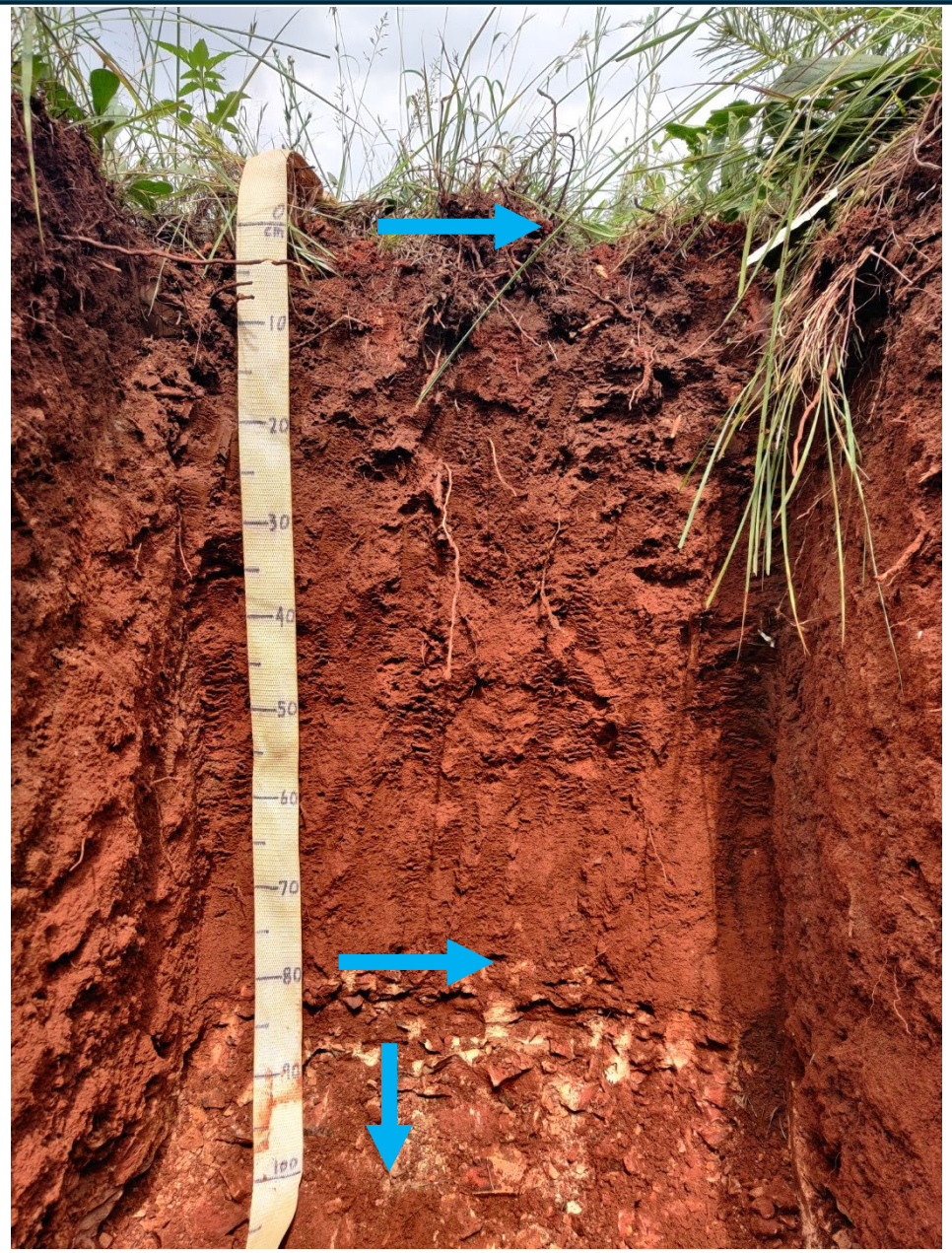
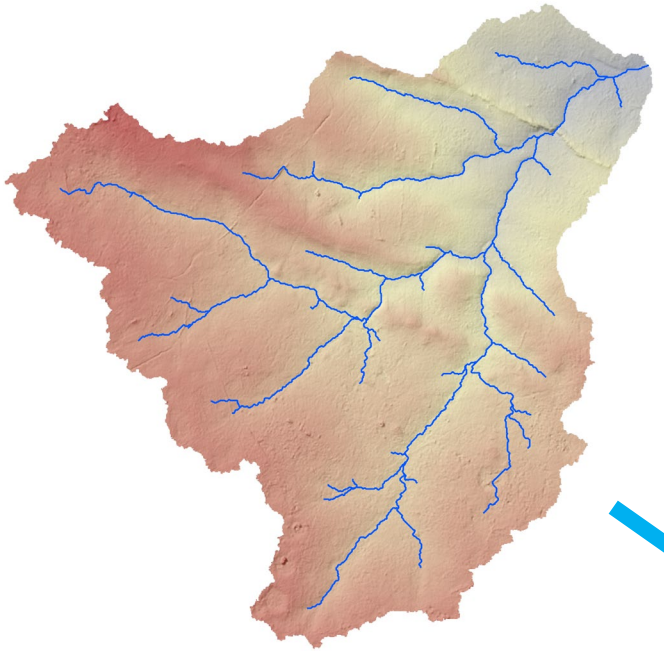
Introduction

Calibration	Outputs	Important parameters
CN2, CN3	surq_gen	Soil hydrologic groups (A, B, C, D), texture, Ksat
ESCO, AWC, SOIL_K, Bd	sw_300, sw_profile	AWC, Bd, texture
latq_co, SOIL_K	latq	Ksat, slope, excess SW
perco, SOIL_K	perc	Ksat, FC, TTperc

