

Aims & Objectives:

Better process understanding

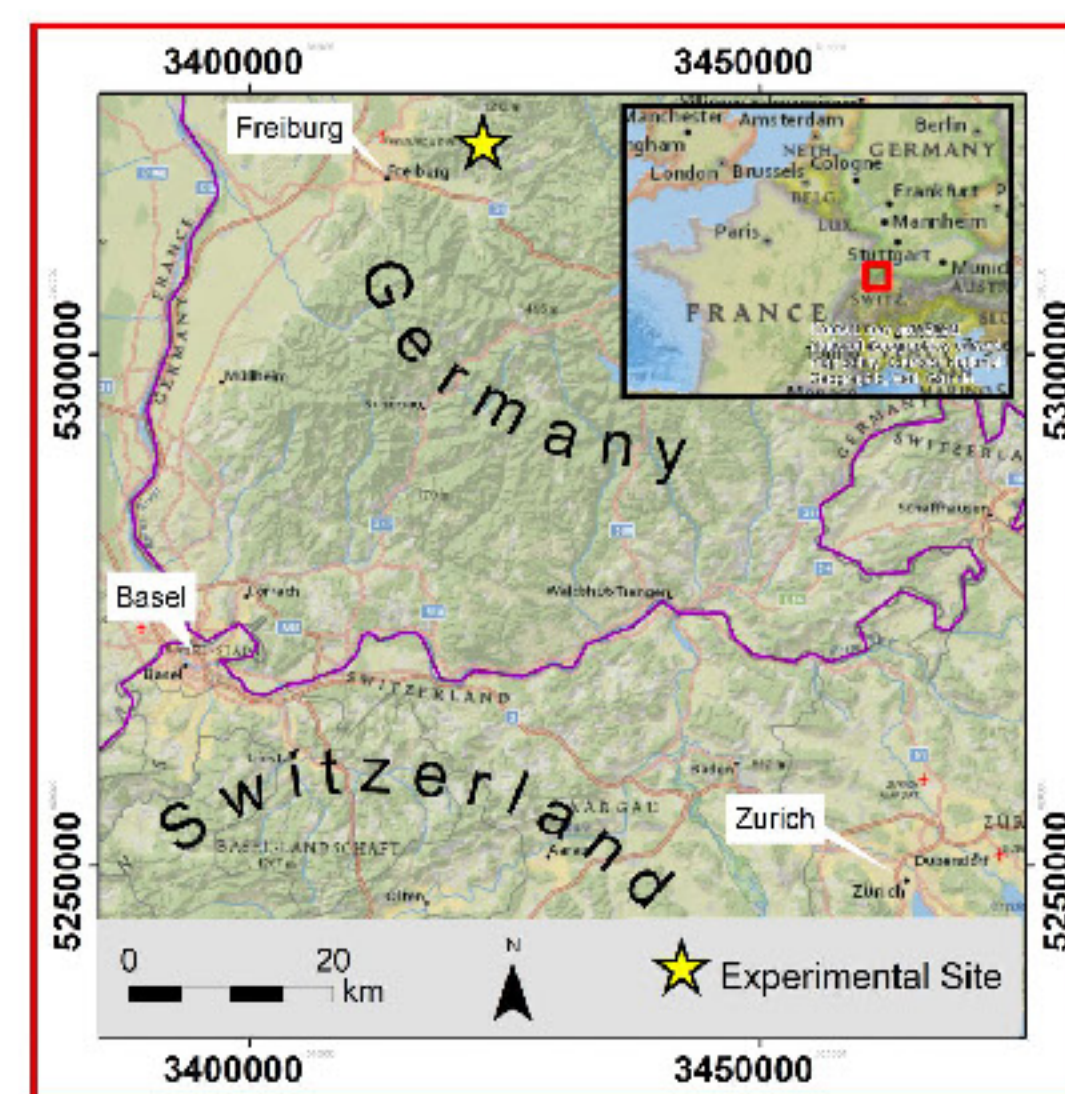
- Lateral & vertical subsurface flow & water balance
- Pre-event/event water fraction
- Ecosystem fluxes (soil water, tree xylem)

Experimental Site:

Conventwald,

Black Forest, Germany

- Soil: Skeletic cambisol
- Texture: Sandy loam
- Geology: Paragneis
- Trees: Fagus Sylvatica
- Altitude: 840 m
- Precip.: 1749 mm/a



