Tree influence on water dynamics in sloped forest soils: insights from stemflow and throughfall experiments and time-lapse ground-penetrating radar monitoring

Gersende Fernandes*, Maria Burguet Marimon, Maria Paz Salazar, Elisa Marras, Ilenia Murgia, Konstantinos Kaffas, Filippo Giadrossich, Ryan D. Stewart, Majdi R. Abou Najm, Alessandro Comegna, Laurent Lassabatere, Daniele Penna, Christian Massari and Simone Di Prima

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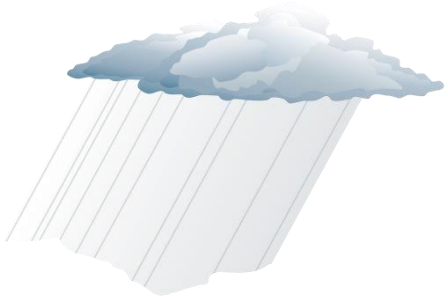
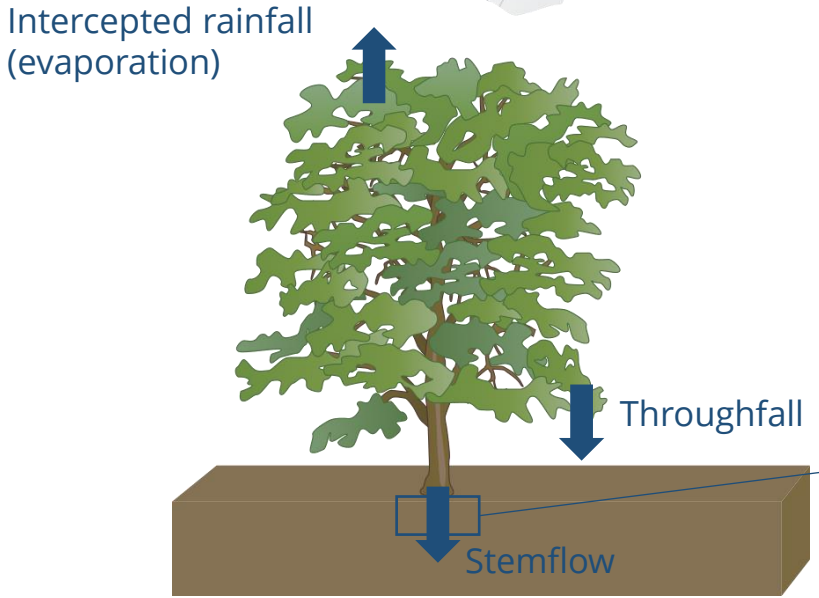
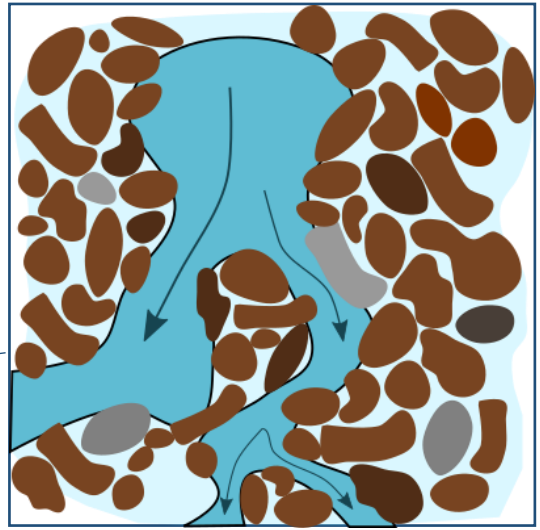
Introduction





Investigation on the contributions of stemflow and throughfall to subsurface water dynamics in a forested hillslope with 2 approaches:

- Infiltrometry (infiltration rate, runoff, hydraulic conductivity…)
- Geophysics (Ground Penetrating Radar)