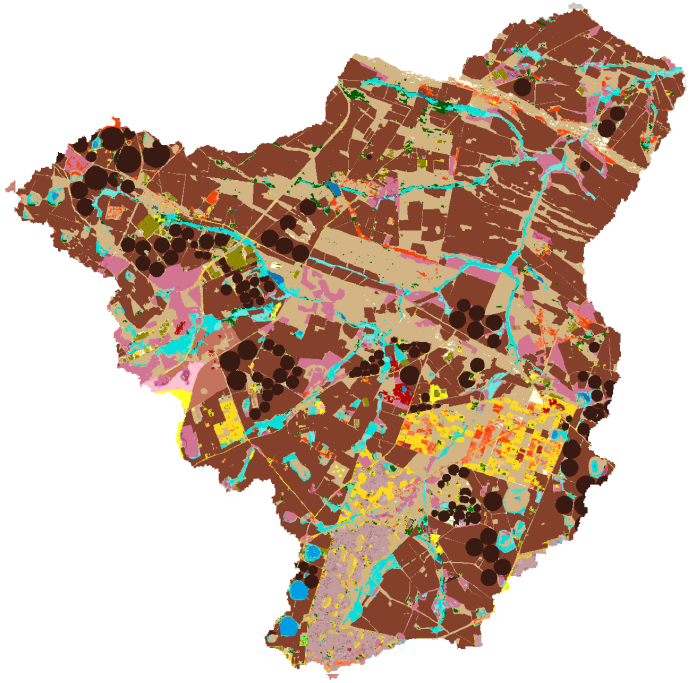


Introduction

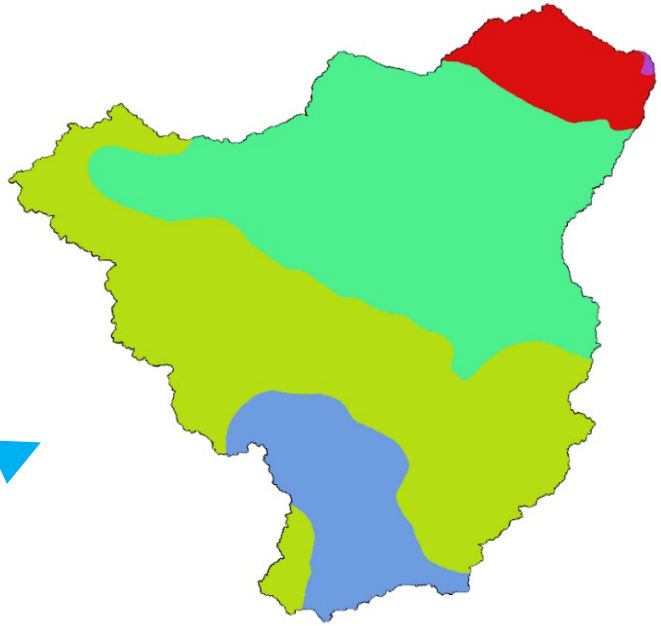


DEM

Soil data remains comparatively coarse.



