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A plot scale modelling investigation of infiltration processes in a landslide

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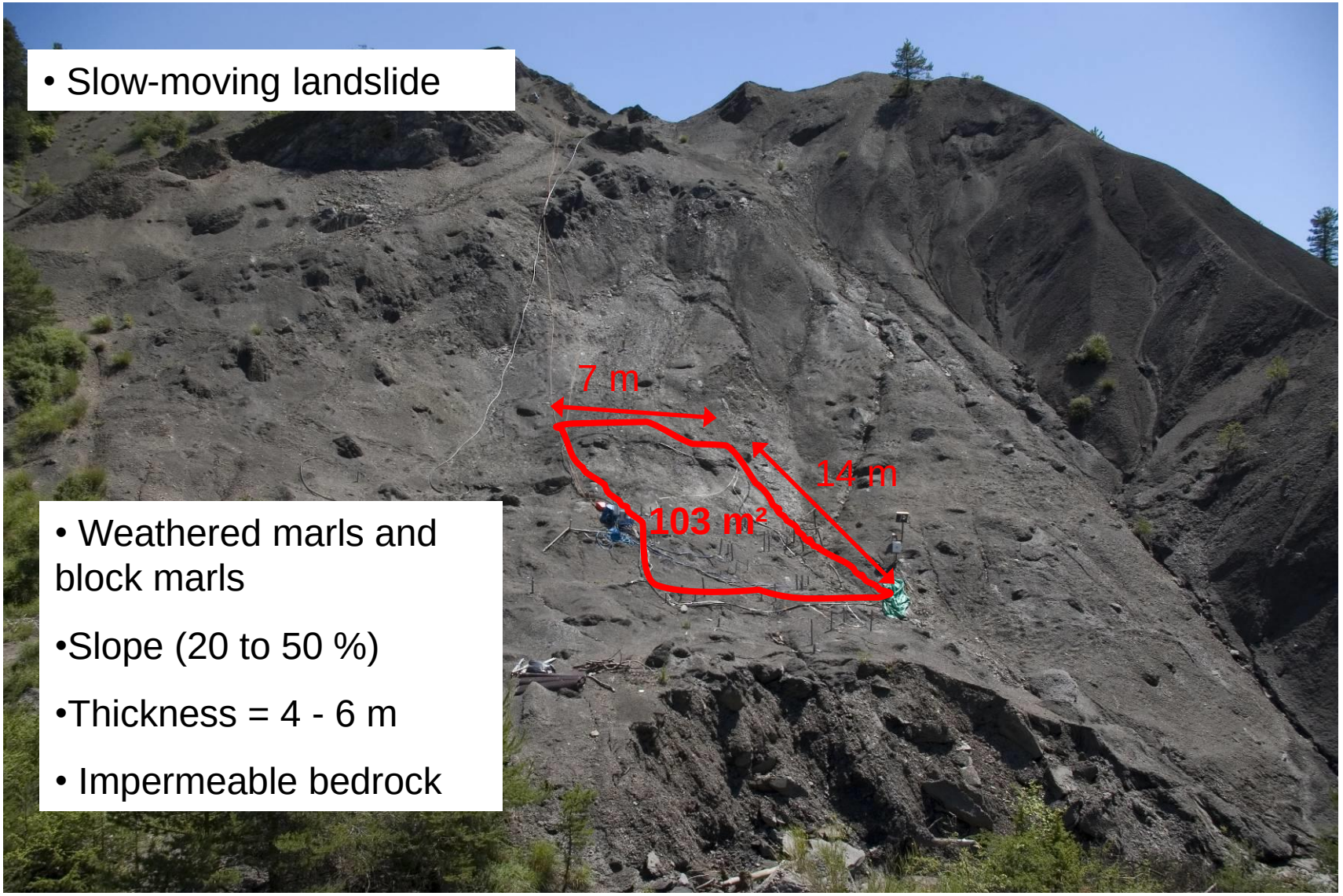
Outline

