### Easy to Use Workflows for Catchment Hydrological Modelling

Towards Reproducible Catchment Modelling Studies





C. George, W. Thiery, A. van Griensven

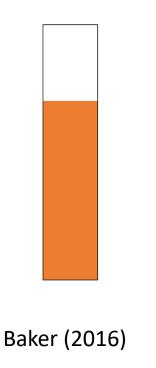
Reproducible research is the foundation on which scientific progress is built

### Preview

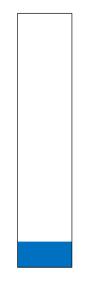
- Reproducibility of catchment hydrological modelling studies
- Improving reproducibility by using automated workflows
- How can catchment hydrology modelling community benefit?

# Large proportion of scientific research is not reproducible

> 70% failed to reproduce
other scientists' work



Only 11% was reproduced successfully by peers



Begley (2012)

There is lack of transparency in reporting scientific research

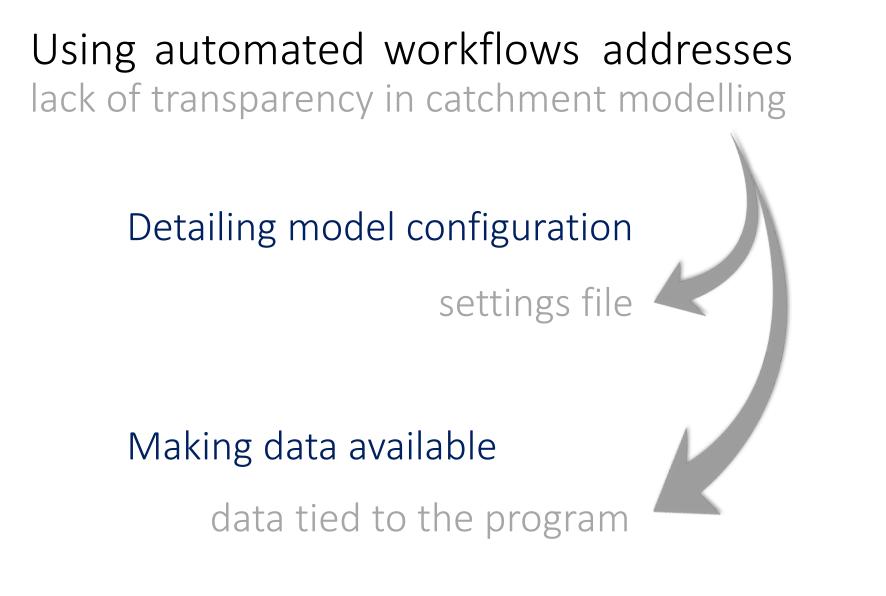
Tools/Code/Data unavailable

Balancing level of detail

Fraud

- Reproducibility of catchment hydrological modelling studies
- Improving reproducibility by using automated workflows
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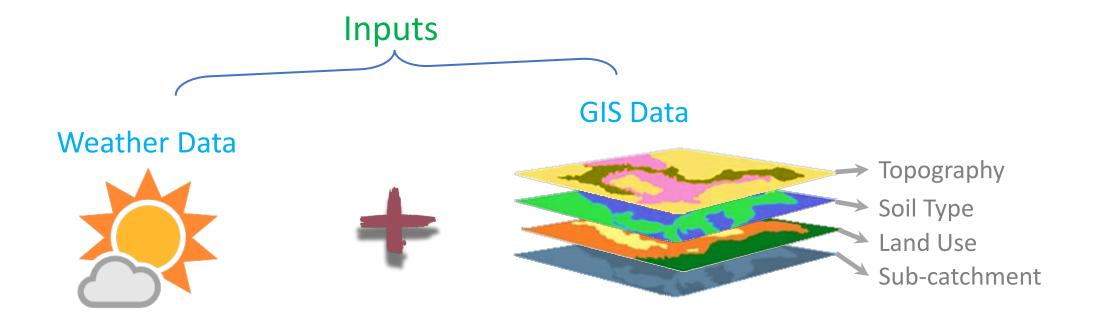
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# We created an automated workflow for the SWAT model

How is the model set up?

How does the new workflow work?