Landuse

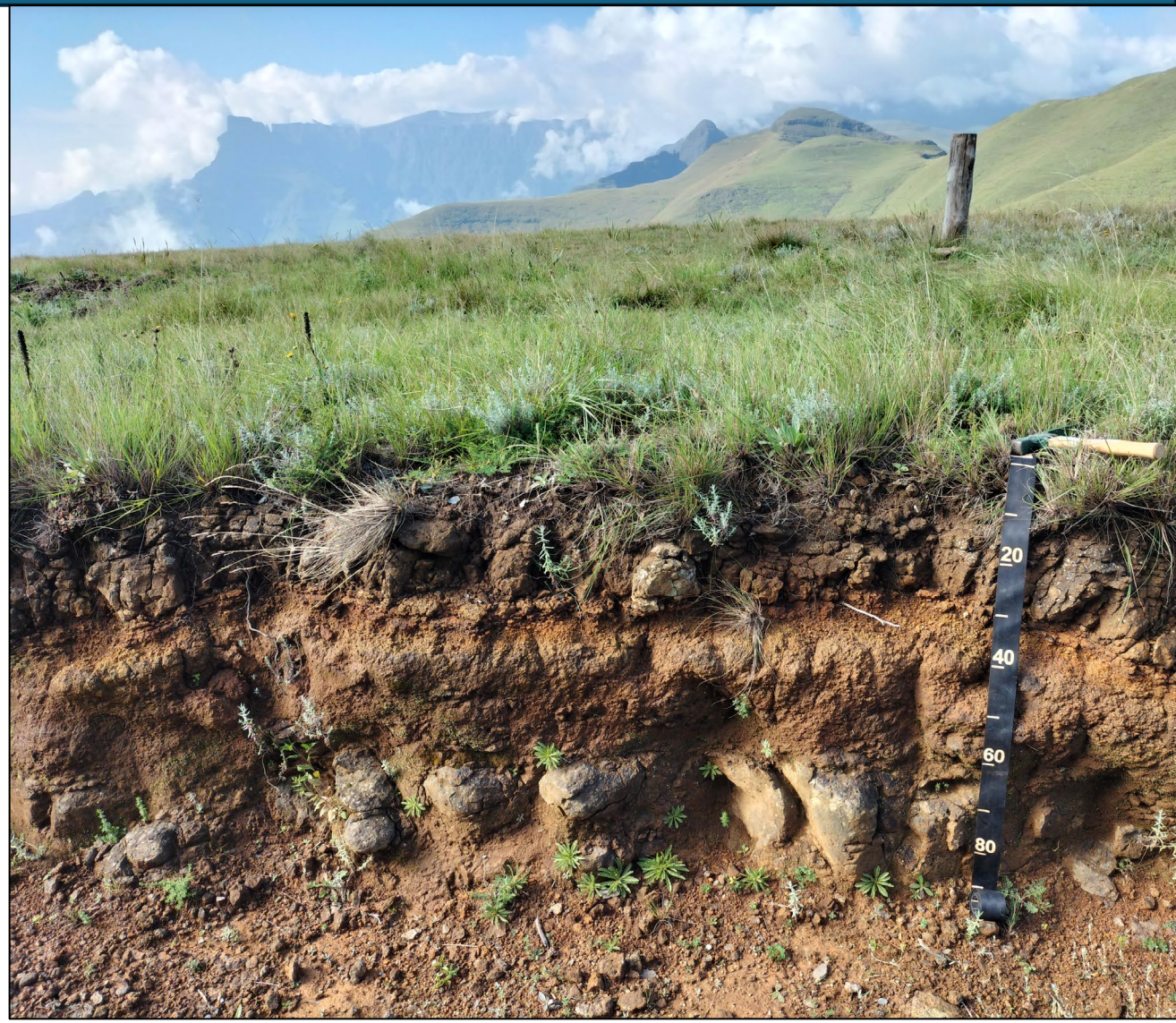


Soil

Hydropedology

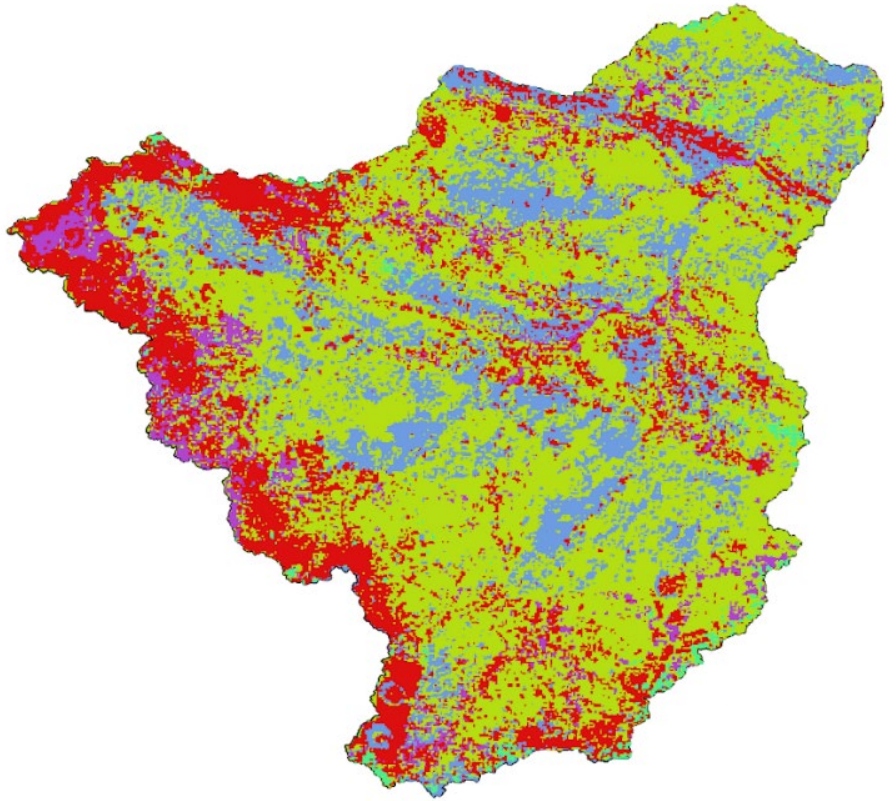
Hydropedology is the study of the interconnected relationship between soils and water.

Connecting soil hydrological processes to soil morphology.



Digital soil mapping

Typical soil map



Digital soil map based on hydropedology

Soils

Soil type	Outputs
Responsive	surq_gen
	sw_300, sw_profile
Interflow	latq
Recharge	perc

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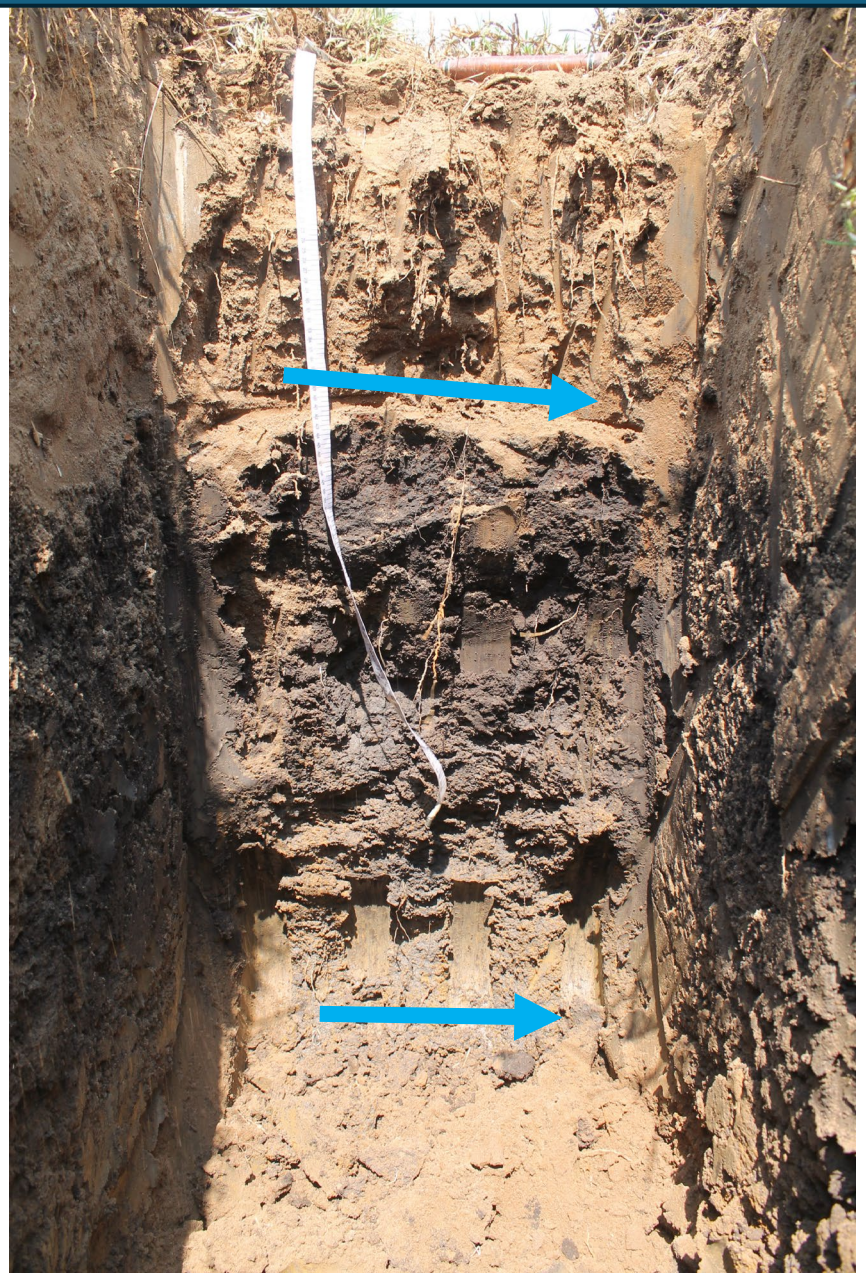