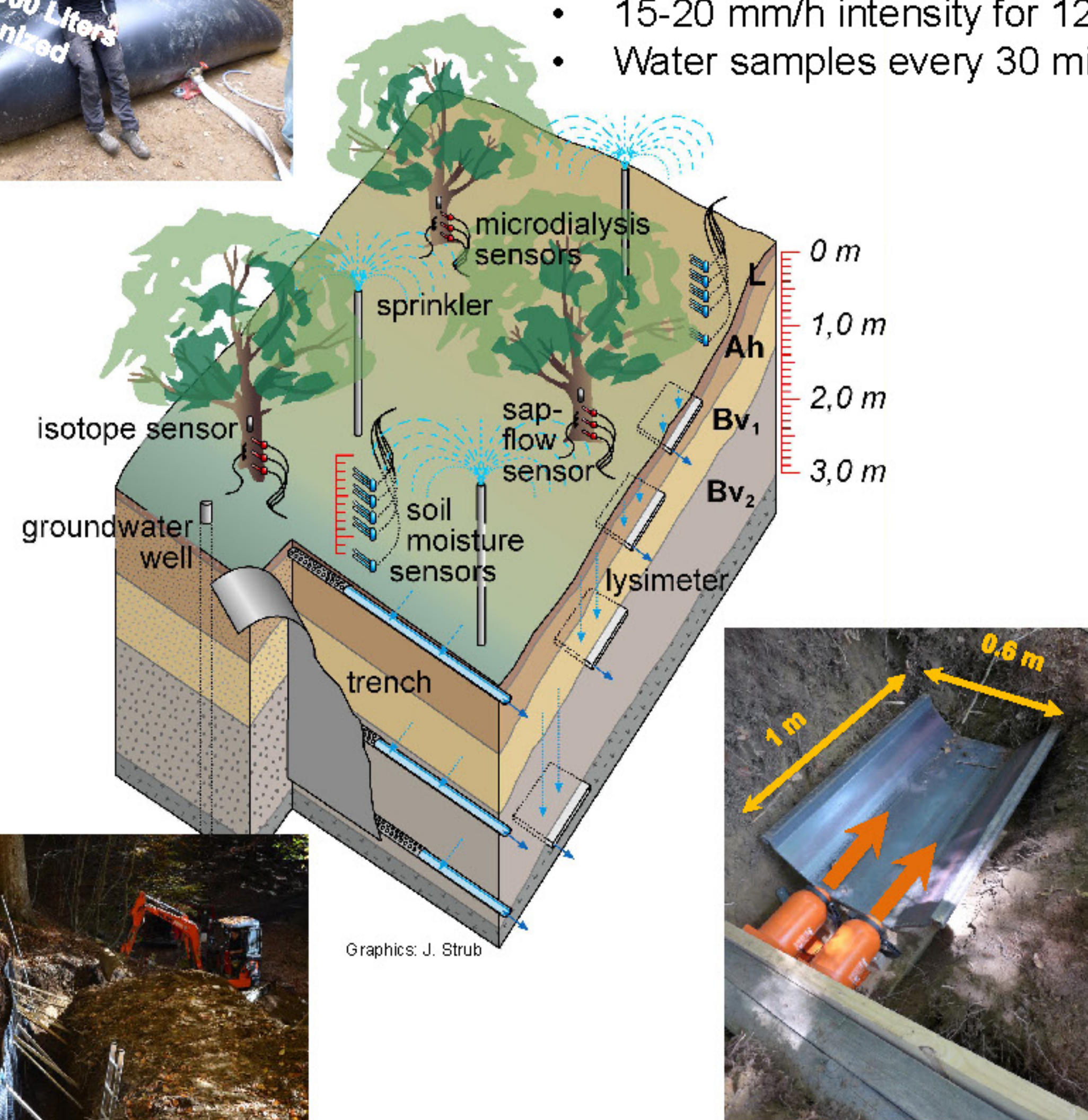
Graphics: Rinderer

Experimental Setup:

- Trench (drains in 10, 150, 300 cm soil depth)
- Lysimeters (in 10, 40, 150, 300 cm soil depth)
- In-situ isotope probes in a soil profile (in 6 depths)
- In-situ isotope probes in 3 trees
- Isotope analyzer continuously operating in the field

Sprinkling experiments:

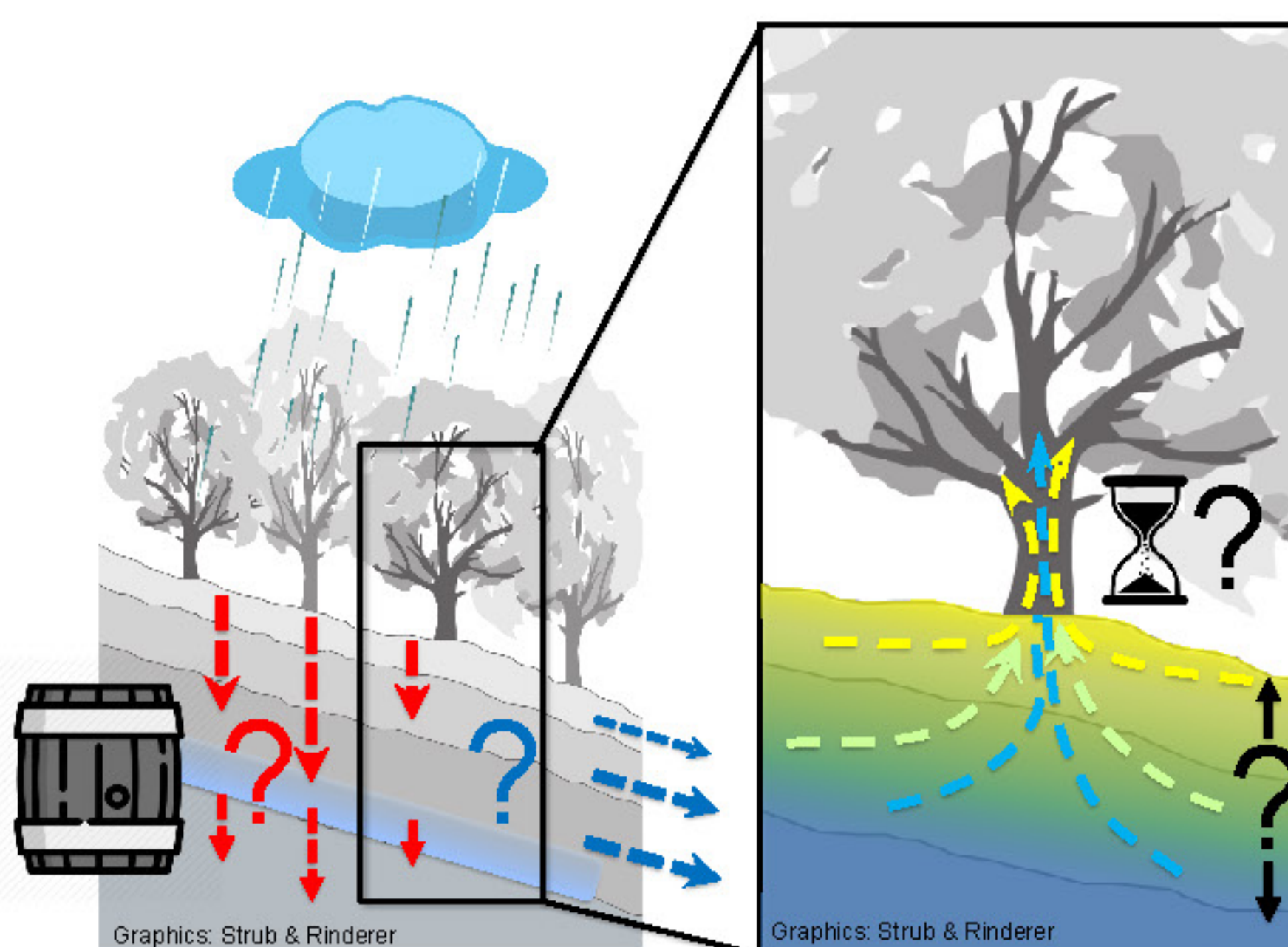
- 60.000 liters, deionized water
- 15-20 mm/h intensity for 12h
- Water samples every 30 min



Graphics: J. Strub

Research Topics:

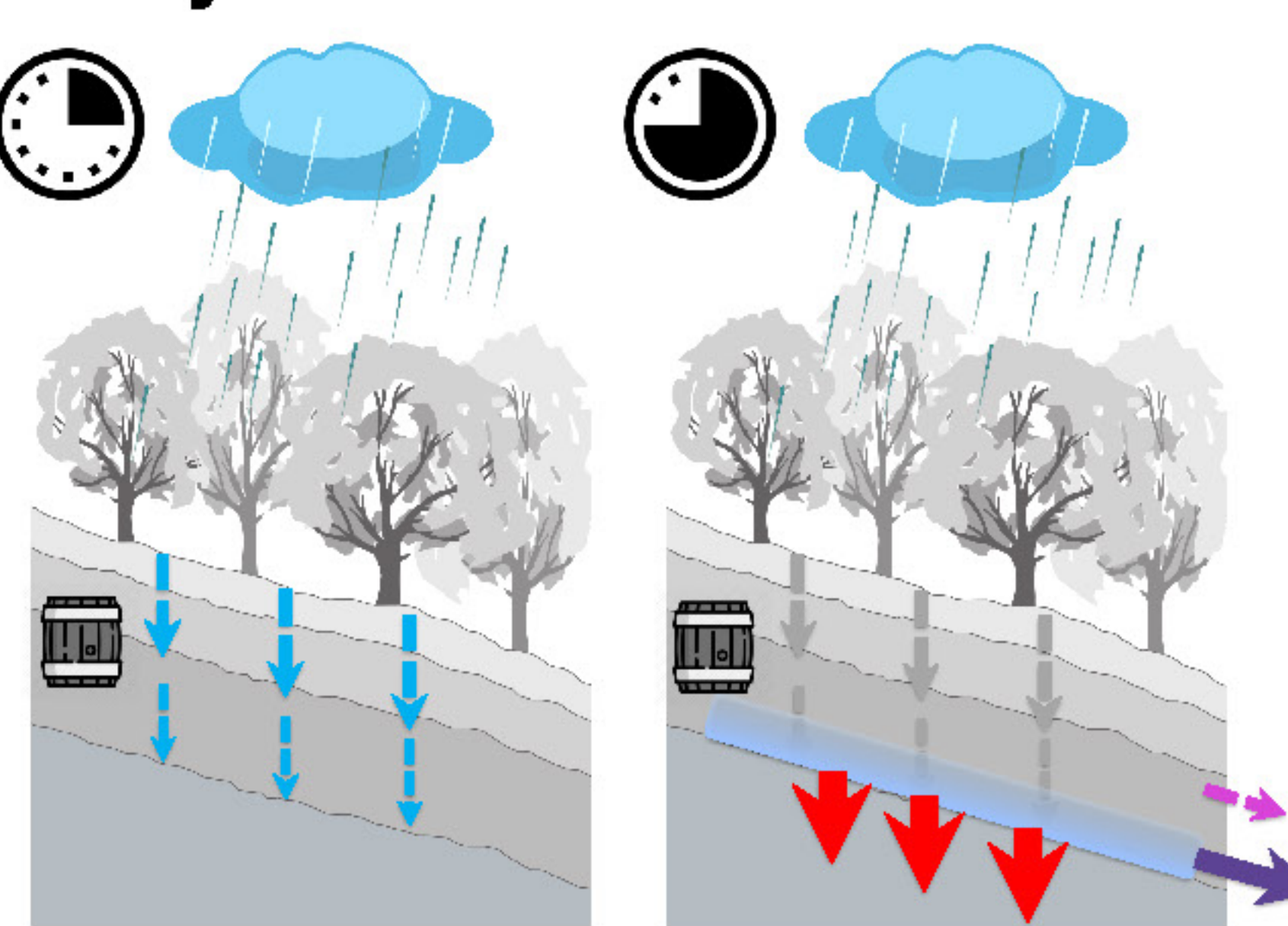
- 1) Lateral & vertical soil water fluxes
- 2) Quantification of soil water storage
- 3) Propagation of wetting front into the soil
- 4) Plant source water depth & uptake delays