1. Experimental site
2. Experimental results
3. Numerical Model
4. Modelling results
5. Conclusion and next stages

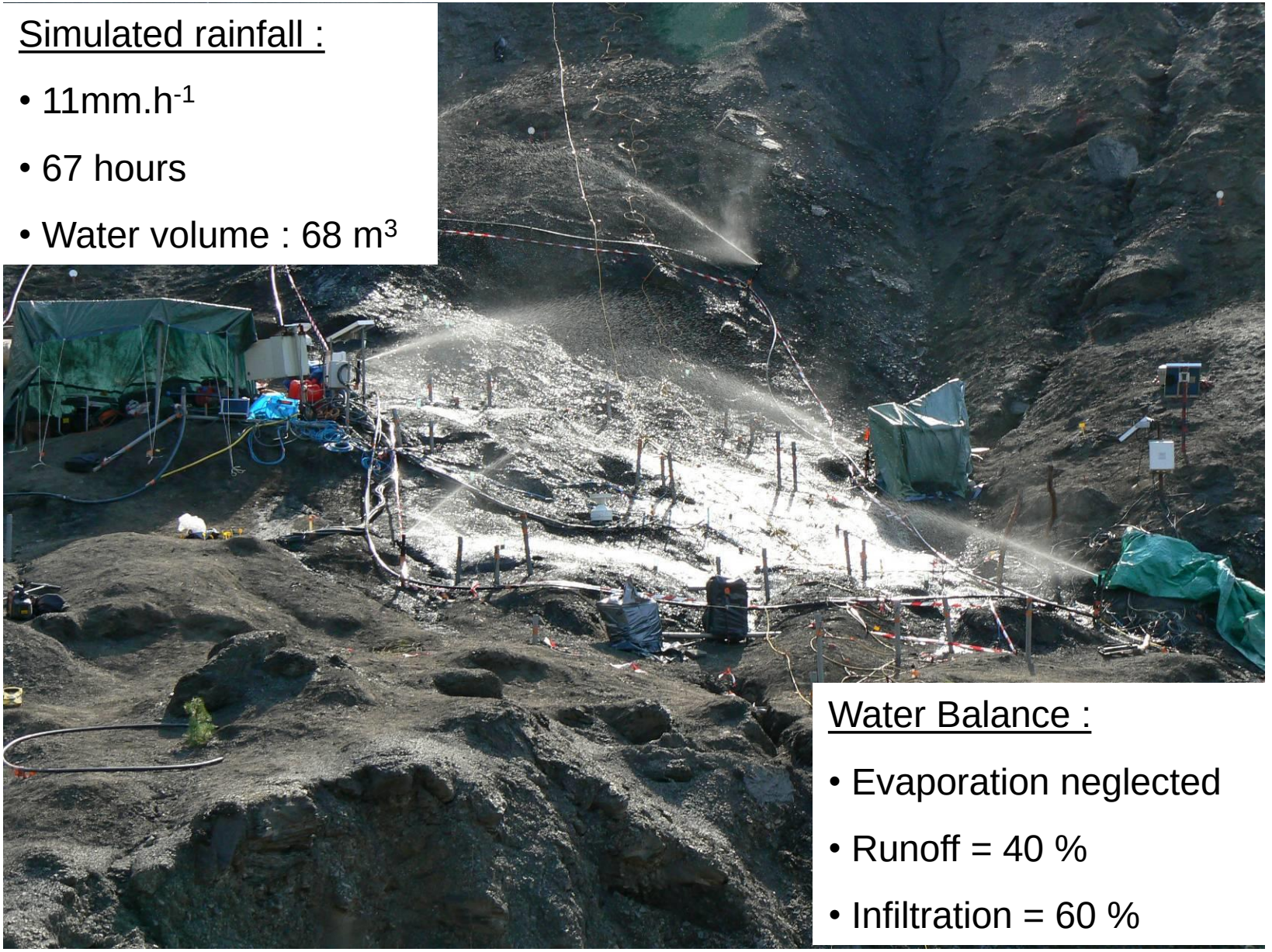
1. Experimental area



2. Experimental results

Simulated rainfall :