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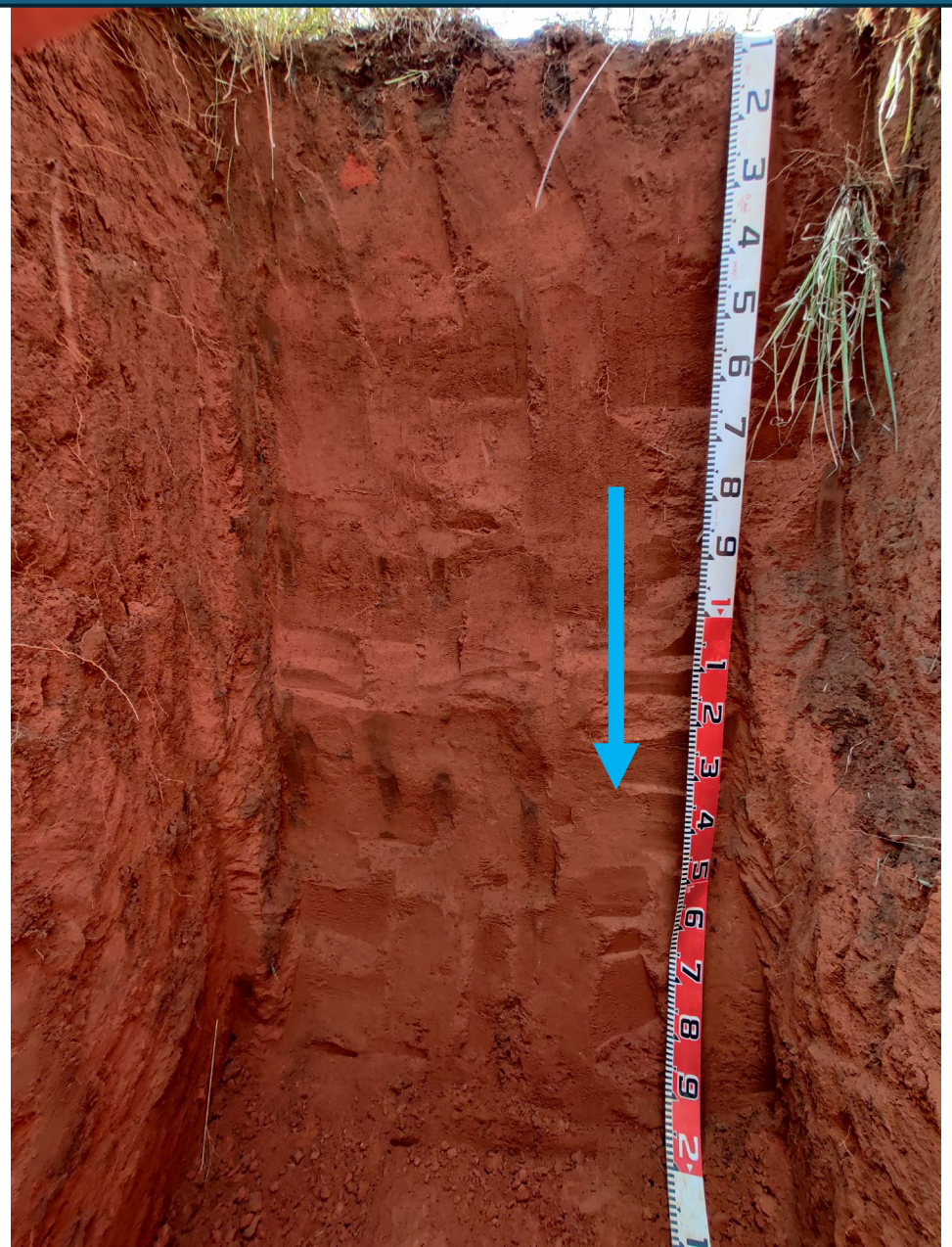

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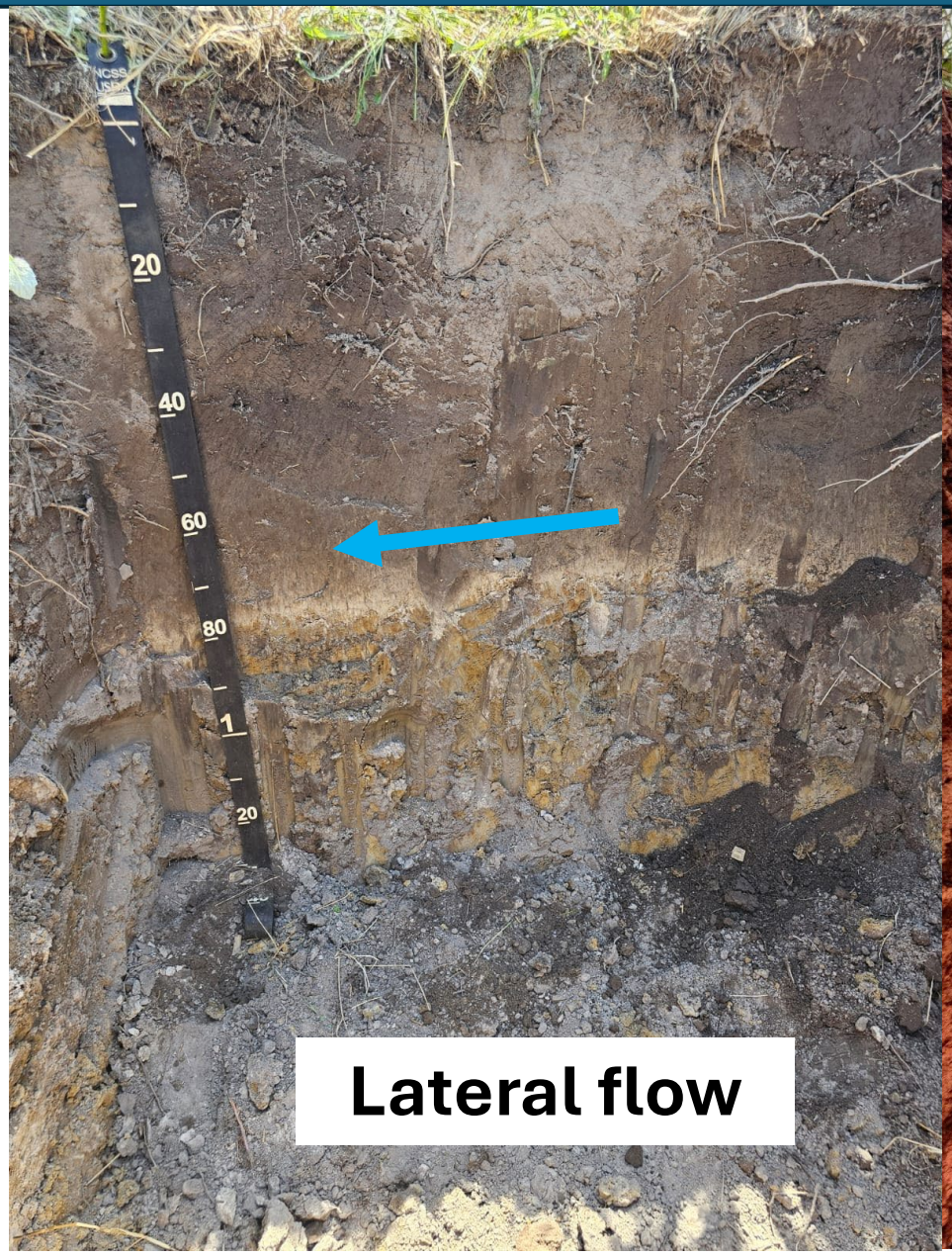

