



Program

Challenges and Opportunities in Porous Media Multiphase Flow and Contaminant Transport Research - International Conference in honor of “Rien” van Genuchten, on the occasion of his 80th birthday

Date: May 7-9, 2025

Promoter: Alberto Luiz Coimbra Institute of Post-Graduation and Engineering Research (COPPE), Federal University of Rio de Janeiro (UFRJ), through the Laboratory of Simulation and Methods in Engineering (LASME) of the Department of Nuclear Engineering

Address: Auditorium COPPE, Centro de Tecnologia II, Cidade Universitária, Ilha do Fundão, Rio de Janeiro, RJ, Brazil.

▪ **ORGANIZING COMMITTEE**

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Elizabeth May Pontedeiro (PEC, UFRJ)

Paulo Couto (LRAP, UFRJ)

Otto Rottuno (PEC, UFRJ)

Wenceslau Teixeira (Embrapa Soils, RJ)

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Boris Faybishenko (Lawrence Livermore Laboratory, USA)

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Renato Cotta (UFRJ, Brazil)

Amir Raoof (Utrecht University, Netherlands)

Horst Gerke (ZALF, Muncheberg, Germany)

Radka Kodesova (Czech University of Life Sciences, Prague)

Yakov Pachepsky (USDA, Beltsville, USA)

Program

Date: May 7 2025



9:00 to 10:00 Inscription and reception (welcome coffee)

10:00 to 10:20 Opening Ceremony

Chair: Majid Hassanizadeh

Broad Overviews

10:20 [Revival of Analytical and Hybrid Methods in Flow and Transport in Porous Media: The van Genuchten Legacy](#)

Renato M. Cotta^{1,2}

¹Mech. Eng. Dept., POLI & COPPE, UFRJ (Brazil), ²General Directorate of Nuclear and Tech. Dev., Brazilian Navy, SP, Brazil

10:40 [HYDRUS and its Specialized Modules \(Version 5\) for Numerical Modeling of Vadose Zone Processes](#)

Jiri Simunek, M. Šejna, G. Brunetti, M. Th. van Genuchten
UC Riverside, USA

11:00 [Multiscale Modeling of Heterogeneous Porous Media: Challenges and Applications in Energy, Agriculture, and Sustainability](#)

Paulo Couto (*LRAP, Civil Eng. Program, UFRJ, Brazil*)

11:20 [Rien van Genuchten and Radiological Safety Assessment of Mining Residues in Brazil](#)

Su Jian (*LASME, Nuclear Eng. Program, UFRJ, Brazil*)

11:40 [Flow and reactive transport in soils, rocks, and other porous materials: upscaling using integrated experimental and numerical approaches](#)

Amir Raoof, E. M. Pontedeiro, M. Lima, P. Couto, M. Th. van Genuchten
Dept. of Earth Sciences, Utrecht University, Netherlands

12:00 to 13:10 **Lunch**

Chair: Paulo Couto

Pore scale, NMR, REV, upscaling

13:20 [Advances in rock typing using versatile multi-scale micro-CT as an addition to conventional \(medical\) CT scans](#)

Wesley de Boever (*Tescan Group, Belgium/Brazil/ Czech Republic*)

13:40 [Spontaneous Imbibition and Multiphase Flow Behavior in a Pre-Salt Rock: Insights from Time-Resolved X-ray Microtomography](#)

Maira Lima, T. Pineiro, M. Bispo, A. D. S. Francisco, C. Castelo, J. Favoreto, A. Raoof, L. Borghi, J. A. Drumond, P. Couto
LRAP, Civil Eng. Program, UFRJ, Brazil