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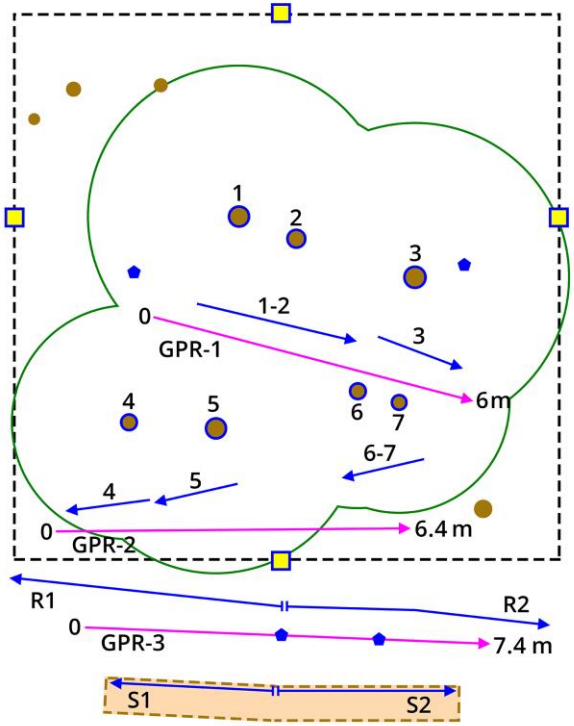
Material

Lecciona catchment



Legend

- Plot perimeter (10 x 10 m)
- Sprinklers
- Trees with stemflow collars
- Crown projection area
- Other trees within the plot
- Trench
- GPR survey lines
- Runoff collecting channels
- Water content profiles

North

Slope (30°)

0 1 2 3 m

Stem collar → Stemflow

Geological radar → Geophysical survey

Sprinklers → Throughflow

Trenches → Runoff collect

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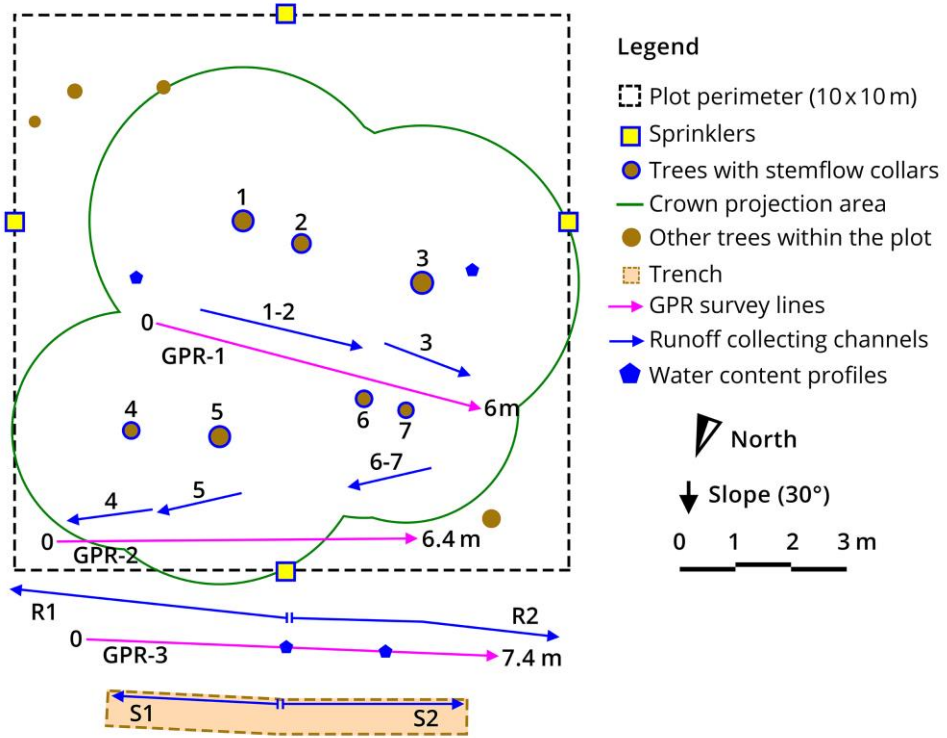
Methods