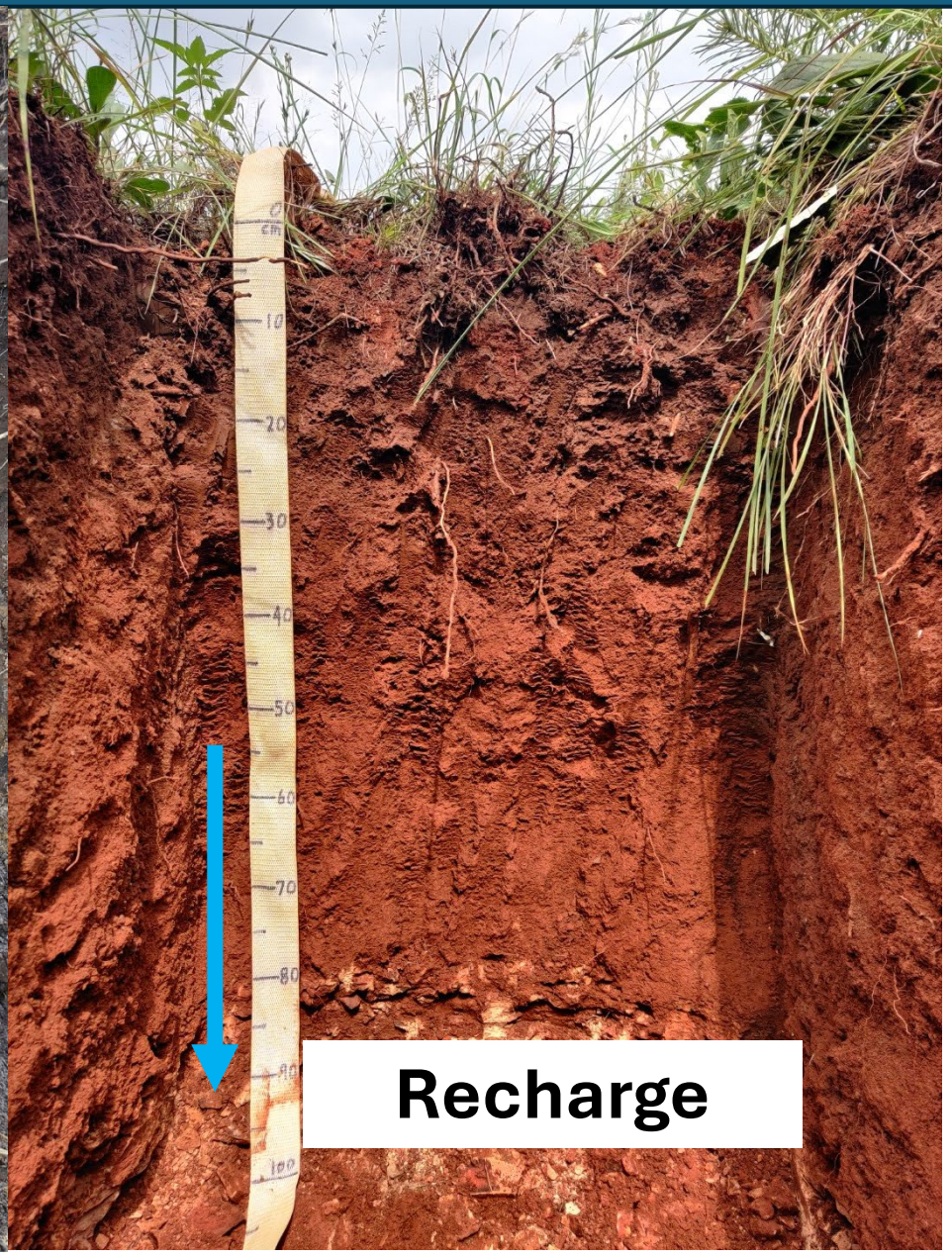

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Introduction

Aim:

Improve modelling accuracy using **hydropedology as soft data** to reflect hydrological processes.

Objectives:

1. Assess sensitivity and applicability of SWAT+ parameters.
2. Calibrate model and each soil type based on their hydropedology.
3. Statistically assess modelling outputs and accuracy.