- 14:00** [Solving New Digital Rock Challenges with van Genuchten's Equation](#)
William Godoy, B. Gehlen, R. L. M. Bazarin, D. N. Siebert, L. O. E. dos Santos
Equinor Brazil
- 14:20** [Water distribution in soil pores: predicted via the Young–Laplace equation vs. Observed via X-ray \$\mu\$ CT](#)
Andrey Guber, M. Rivers, A. Kravchenko
Dept. of Plant, Soil and Microbial Sciences, Michigan State Univ., USA
- 14:40** [Lattice Boltzmann Multicomponent-Multiscale Modeling for Fluid Flow through Porous Media](#)
Ricardo Bazarin, D. N. Siebert, L. O. E. dos Santos
Joinville Technological Center, University of Santa Catarina, Brazil

15:00 to 15:30h

Coffee Break

Chair: William Godoy

- 15:30** [Correcting the micro-continuum model for simulation of absolute permeability of rocks](#)
Alex Machado, P. L. C. Lage, P. Couto
LRAP, Civil Eng. Program, UFRJ, Brazil
- 15:50** [MRI Insights into flow processes within REV](#)
Milena Císlerová (CTU, Prague, Czech Republic)
- 16:10** [REV Analysis Through Morphological Young–Laplace Numerical Method](#)
B. Gehlen, R. L. M. Bazari, D. N. Siebert, L. O. E. dos Santos
Joinville Technological Center, University of Santa Catarina, Brazil

16:30 to 17:10

The Legacy of Rien van Genuchten

Special Session: *Tribute to Dr. Rien van Genuchten; celebration on the occasion of his 80th birthday*

Majid Hassanizadeh (Utrecht University, Netherlands):- [Celebrating Rien van Genuchten: A Life of Science, Mentorship, and Impact](#)

Jiri Simunek (UC Riverside, USA): [The Legacy of Rien van Genuchten, a Recipient of the 2023 Wolf Prize for Agriculture](#)

Renato Machado Cotta (UFRJ and Brazilian Navy, Brazil): [The legacy of Rien in Brazil](#)

Rien van Genuchten – [Thanks, and](#)

SHORT VIDEOS

17:10 to 19:00

Reception

Date: May 8 2025



Chair: Nobuo Toride

Unsaturated soil and rock hydraulic properties

9:00 Extended Simplified Evaporation Method (XSEM) to determine soil hydraulic properties across the full moisture range

J. Bosse, S. Iden, A. Peters, **Wolfgang Durner**

Inst. of Geoecology, Tech. Universität Braunschweig (Germany) and Meter Group (USA)

9:20 Development and optimization of multimodal unsaturated soil hydraulic models: Implementation of the Unsatfit library and its performance

Katsutoshi Seki, N. Toride, M. Th. van Genuchten

Toyo University, Japan

9:40 A robust variant of the van Genuchten curve and an associated conductivity curve: Theory, parameter fitting, and performance

Gerrit de Rooij, A. Nambiar, R. Madi, J. Mai, H. Mielenz

Helmholtz-Zentrum – UFZ/Germany

10:00 A soil shrinkage model inspired by van Genuchten's SWRC model and beyond

Xinhua Peng, Rainer Horn

Chinese Academy of Agricultural Sciences, China

10:20 to 10:50 **Coffee break**

Chair: Gerrit de Rooij

Preferential flow; soil structure

10:50 Improving the Tension and Pressure Extractor Moisture Retention Curve Method by Implementing HydraProbe Soil Sensor in Soil Cores

Keith Bellingham, Stevens Water Monitoring Systems, Inc. , Portland, Oregon, USA and **Alan**

Farsad, SoilMoisture Equipment Corp., California, USA

11:10 Characterization of macropore-matrix mass exchange for modeling preferential flow and soil hydro-mechanics in the drilosphere

Horst Gerke, L. A. P. Barbosa

Leibniz Centre for Agricultural Landscape Research (ZALF), Munchenberg, Germany

11:30 Soil pore space structural classification system (SPSCS): I - Theory

Theofilo Ottoni, M. V. Ottoni

Department of Water Resources and Environment, UFRJ, Brazil

11:50 Should soil structure dynamics be included in modeling variable-saturated water flow?