DAY 1	DRY SOIL	GPR-1, GPR-2, GPR-3
	Stemflow trees 1-3	GPR-1, GPR-2, GPR-3
	Stemflow trees 4-7	GPR-2, GPR-3
	Rainfall	GPR-3
DAY 2	DRY SOIL	GPR-1, GPR-2, GPR-3
	Stemflow trees 1-3	GPR-1, GPR-2, GPR-3
	Stemflow trees 4-7	GPR-2, GPR-3
	Rainfall + stemflow	GPR-3

Runoff collection automatized in time



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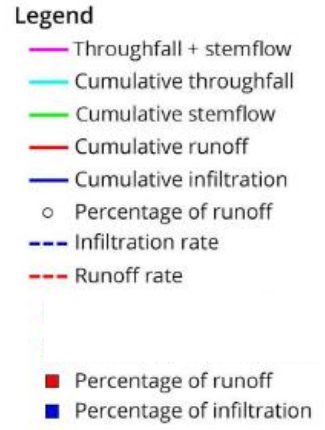
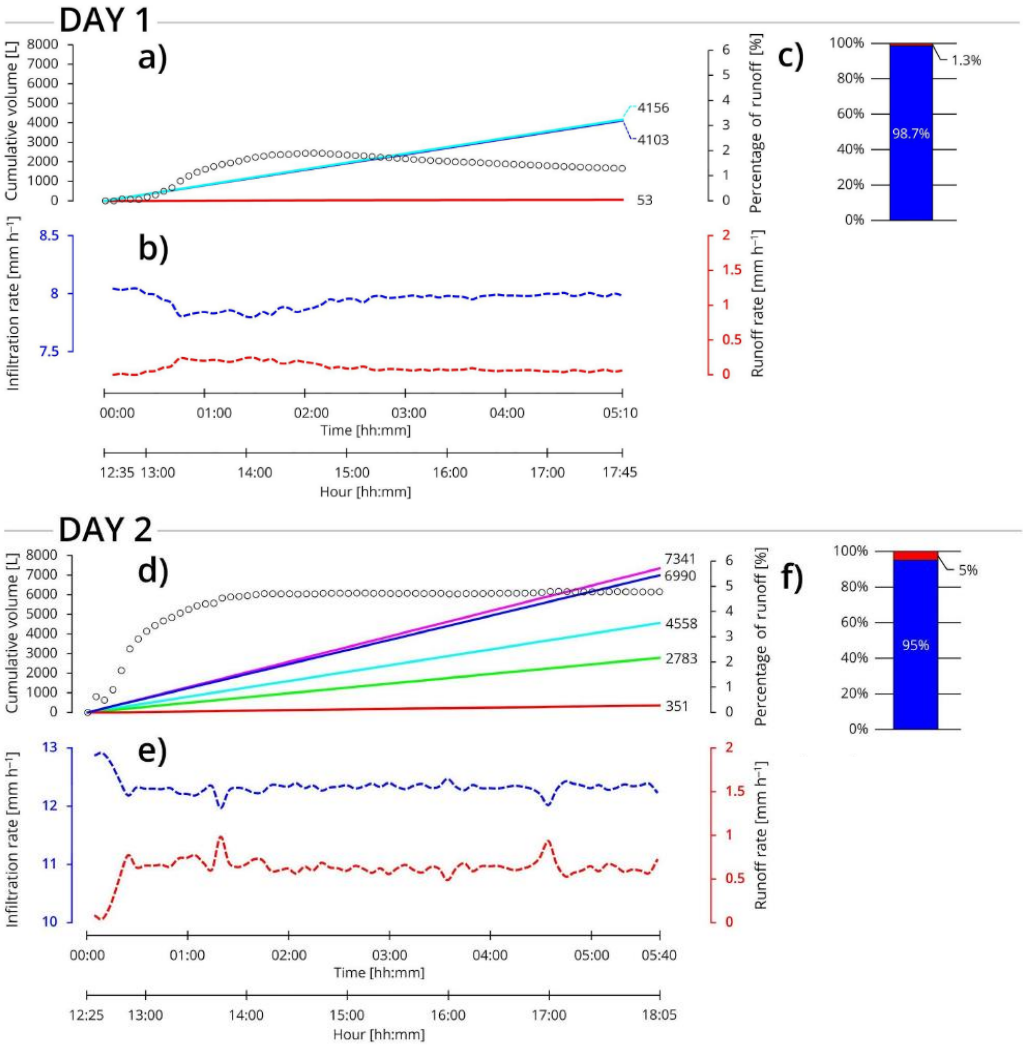
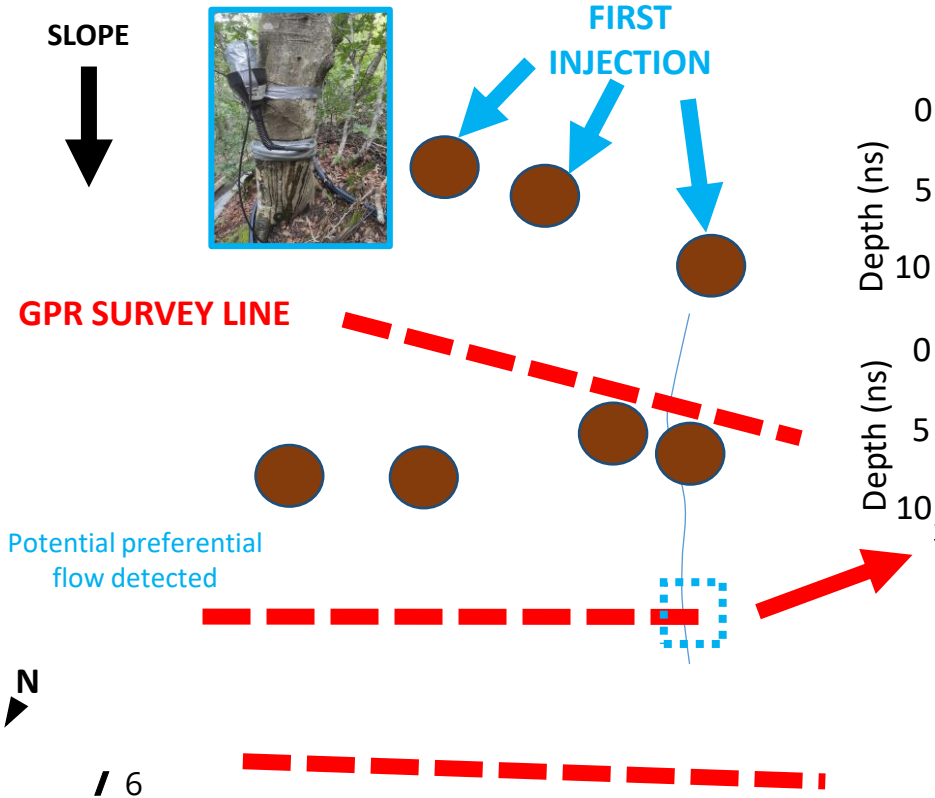
Infiltration results

