

Characterizing soil piping networks using ground-penetrating radar

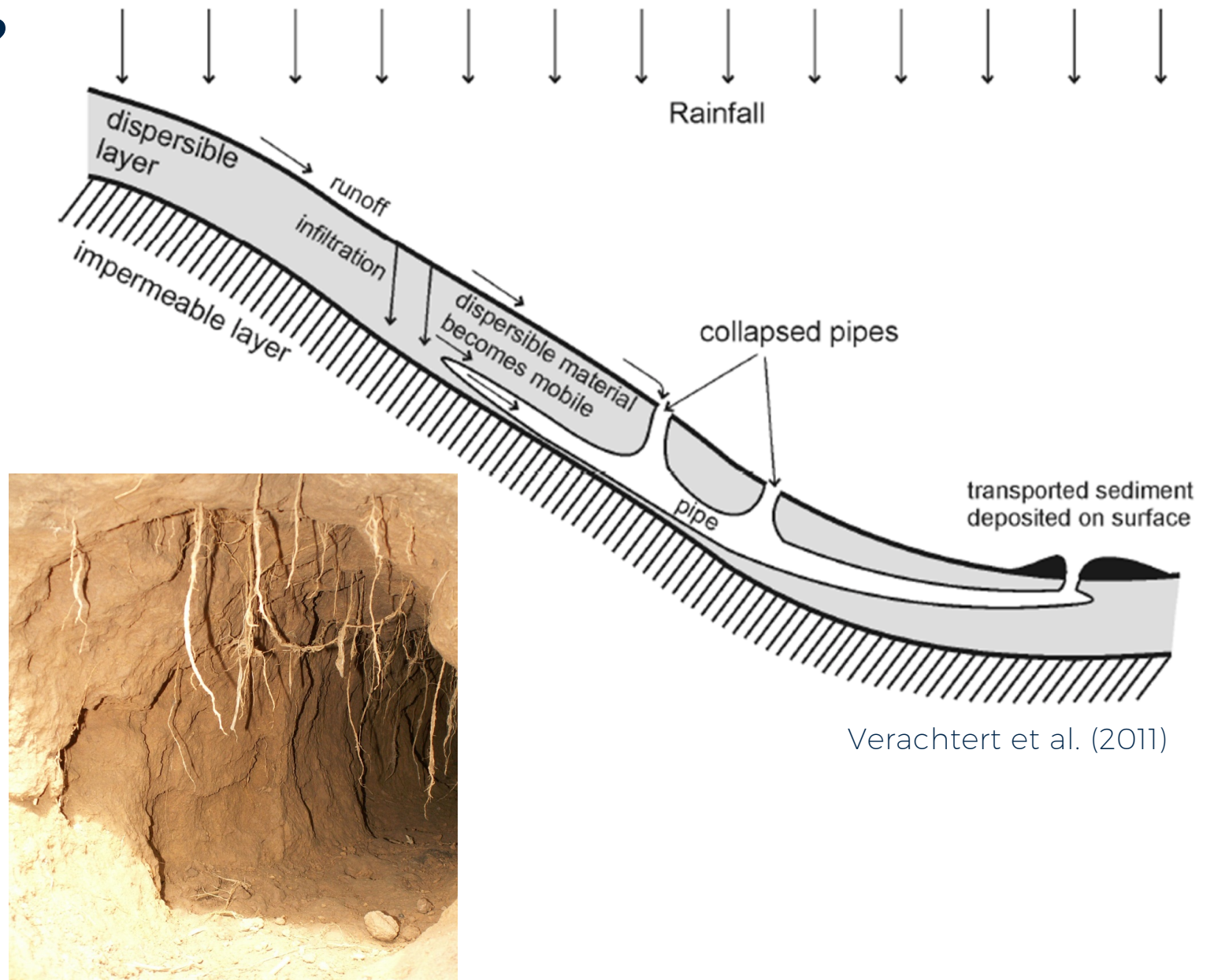
J.-B. Got, C. Bielders, S. Lambot

EGU 2019



What is soil piping?