- 11mm.h^{-1}
- 67 hours
- Water volume : 68 m^3

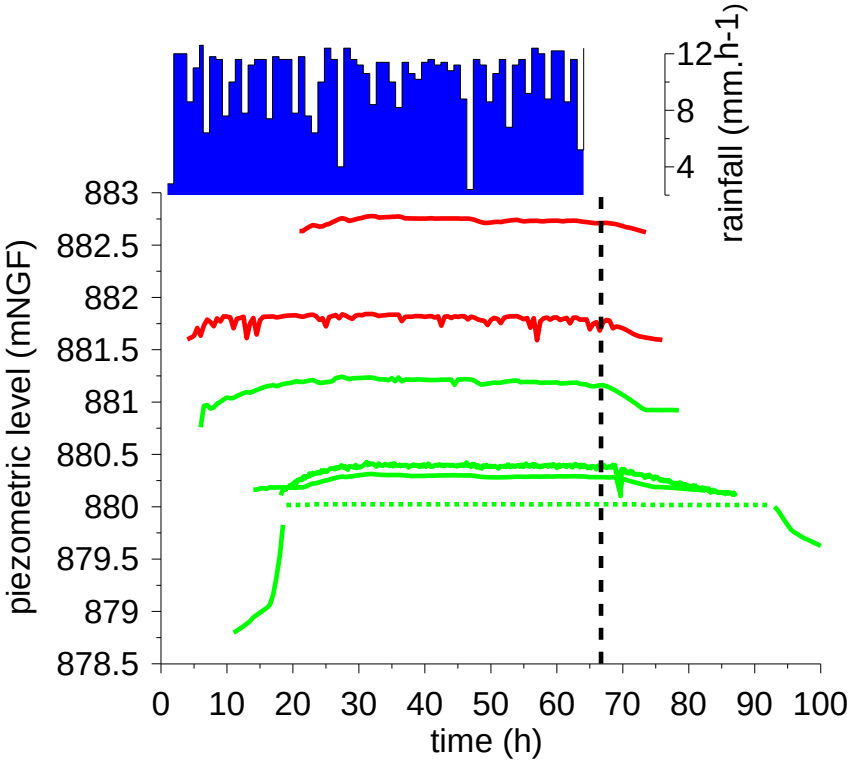


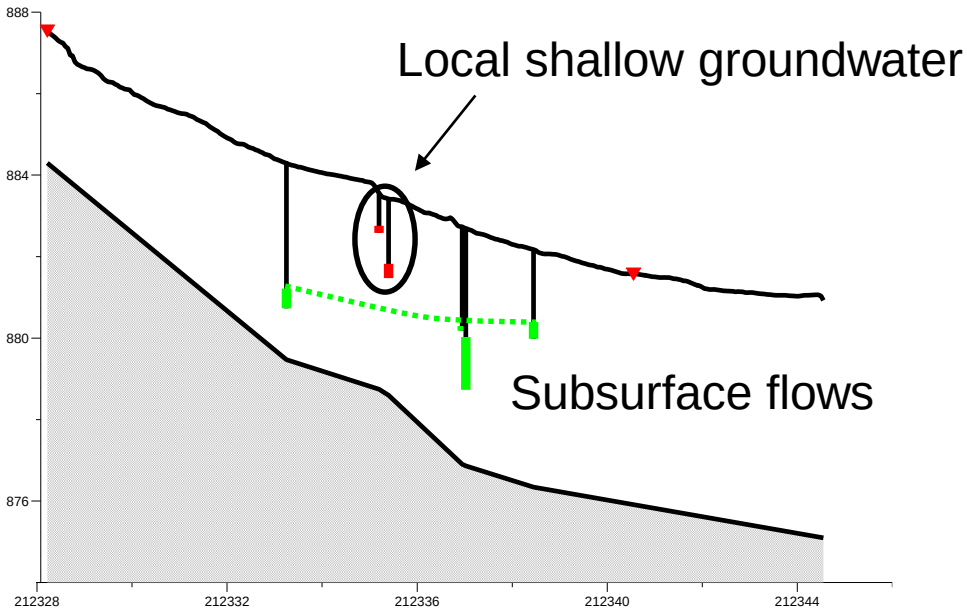
Water Balance :