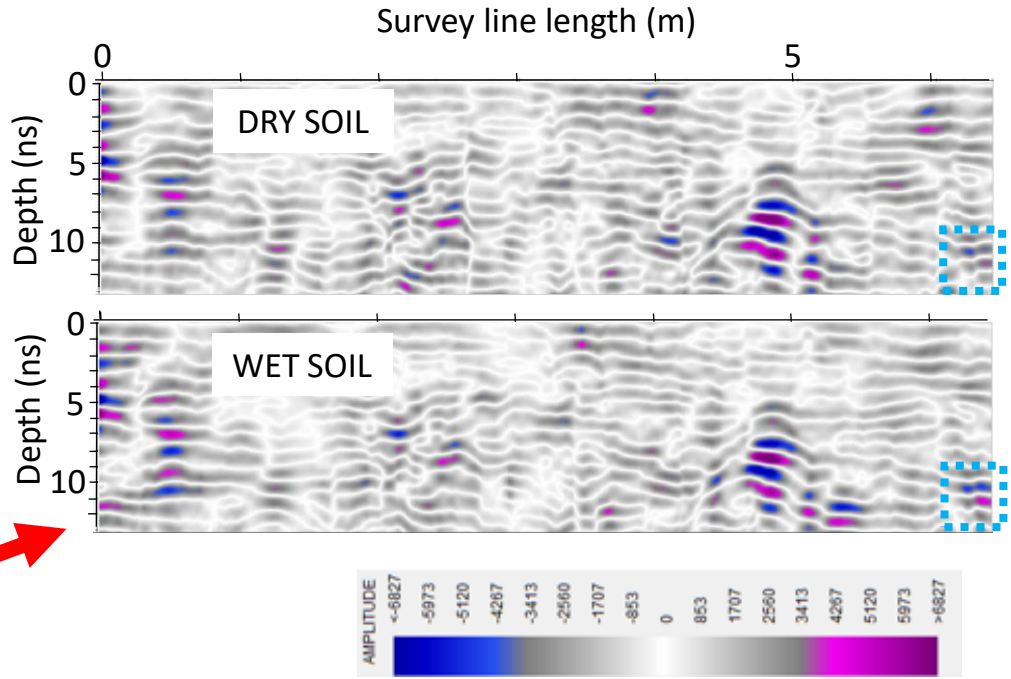


- → High percentage of infiltration in both cases
- → Increase of runoff with the stemflows experiments
- → Influence of trees on the hydrological response of the hillslope