- Sub-surface erosion process
- Present in a wide range of pedoclimatic environment
- Impacts :
 - Soil stability
 - Soil loss
 - Water, sediment and solute transfer



Pipe network characterization, a challenge

Geomorphological mapping:

→ Underestimate pipe length
and network densities

Geophysical mapping:

→ Able to detect soil pipes, not yet
to characterize networks



Objective

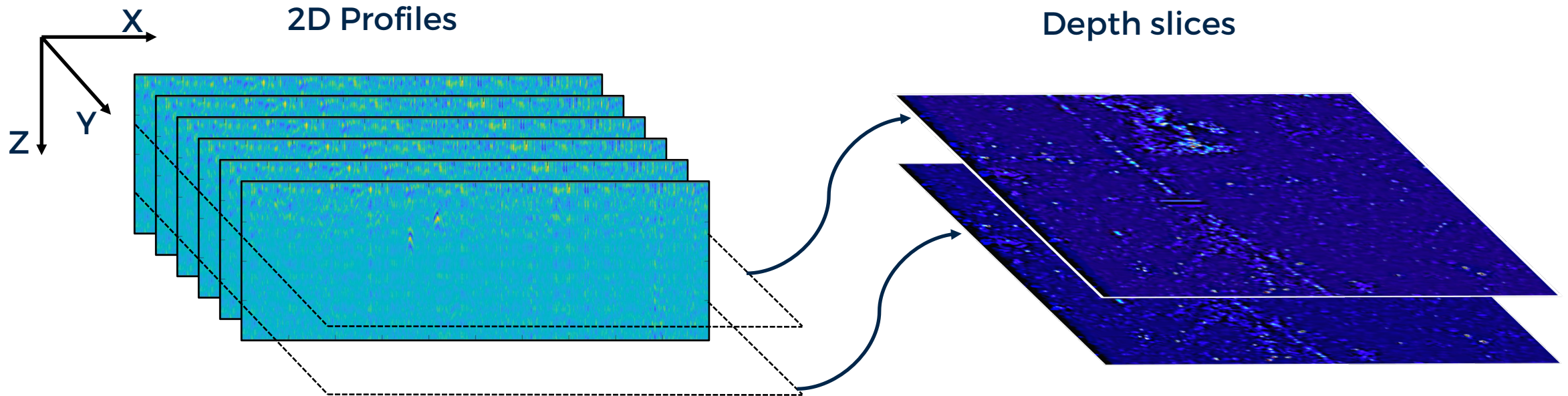
Evaluate the ability of **high-resolution GPR scanning** to **characterize natural pipe networks**



Methodology

Looking for small features over large distances in heterogenous conditions:

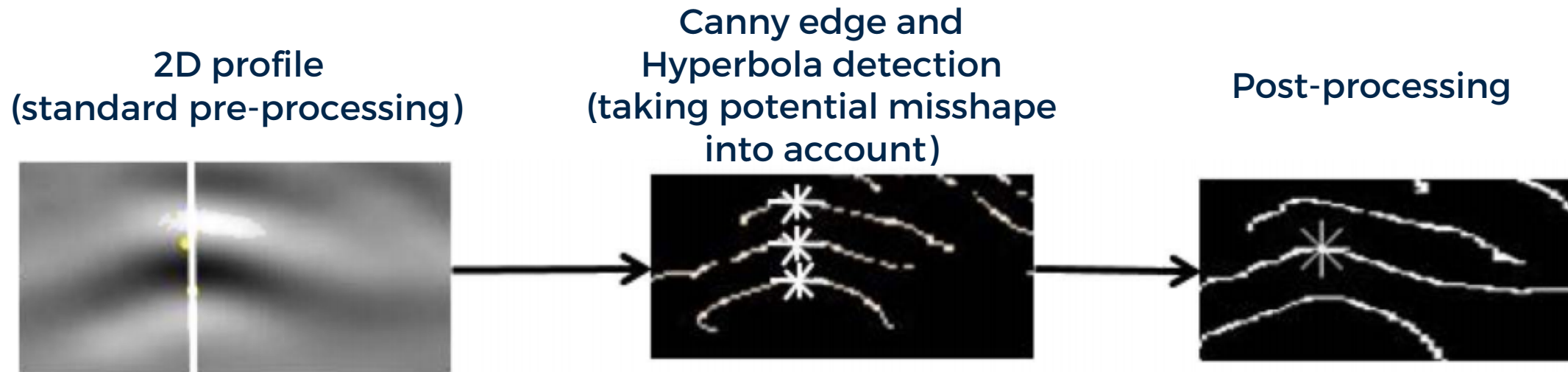
→ **High resolution scanning** and **3D imaging** to assess continuity
(200 MHz, 25 cm spacing)



