

The first comparison of RSWMS and DUMUX

Model description:

Computational domain:

Space:

Soil domain: 10cm x10cm x10cm which is refined by 20x20x20

Static root system: lupin root system with 1738 root segments.

Simulation time: 1 day with time step: 0.1 day

Boundary condition:

Soil: Neumann condition on 6 faces: No flux.

Root: Neumann condition at root collar: Constant transpiration rate: 2.15E-08 [kg/s] in DUMUX and 1.8576 [cm³/d] in RSWMS

Initial condition:

Soil pressure at top: -9.43E+03 [Pa] in DUMUX and -96.126 [cm] in RSWMS

Root pressure: 0 [Pa] in DUMUX or 0 [cm] in RSWMS

Soil hydraulic properties:

DUMUX		RSWMS	
Porosity [-]	0.4	ths [-]	0.4
S _{wr} [-]	0.05	thr [-]	0.02
alpha [1/Pa]	2.96E-04	alpha [1/cm]	0.029
n	1.5	n	1.5
Permeability [m ²]	2.57E-12	Ks [cm/d]	217.32

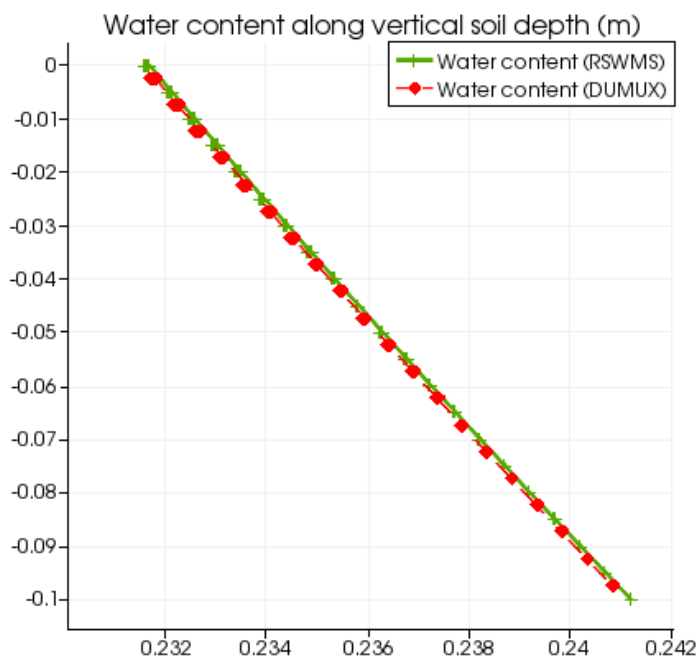
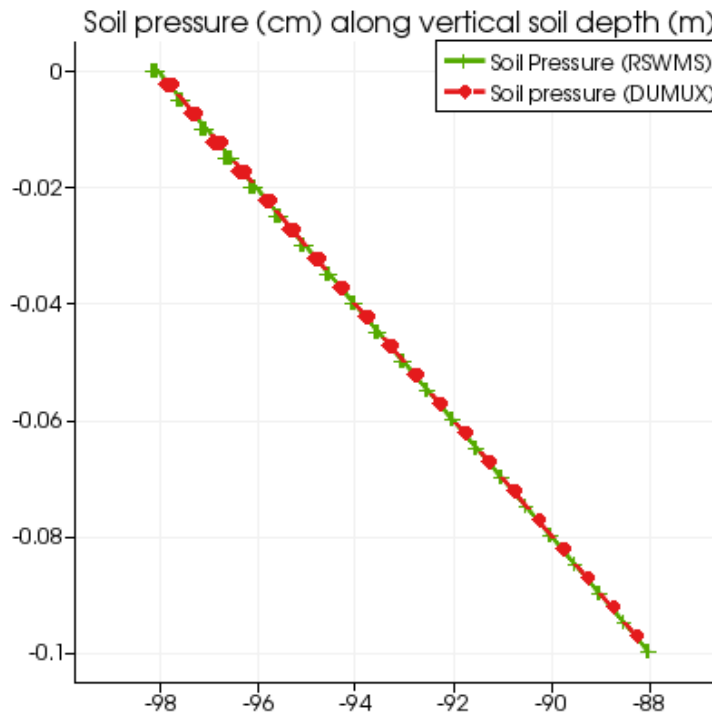
Root hydraulic properties:

DUMUX		RSWMS	
K _x [m ⁴ /s/Pa]	5.10E-17	KhRoot [cm ³ /d]	0.043227
K _r [m/s/Pa]	2.04E-13	Lr [cm/d]	0.00017291

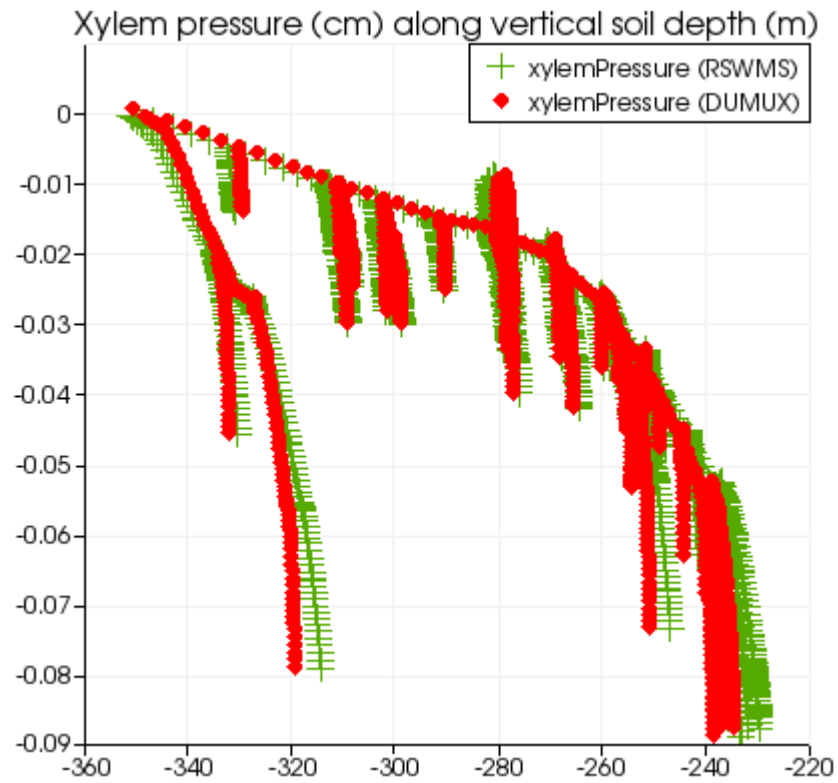
Notes:

- There is also a available matlab script for parameter conversion from DUMUX to RSWMS in doc folder.
- to run and measure total simulation time of DUMUX and RSWMS model: use command "python runNmeasureTime.py"

Simulation results:



We can see an agreement in soil pressure and water content from these simulations. Some large differences at boundaries just because of the extrapolation from DUMUX results (from cell value to point value). The relative difference in soil pressure is about 0.015%, and in water content is $\sim 0.04\%$ which could be considered small.



In xylem pressure in root system, we see more deviation between two simulations. The difference could be from algorithms in calculating pressure at root-soil interface in two models and the dumux-multidimension still not implement gravitational component in root pressure. The relative difference in xylem pressure ranges in 0.2% to 2.3%.