Results

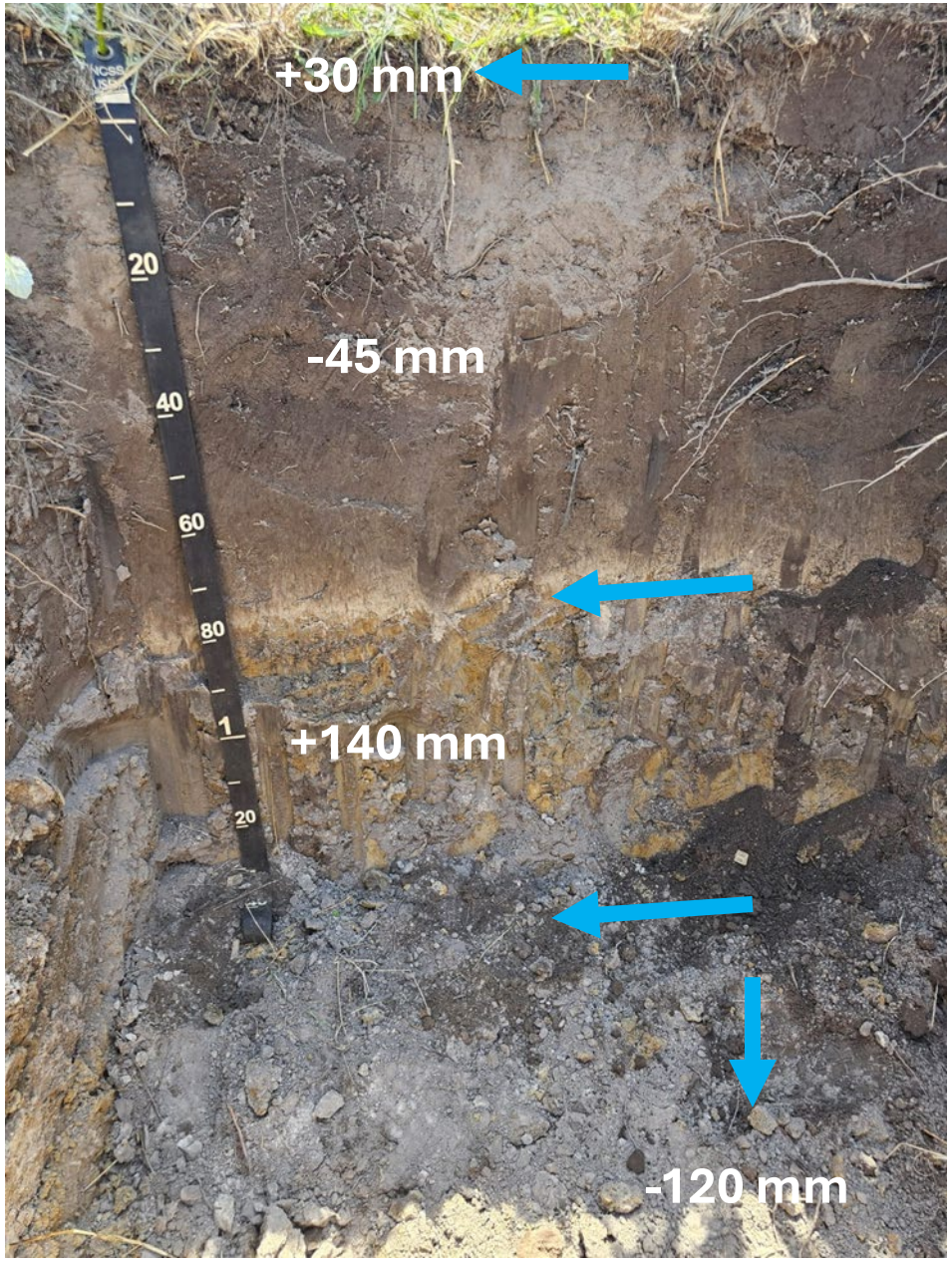
Outputs

surq_gen

sw_300,
sw_profile

latq

perc



Calibration

Parameter	Default value	Calibrated value
CN	32-67	35-70
PERCO	1	0.5
LATQ_CO	1	1

Results

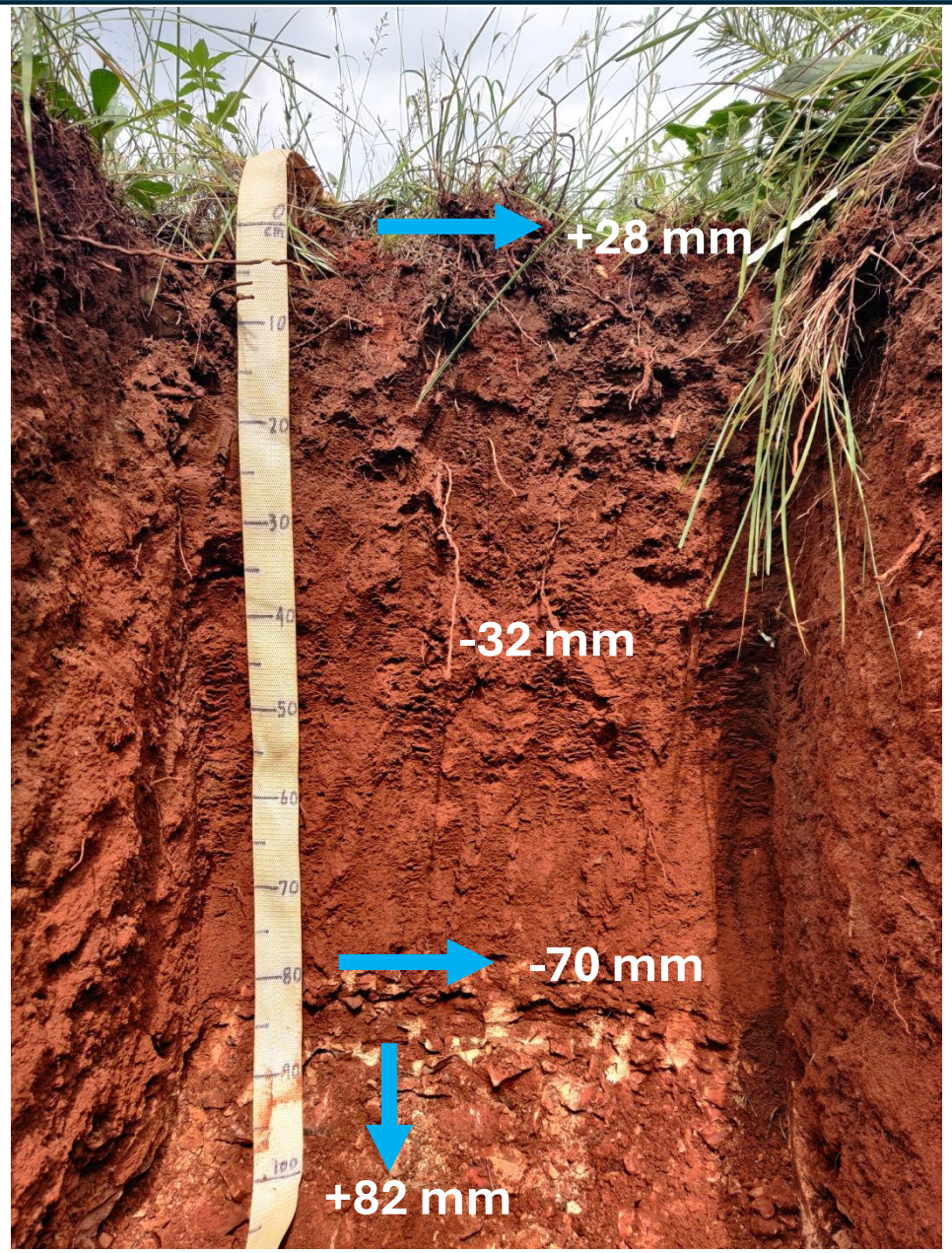
Outputs

surq_gen

sw_300,
sw_profile

latq

perc



Calibration

Parameter	Default value	Calibrated value
CN	32-67	35-70
PERCO	1	1
LATQ_CO	1	0.8

Results

Table 4. The statistical indicators of model performance of long-term streamflow (2004-2019).

Catchment	Soil data	Model	R^2	NSE	KGE
56 km^2	Land Type	Uncalibrated	0.42	-3.24	-0.55
	Hydrosol		0.57	-0.22	0.41
	Hydrosol	Calibration	0.63	0.84	0.74
	Hydrosol	Validation	0.62	0.67	0.65
174 km^2	Land Type	Uncalibrated	0.68	0.3	0.48
	Hydrosol		0.67	0.48	0.58
	Hydrosol	Calibration	0.72	0.36	0.53
	Hydrosol	Validation	0.79	0.61	0.60
674 km^2	Land Type	Uncalibrated	0.70	-0.41	0.09
	Hydrosol		0.71	0.54	0.67
	Hydrosol	Calibration	0.79	0.56	0.58
	Hydrosol	Validation	0.83	0.76	0.74