Geophysical results – day 2





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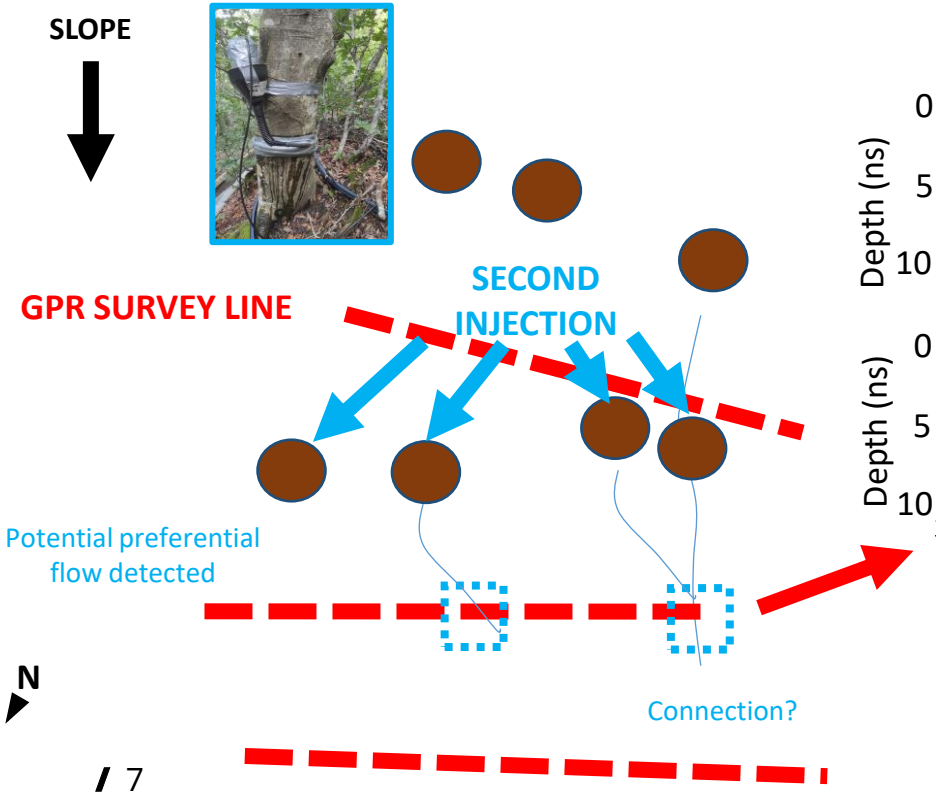
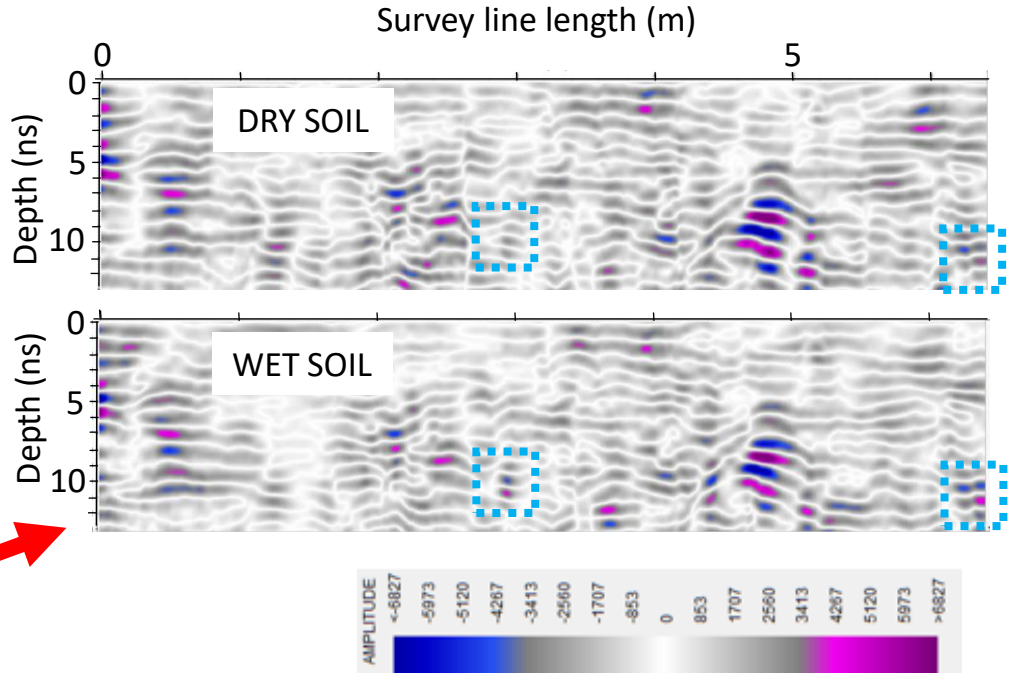
