Curriculum Vitæ

Yves MÉHEUST, Maître de Conférence Hors Classe (Distinguished Associate Professor) at Géosciences Rennes (UMR CNRS 6118) and Univ. Rennes 1 since 2006; 49 years old, married with three children (13, 10 and 7 year old),
yves.meheust@univ-rennes1.fr; French national.
ORCID: https://orcid.org/0000-0003-1284-3251
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SCIENTIFIC FIELDS: Environmental Fluid Mechanics, Hydrogeology, Rock Physics.

RESEACH TOPICS: Heat transport by flow in subsurface permeable media (2019-); Convective dissolution of supercritical CO_2 in subsurface brine (2017-); coupling between flow, transport and biological activity in porous media (2015-); link between electrical transport and solute transport in subsurface media (2014-); flow of non-Newtonian fluids (foams, emulsions, biopolymer solutions) in porous media (2011-); solute transport in 2D porous media (2011-); free surface flows of thixotropic clayey muds (2008-); solute transport in fractured media (2006-); physical properties of smectite clay minerals (2002-); two-phase flows in 2D porous media and fractures (2000-); single phase flow in fractured media (1998-2001 and 2009-2011).

APPROACH AND TECHNICAL EXPERTISE:
My work is **mostly based on laboratory experiments**, with complementing numerical simulations and/or theoretical models. Some studies are purely theoretical/numerical. My technical competences include flow and transport experiments in milli- and micro-fluidic setups, X-ray diffraction and small-angle X-ray scattering, rheometry measurements of complex fluids, image treatment to characterize liquid phases and measure concentration fields, velocity fields, and local reaction rates, as well as numerical modeling of (mono- or bi-phasic) Newtonian or shear-thinning flows by custom-written finite differences codes or using finite element or finite volume numerical frameworks (Freefem++, Comsol, Openfoam).
One of the specificities of my approach is that **I work at the hydrodynamic scale** (i.e., at the pore / fracture scale) where physical and bio-chemical processes take place, and **aim at upscaling the description of these processes to the continuum scale**. I have also done a significant amount of work investigating scales at which the hydrodynamic description is not valid (nanoscales), in particular in studies involving clay minerals.

EDUCATION: Habilitation à Diriger des Recherches (2016, Université Rennes 1) in Earth Sciences; PhD (2002, Laboratoire de Géologie, ENS Paris) in Hydrogeology; MSc in Statistical Physics and Nonlinear Phenomena (1998, ENS-Lyon), BSc in Fundamental Physics (1994-1997, ENS-Lyon).

TEACHING:
In charge of subprogram "Modelling of Hydrological Transfers" of MSc program "Sciences de l'Eau (SdE)" (i.e., Water Sciences) of Univ. Rennes 1 since 2017, and of subprogram Terre et Environnement (Earth and Environment) of the M.Sc. program Systèmes Complexes Naturels et Industriels (SCNI) at Univ. Rennes 1 between 2008 and 2012. See http://osur.univ-rennes1.fr/masterSCNI.
Current lectures (since 2017), all at M. Sc. level: *Hydrogeological Modelling and Transport*, *Surface Hydrology Field Trip*, *Fluid Mechanics*.
Past lectures (2006-2017), all at M. Sc. level: *Continuum Mechanics*, *Environmental Risks*, *Hydrological Risks, Flows in Fractured Media*, *Two-phase Flows in Porous Media*, *Surface Hydrology Field Trip*.

PAST PROJECTS FUNDED (LAST 5 YEARS):
ANRs (France) "CO2-3D" (2017-2021, 268 k€, co-PI), "IMAGE" (2022-2026, 712 k€ with 160 k€ for my group, PI of WP3), and ANR/DFG (France/Germany) "2PhlowFrac" (2021-2024, 240 k€ on French side, PI on the French side).
Marie Skłodowska-Curie (EU) projects "GeoElectricMixing" (2017-2019, 176 k€, Supervisor), "UnsatPoreMix" (2019-2021, 197 k€, Supervisor), and "expeCO2SolTrap" (2022-2024, 187 k€, supervisor) .
Bienvenüe (EU/Région Bretagne) "COsmerysh" (2022-2024, 198 k€, PI).
Région Bretagne (France) "CO2seq3D" (2018-2019, 68 k€, PI).
ERC Consolidator (EU) "Reactive Fronts" (2016-2010, 2 M€, participant, responsible for lab experiments).
ANR (France) "Subsurface Mixing and Reaction" (2014-2017, 299 k€, participant).
NFR Petromaks 2 (Norway) "Nanofluids for IOR and Tracer Technology" (2018-2021, 1.6 M€, participant).

SUPERVISION OF RESEARCH: Co-supervized or co-supervizing 10 postdoctoral projects and 13 PhD students since 2002.