- Evaporation neglected
- Runoff = 40 %
- Infiltration = 60 %

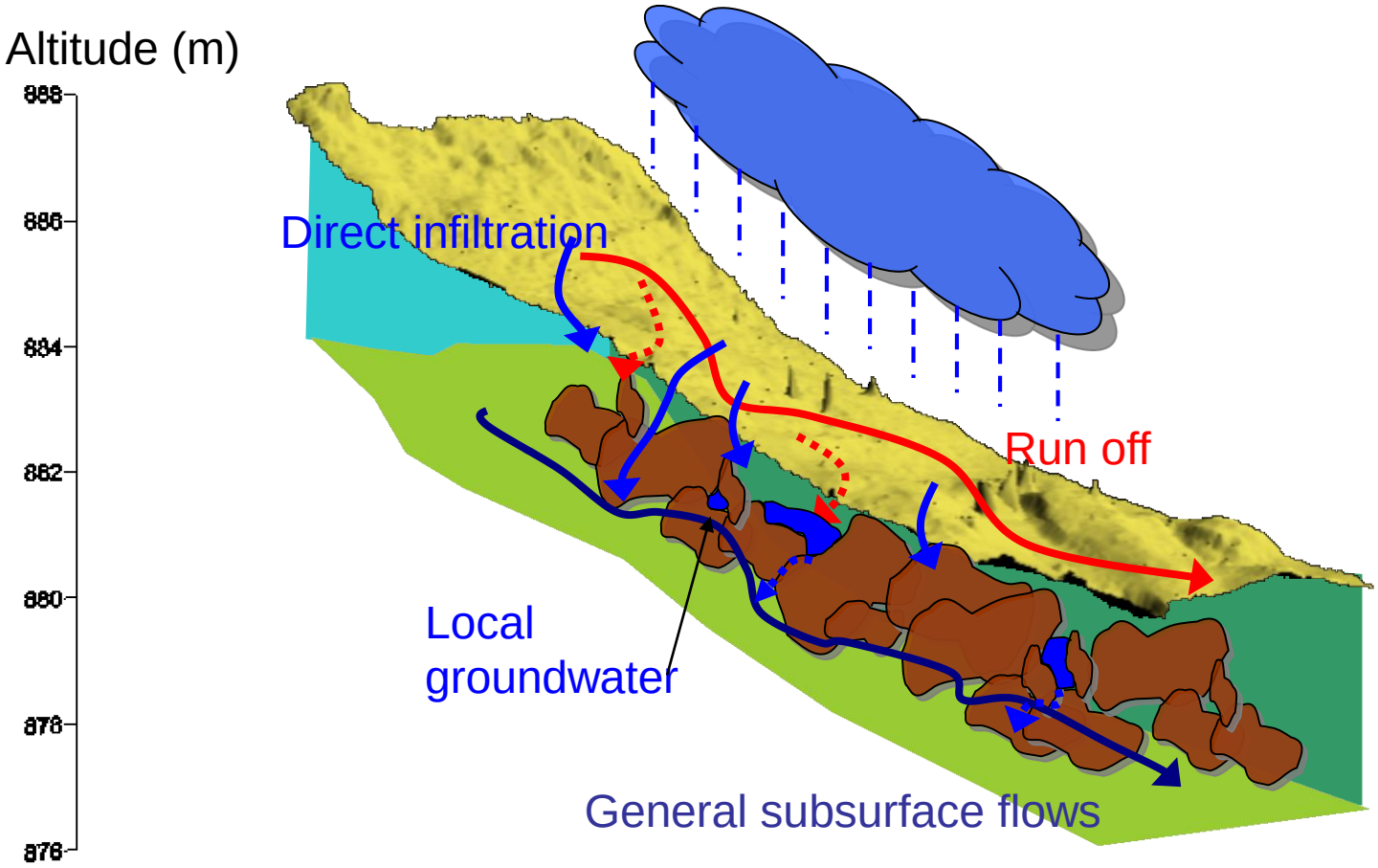
2. Experimental results

Groundwater level





2. Experimental results



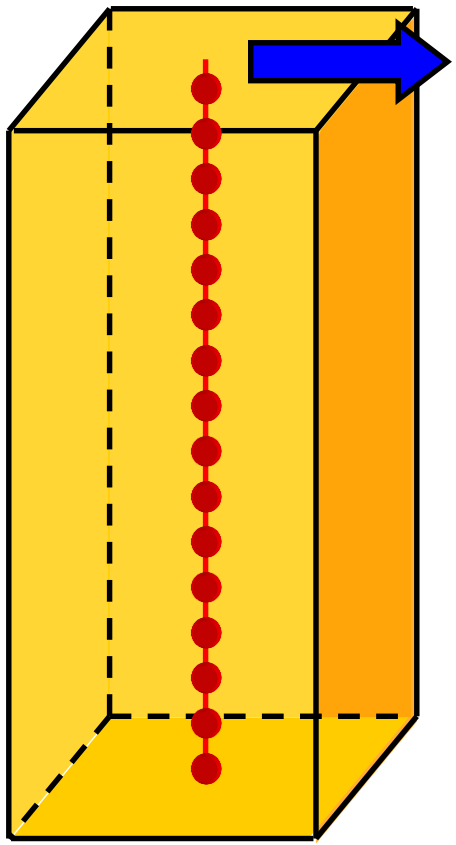
3. Numerical Model

One-dimensional mechanistic model

PASTIS : Prediction of Agricultural Solute Transfer In Soils (Lafolie, 1991)

Water transport : Richards' Equation

$$\frac{\delta\theta}{\delta t} = \frac{\delta}{\delta x}\left[K(\theta)\left(\frac{\delta h}{\delta z} - 1\right)\right]$$



Run off :