## SWAT model preparation process constantly requires input from user

QSWAT 1.5	- 🗆 X About
Soil & Water Assessment Tool	Select Project           New Project         Existing Project
	Main Steps
	Step 1 Delineate Watershed
	Step 2 Create HRUs
QSWAT parameters	Step 3 Edit Inputs and Run SWAT
	OK Cancel
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Delineate Wate	🕺 Create HRUs		-	- 🗆 X	
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Draw inlets/ Snap threshold (r	Clear Slope banc	<ul> <li>Dominant landuse, soil, sk</li> <li>Dominant HRU</li> </ul>	0 Landuse (%		
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Merge subbasins-	Optional	<ul> <li>Target number of HRUs</li> </ul>		G0	
Select su	Exempt landuses	Threshold method	0 Slope (%)		
Add reservoirs an	Elevation bands	<ul> <li>Percent of subbasin</li> <li>Area (Ha)</li> </ul>			
Number			Create HRU	s Cancel	

### SWAT model preparation process constantly requires input from user

SWrite SWAT	Database Tables 🛛 🗌	$\times$
Select Tabels	to Write	
Completed	Confirguration File (.Fig)	
Completed	Soil Data (.Sol)	
Completed	☑ Weather Generator Data (.Wgn)	
Completed	▼ Subbasin/Snow Data (.Sub/.Sno)	

 $\times$ 

SWAT Editor		-			Х
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SWAT Param	Set Default Simul	ation		_	
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SWAT Executable	Folder				
C:\SWAT\SWATE	ditor\			S I	
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Exit	Conne	ect to Databases			

