

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

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The subject of experimental research presented in this paper is recurrent ponded infiltration (RPI) on undisturbed soil samples. The aim of the paper is to study the flow dynamics during RPI on undisturbed soil samples. The paper is divided into two parts: the first part is devoted to the description of the experimental setup and the second part is devoted to the results of the experiment. The paper is organized as follows: Introduction, Experimental setup, Results, and Conclusion.

Experimental setup

The experimental setup consists of a soil sample, a water reservoir, and a measuring device. The soil sample is placed in a container and the water reservoir is placed on top of it. The measuring device is used to measure the water content of the soil sample during the experiment.

Results

The results of the experiment show that the flow dynamics during RPI on undisturbed soil samples are characterized by a rapid initial infiltration followed by a slower infiltration rate. The flow dynamics are also characterized by a high degree of heterogeneity in the soil sample.

Conclusion

The results of the experiment show that the flow dynamics during RPI on undisturbed soil samples are characterized by a rapid initial infiltration followed by a slower infiltration rate. The flow dynamics are also characterized by a high degree of heterogeneity in the soil sample.

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) is a non-destructive technique for measuring the water content of soil samples. The MRI setup consists of a soil sample, a water reservoir, and a measuring device. The MRI setup is used to measure the water content of the soil sample during the experiment.

Neutron Imaging

Neutron imaging is a non-destructive technique for measuring the water content of soil samples. The neutron imaging setup consists of a soil sample, a water reservoir, and a measuring device. The neutron imaging setup is used to measure the water content of the soil sample during the experiment.

Neutron & X-Ray tomography

Neutron and X-ray tomography are non-destructive techniques for measuring the water content of soil samples. The neutron and X-ray tomography setup consists of a soil sample, a water reservoir, and a measuring device. The neutron and X-ray tomography setup is used to measure the water content of the soil sample during the experiment.

Magnetic resonance setup

The magnetic resonance setup consists of a soil sample, a water reservoir, and a measuring device. The magnetic resonance setup is used to measure the water content of the soil sample during the experiment.

Neutron imaging setup

The neutron imaging setup consists of a soil sample, a water reservoir, and a measuring device. The neutron imaging setup is used to measure the water content of the soil sample during the experiment.

Neutron & X-ray tomography setup

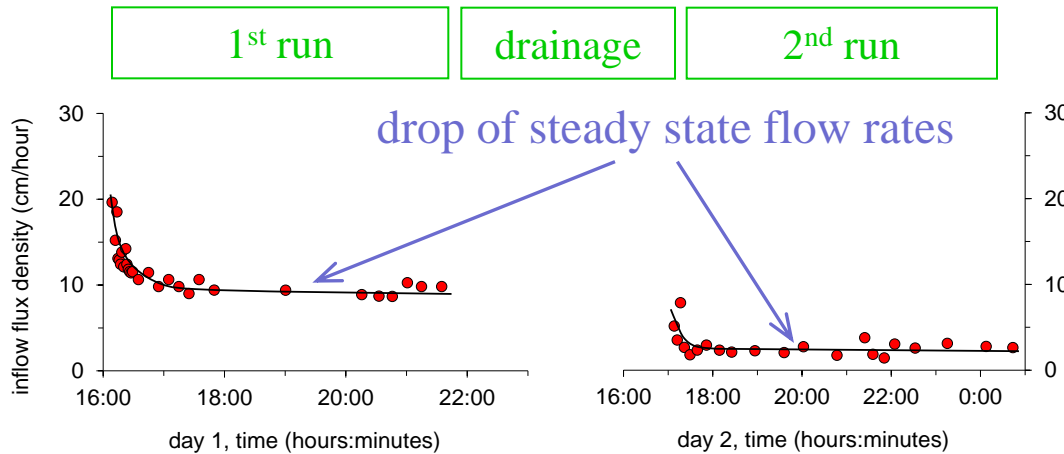
The neutron and X-ray tomography setup consists of a soil sample, a water reservoir, and a measuring device. The neutron and X-ray tomography setup is used to measure the water content of the soil sample during the experiment.

Conclusion

The results of the experiment show that the flow dynamics during RPI on undisturbed soil samples are characterized by a rapid initial infiltration followed by a slower infiltration rate. The flow dynamics are also characterized by a high degree of heterogeneity in the soil sample.

