

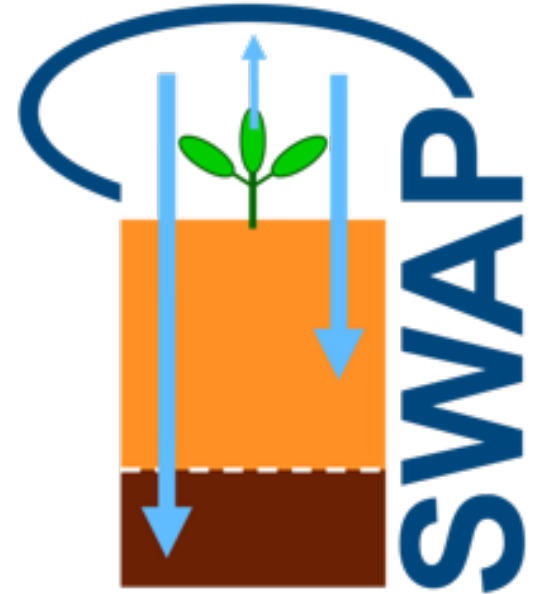
SWAP graphical interface and use in education

A landscape photograph showing a waterway with a bridge and a path. The sky is blue with white clouds. The water is calm, and there are reeds and grasses along the banks. A path leads towards the bridge.

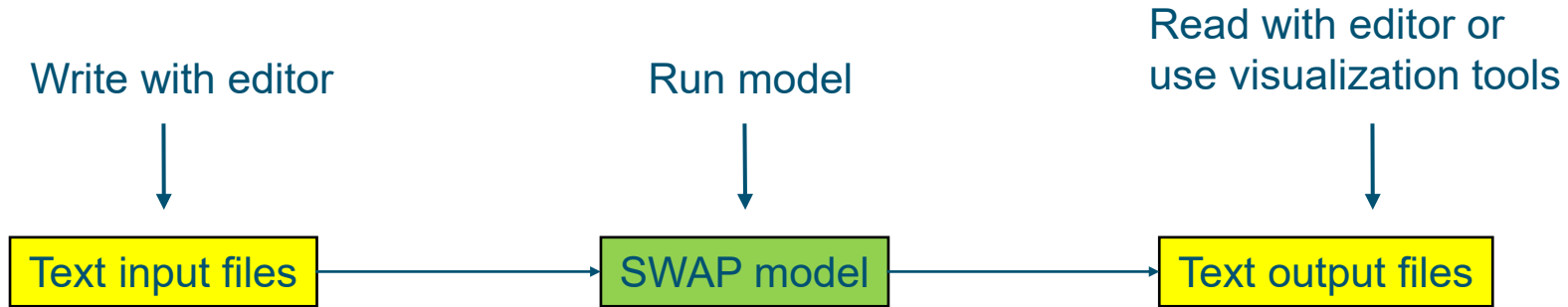
Functions SWAP in education
Regular SWAP use
Graphical user interface
Demonstration

Functions SWAP in education

- Make invisible phenomena in the soil visible
- Quantify interactions soil-water-atmosphere-plant
- Tool for analysis of environmental problems
- Make knowledge accessible
- Development platform to test new concepts



Regular use of SWAP



Advantages

- Fast and flexible
- Batches of many simulations
- Use favorite visualization tool

Disadvantages

- Requires overview of many input variables
- Visualization requires extra step

Graphical user interface (GUI) for SWAP

Goal

- Easy access to SWAP for unexperienced users
- Visualization of output
- Comparison of different experiments or scenarios