Geophysical results – day 2





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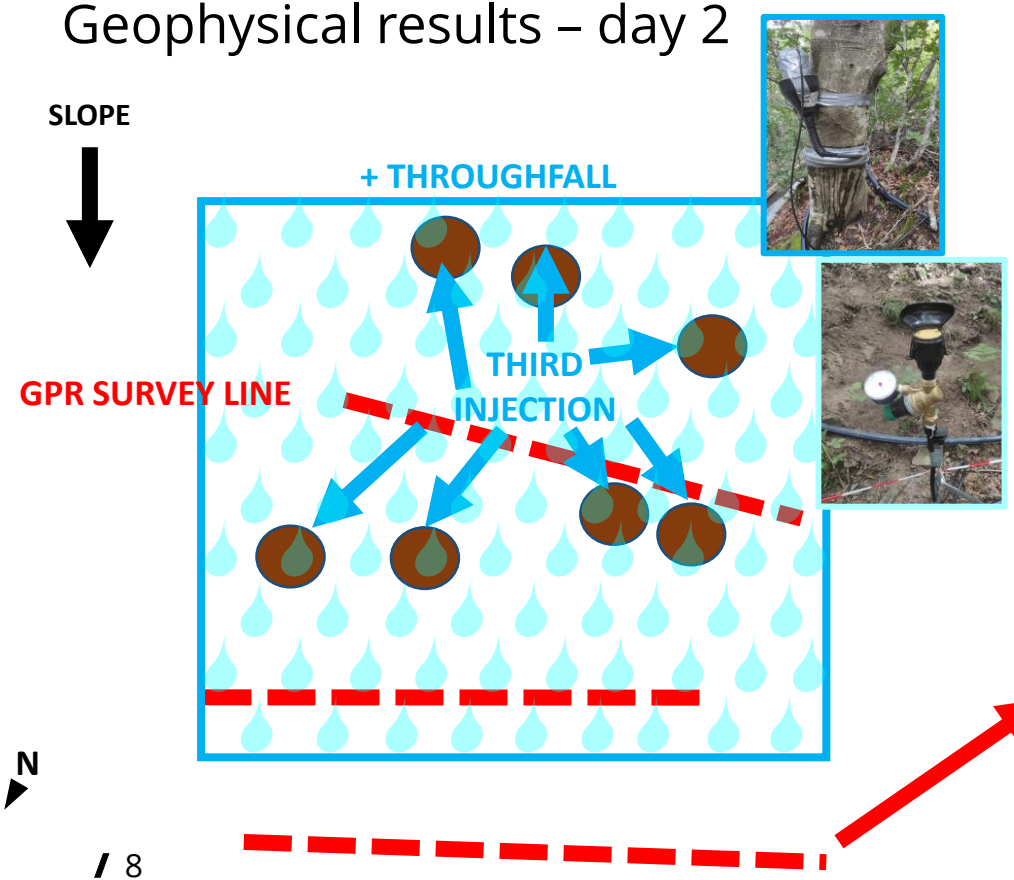