Setup and Run SWAT Model Simulation		_	
Period of Simulation			
Starting Date : 1/1/1979 Min Date = 01/01/1979	Ending Date : 12/31/2013 Max Date = 12/31/2013		
Rainfall Sub-Daily Timestep	Printout Settings		
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C Mixed exponential 1.3	Print MGT Output Print WTR Output	Frint Ca	lendar Dates
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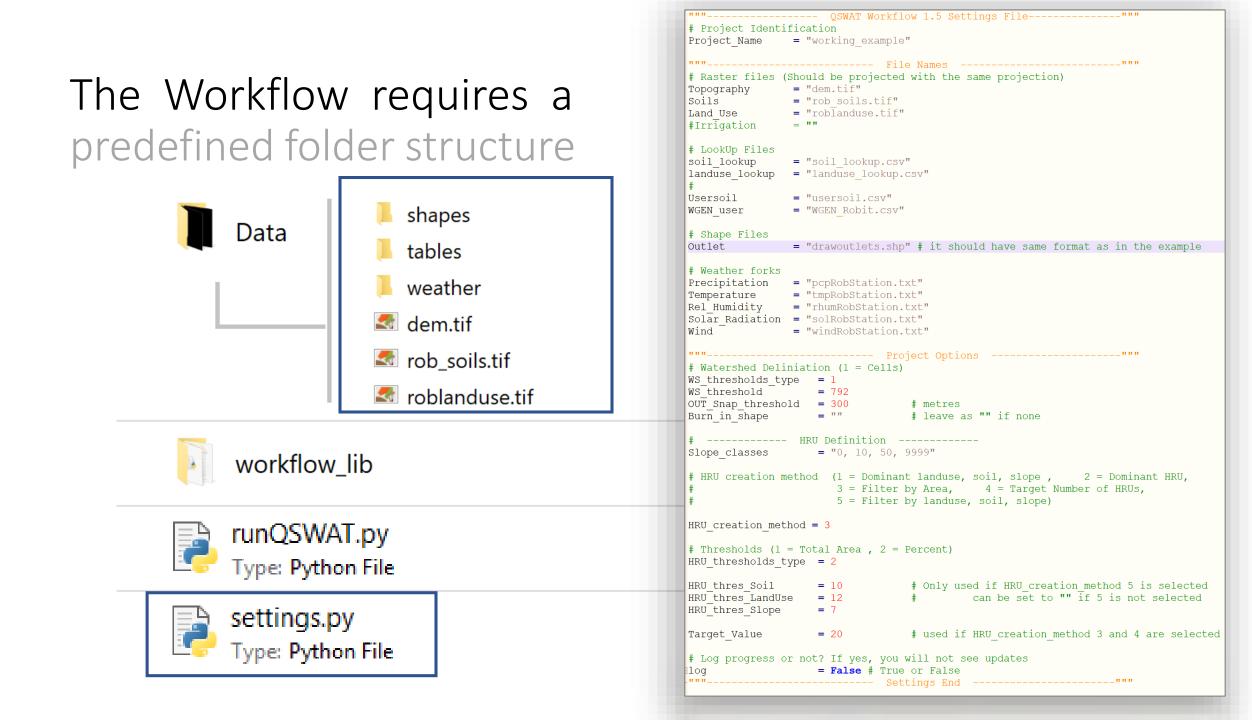
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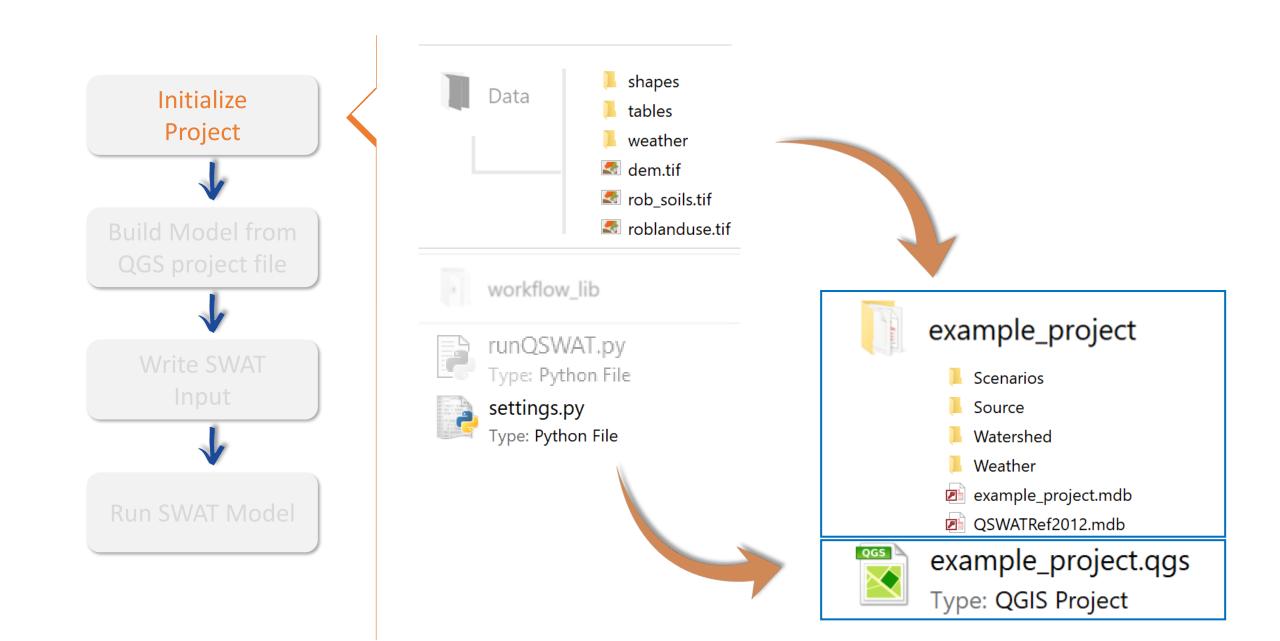
## How is the model set up?

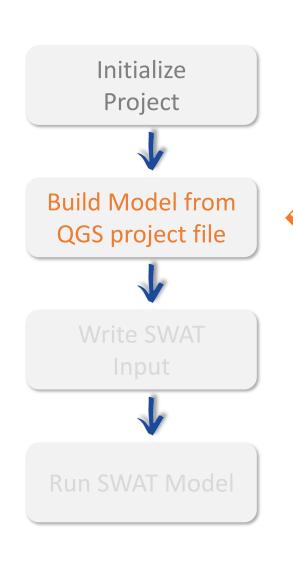
How does the new workflow work?