MANAGEMENT OF RESEARCH AND INFRASTRUCTURES:
Jan 2022-: Responsible for team TERA (Fluids, Transport, Reactivity) of Géosciences Rennes: 11 permanent researchers and professors, 3 engineers, 15 PhD students and postdocs: ~ 15 k€ per year of recurrent budget (projects not included).
Dec 2019-Dec2021: Responsible for team DIMENV (Dynamics, Imaging and Modeling of Environmental systems) at Géosciences Rennes: 20 permanent researchers and professors, 8 engineers and 37 PhD students and postdocs: $\sim$ 80 k€ per year of recurrent budget (projects not included).
2018-: Responsible for the Hydrology group within team DIMENV (Dynamics, Imaging and Modeling of Environmental systems) at Géosciences Rennes: 9 permanent researchers and professors, 5 engineers and 23 PhD students and postdocs: $\sim$ 45 k€ per year of recurrent budget.
2008 - 2012 and 2018- : Scientific responsability of the *Laboratory for Analog Modeling* of Géosciences Rennes, for activities

involving Fluid Mechanics.
2015-2021: In charge of action "Tranport by Flows"of the Contrat-Plan-État-Région (CPER) "Buffon": writing of the initial proposal and of the subsequent calls for bids; coordination of the choice of equipments with all lab users, coordination of their buying and installation. Budget: ∼450 k€ over 7 years.

PARTICIPATION IN PHD THESIS COMMITTEES AND SELECTION COMMITTEES (LAST 6 YEARS):
Reviewer for PhD theses of MacLean Eneotu (Univ. Strathclyde, United-Kingdom, 2021), Romain Aranda (Univ. Bordeaux, France, 2020), Valentin Jules (IPGP Paris, France, 2020), Sofia Bouarafa (INSA Lyon , Lyon, France, 2019), Alexis Mauray (Laboratoire de Rhéologie, Grenoble, France, 2018), Sandy Morais (ICMCB, Bordeaux, France, 2016), and Andrea Ferrari (Univ. Lausanne, Switzerland, 2014). Examiner for Edouard Canot's Habilitation à Diriger des Recherches (Physics Institute of Rennes, Rennes, France, 2019) and Xiaocong Luy's PhD thesis (Univ. Delft, Netherlands, 2021).
Member of selection committee for the recruitment of an Associate Professor (MdC) in reactive transport in porous media (ISTO, Orléans, 2017).

EDITORIAL ACTIVITIES:
Member of the Interpore Publication Committee (2017-2021)**;** Associate Editor for the Vadose Zone Journal (two terms, 2011-2016); referee for various Earth Sciences, Soil Sciences, Physics, Physical Chemistry, and Engineering journals (2003-); referee for 25 research proposals since 2010 (including 7 for the French ANR, 1 for the English EPSRC, 1 for the German DFG, 2 for the Fonds de Recherche Nature et Technologie du Québec, 2 for the Chilian CONICYT, 3 for the PRF of the American Chemical Society, 1 for the Canadian MITACS).

ORGANIZATION OF SCIENTIFIC MEETINGS/SESSIONS (LAST 6 YEARS):
Convener of sessions at Interpore (2 sessions in 2017, 1 in 2018, 1 in 2020, 2 in 2021, 1 in 2022), AGU (1 in 2016, 1 in 2017), EGU(1 in 2017, 1 in 2018, 1 in 2021, 1 in 2022), CMWR (2 in 2018, 1 in 2020, 1 in 2022); member of the Organization Committee for CMWR 2018 (Saint-Malo, France), as well as for the 3rd (2015) and 4th (2018) Cargèse Summer School on Flow and Transport in Porous and Fractured Media (Cargèse, Corsica, France) ; main organizer of the Rennes Interdisciplinary School on Complex Systems (Rennes, France), held every year (2013-2016).

SCIENTIFIC COMMUNICATION:
26 invited talks at international Conferences and Workshops since 2004, 183 contributed talks to international conference, 79 of which presented by me.
25 invited seminars given outside of my home institution since 2002, including 13 abroad. Last 5 years:

1. Mars 2022: Engineering Department of Univ. Bologna (Italy), «Coupled flow and transport of electrical charges in geological fractures».
2. Décembre 2021: Institut de Mécanique des Fluides de Toulouse (France), «Solubility trapping of CO_2 in geological formations: convective dissolution from pore scale to aquifer scale».
3. Avril 2021: PoreLab (Norvège), online seminar, «Choatic advection/mixing in 3D granular porous media».
4. Mai 2021: Institut de Mécanique des Fluides de Toulouse (France), «Complex flows and reactive transport in subsurface permeable media: two studies based on analog experiments».
5. Avril 2021: PoreLab lecture, NTNU (Trondheim) & UiO (Oslo) & en visioconférence, «Chaotic advection/mixing in 3D granular porous media».
6. December 2019: Physics Faculty-IMRE, University of Havana (Cuba), «Transport, mixing and reactions of solutes in subsurface porous media: upscaling and quantification from electrical measurements».
7. December 2019: Physics Faculty-IMRE, University of Havana (Cuba), «Rayleigh-Taylor instability in a granular porous medium: pore scale experiment and numerical simulation».
8. May 2019: Faculty of Engineering, Department of Earth Science & Engineering, Imperial College London (UK), «Coupled flow and transport of electrical charges in porous and fractured media».
9. February 2019: Institut de Physique du Globe, University Sorbonne Paris-Cité, Paris (France): «Solute transport, mixing and reactions in subsurface porous media: upscaling and quantification from electrical measurements».
10. July 2018: Institute PHENIX (UMR8234), Univ. Pierre et Marie Curie, Paris (France), «Vapor transport in clay powders: cationic control of normal vs. anomalous diffusion».
11. January 2018: Department of Mechanical Engineering, PUC-Rio, Rio de Janeiro (Brésil), «Foam flows in porous media: preferential paths, local intermittency and evolution of the bubble size distribution».
12. November 2017: Subsurface Environmental Processes, ETH Zürich, Zürich (Suisse), «Foam flows in porous media: preferential paths, intermittency and non-stationary bubble size distributions».
13. May 2016: Earth & Environmental Sciences, Los Alamos National Laboratory (LANL), «Foam flows in analog porous media».
14. December 2015: Biological and Ecological Engineering, Oregon State University (OSU), «The flow of a foam in a two-dimensional porous medium».

CITATION RECORD: 63 articles published, 5 manuscripts under review. See full publication list.
ISIS Web of Science (Web of Science / *Google Scholar*) on June 20th 2022: 59 (61) publications, 1891 (1993 / 2672) citations, 30.1 (30.1) citations per article, h-index 25 (24 / *29*).

INVITATIONS AND AWARDS (LAST 10 YEARS):
Invited Professor at Univ. Bologna, Italy (2022, 1 month); Invited Researcher at NTNU Trondheim, Norway (2019 and 2020, one month per year), University of Lausanne (UNIL) (2014, 3 weeks), and the Center of Advanced Studies of the Norwegian Academy of Science (May 2012, 1 month).
Award for Student Supervision and Research (Prime d'Encadrement Doctoral et de Recherche, 2017-2020) and Award for Excellence in Research (Prime d'Excellence, 2013-2016), both awarded to the best 15% of applicants nationally.

10 KEY PUBLICATIONS (LAST 10 YEARS):
PhD students and postdocs (co-)supervized by me are indicated by * and †, respectively.

- J.-R. de Dreuzy, **Y. Méheust** & G Pichot (2012), Influence of fracture scale heterogeneity on the flow properties of three-dimensional Discrete Fracture Networks (DFN), *J. Geophys. Res.* **117**, B11207.
- P. de Anna*, J. Jimenez-Martinez†, H. Tabuteau, R. Turuban*, T. Le Borgne, M. Derrien and **Y. Méheust** (2014), Mixing and reaction kinetics in porous media: an experimental pore scale quantification, *Environ. Sci. Tech.* **48**, 508-516.
- J. Jimenez-Martinez†, P. de Anna*, H. Tabuteau , R. Turuban*, T. Le Borgne, and **Y. Méheust** (2015), Pore-scale mechanisms for the enhancement of mixing in unsaturated porous media and implications for chemical reactions, *Geophys. Rev. Lett.* **42**(13), 5316-5324.
- A. Ferrari*, J. Jimenez-Martinez†, T. Le Borgne, **Y. Méheust**, and I. Lunati (2015), Challenges in modeling unstable two phase flow experiments in porous micromodels, *Water Resour. Res.* **51**(3), 1381-1400.
- B. Géraud†, S. A. Jones†, I. Cantat, B. Dollet and **Y. Méheust** (2016), The flow of a foam in a two-dimensional porous medium, *Water Resour. Res.* **52**, 773-790.
- B. Géraud†, **Y. Méheust**, I. Cantat, B. Dollet (2017), Lamella Division in a Foam Flowing through a Two-Dimensional Porous Medium: A Model Fragmentation Process, *Phys. Rev. Lett.* **118**(9), 098003.
- R. Turuban*, D. R. Lester, T. Le Borgne, & **Y. Méheust** (2018), Space-Group Symmetries Generate Chaotic Fluid Advection in Crystalline Granular Media, *Phys. Rev. Lett.* **120**(2), 024501.
- R. Turuban*, D. R. Lester, H. Heyman†, T. Le Borgne & **Y. Méheust** (2019), Chaotic Mixing in Crystalline Granular Media, *J. Fluid Mech*. **871**, 562-594.
- J. Heyman†, D. R. Lester, R. Turuban*, **Y. Méheust**, & T. Le Borgne (2020), Stretching and folding sustain microscale chemical gradients in porous media., *Proc. Nat. Acad. Sci.* **117** (24), 13359-13365.
- J. Dhar, P. Meunier, F. Nadal, & **Y. Méheust** (2022), Convective dissolution of carbon dioxide in two- and three-dimensional porous media: The impact of hydrodynamic dispersion, *Phys. Fluids* **3**4, 064114.

June 24th, 2022.