Methodology

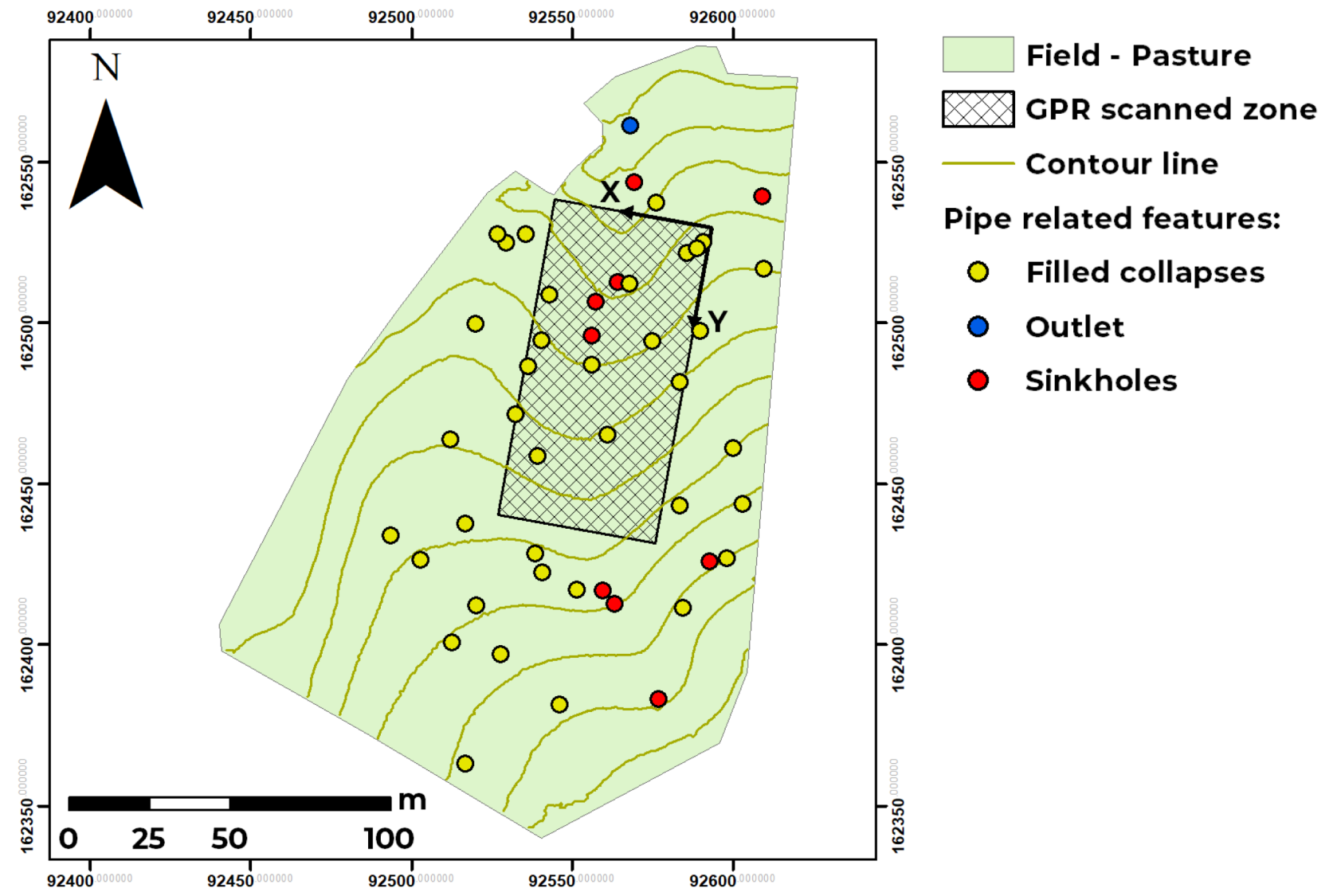
Soil pipes are highly variable in depth, visualization through successive depth slices may be misleading:

→ **Automated hyperbola detection** using algorithm of *Mertens et al.* (2016)



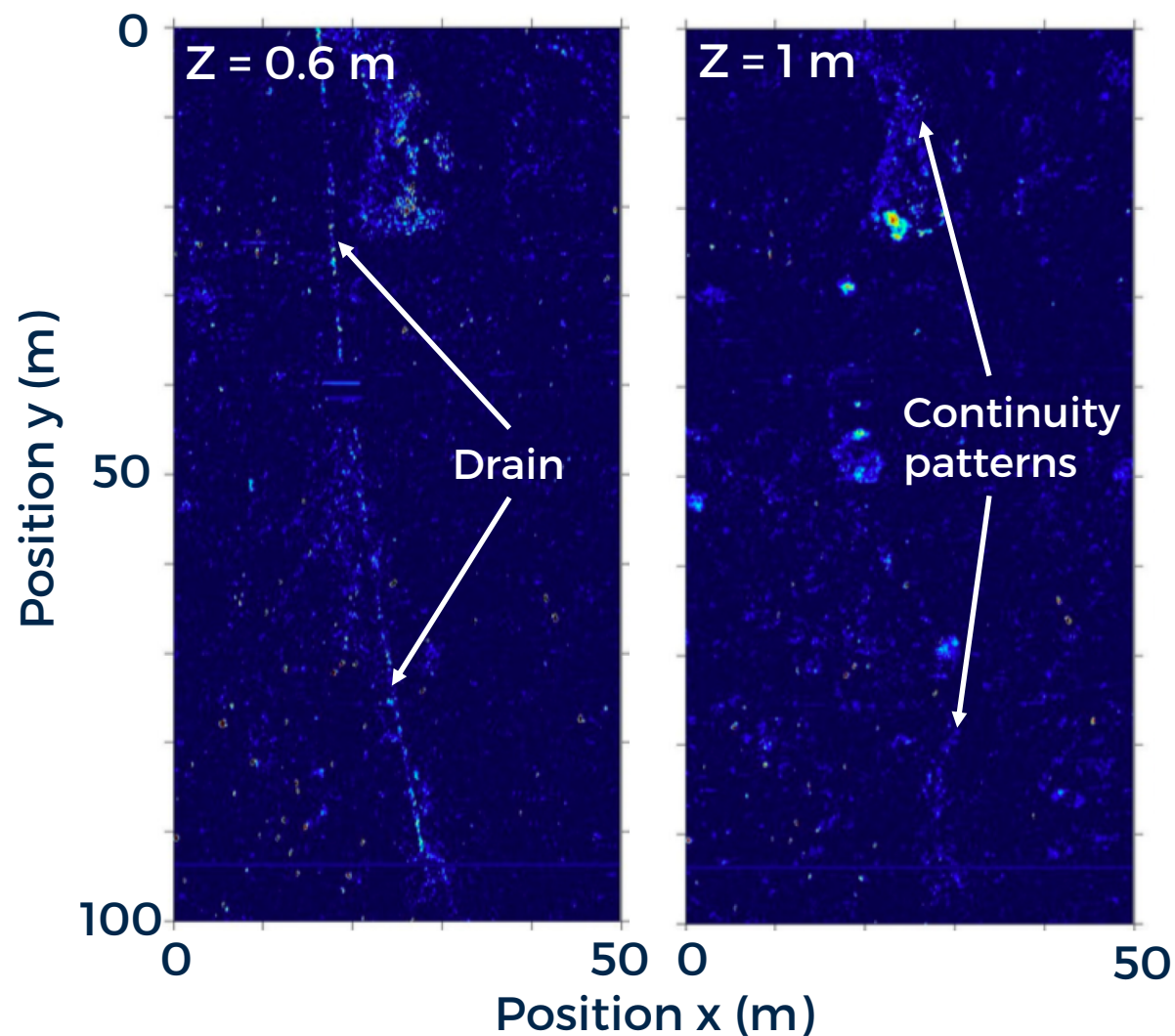
Study site: Khuisbergen (Belgium)

