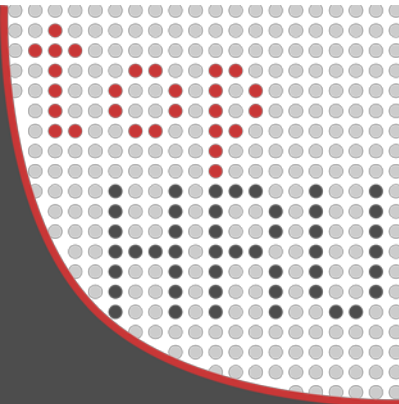




# SWAT

Soil & Water  
Assessment Tool



a  
Rasto  
CAT



# GitHub



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Bringing two open source  
worlds closer together:

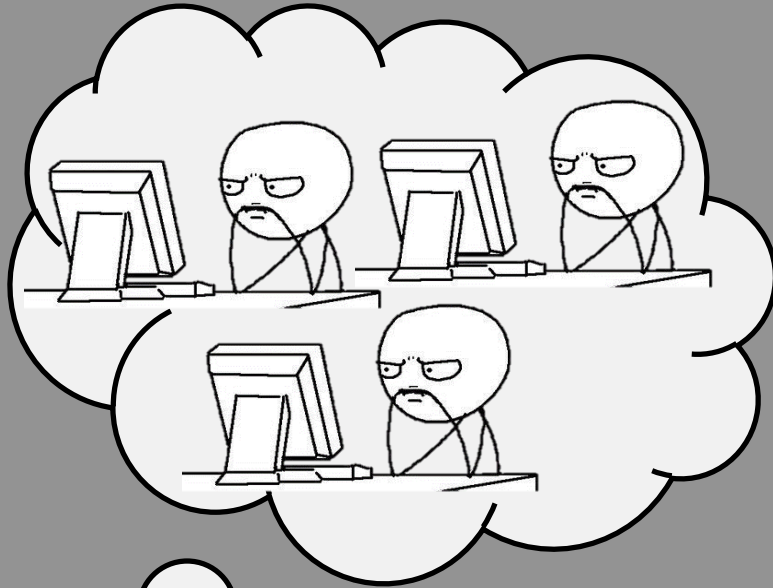
Execution and processing  
of **SWAT** projects in **R**

Christoph Schürz<sup>1</sup>, Michael Strauch<sup>2</sup>,  
Bano Mehdi<sup>1</sup>, and Karsten Schulz<sup>1</sup>

<sup>1</sup> BOKU University Vienna

<sup>2</sup> UFZ Leipzig

SWAT  
+ R

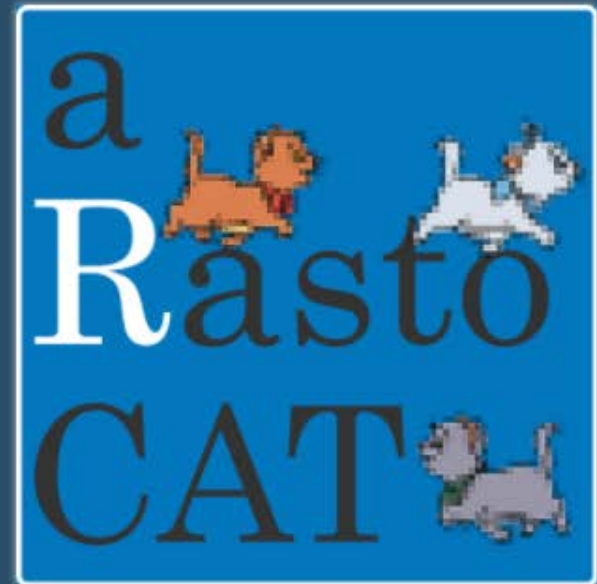
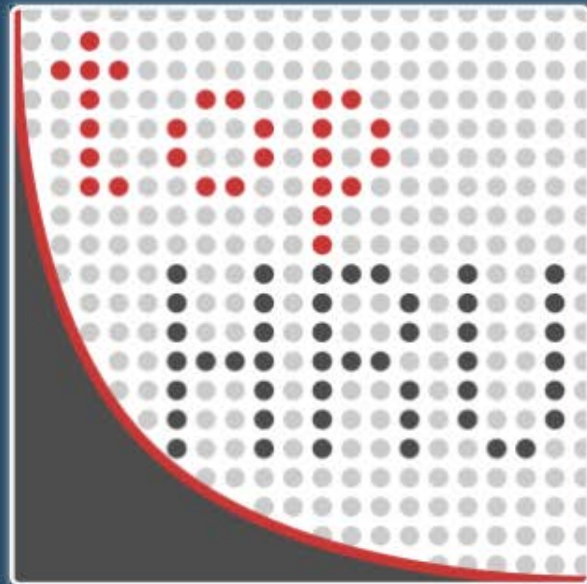