Hypotheses:

- 1) Coarse textured soil:
 - > predominantly vertical flow
 - > high event water fraction
- 2) Trees:
 - > tracer arrival in stem on same day
- 3) Incoming natural precipitation:
 - > isotopic tracer further pushed down to deeper soil depth

Syntheses:



Graphics: Strub & Rinderer

Runoff processes:

Coarse textured soils, small storage:

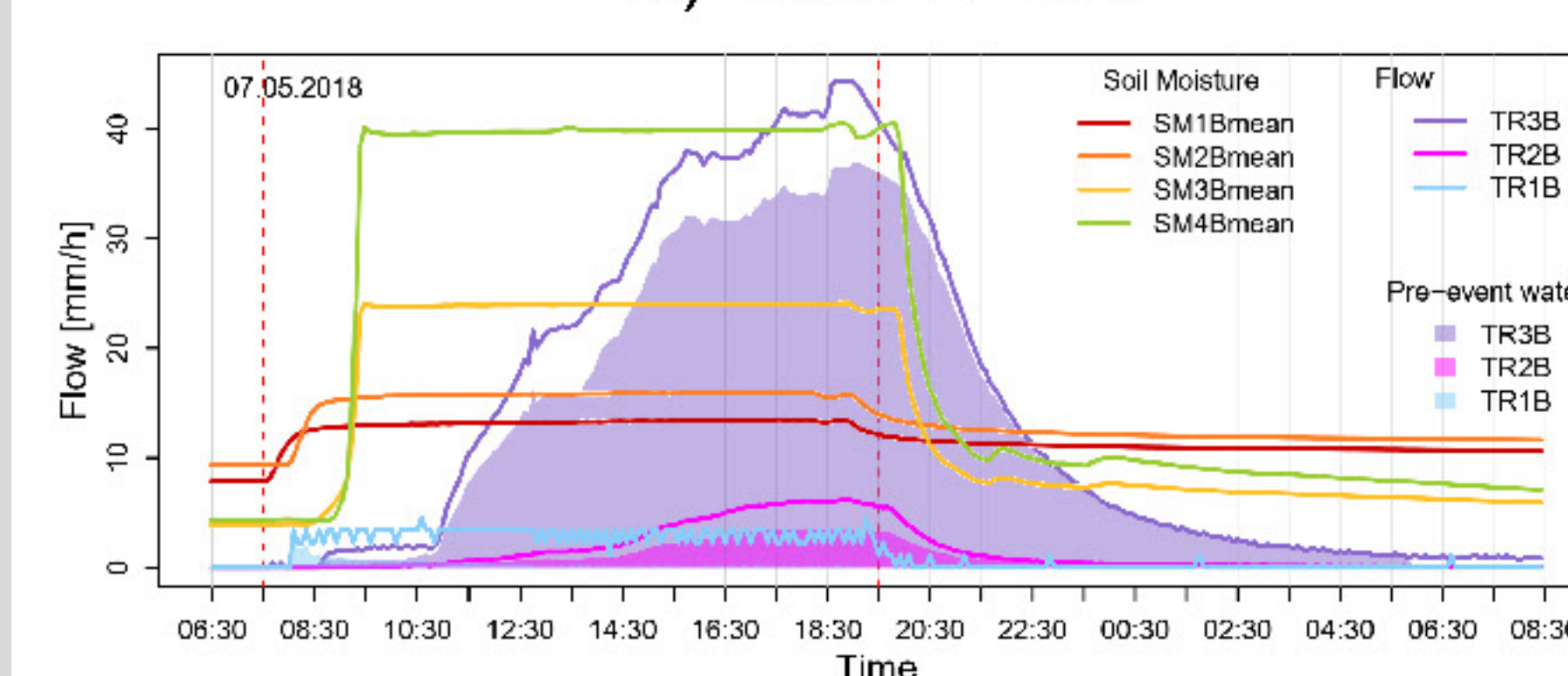
- Fast vertical flow
- Saturation and additional lateral flow at the saprolite-soil interface