Efstathios Diamantopoulos, M. Nielsen, D. Vdovenko, C. V. Henri, F. Leuther

University of Bayreuth, Bayreuth, Germany

12:10 Relative Permeability Uncertainty Quantification and Reduction in Coreflooding Experiments

Felipe Eler, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil



12:30 – 14:00

Lunch

Chair: Horst Gerke

14:00 [Maps of van Genuchten parameters for the Contiguous USA at 100 Meter Resolution and Seven Depths: Code Design and Preliminary Results](#)

Marcel Schaap, Y. Zhang, C. Rasmussen

College of Agriculture, Life Sciences and Environmental Sciences, Department of Environmental Science, University of Arizona, USA

14:20 [Characterizing Large-Scale Preferential Flow Across Continental United States](#)

Binayak Mohanty, E. Kocian

Biological and Agricultural Engineering, Texas A&M University, College Station, TX, USA

14:40 [The Distinct Physical and Hydraulic Behaviors of Tropical and Temperate clayey soils](#)

Wenceslau Teixeira (*Embrapa Soils, RJ, Brazil*)

15:00 [Water Monitoring using Hydrological Modeling and Satellites](#)

Otto C. Rotunno Filho

Lab. of Water Resources and Environmental Studies (LABH2O), Civil Eng. Dept., UFRJ, Brazil

15:20 [An updated version of the hydrophysical database for Brazilian soils: perspective for generating maps of soil hydraulic properties](#)

Marta Ottoni, L. R. Souza, L. M. C., et al.

Department of Hydrology, Geological Survey of Brazil

15:40 [Improving infiltration modeling in the National Water Model](#)

John Nieber, P. La Follette, A. J. Khattak, F. L. Ogden

University of Minnesota, USA

16:00 – 16:30

Coffee Break

16:30 – 18:00

Online Presentations

[Analytical and HYDRUS Modeling of 2-D Heat Conduction in Design of Optimal Locus-Shape of Galleries/Subterranean Holes: Lobachevskii's Geophysical Legacy in Solving Inverse Problems Revisited](#)

Anvar R. Kacimov, A.B.Umarova

Department of Soils, Water and Agricultural Engineering, Sultan Qaboos University, Oman

[CO₂ underground storage: Generalizing fractional flow theory](#)

S. Senevirathna, A. Zemlyanova, S. A. Kelly, Q. Hu, Y. Zhang, **Behzad Ghanbarian**

Dept. of Earth and Environmental Sciences, University of Texas, Arlington, USA

[Commodifying a Carcinogen: Critical Raw Materials from Arsenic-laden Groundwater](#)

K. Wang, **Case van Genuchten**

Department of Geochemistry, Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark

[The Unsaturated, the Bio-Cemented, the Contaminant, and the Heated: the Tale of our Journey with Rien](#)

Ehsan Nikoosaei, R. Mirghafari

Dept. of Civil and Environmental Eng., Shiraz University, Iran

Statistical Characterization of Solute Transport in Heterogeneous Aquifers: Implications for Groundwater Risk Assessment

Felipe de Barros

Sonny Astani Department of Civil & Environmental Engineering, University of Southern California



16:30 – 18:00

Poster Session

Assessment of Experimental Uncertainty Impact on Capillary Pressure Determination via the Centrifuge Technique

Felipe Eler, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

A systematic global recharacterization method for reservoir fluids in compositional simulations

Barbara Esteves, F. C. de Oliveira, P. Couto, P. L. C. Lage

LRAP, Chemical Eng. Program,, UFRJ, Brazil

Comparison of NMR Log T2 Distributions with Petrographic Image Analysis and Special Core Analysis in Pre-Salt Formations

Gabriel Ribeiro, A. Boyd, M. Lima, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

Open-access inventory of pedotransfer functions for hydraulic properties in Brazilian soils

B. Sturm, **Marta V. Ottoni**, Q. de Jong van Lier, V. O. Silva, N. Curi, J. M. Reichert

Geological Survey of Brazil, Department of Hydrology, Rio de Janeiro, Brazil

Integral Transform Solution for the Three-dimensional Modeling of Aquifer Drawdown and Recovery by Multiple Wells