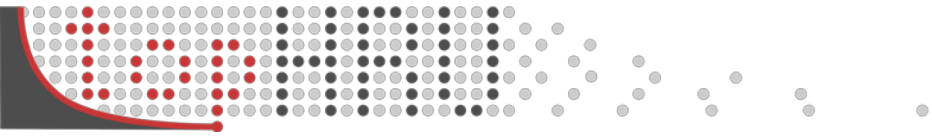
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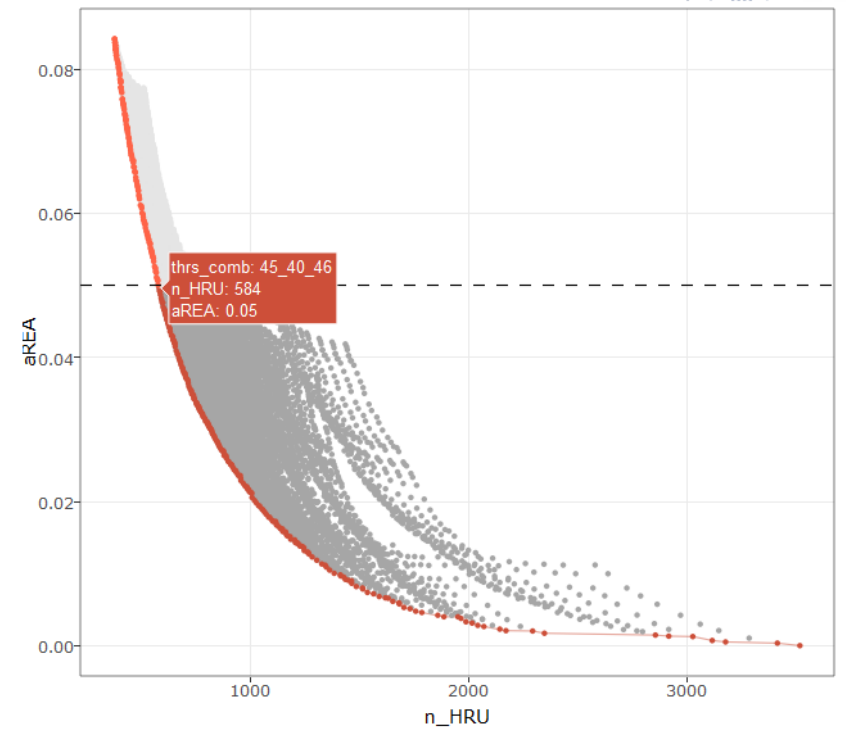


- To minimize trade offs between model simplicity and “spatial error” of the input data
- Calculates the average Relative Error of Aggregation (aREA) for thousands of LUSE-SOIL-SLOPE threshold combinations