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Results

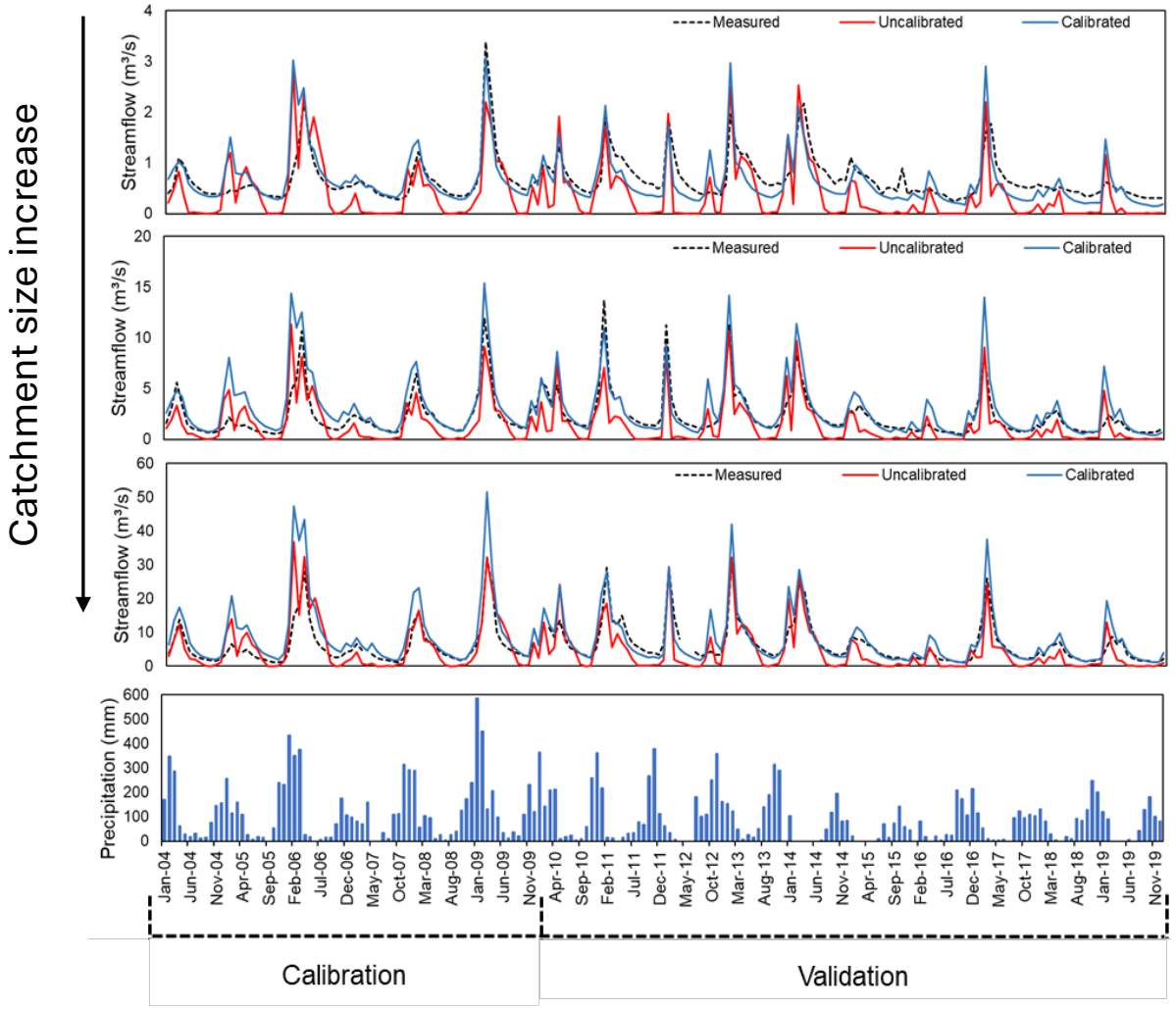

Fig. 3. Hydrosol streamflow simulations.

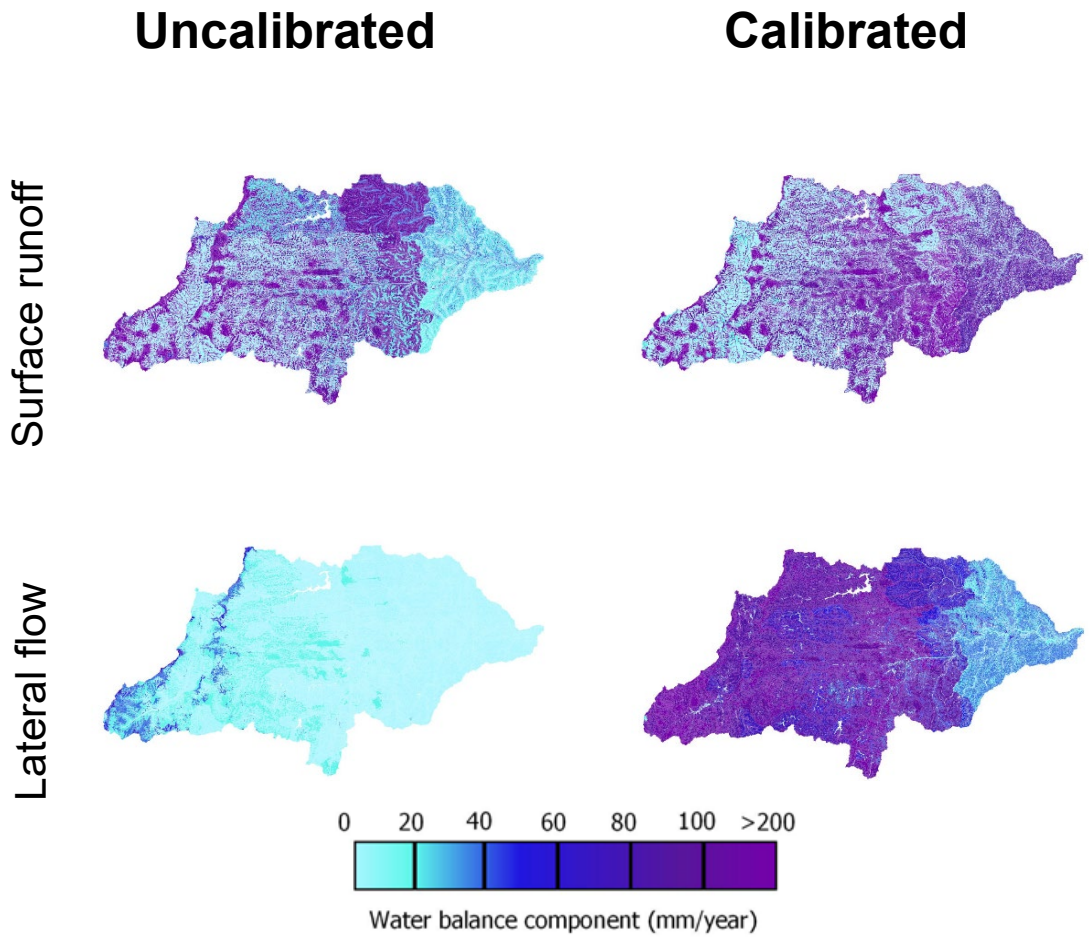

Fig. 3. Average annual processes (mm) between models.