Results:

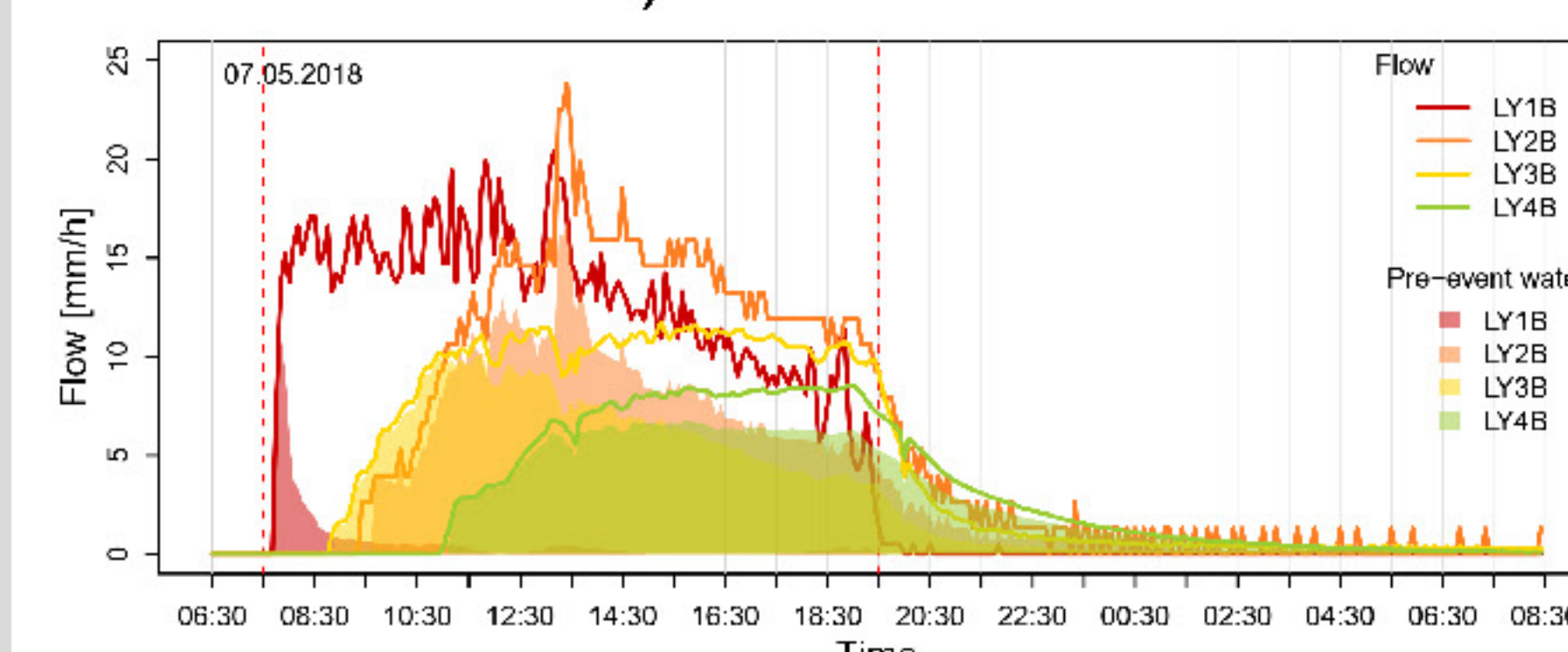


Sprinkling Experiment

a) Lateral flow



b) Vertical flow



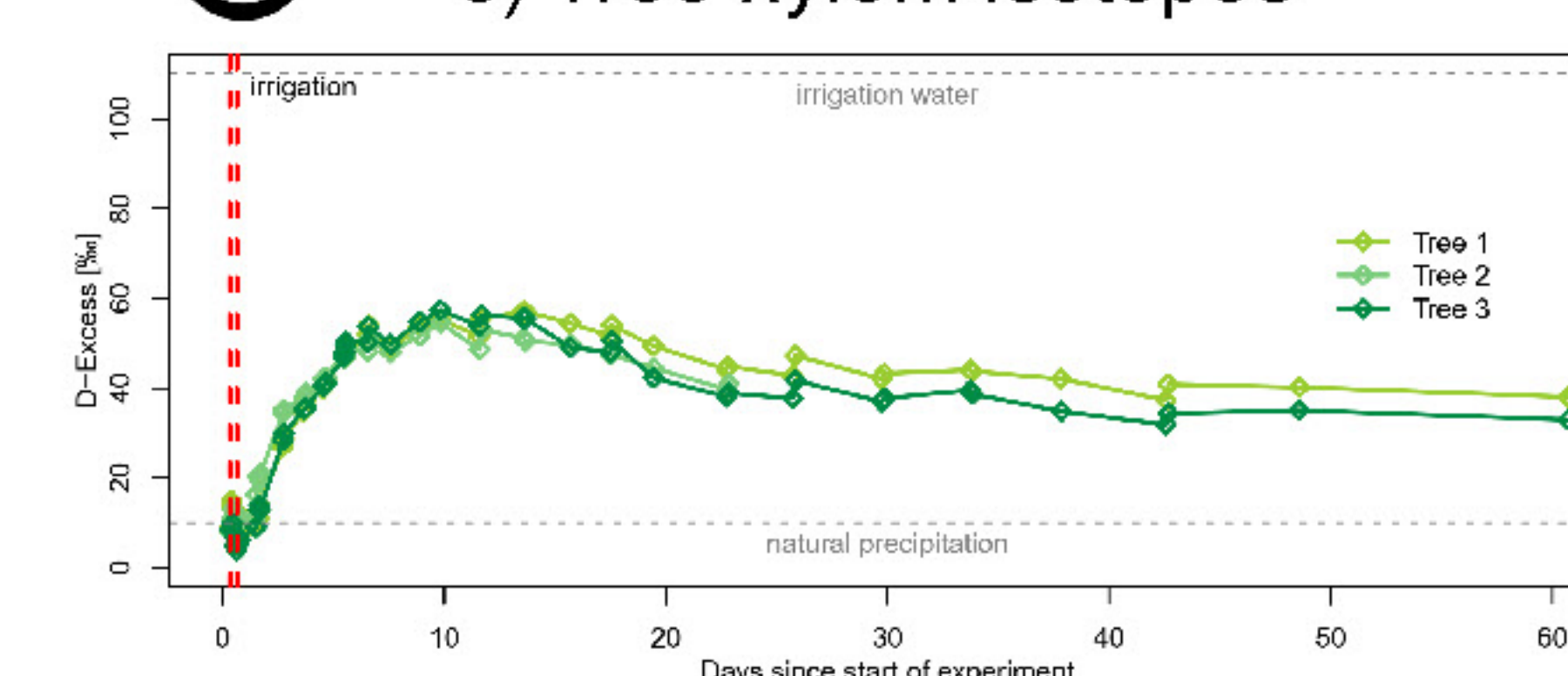
Lateral & vertical soil water flow:

- Flux per m² is larger for lateral than vertical flow (a, b)
- Reason: saturation in deeper soil depth indicated by soil moisture data
- Large fraction of pre-event water at deeper soil depth

