ANTOINE B. JACQUEY

Research Associate
Tufts University

14 Ward St, Somerville, MA 02143, USA.
+1 (857) 285-0608
antoine.jacquey@tufts.edu
Google scholar
0000-0002-6259-4305
Antoine_Jacquey
@antoine_jacquey
linkedin
ajacquey
https://ajacquey.github.io

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RESEARCH INTERESTS

My research interests lie primarily in the dynamics controlling the deformation of porous reservoir rocks and faults at various scales. Understanding the deformation induced by anthropogenic activities in engineered geological reservoirs and on surrounding geological faults is key to improve environmental safety and sustainability of relevant subsurface energy technologies in the context of climate change such as geothermal energy production or geological CO_2 storage. My multidisciplinary approach combines fundamental theoretical and modeling techniques to describe the multiphysics coupling controlling the deformation of porous rocks and slip on fault planes in response to anthropogenic forcing conditions at various pressure and temperature conditions as relevant to develop strategies for mitigating induced hazards.

ACADEMIC POSITIONS

Sep. 2022–present — **Research Associate** — **Tufts University**, USA
Fluid-induced seismic and aseismic fault slip
Advisor: Prof. Robert Viesca

Mar. 2021–Sep. 2022 — **Postdoctoral Scholar**
Fluid-induced aseismic fault slip
Advisor: Prof. Robert Viesca

Mar. 2020–Feb. 2021 — **Postdoctoral Associate** — **Massachusetts Institute of Technology**, USA
Multiphase flow poromechanics for induced seismicity problems
Advisor: Prof. Ruben Juanes

Aug. 2019–Nov. 2019 — **Visiting Scholar** — **University of New South Wales**, Australia
Thermomechanics for deriving constitutive mechanical models for porous rocks
Advisor: Prof. Klaus Regenauer-Lieb

Apr. 2019–Jun. 2019 — **Visiting Scholar** — **Duke University**, USA
Regularization techniques for strain localization problems
Advisor: Prof. Manolis Veveakis

Feb. 2017–Feb. 2020 — **Postdoctoral Fellow** — **GFZ German Research Center for Geosciences**
Helmholtz Earth System Modelling project: modeling deformation across the lithosphere
H2020 DESTRESS project: modeling stimulation treatment of a geothermal site
Advisors: Dr. Mauro Cacace and Dr. Guido Blöcher

Feb. 2014–Jan. 2017 — **Doctoral Student** — **GFZ German Research Center for Geosciences**
RWTH Aachen University, Germany
Numerical modeling of Thermo-Hydro-Mechanical processes in faulted geothermal reservoirs
Advisors: Prof. Magdalena Scheck-Wenderoth and Prof. Florian Wellmann

Sep. 2013–Jan. 2014 — **Research intern** — **Institute for Energy Technology**, Norway
Numerical modeling of heat transfer within a geothermal sedimentary reservoir
Advisor: Dr. Nina Simon, Dr. Alban Souche, Dr. Magnus Wangen

Apr. 2012–Sep. 2012 — **Research intern** — **Royal Institute of Technology**, Sweden
Numerical modeling of vertical U-tube ground heat exchanger
Advisor: Prof. Björn Palm

EDUCATION

2017	**Doctoral degree** (Dr.-Ing.) in Geosciences	**RWTH Aachen University**, Germany **GFZ German Research Center for Geosciences**
	Thesis: *Coupled thermo-hydro-mechanical processes in geothermal reservoirs: a multiphysic and multiscale approach linking geology and 3D numerical modelling* Advisors: Prof. Magdalena Scheck-Wenderoth, Prof. Florian Wellmann *With distinctions*	
2014	**Engineer degree** (M.Sc.) in Energy & Process Eng.	**École des Mines de Saint-Étienne**, France
	Including 1 year exchange at the Technical University of Berlin M.Sc. thesis: *Numerical modeling of heat transfer within a geothermal sedimentary reservoir* Advisors: Dr. Nina Simon, Prof. Daniel Garcia	
2007–2010	**Classes Préparatoires aux Grandes Ecoles** (CPGE) *Mathematics, Physics, and Chemistry*	**Lycée Joffre**, France

