Looking inside the riverbed using hydrogel beads!

- Introduction

Underwater view of the River Tara riverbed, Montenegro, USA @ LiquiArt

Sanmenxia Dam during silt flushing, China @ RolfMueller

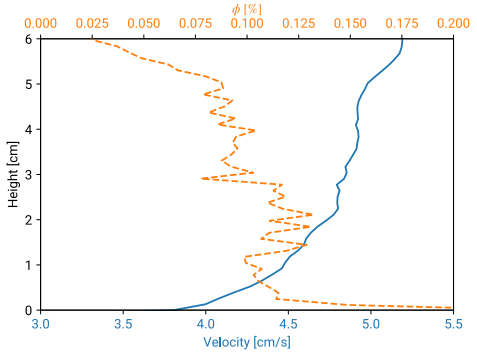
The porous riverbed plays a crucial role in many transfers between the river and surrounding aquifers. As **fine particles** suspended within the flow settle, they **can infiltrate the pores**. **Quantifying this process is challenging**. In the field, **measurements** either are **difficult** (cryogenic sampling) or have **limited accuracy** (inference from hydraulic conductivity). In laboratory experiments, the **porous matrix is optically opaque** (sand, glass beads), resulting in sampling after the experiment. **This results in measurements at a single point in space and time.**

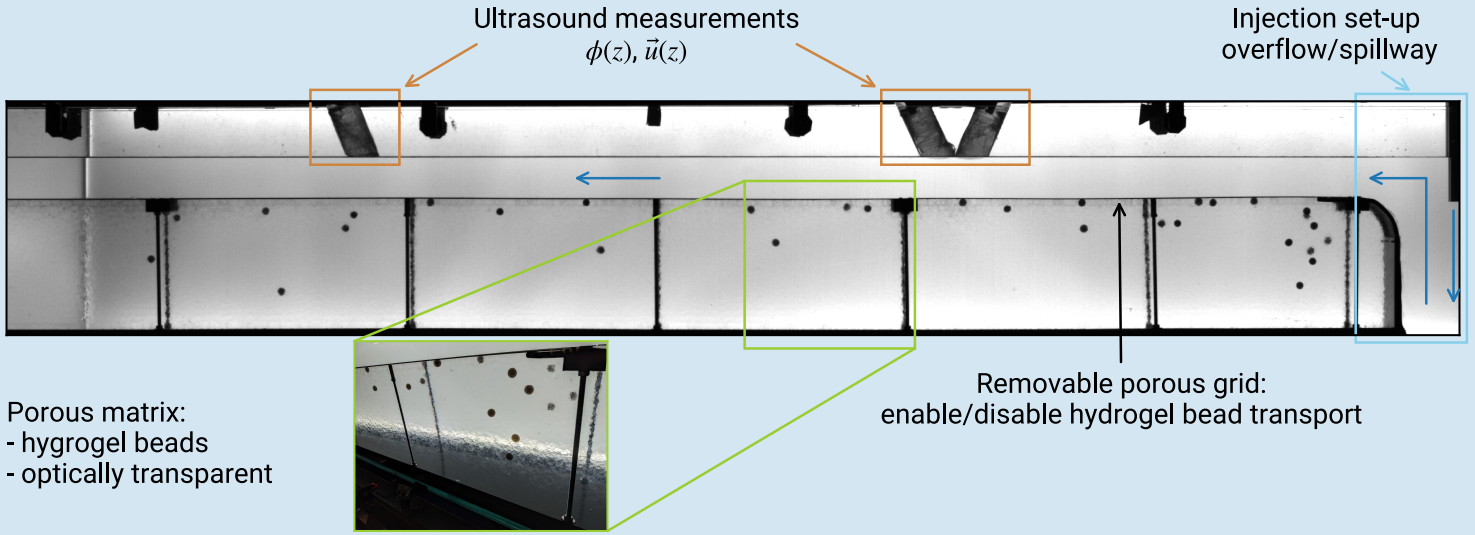
How to measure continuously the spatio-temporal dynamics of the infiltration?

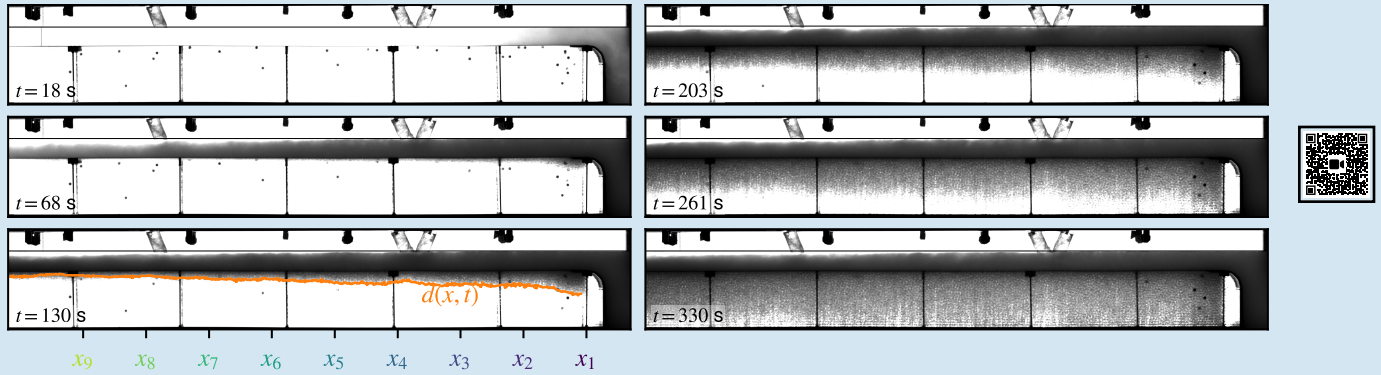
- Methods

- See the center column for the experimental setup
- Parameters:
  - flow velocity ~ 5 cm/s
  - suspended sediment: polystyrene beads, $d \sim 140\ \mu$m
  - hydrogel beads: $d \sim 1.5$ cm
  - volume fraction: $\phi \sim 0.1$ %

- Results (suspended flow)

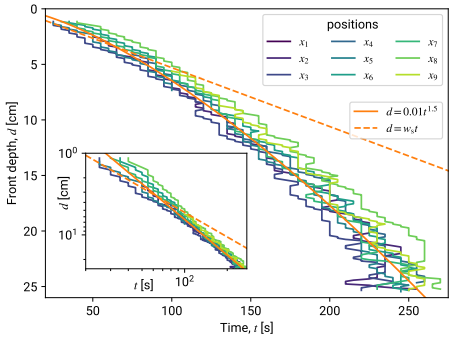






Snapshots of an experiment.

- Results (porous matrix)



- infiltration velocity starts at w_s, then increases in $t^{1/2}$

- Conclusion

- → characterizable in terms of inflow conditions
- → spatio-temporal monitoring of infiltration

- Discussion/Perspectives

- Full exploration of parameter space:
  - spatio-temporal law for infiltration
  - link with flow conditions
  - clogging and unclogging thresholds
- particle dynamics inside porous media, close-up view

Close-up view on the transparent porous matrix filled with fine particles.

An experimental set-up for the spatio-temporal quantification of fine particle infiltration in porous beds

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