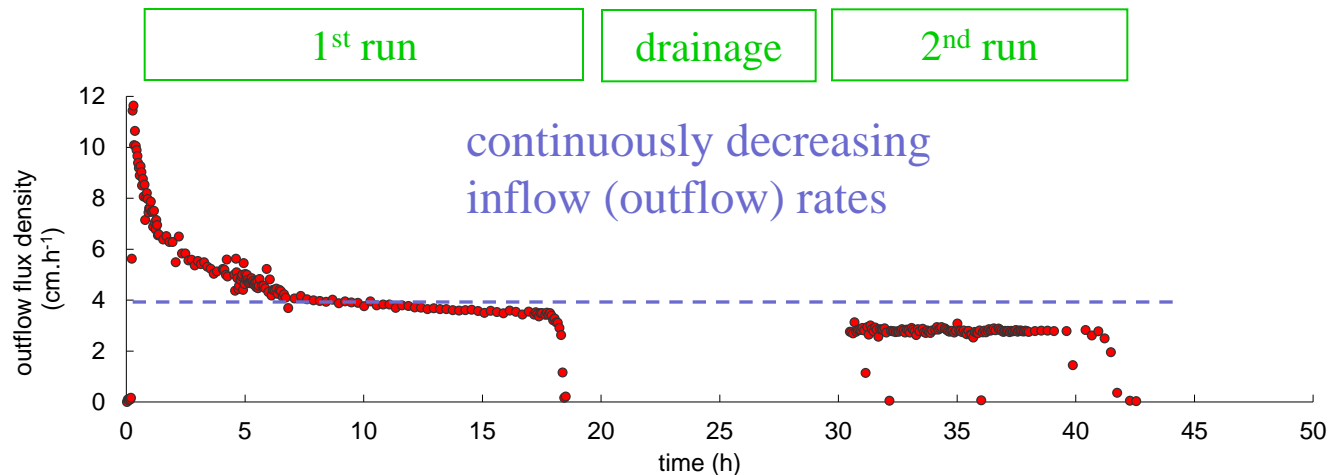


PREFERENTIAL FLOW



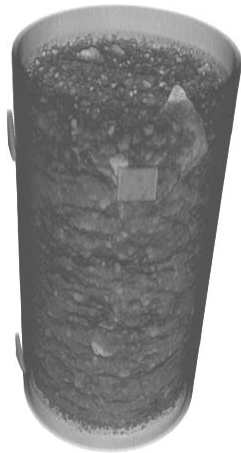
- ❑ heterogeneous soil
- ❑ undisturbed soil samples
- ❑ recurrent ponded infiltration
- ❑ flow instability
- ❑ air entrapment

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



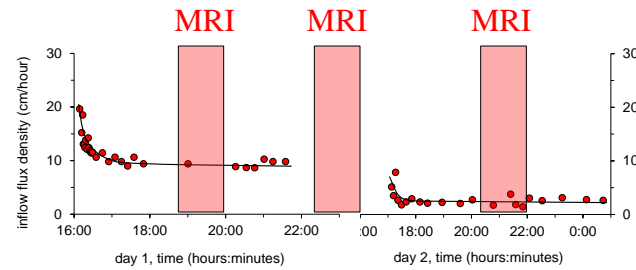
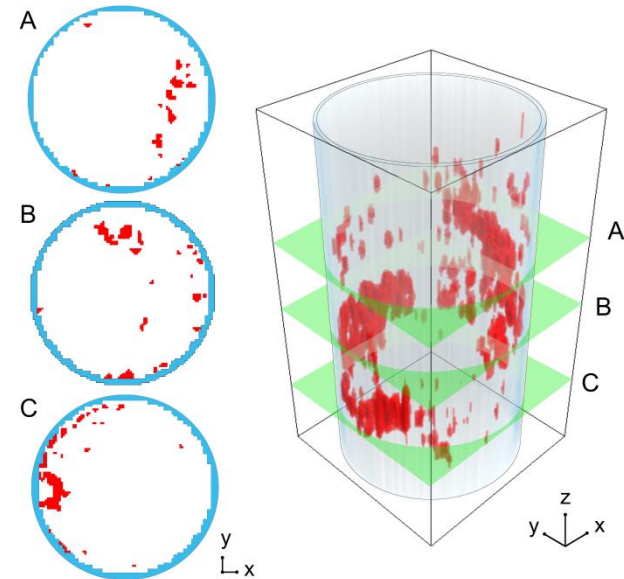
X-RAY CT & MRI

