



## **3D model-based interpretation of tracer tests in large undisturbed columns from clayey till**

**Mosthaf, Klaus; Jørgensen, Peter; Lanfers, Chloe ; Badawi, Nora; Aamand, Jens; Rolle, Massimo**

*Publication date:*  
2019

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Mosthaf, K., Jørgensen, P., Lanfers, C., Badawi, N., Aamand, J., & Rolle, M. (2019). *3D model-based interpretation of tracer tests in large undisturbed columns from clayey till*. Abstract from 11th Annual Meeting Interpore 2019 Valencia, Valencia, Spain.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



Abstract ID : 537

## 3D model-based interpretation of tracer tests in large undisturbed columns from clayey till

### Content

Large undisturbed columns (LUC) provide the possibility of well-controlled laboratory experiments of macroporous and fractured media to investigate transport pathways and the risk of pesticide leaching to the groundwater. We have conducted several flow and solute transport tests in large undisturbed columns, which were excavated from an agricultural field site in Denmark with a clayey till geology. Hydraulic tests were performed on the columns to determine the main hydraulic properties. A series of solute transport tests was performed under in-situ pressure and temperature conditions. First a mixture of different pesticides was injected, followed by an injection of a conservative bromide tracer and finally by an injection of the color tracer brilliant blue, all under constant flow conditions. After the brilliant-blue tracer injection, the column was opened and segmented, which allowed to map the location of conductive fractures and to inspect the column interior.

Distinct macropores and fractures could be identified as major transport pathways, with a strong hydraulic conductivity contrast between fractures and matrix. Several visible fractures contained iron precipitate, that blocked parts of the fractures and channeled the flow in the open parts. Based on the mapping and on the characterization of the clayey till matrix, a detailed 3D discrete fracture model was setup to simulate the flow and solute transport in the column considering both the preferential flow through the fractures and the interaction with the clayey-till matrix. The pesticides used in the flow-through experiments (bentazone, MCPA, tebuconazole) have different sorption and degradation characteristics, which were analyzed in the laboratory and included in the model simulations. The model allowed interpreting the resulting breakthrough curves of the pesticides and of the bromide tracer in the LUC setups taking into account the physical and biogeochemical processes controlling the transport and breakthrough of the different compounds. Furthermore, the influence of various parameters on solute transport through macroporous fractured clayey till could be analyzed with a sensitivity study using the calibrated model.

### References

### Procter and Gamble Student award

### Acceptance of Terms and Conditions

[Click here to agree](#)

**Primary author(s) :** Dr. MOSTHAF, Klaus (Technical University of Denmark); Dr. JØRGENSEN, Peter (PJ Bluetech); LANTERS, Chloe (DTU Environment); Dr. BADAWI, Nora (Geological Survey of Denmark and Green-

land); Prof. AAMAND, Jens (Geological Survey of Denmark and Greenland); Prof. ROLLE, Massimo (Technical University of Denmark)

**Presenter(s) :** Dr. MOSTHAF, Klaus (Technical University of Denmark)

**Track Classification :** MS 3 - MS 3 Flow, transport and mechanics in fractured porous media

**Contribution Type :** Oral 15 Minutes

Submitted by **Dr. MOSTHAF, Klaus** on **Thursday 22 November 2018**