Setup

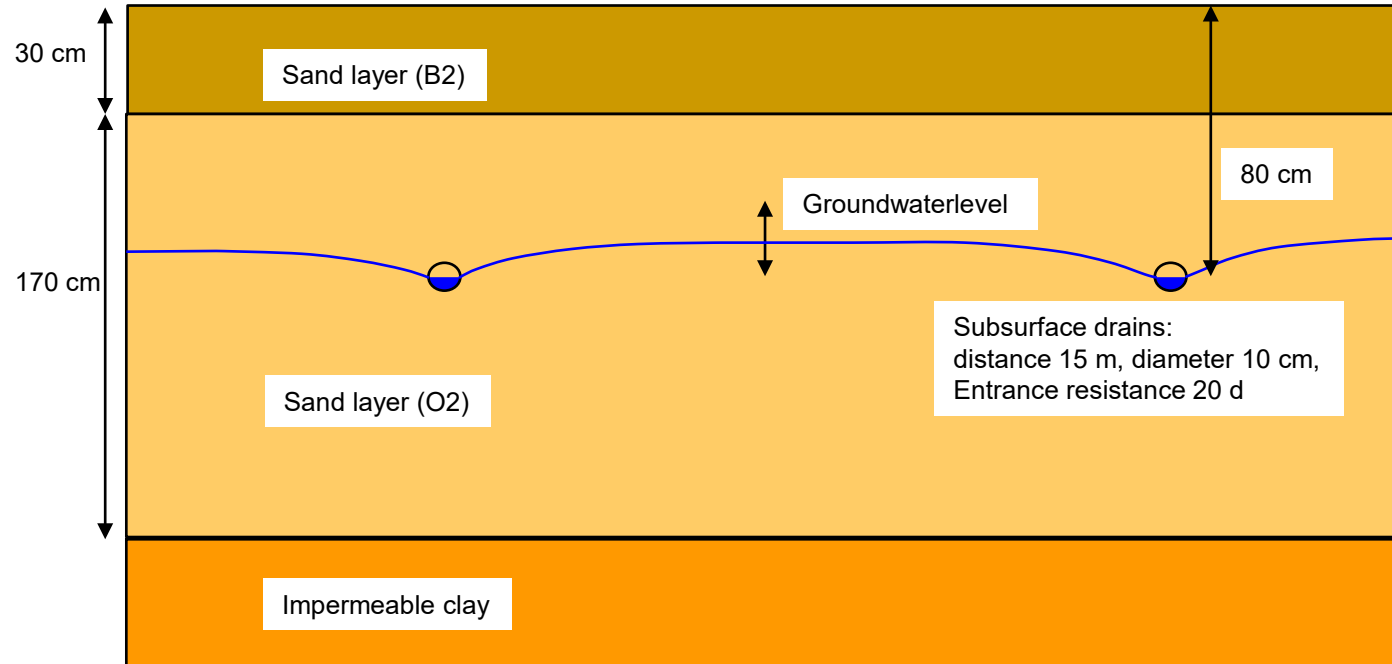
- GUI is written in RShiny
- Developed by Martin Mulder, Arnold Moene and Jos van Dam
- Experience at Wageningen University in Bachelor course Atmosphere-Vegetation-Soil Interactions

Hydrologic situation of an GUI example

Years 2016-2018, daily weather data of station De Bilt

Cultivation maize and grass

Tracer added on 5 maart 2017



▼ Experiment

Open experiment:

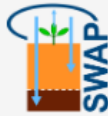
- Demonstration grass
- Demonstration maize

📁 Import exp.

📄 Export exp.

🔄 Exit

🔗 Help



Input

Output

Main

Meteo

Soil

Crop

Irrigation

Drainage

Solute

Settings for all experiments:

Simulation period: 2016-01-01 - 2018-12-31

▼ Adjust settings

Time interval of simulation output

- One day
- One hour

Settings for selected experiment:

Simulation of processes

- Crop
- Irrigation
- Drainage
- Solute transport
- Heat transport

Settings for next simulation

- Save all state variables to be used as initial conditions for new run (pressure head, solutes, ...)

Main input screen

- Selection of main processes
- Only input for selected processes is shown
- Help available

[Input](#)[Output](#)[Main](#)[Meteo](#)[Soil](#)[Crop](#)[Irrigation](#)[Drainage](#)[Solute](#)

Soil hydraulic functions

[General](#)[Settings](#)

LAYER

ORES

OSAT

ALFA

NPAR

KSAT

LEXP

ALFAW

H_ENPR

KSATEXM

1

0.02

0.42

0.0276

1.491

12.52

-1.06

0.0276

0

12.52

2

0.02

0.42

0.0276

1.491

12.52

-1.06

0.0276

0

12.52

3

0.02

0.38

0.0213

1.951

12.68

0.168

0.0213

0

12.68

4

0.02

0.38

0.0213

1.951

12.68

0.168

0.0213

0

12.68

Showing 1 to 4 of 4 entries

Adjust settings

Input soil hydraulic functions

- Default soil hydraulic parameters are shown based on soil texture
- Each parameter can be adjusted by the user

Input

Output

Main

Meteo

Soil

Crop

Irrigation

Drainage

Solute

Rotation

Growth

Select crop:

Maize (Wofost)

Select module:

Drought Stress

Drought stress

Macroscopic

Microscopic

Pressure head below which water uptake red. starts at high Tpot: **-400** [cm]

Pressure head below which water uptake red. starts at low Tpot: **-500** [cm]

No water extraction at lower pressure heads: **-10000** [cm]

Level of high atmospheric demand: **0.5** [cm d⁻¹]

Level of low atmospheric demand: **0.1** [cm d⁻¹]