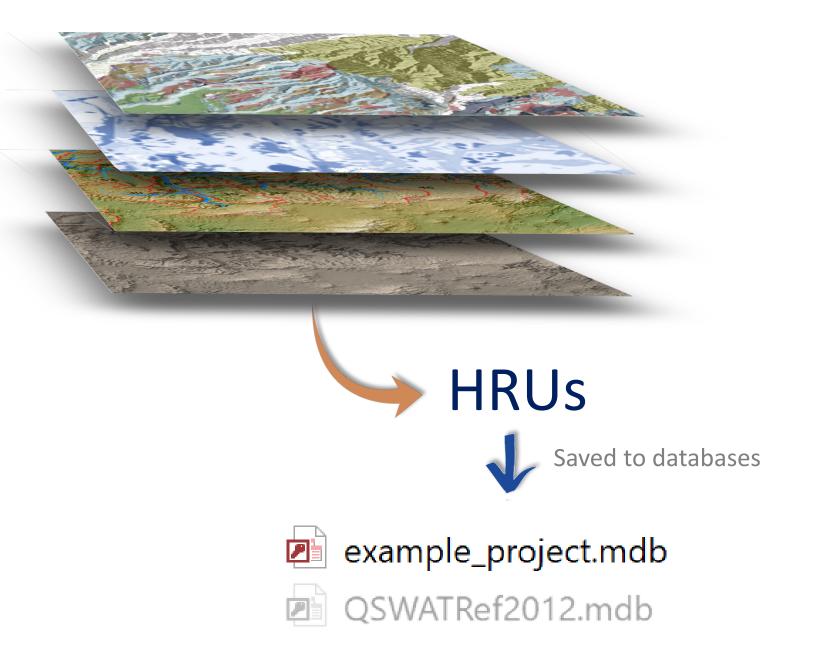
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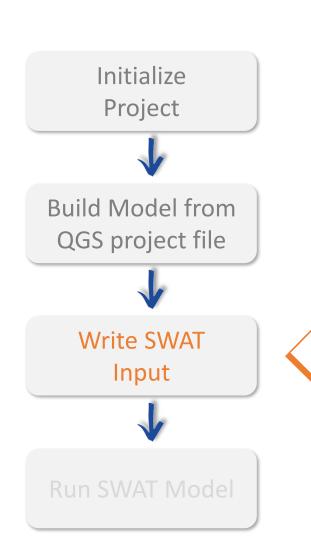
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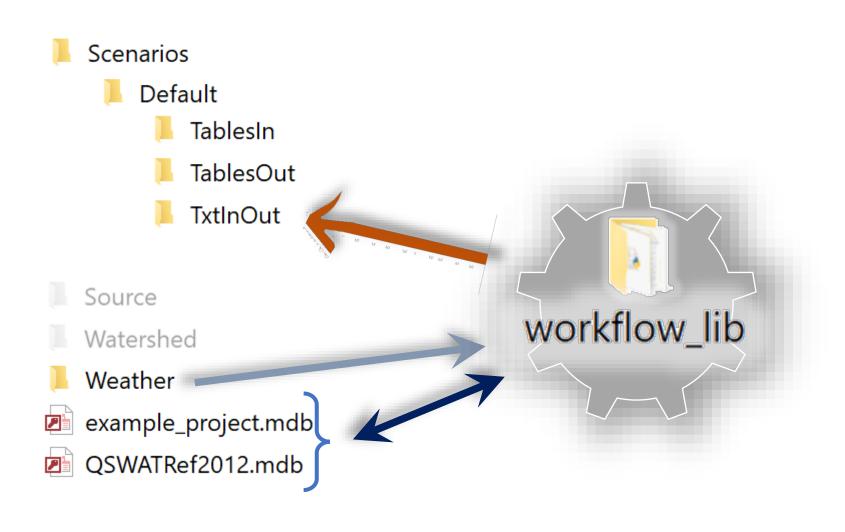