Elizeu Melo, J. N. N. Quaresma, E. N. Macêdo, R. M. Cotta

School of Mining Eng., UNIFESSPA, Federal University of South and Southeast of Pará, Marabá, PA, Brazil

Developing a simplified landslide alert model for Petrópolis, Brazil, using HYDRUS-1D

Cristiane R. Melo, M. V. Ottoni, P. A. Guedes

Geological Survey of Brazil, Recife, PE, Brazil

Plant available water – proposal of a flux-based approach

Quirijn de Jong van Lier (*University of São Paulo, Brazil*)

Modelling the Effects of Compaction on Soil Water Retention and Infiltration

D. Ngo-Cong, **Diogenes L. Antille**, M. Th. van Genuchten

CSIRO Agriculture and Food, Canberra, ACT, Australia

Water retention curves of sandy soils in northern Poland

Wioletta Gorczewska-Langner, A. Szymkiewicz, B. Jaworska-Szulc

Dept. of Geotechnical and Hydraulic Eng., Faculty of Civil and Environmental Eng., Gdańsk University of Technology, Poland

Soil pore space structural classification system (SPSCS): II - Application for Brazilian Latosols

Victor M. dos Santos, M. V. Ottoni, T. B. Ottoni Filho

Geological Survey of Brazil, Department of Hydrology, Rio de Janeiro, Brazil

Dynamic Effects on Solute Transport in an Unsaturated Soil

Luwen Zhuang, Y. Zheng, M. Th. van Genuchten

Center for Water Resources and Environment, Sun Yat-sen University, China

Analyzing macro- and microporosity with MicroCT images for improving NMR and resistivity interpretation

Silvia Bermudez, G. Ribeiro, A. Boyd, M. Lima, T. Pineiro, A. Zuniga, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

Evaluation of Permeability in Carbonate Rocks by using Critical Path Analysis and combining MICP and NMR Measurements

E. Pontedeiro, **Paulo Moreira**, M. Lima, G. Ribeiro, S. Bermudez, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

The potential of micropollutants that may be present in irrigation water to contaminate soil and groundwater

R. Kodešová, **Vít Kodeš**, A. Sadchenko, M. Kočárek, M. Fér, H. Švecová, A. Klement, A. Nikodem, R. Grabic

Czech Hydrometeorological Institute, Czech Republic

Analysis of Soil Water and Soil Aeration Corequisites for Plant Growth

T.K.K. Chamindu Deepagoda, K. Wiffen, M.M.T. Lakshani, S. Carrick, T. J. Clough

Department of Soil and Physical Sciences, Lincoln University, Lincoln, New Zealand

Influence of Inlet-End Diffusers Under Heterogeneous Conditions in 3D SCAL Models

C. H. Dias, **Douglas Silva Almeida**, F. O. da Silva, G. Stieven, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

Enhancing Relative Permeability Uncertainty Quantification via Sobol-Based Parameter Reduction in Unsteady-State Core Flooding

Filipe Oliveira da Silva, E. S. Assis, G. M. Stieven, C. H. Dias, P. Couto

LRAP, Civil Eng. Program, UFRJ, Brazil

Required Log Reduction Values of virus for groundwater protection and for potable reuse of wastewater

Jack Schijven, M. Hassanizadeh, H. van den Berg, M. de Winter, W. Betancourt, P. Teunis

Environmental Hydrogeology Group, Dept. of Earth Sciences, Utrecht University, The Netherlands

Novel Application of Hydrus-1d: Modeling Overland Solute Transport During Furrow Fertigation

A. Ashrafi, **M. Th. van Genuchten**, B. Ghanbarian, H. Ebrahimian

Department of Irrigation and Reclamation Engineering, College of Agriculture and Natural Resources, University of Tehran, Karaj, Iran