→ Rs,max

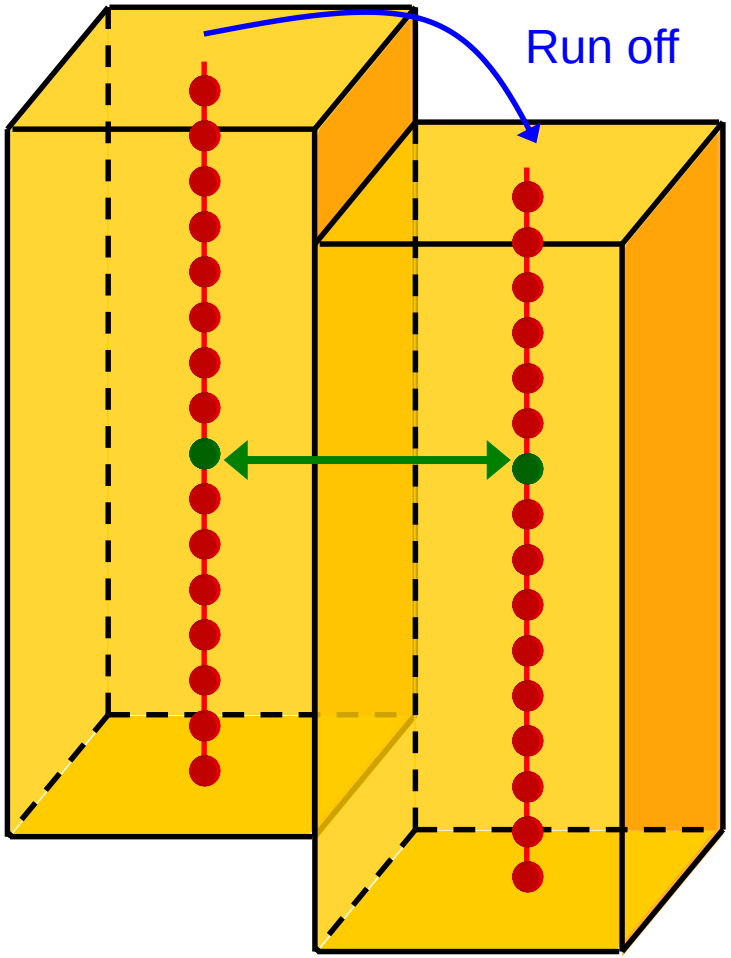
→ Slope

Storage capacity

$$R_{s,max}(t) = \frac{\theta_{max}}{\rho} DM(t)$$

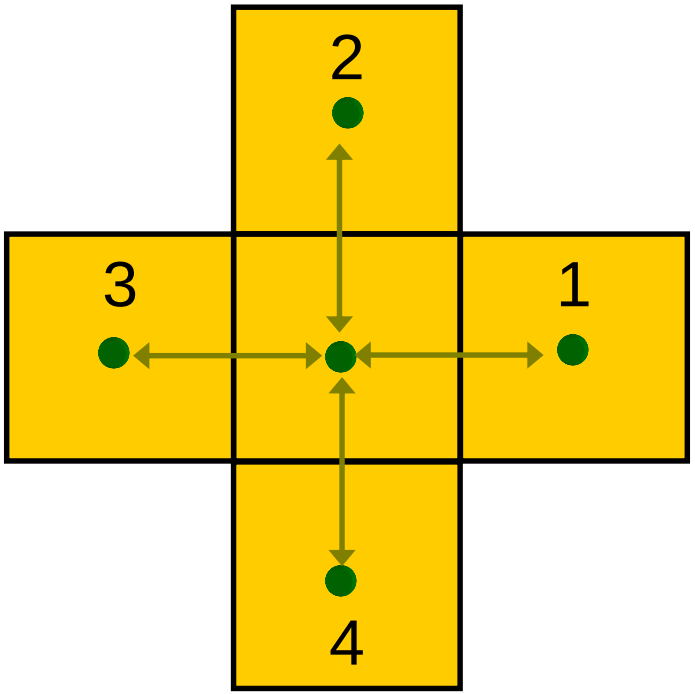
3. Numerical Model

PASTIS « 3D » Juxtapositon of columns 1D which interacting simultaneously



Exchange function

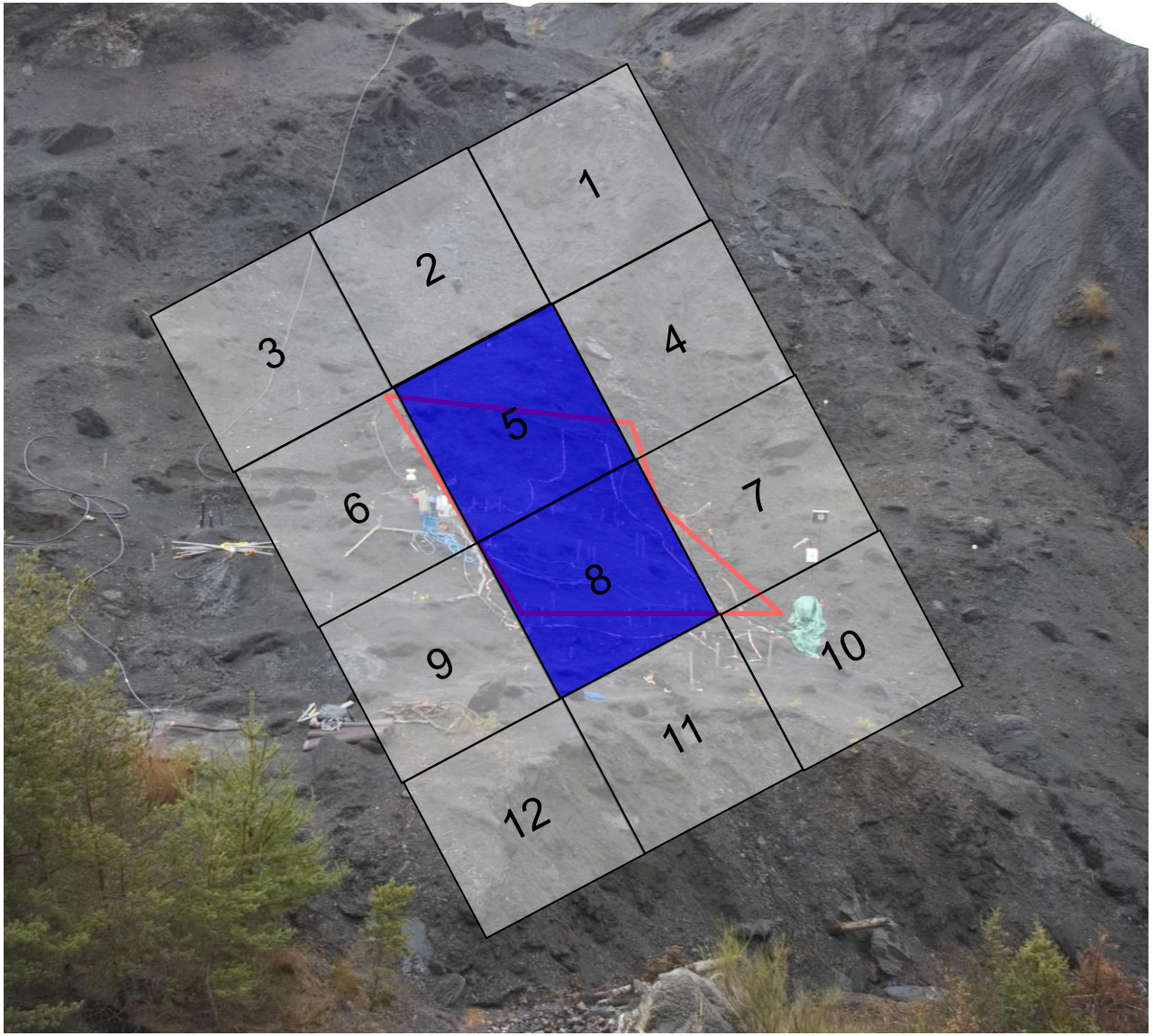
$$\frac{\delta\theta}{\delta t} = \frac{\delta}{\delta x}\left[K(\theta)\left(\frac{\delta h}{\delta z} - 1\right)\right] + S\left(\beta K_{mean}\frac{\delta h}{(\delta x)^2}\right)$$



