Flow dynamics during recurrent ponded infiltration on undisturbed soil samples studied by magnetic resonance imaging and neutron imaging

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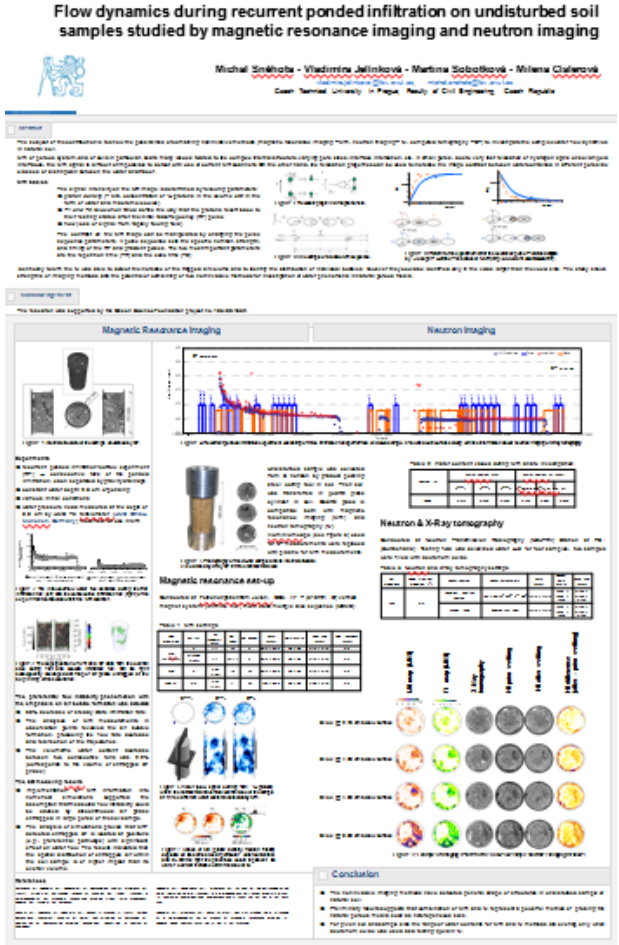
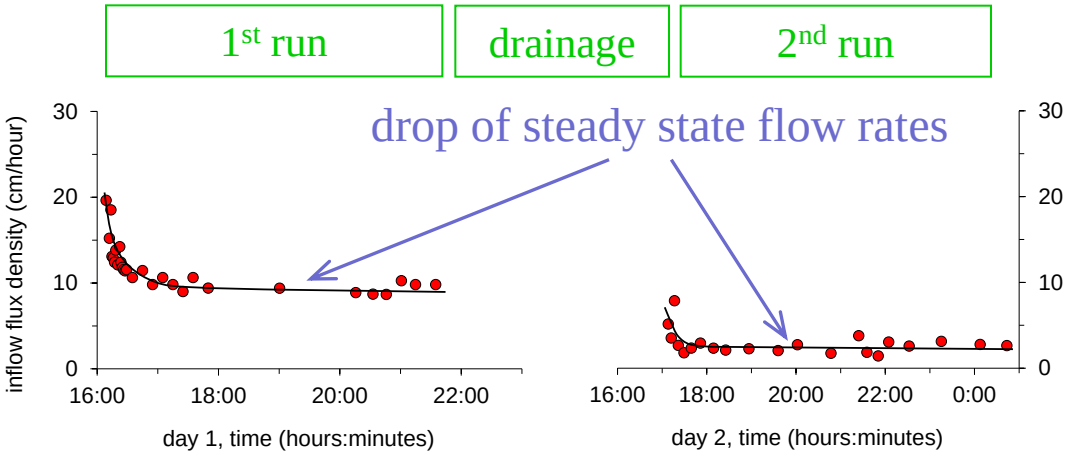
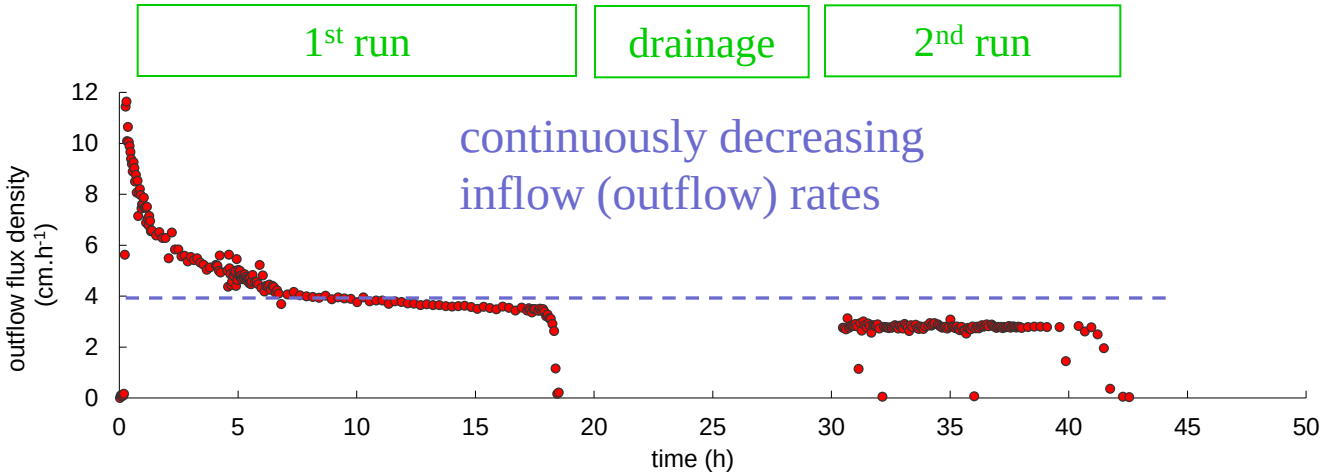