- Loess-derived soil
- One active pipe located near the talweg

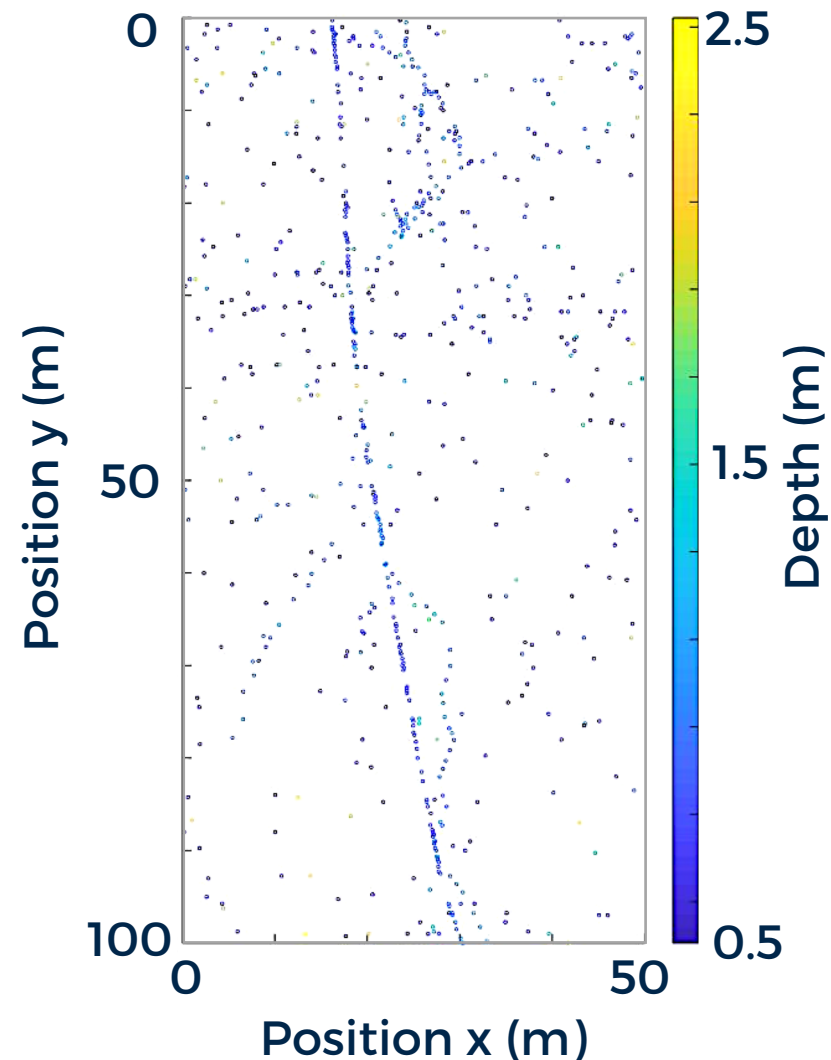


Results

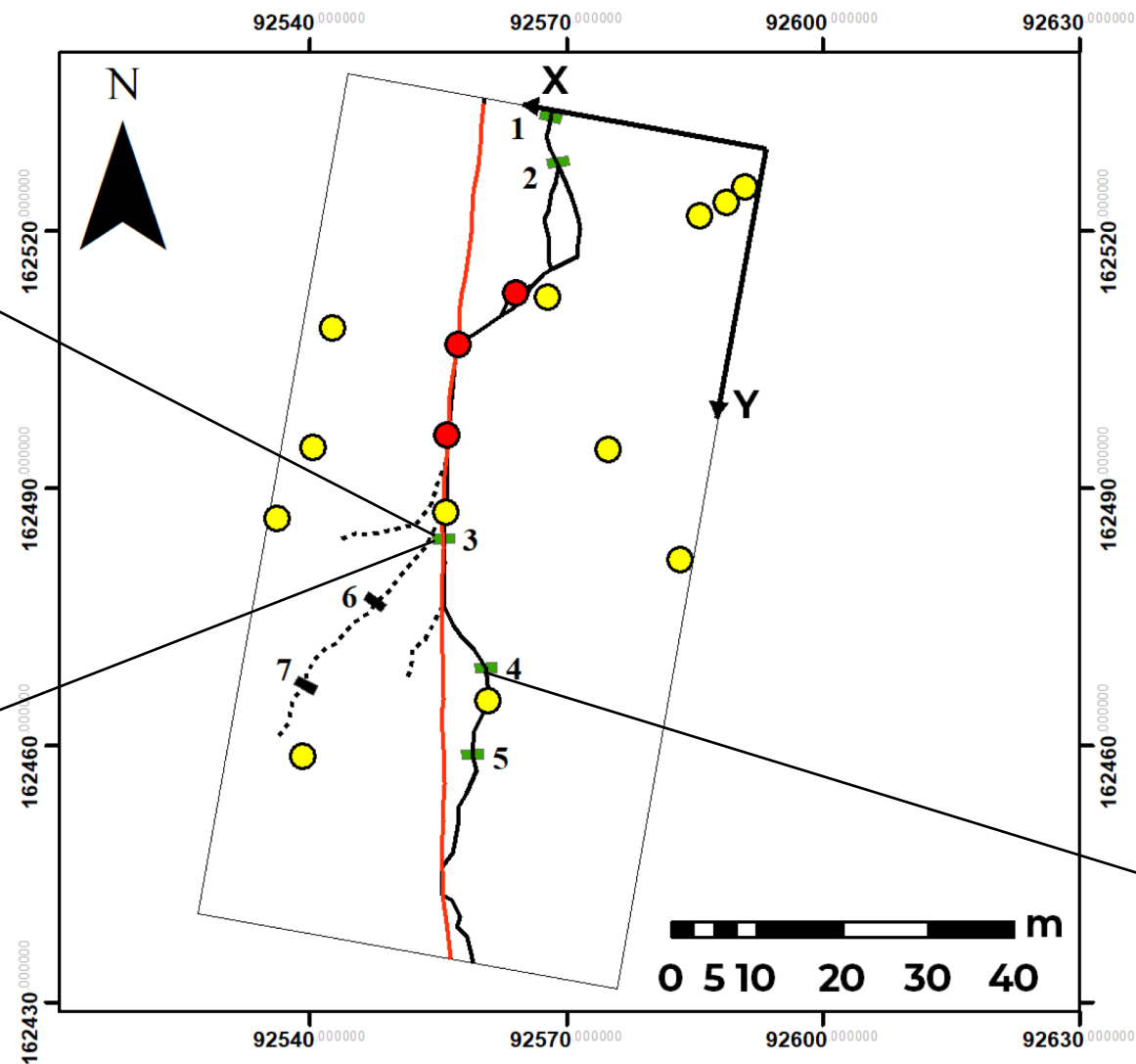
3D imaging: depth slices



Automated hyperbola detection



Validation



□ GPR scanned zone

Pipe related features:

● Filled collapses

● Sinkholes

Detected sub-surface structures:

— Drain

— Potential pipe clearly discernible

..... Potential pipe less discernible

Validation trenches:

■ Not validated

■ Validated



Conclusions

- GPR is a promising technique for soil piping networks characterization
- 3D imaging and automated hyperbola detection are complementary tools
- Challenge remains in the need of high spatial resolution scanning:
 - Time consuming
 - Not always feasible