19:00

GALA DINNER

Restaurant: Steakhouse Mocellin Ilha do Governador

Address: Estrada do Galeão 5285, Ilha do Governador, Rio de Janeiro

Date: May 9 2025



Chair: Naftali Lazarovitch

Contaminant Transport Applications

- 9:00** [The HPx tool for geochemical and coupled reactive transport simulations for engineered and environmental porous systems](#)
Diederik Jacques, J. Šimůnek
Engineered and Geosystem Analysis, Belgian Nuclear Research Centre, Belgium
- 9:20** [Fate and transport of substances associated with aerobic and anaerobic SOM decomposition in paddy soils using the HP1 program](#)
Koharu Tasaki, N. Toride, I. Tokumoto
The United Graduate School of Agricultural Sciences, Kagoshima Univ., Kagoshima, Japan
- 9:40** [The mobile-immobile model for reactive transport with aerobic and anaerobic SOM decomposition in soils using the HP1 program](#)
Nobuo Toride, K. Tasaki, I. Tokumoto, M. Th. van Genuchten
Graduate School of Bioresources, Mie University, Mie, Japan
- 10:00** [Behavior of selected micropollutants originating from treated wastewater and sewage sludge in the soil-water-plant system](#)
Radká Kodesová, A. Sadchenko, H. Švecová, A. Klement, M. Fér, G. Fedorova, A. Nikodem, R. Grabic
Czech University of Life Sciences Prague, Faculty of Agrobiology, Food and Natural Resources, Dept. of Soil Science and Soil Protection, Czech Republic
- 10:20 to 10:50** **Coffee break**

Chair: Jan Vanderborght

Field-scale Contaminant Transport Problems

- 10:50** [Nitrogen Dynamics in Hyporheic Zones: Interactions among Porous Flow, Reactive Nutrient Transport, and Biofilm Growth](#)
Menggui Jin, Y. Xian, X. Ping, Z. Zhang, X. Liang
School of Environmental Studies, China University of Geosciences, Wuhan, P. R. China
- 11:10** [Application of Superabsorbent Polymers for Water Content Control and Volumetric Stability in Iron Ore](#)
Talita Menegaz, R. Soares, J. P. Silva, F. A. M. Marinho
Institute of Geoscience of the University of São Paulo, Brazil, Brazil
- 11:30** [Estimating the Field-Scale Dispersivity of Unsaturated Sediments](#)
Zhuanfang Fred Zhang (*INTERA Incorporated, Richland, Washington, USA*)
- 11:50** [Using HYDRUS to Optimize Soil Mounds for Efficient Irrigation in Date Palm Orchards](#)
O. Agaba, I. Rajj-Hoffman, **Naftali Lazarovitch**
French Associates Institute for Agriculture and Biotechnology of Drylands, The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Israel

12:10 to 13:40 **Lunch**



Chair: Quirijn de Jong van Lier
Vegetation and plant-water relationships

- 13:40** [The mechanism of *Bacillus subtilis* to guarantee the safe utilization of brackish water by improving soil physical properties and cotton production](#)
Beibei Zhou, Xi'an University of Technology, China
- 14:00** [Modeling soil salinity in mangrove swamp rice production systems of Guinea Bissau, West Africa](#)
G. Garbanzo, M. Temudo, M. R. Cameira, P. Paredes, **Tiago Ramos** (*Instituto Superior Técnico, University of Lisbon, Portugal*)
- 14:20** [Using mechanistic models to derive root water and solute uptake functions and their parameters](#)
Jan Vanderborght, M. Giraud, J. B. Cabrera, D. Leitner, H. Pagel, A. Schnepf, G. Lobet, M. Javaux, H. Vereecken
Agrosphere Institute (IBG-3), Forschungszentrum Jülich GmbH, Germany
- 14:40** [Modeling Residue Disposal Using the HYDRUS Software](#)
Elizabeth M. Pontedeiro, M. B. Nunes, M. Th. van Genuchten, P. Couto, J. Su
LRAP, Civil Eng. Program, UFRJ, Brazil
- 15:00 – 15:30** **Closing Ceremony**