PREFERENTIAL FLOW



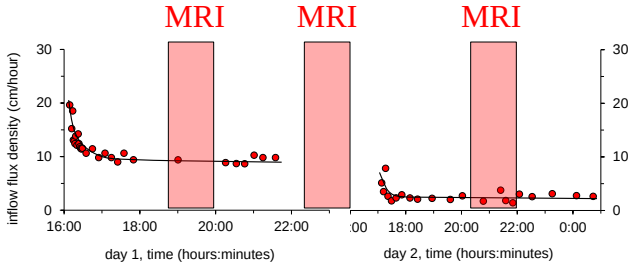
- heterogeneous soil
- undisturbed soil samples
- recurrent ponded infiltration
- flow instability
- air entrapment

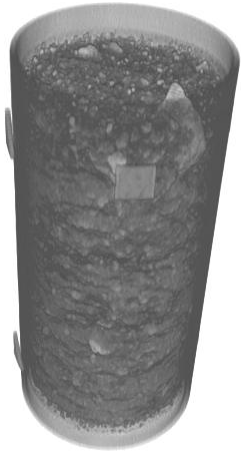
- noninvasive methods
  - X-ray CT
  - MRI
  - NI



X-RAY CT & MRI

SAMPLE 1





CT

(0.2 × 0.2 × 0.6 mm^3)

dia. 55 mm

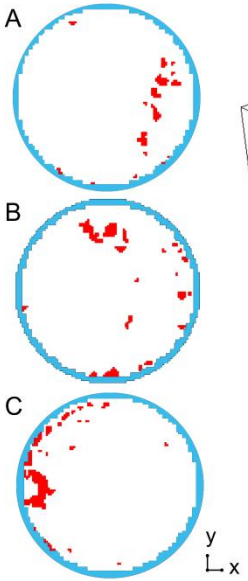
height 112 mm

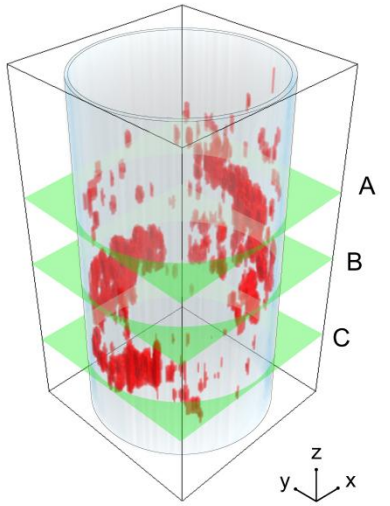
MRI

(1 × 1 × 5 mm^3)