▼ Adjust settings

Input drought stress

- Select macroscopic or microscopic concept
- Input parameters for selected concept



Open experiments:

- Demonstration grass
- Demonstration maize

Exit

Help

Output control

Modus

Info

Zoom

Time: 2017-05-14 - 2017-05-15



Time

Interval selected: OneDay

Range selected: 2016-01-01 to 2018-12-31

Adjust settings

Color

Demonstration grass

Demonstration maize

Adjust settings

Input

Output

Timeseries

Profile

Balance

Actual soil evaporation

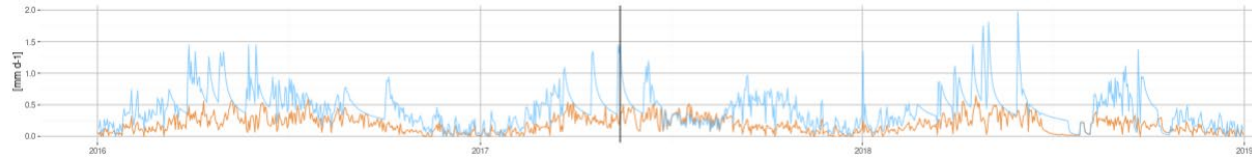
Time: 2017-05-14 - 2017-05-15

0.2965

1.4497 [mm d⁻¹]

Download

Adjust settings



Actual transpiration

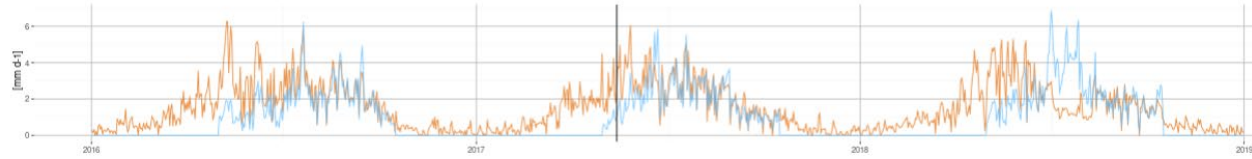
Time: 2017-05-14 - 2017-05-15

2.9093

1.0907 [mm d⁻¹]

Download

Adjust settings



Groundwaterlevel

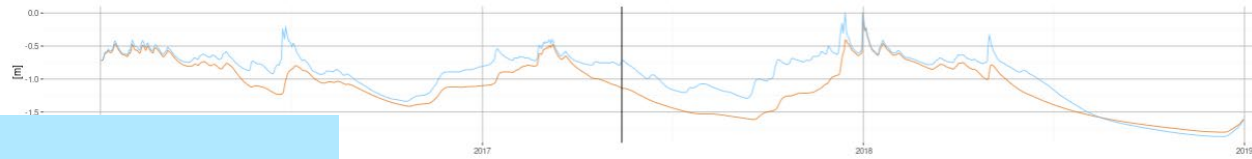
Time: 2017-05-14 - 2017-05-15

-1.137

-0.726 [m]

Download

Adjust settings



Example output

- Panels with 3 time series to compare fluxes and state variables
- Different experiments in the same graph
- User may zoom in at particular time periods
- Quantitative information at arbitrary dates can be requested

Solute concentration in soil water

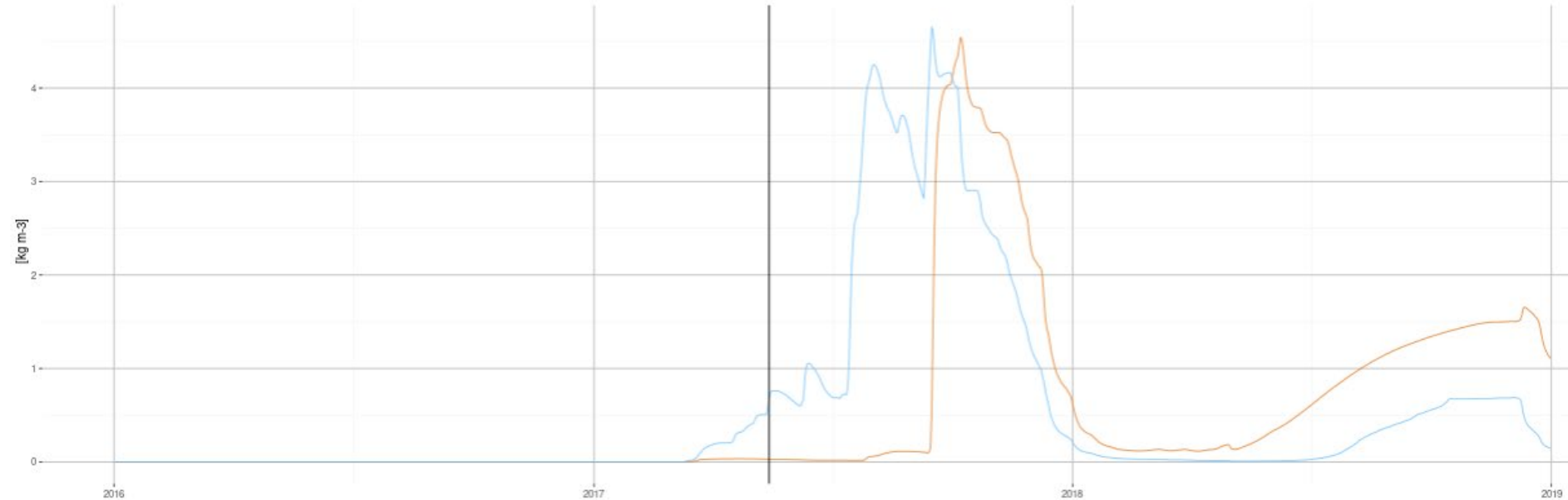
Time: 2017-05-14 - 2017-05-15 Depth: -0.5 [m]