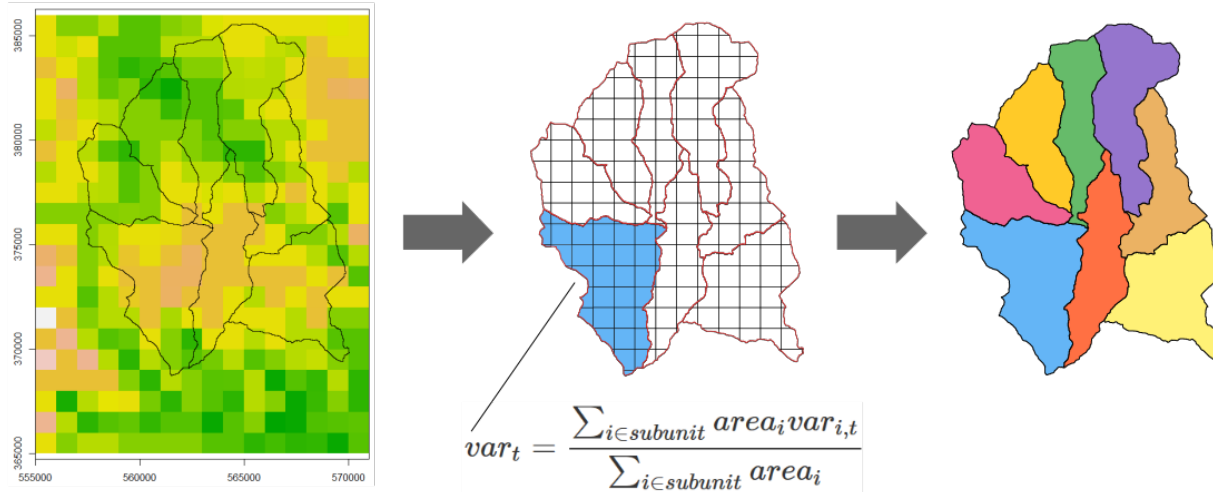
$$REA_{lu,sol,slp} = \frac{0.5 \times \sum_{i,k=1}^{I,K} |y_{agg_{i,k}} - y_{ref_{i,k}}|}{A}$$

$$aREA = \frac{\frac{1}{\omega_{lu}} REA_{lu} + \frac{1}{\omega_{sol}} REA_{sol} + \frac{1}{\omega_{slp}} REA_{slp}}{3}$$

$y$  = Area ( $agg$ : aggregated,  $ref$ : reference)  
 $i$  = Specific land use/soil/slope class  
 $k$  = Subbasin number  
 $A$  = Total watershed area  
 $\omega$  = Weighting factor (optional)



Aggregate NetCDF weather data and create SWAT inputs:



year	mon	day	hour	min	sub_1	sub_2	sub_3	sub_4	sub_5	sub_6	sub_7	sub_8
1971	1	1	0	0	3.08	3.18	3.04	3.15	3.11	3.04	3.04	3.08
1971	1	2	0	0	0.64	0.76	0.60	0.69	0.89	1.04	0.99	1.32
1971	1	3	0	0	8.05	8.44	8.00	8.22	8.73	8.96	8.88	9.50
1971	1	4	0	0	2.34	2.27	2.38	2.33	2.28	2.17	2.06	1.99
1971	1	5	0	0	13.83	13.36	14.39	13.63	14.85	14.34	13.59	14.52
1971	1	6	0	0	23.82	24.04	24.25	23.94	25.70	24.93	23.71	25.25
1971	1	7	0	0	11.90	12.12	12.08	12.02	12.64	12.46	12.25	12.66
1971	1	8	0	0	0.14	0.15	0.18	0.14	0.23	0.24	0.20	0.29
1971	1	9	0	0	3.47	3.38	3.62	3.42	4.07	3.98	3.61	4.09
1971	1	10	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## Workflow provided by the R package:

`build_SWATproject()`

Build folder structure for parallel SWAT execution



`sample_factor()`

MC, optimLHS, randomLHS, STAR, FAST



`run_SWAT()`

Parallel SWAT execution using sampled parameters

**Results in structured output:**

```
sim$flow_15$run_00001
  $no3_7   $run_21500
  $ptot_8
```



### Analysis

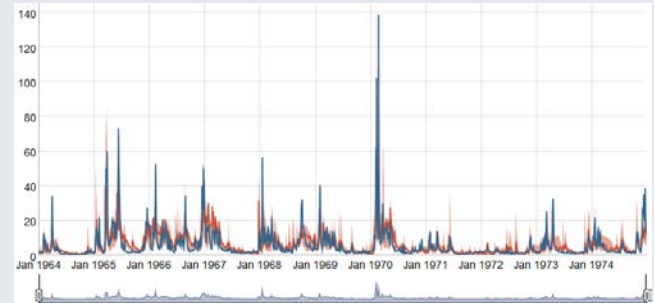
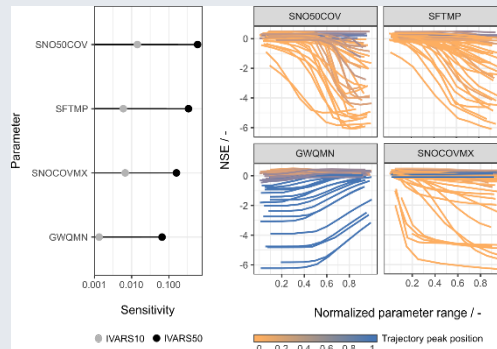
- `evaluate_simulation()`: Apply e.g. NSE, pbias, signature measures
- `assess_sensitivity()`: analyze GSA e.g. STARVARS (Razavi & Gupta, 2016)