No difference in time on the last GPR survey line with the « dry » soil state

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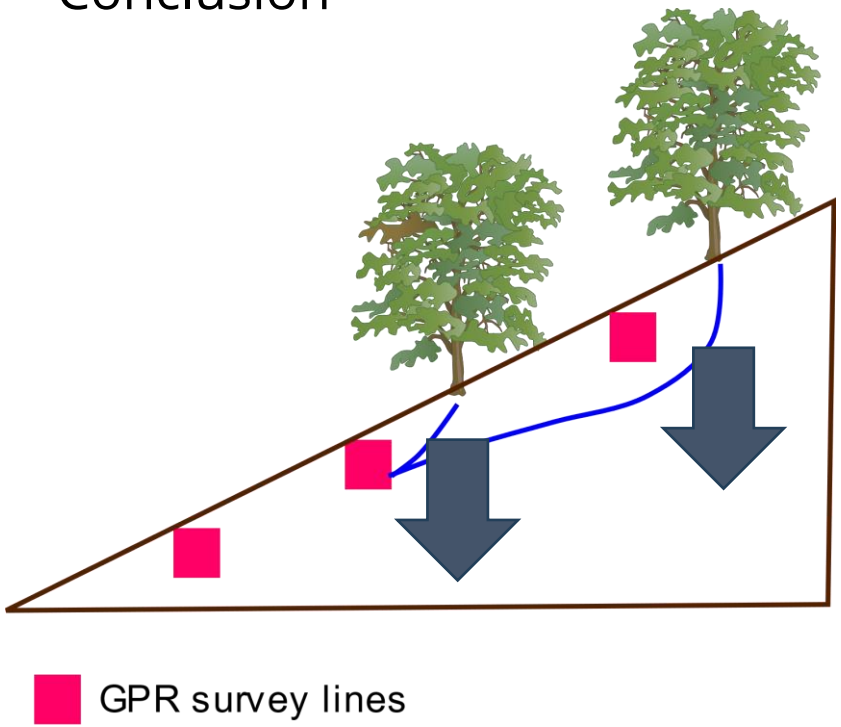
Conclusion



Main results:
- The trees drive the hydrological answer of the hillslope
- There are only two lateral paths detected by the GPR

Conclusions:
Flows are driven by the stems and infiltrate mainly vertically with sporadic lateral paths detected

Next step:
- Modeling the hydrology of the hillslope
- Better linking the continuum rainfall interception-stemflow to preferential flows

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Thank you for your attention!

Do not hesitate to contact me if you have any further questions.

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