SAMPLE 1

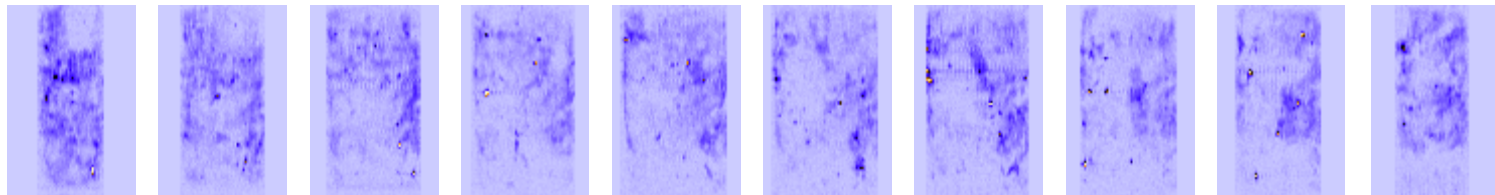


CT
 (0.2 × 0.2 × 0.6 mm³)
 dia. 55 mm
 height 112 mm

MRI
 (1 × 1 × 5 mm³)
 Three dimensional
 map of entrapped air



MRI
 (1 × 5 × 0.75 mm³), Ni(NO₃)₂ tracer pulse breakthrough

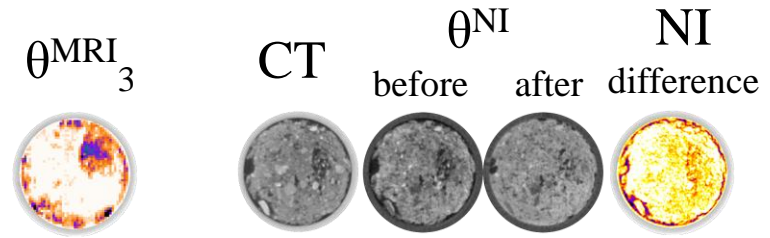
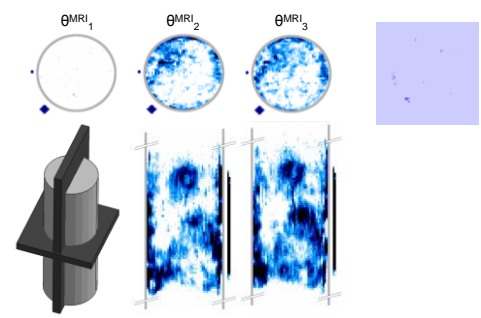
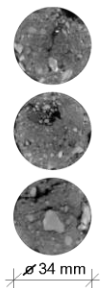
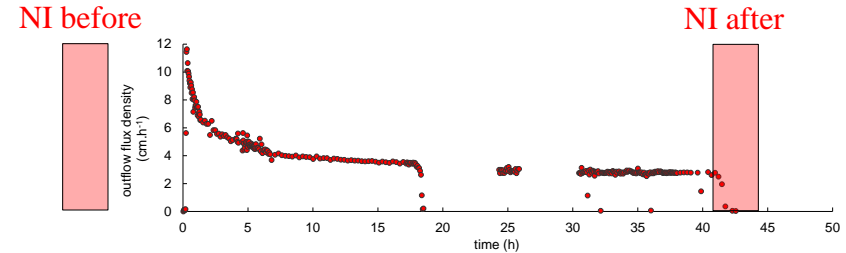


X-RAY CT & MRI & NI

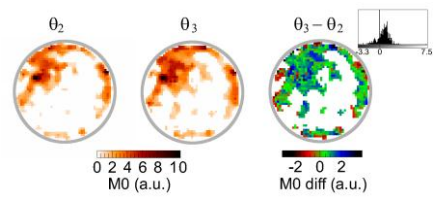
SAMPLE 2



MRI water content (H ₂ O)			NI water content (H ₂ O, D ₂ O)		
θ^{MRI}_1	θ^{MRI}_2	θ^{MRI}_3	$\theta^{NI}_{\text{before exp}}$	$\theta^{NI}_{\text{after exp}}$	θ_s
0.072	0.330	0.389	0.105	0.441	0.489



NI, CT
(0.109 × 0.109 × 0.109 mm³)



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.