### Visualization

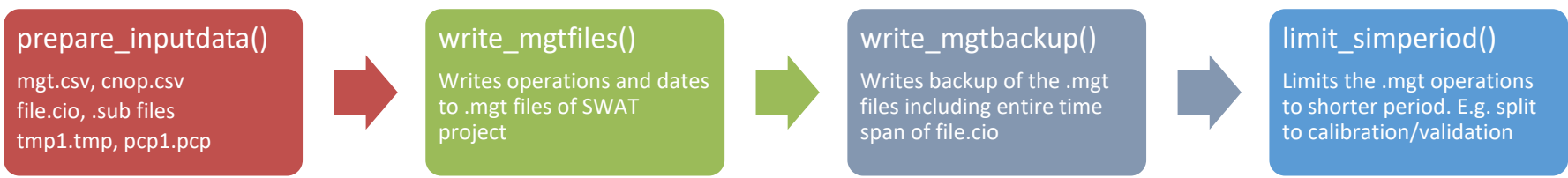
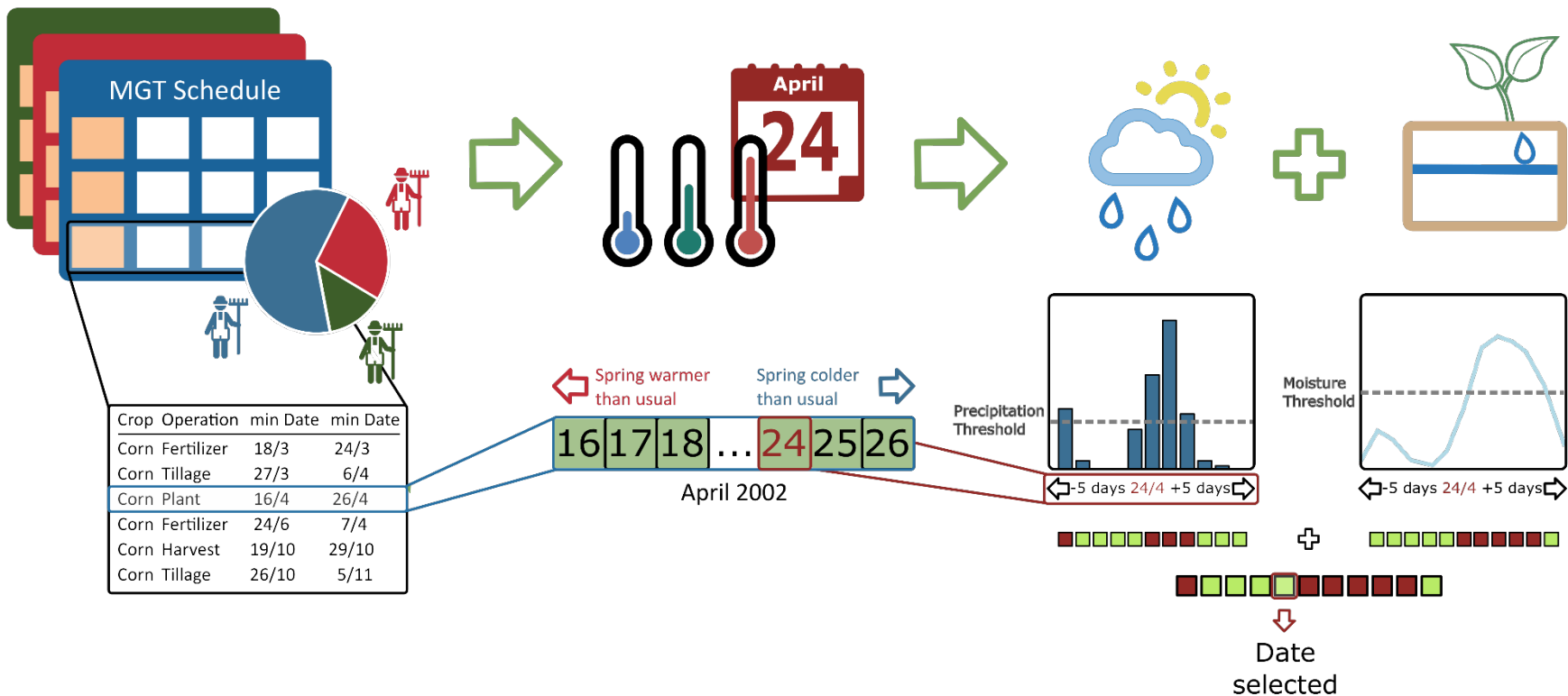
- `plot_simind()`: Plot selected simulation runs
- `plot_simcrit()`: Plot simulations above an objective criterion
- `plot_dotty()`: Dotty plots for modified parameters
- `plot_sensitivity()`: Visualization of STARVARS

Visualization of global parameter sensitivities using STARvars



Visualization of discharge with NSE > 0.5

Define .mgt operation dates applying following simple rules:



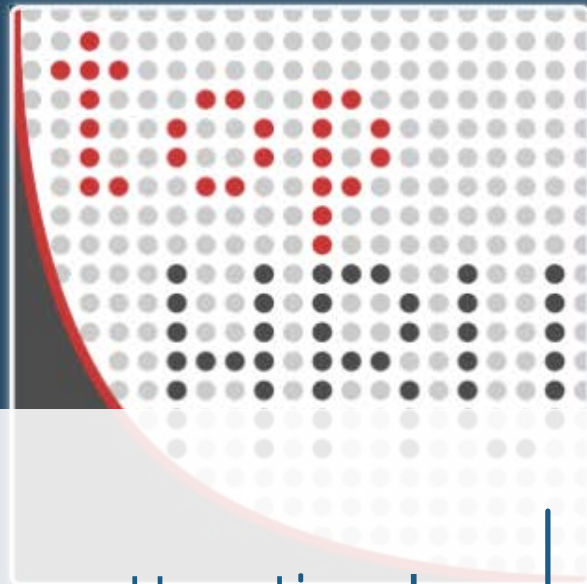
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Thank you for your attention!  
Any questions?



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