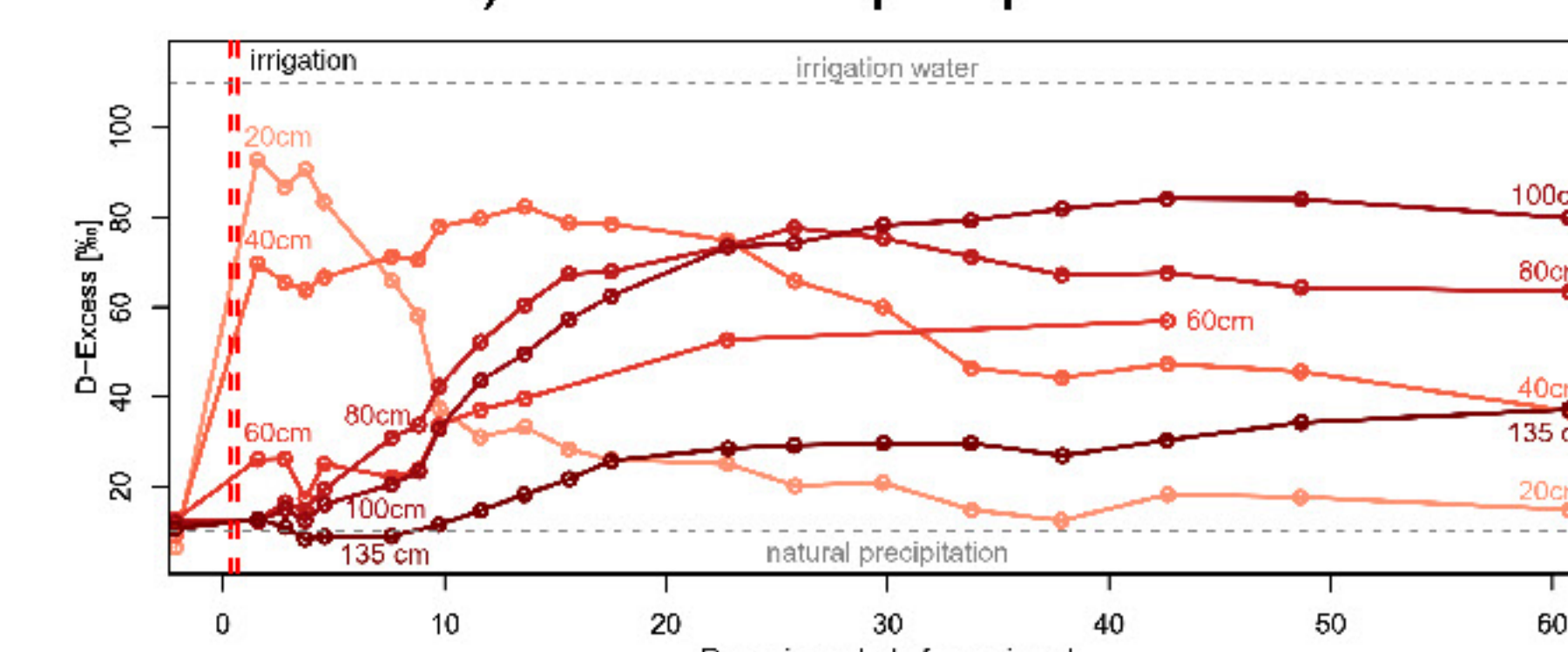


Weeks after sprinkling experiment

c) Tree xylem isotopes



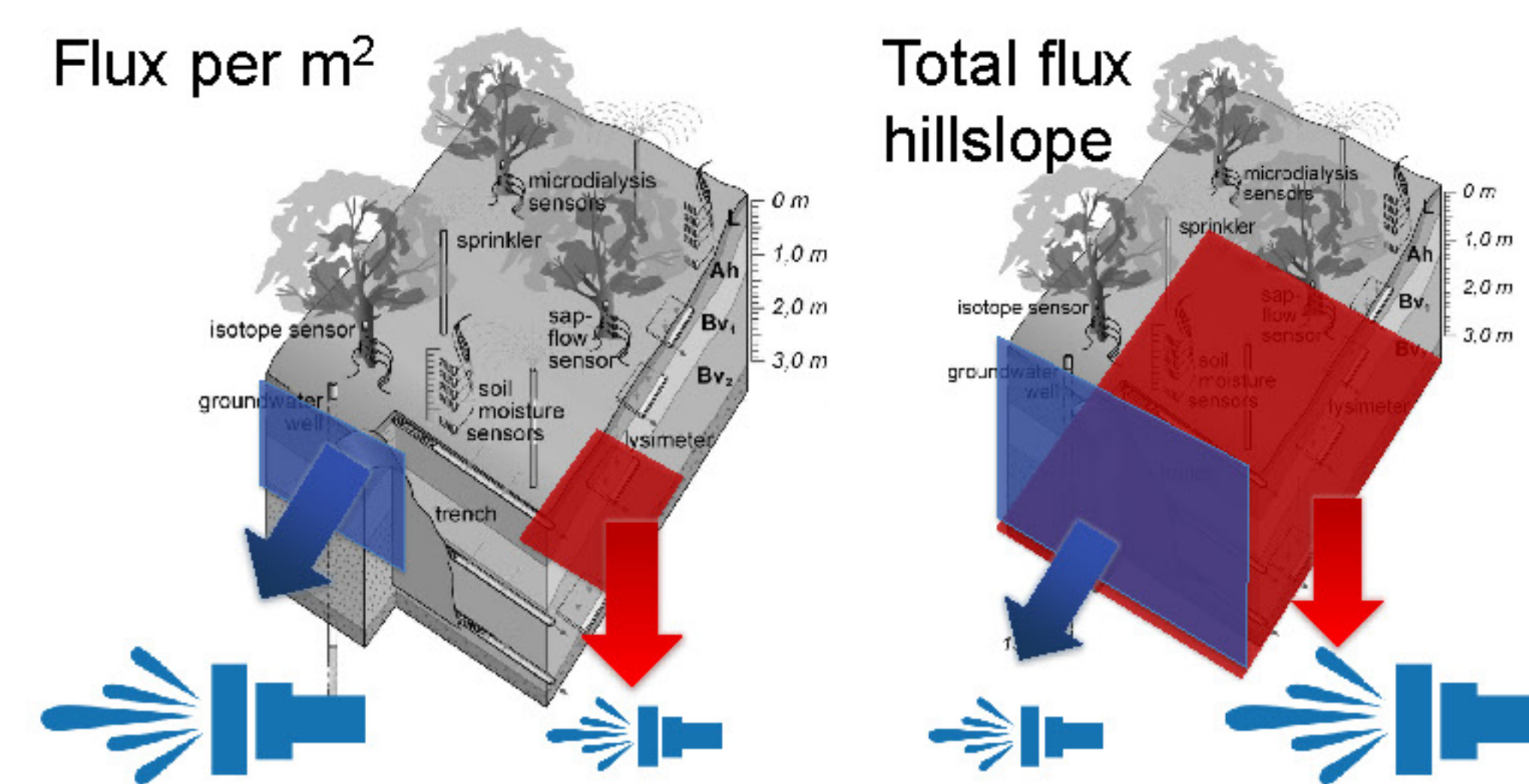
d) Soil isotopic profile



Graphics: Rinderer & Seeger

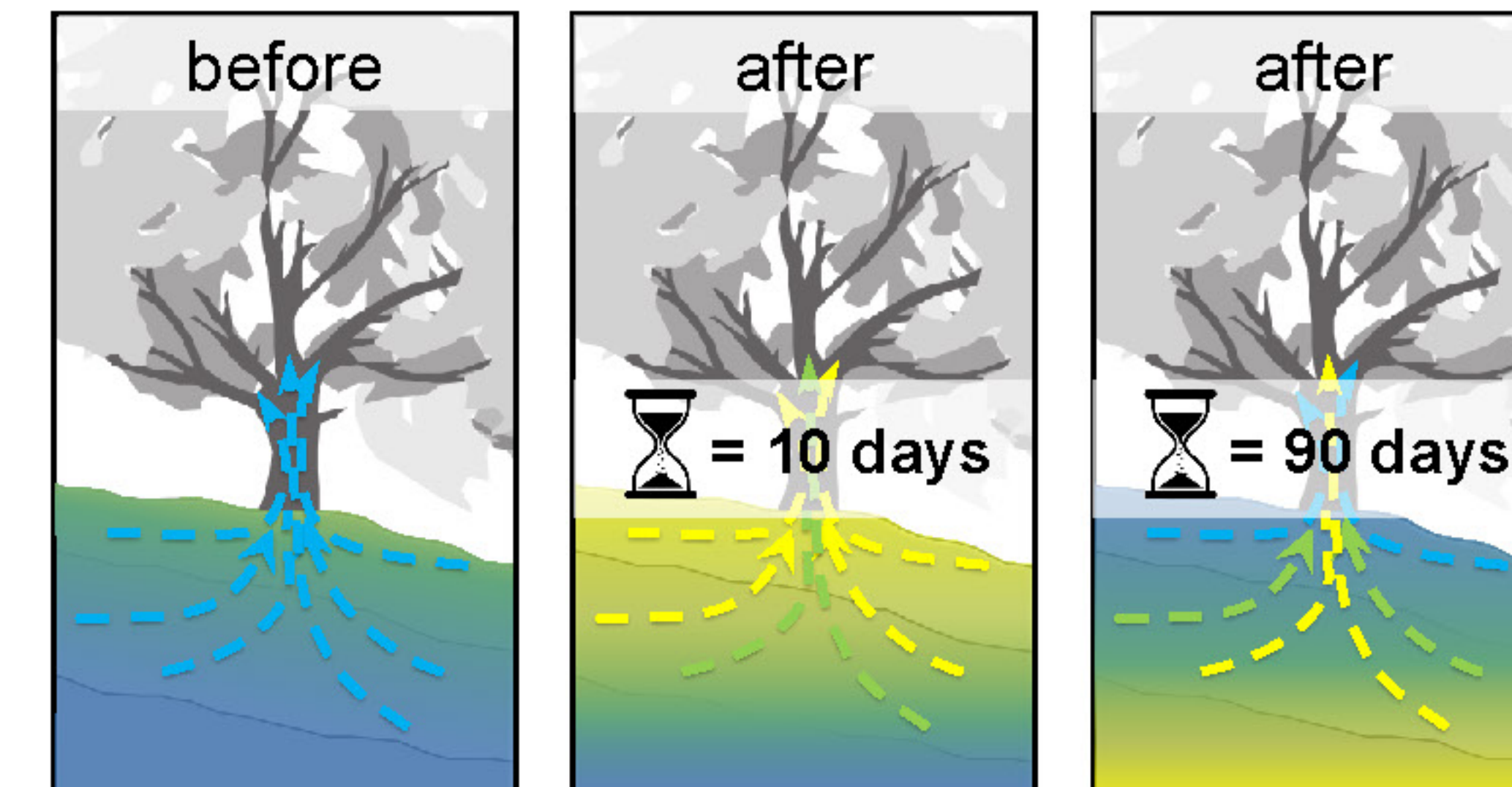
Plant water uptake and soil isotopic profile:

- Isotopic tracer in tree stem first measured after 2-3 days; peak after ca. 10 days (c)
- The isotopic tracer of the sprinkling water was further propagated into the soil profile by incoming natural rainfall (d)



Water balance:

- Lateral flux per m² is larger than vertical flux but
- Total lateral flux is smaller than total vertical flux for the hillslope
- > major loss due to deep percolation



Graphics: Strub & Rinderer

Soil water and xylem isotopes:

- Sprinkling water mobilizes pre-event water
- Label pulse reaches stem at breast height (1.5 m) with delay
- Isotopic signature of soil profile reverses with subsequent natural rainfall