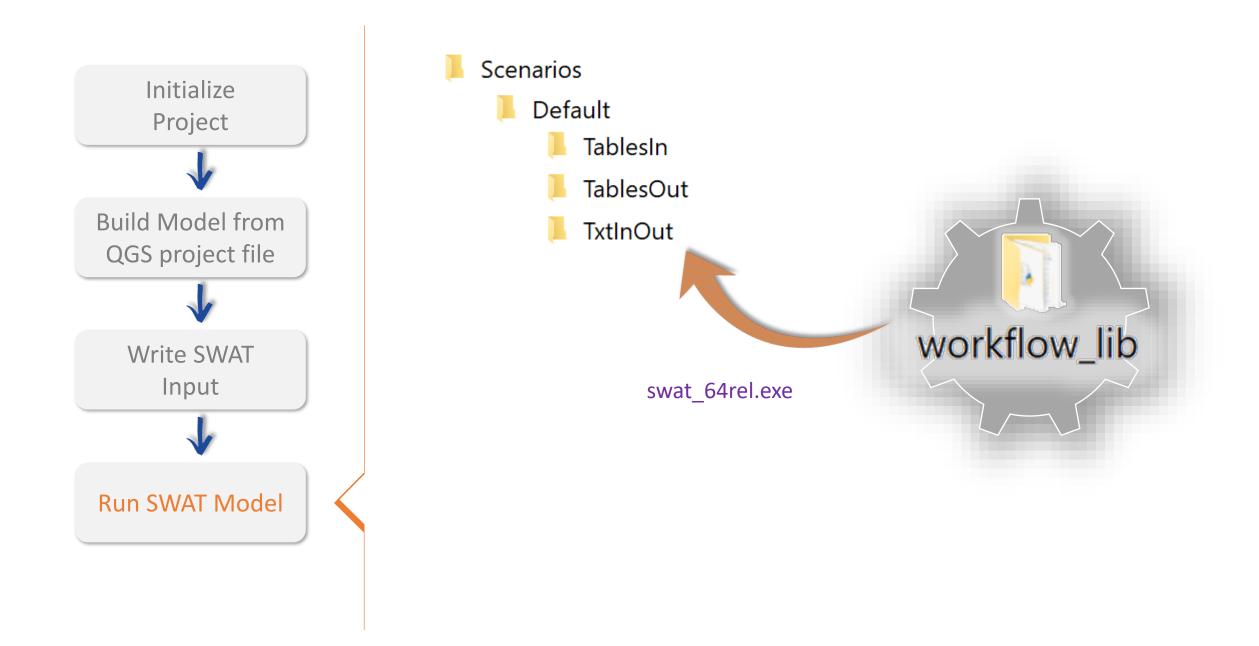




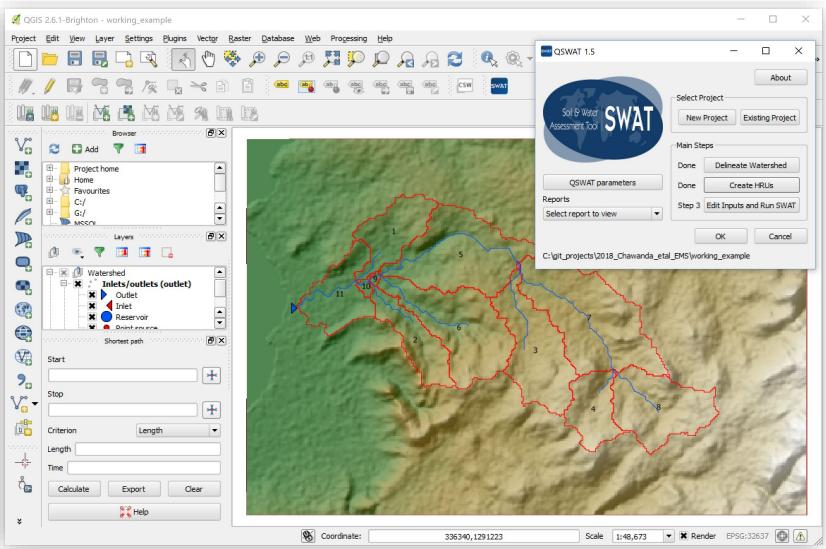




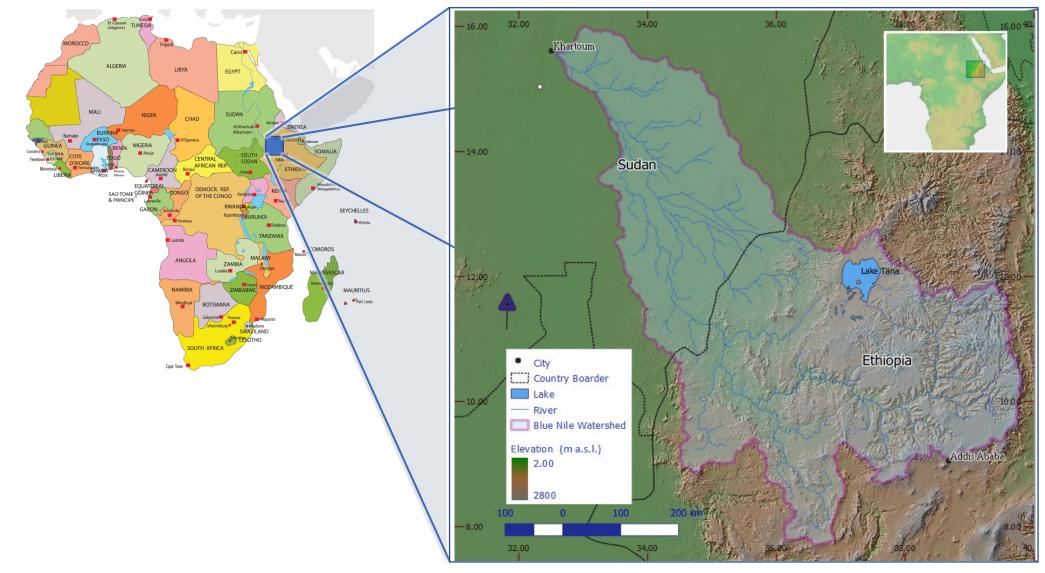




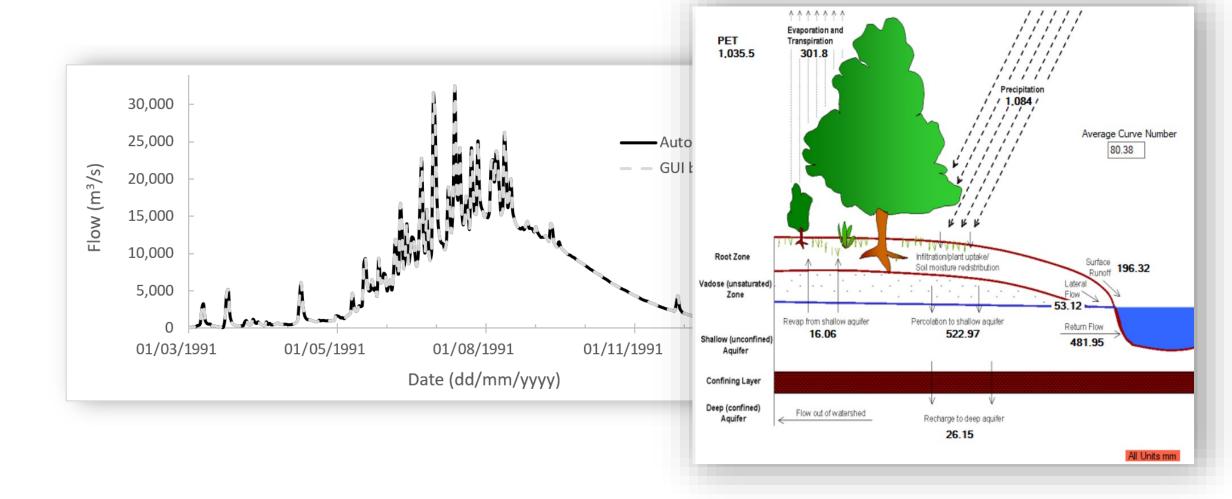
## The model can be visualised and Modified in the GUI



#### Application on Blue Nile



## We compared the model setups scripted workflow vs GUI set-up



- Reproducibility of catchment hydrological modelling studies
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## The catchment modelling community can benefit from automated workflows

Easy and transparent way of sharing modelling settings, options and data used in a publication

Saves time and effort

Opens up opportunities for using high performance computing and cloud computing

Most catchment modelling research does not provide enough information to audit and reproduce the published results

We propose automated workflows that are easy to use as demonstrated with the QSWAT workflow

Once the data bound to the workflow is publicly made available and cited there will be more reliable background material for further research

← → ♡ ŵ

GitHub, Inc. [US] https://github.com/VUB-HYDR/QSWAT\_Automated\_Workflow



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