Results

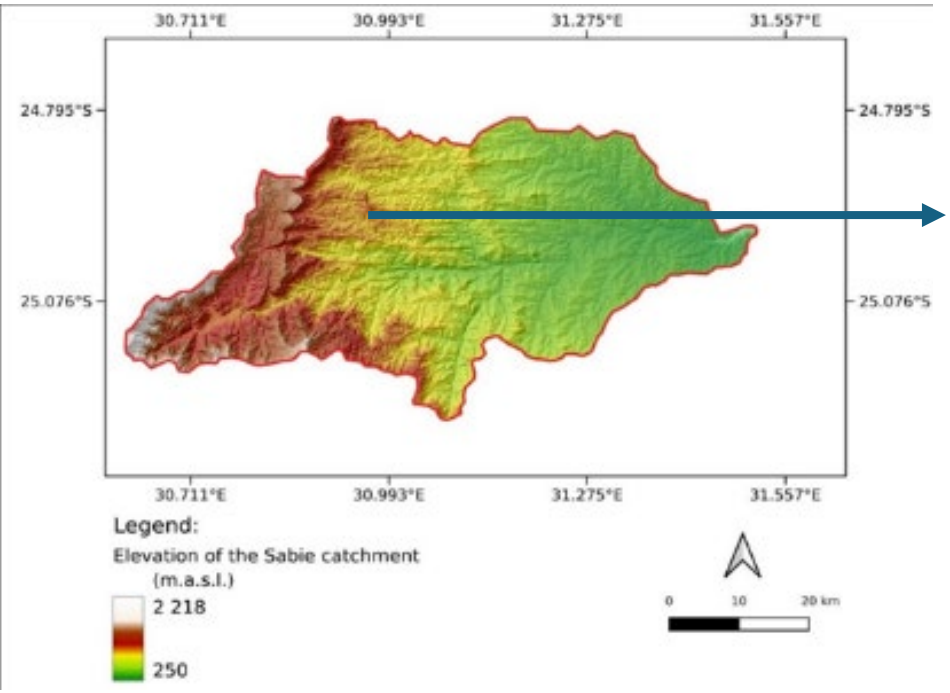

Fig. 8. Location of a wetland to use as an example of process simulations.

Results

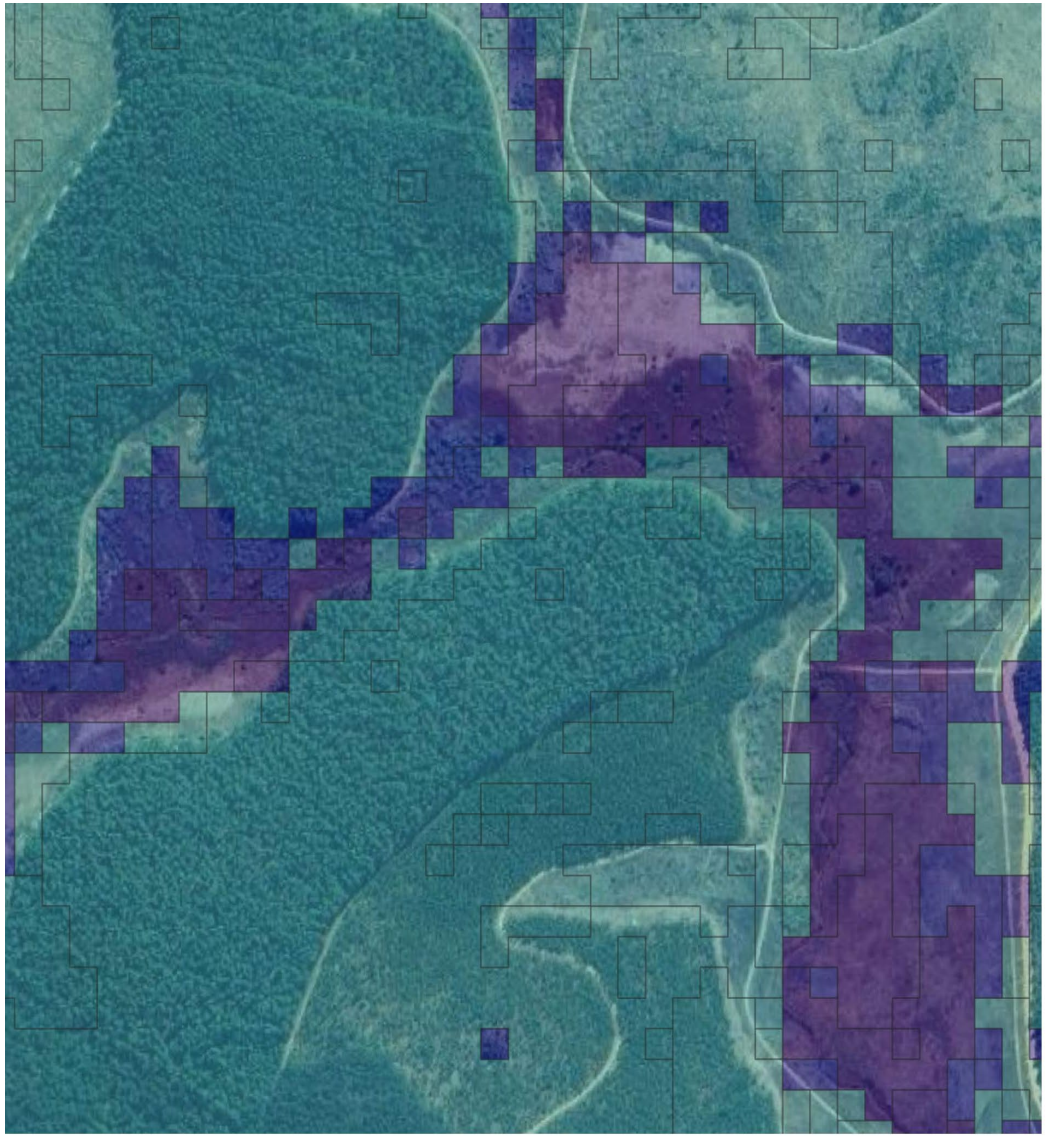

Fig. 8. Location of a wetland to use as an example of process simulations.

Conclusion

1. Improved processes = Right answer of the right reason
2. We can spatially link soil data to hydrological processes in SWAT
3. Why not use wetland soil water contents as calibration tool?

Thank you

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