0.0282

0.6915 [kg m⁻³]

Download

Adjust settings



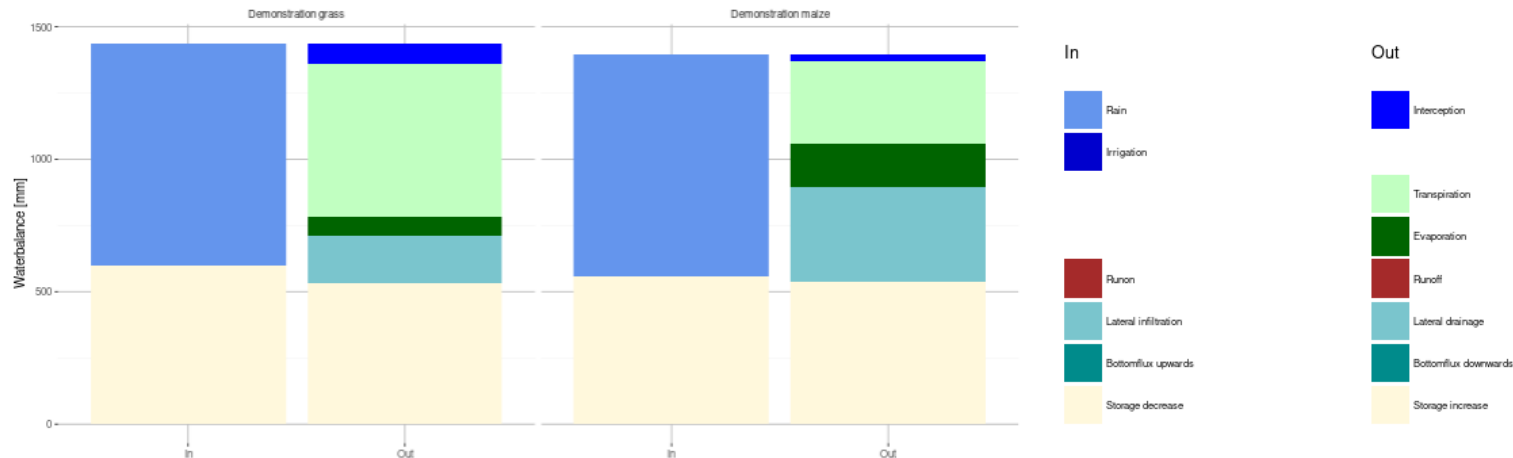
Example output for soil profile

- Data on moisture, solute concentrations and temperatures
- Vertical profiles at selected times
- Time series at selected depths

Input **Output**

Timeseries Profile **Balance**

Output water balances



In	Demonstration grass	Demonstration maize	Out	Demonstration grass	Demonstration maize
Total	1437.72	1393.49	Total	1437.73	1393.49
- Rain	838.00	838.00	- Interception	77.95	22.16
- Irrigation	0.00	0.00	- Transpiration	577.49	310.94
- Runon	0.00	0.00	- Evaporation	72.04	165.85
- Lateral infiltration	0.00	0.00	- Runoff	0.00	0.00
- Bottomflux upwards	0.00	0.00	- Lateral drainage	177.92	354.69
- Storage decrease	599.73	555.49	- Bottomflux downwards	0.00	0.00
			- Storage increase	532.33	539.86

Next steps graphical user interface

- Coupling to most recent SWAP version
- More functionality for input weather and crop data
- Define range of representative applications
- Online SWAP manual
- Make GUI accessible to run on a server or stand-alone