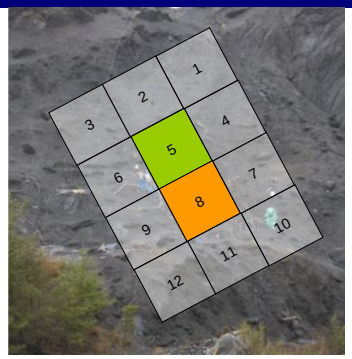
4. Modelling results

Sprinkling area =
2 cells 7m × 7m

4. Modelling results

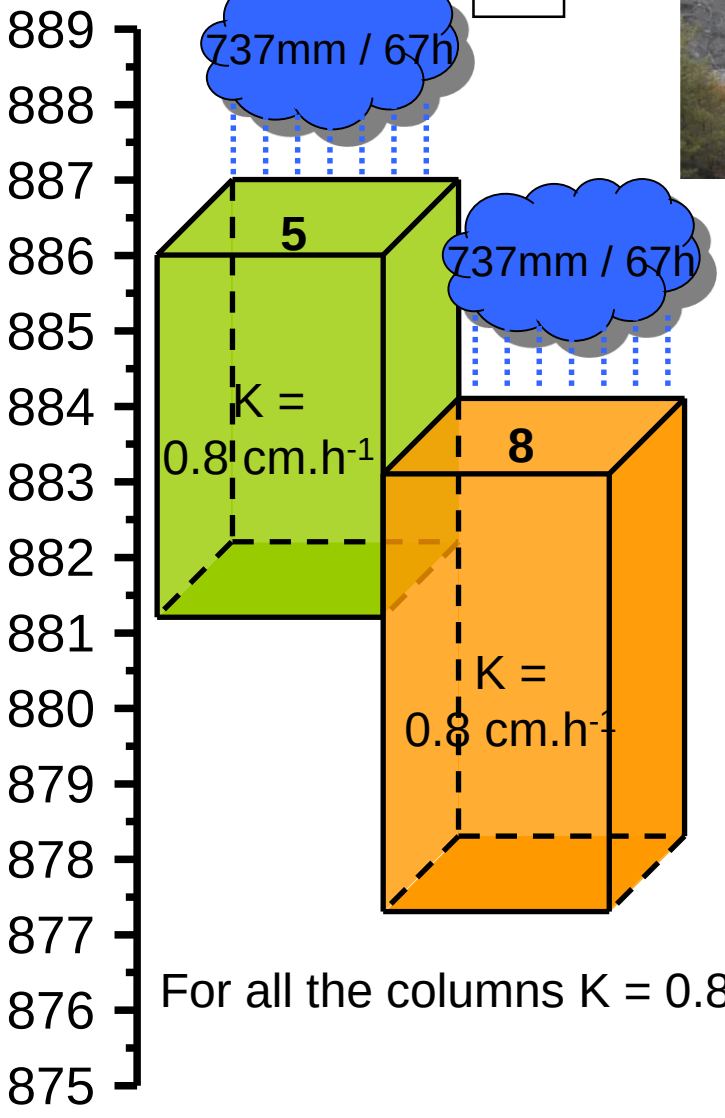


4. Modelling results



Altitude (m)

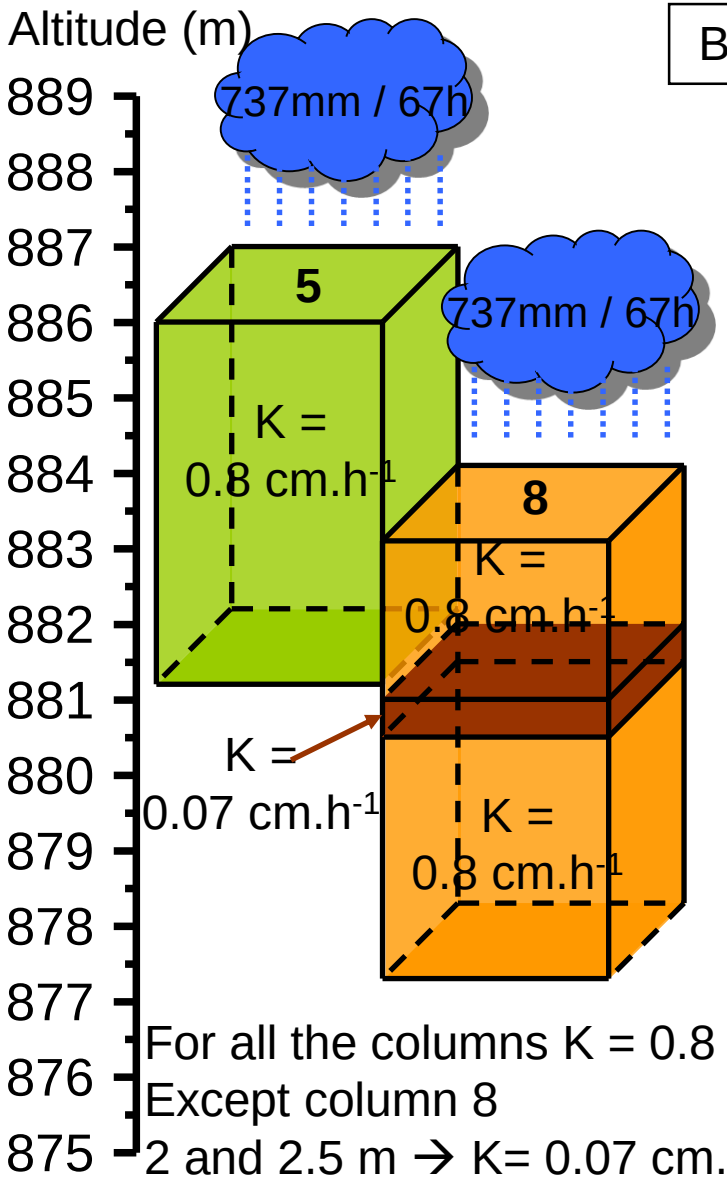
A



For all the columns K = 0.8 cm.h^{-1}

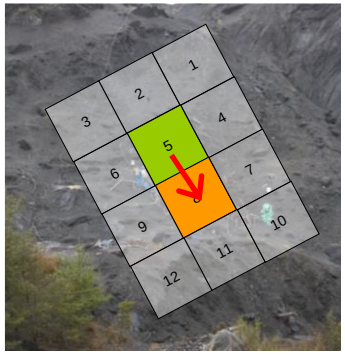
Altitude (m)