Three dimensional

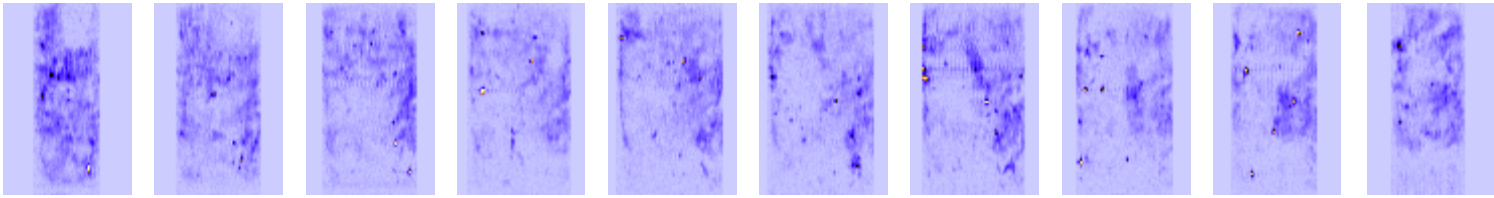
map of entrapped air



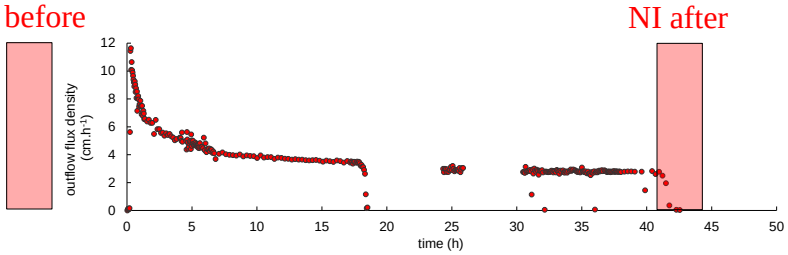


MRI

(1 × 5 × 0.75 mm^3), $Ni(NO_3)_2$ tracer pulse breakthrough

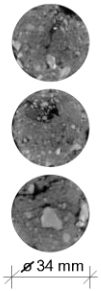


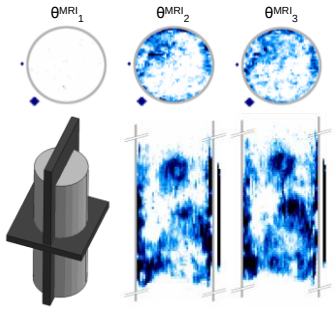
X-RAY CT & MRI & NI



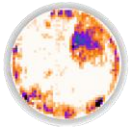
SAMPLE 2

MRI water content (H_2O)			NI water content (H_2O, D_2O)		
θ^{MRI}_1	θ^{MRI}_2	θ^{MRI}_3	$\theta^{NI}_{before\ exp}$	$\theta^{NI}_{after\ exp}$	θ_S
0.072	0.330	0.389	0.105	0.441	0.489

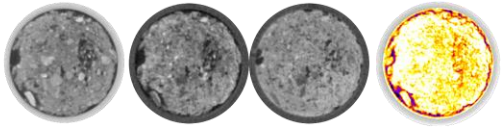




θ^{MRI}_3

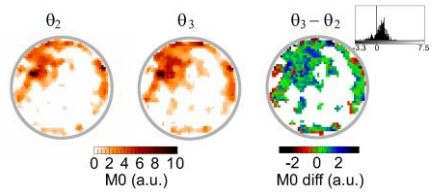


CT | θ^{NI} before | θ^{NI} after | NI difference



NI, CT

$(0.109 \times 0.109 \times 0.109\ mm^3)$



For given soil and sample size the range of detectable water contents for MRI and NI methods did overlap only when deuterium oxide was used as a testing liquid in NI.

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