B



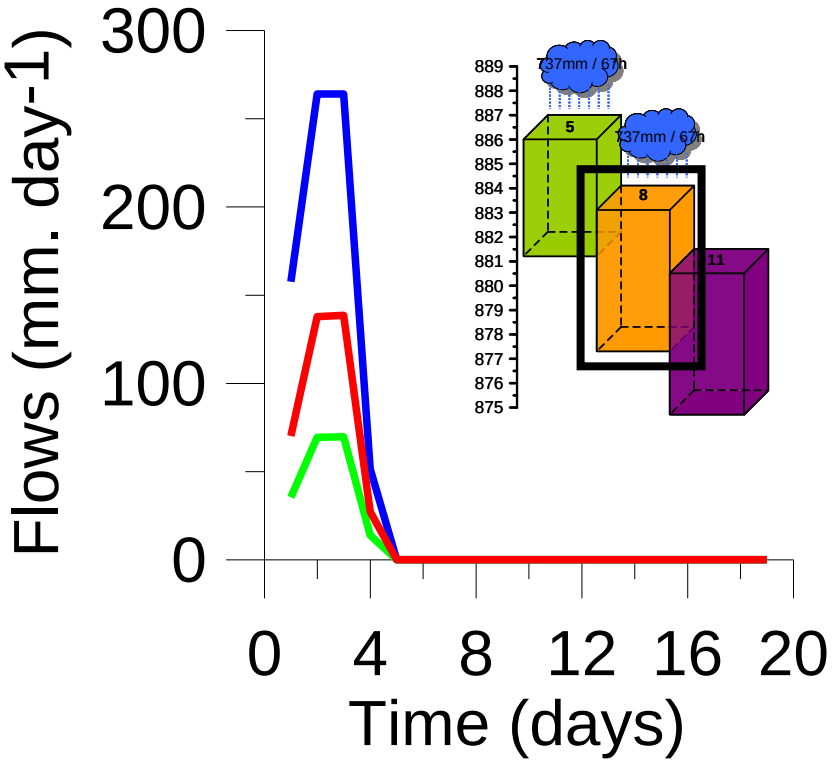
For all the columns K = 0.8 cm.h^{-1}
Except column 8
2 and 2.5 m → K= 0.07 cm.h^{-1}

4. Modelling results



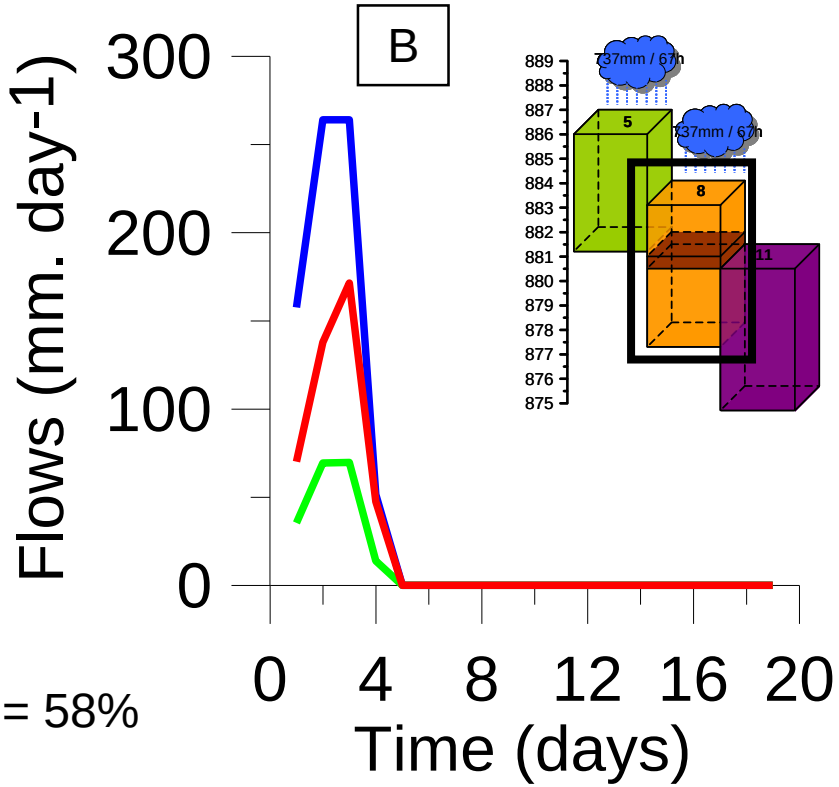
Rainfall
Surface inflow
Surface outflow

A



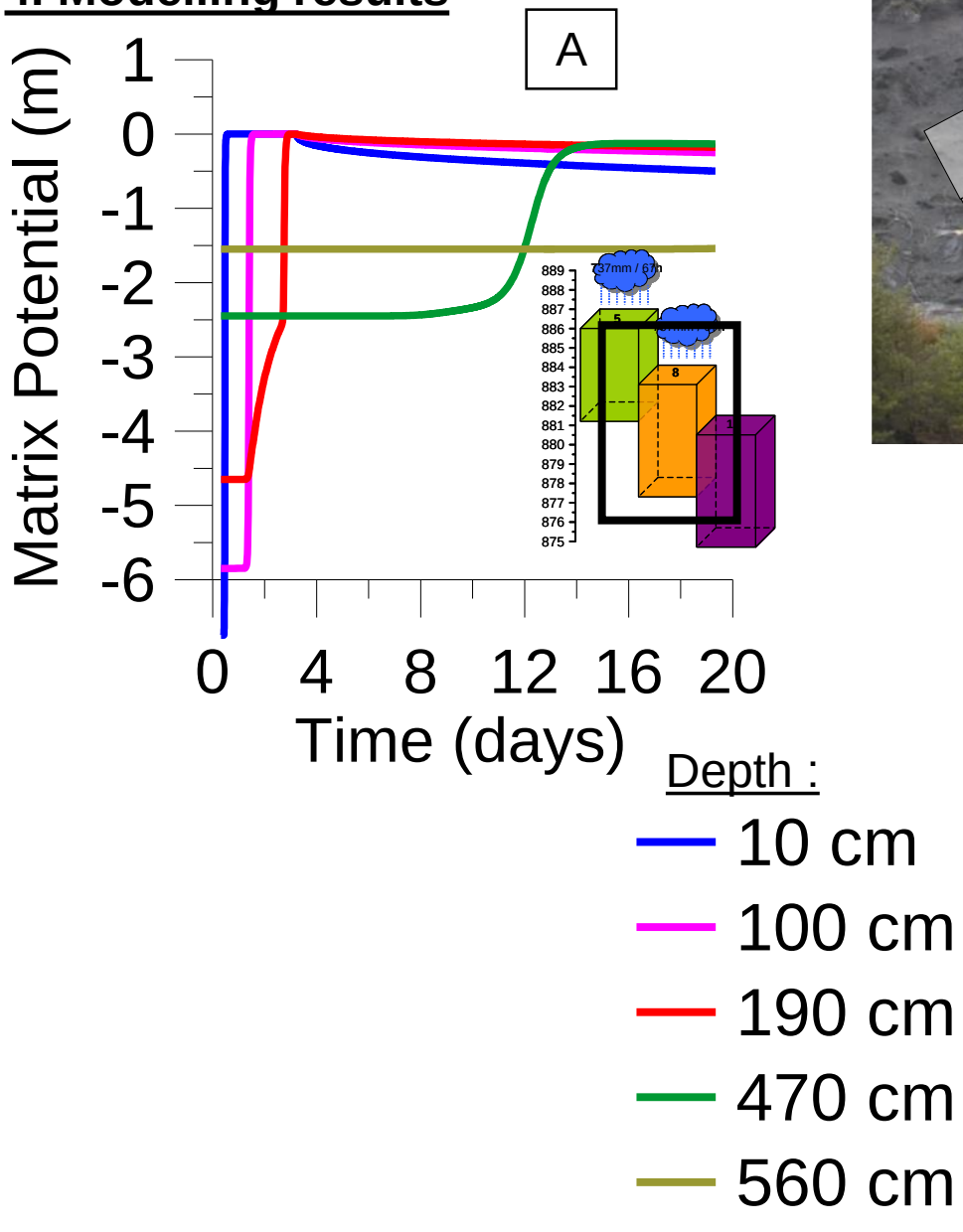
Runoff = 50%

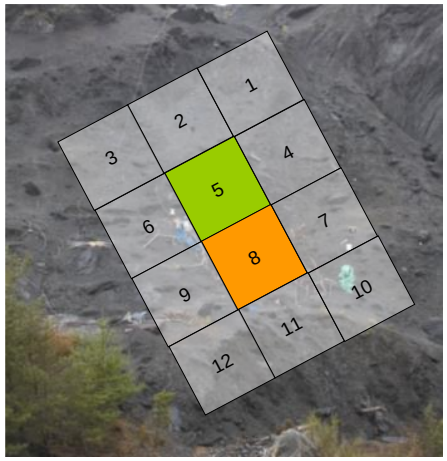
B

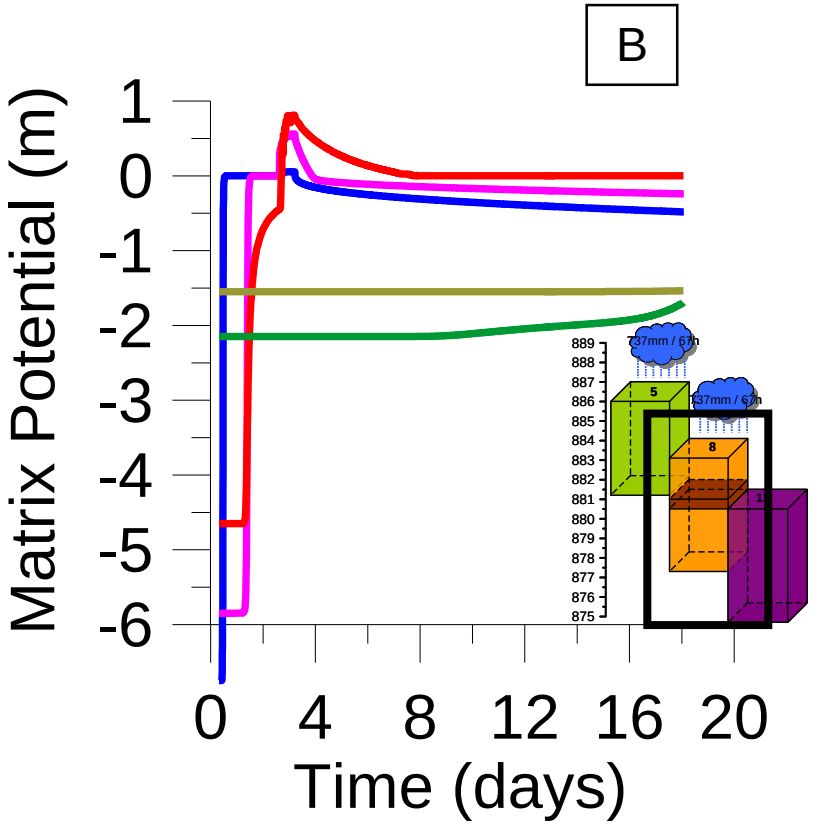


Runoff = 58%

4. Modelling results







5a. Conclusion

- Ability of the model to reproduce the right processes and right orders of magnitude without calibration
- Area and depth distribution of marl blocks needed to define the boundary conditions of the system
- Richard's equation inappropriate to simulate observations

5b. Next work

- Implementation of the blocks distribution from additional field data (ongoing)
- Refining the grid for a model application extended to 18 columns 2.3 m $\times$ 2.3 m
- Including preferential pathways in the model structure
- Combining with non reactive solute transport (tracers)

5c. Expected results

- Improving the water balance estimation
- Improving subsurface flows quantification
- Water residence time