AWARDS & HONORS

2019	EGU Roland Schlich Travel Support for Early Career Scientists
2018	Helmholtz Doctoral Award, field Energy, Helmholtz Association
2018	Heitfeld Award (outstanding contribution in the field of Geosciences), RWTH Aachen
2018	Borchers Badge (Doctoral thesis with distinctions), RWTH Aachen
2015	Zero-fee grant, EURO-Conference for Rock Physics and Geomechanics

TEACHING, MENTORING & OUTREACH

2021	Teaching Assistant, “Fluid Mechanics” (Prof. R. Viesca), Tufts University
2019	Guest lecture, “Geothermal Engineering” (Prof. K. Regenauer-Lieb), UNSW
2019	Guest lecture, “Modelling lithosphere structure and dynamics” (S. Brune and J. Sippel), Potsdam University
2018–2019	Teaching Assistant, “Rock and Reservoir Mechanics” (M. Cacace and G. Blöcher), TU Berlin
2017–2018	Teaching Assistant, “Rock and Reservoir Mechanics” (M. Cacace and G. Blöcher), TU Berlin
2018	Supervision of a student assistant, Michael Pitz (master student), GFZ Potsdam and TU Berlin
2018	Participation to outreach event “Long night of science”, GFZ Potsdam
2017	Instructor for unofficial MOOSE training workshop, TU Münich
2017	Participation to outreach event “Long night of science”, GFZ Potsdam
2016–2017	Supervision of a student assistant, Valentin Geißler (master student), GFZ Potsdam and TU Berlin
2010–2014	Member of Min’Bot: robotic and electronic outreach events in primary/middle schools, Saint-Étienne region

INVITED TALKS & SEMINARS

2018	European Geothermal Workshop 2018, Strasbourg
2017	Hydrogeology Seminars, TU Munich
2017	Aachen Institute for Advanced Study in Computational Engineering Science, RWTH Aachen

SUCCESFUL PROPOSALS & GRANTS

2022	Southern California Earthquake Center (SCEC) award # 22142, *Nucleation and arrest of fluid-induced aseismic fault slip*, $25,000, (co-PI, PI: R. C. Viesca)
2019–2020	Computing time on JUWELS HPC, Jülich Supercomputing Centre *Quantitative HPC Modelling of Sedimentary Basin Systems*, 5 millions core–h, (co-PI, PI: M. Cacace)
2016	Experimental funds, Aachen Institute for Advanced Study in Computational Engineering Science *Microstructure Analysis of Sandstones Samples GFZ/AICES*, 9,100 €, (PI)

SUBMITTED PAPERS

1. **Jacquey, A. B.** and RC Viesca (2022). Nucleation and arrest of fluid-induced aseismic slip. *Earth and Space Science Open Archive*, 13. DOI: 10.1002/essoar.10512431.1.

PEER-REVIEWED PAPERS

1. **Jacquey, A. B.**, H Rattez, and M Veveakis (2021). Strain localization regularization and patterns formation in rate-dependent plastic materials with multiphysics coupling. *Journal of the Mechanics and Physics of Solids*. DOI: 10.1016/j.jmps.2021.104422.
2. **Jacquey, A. B.** and K Regenauer-Lieb (2021). Thermomechanics for geological, civil engineering and geodynamic applications: Rate-dependent critical state line models. *Rock Mechanics and Rock Engineering*. DOI: 10.1007/s00603-021-02397-z.
3. **Jacquey, A. B.**, K Regenauer-Lieb, and M Cacace (2021). Thermomechanics for geological, civil engineering and geodynamic applications: Numerical implementation and application to the Bentheim sandstone. *Rock Mechanics and Rock Engineering*. DOI: 10.1007/s00603-021-02582-0.
4. Regenauer-Lieb, K, M Hu, C Schrank, X Chen, SP Clavijo, U Kelka, A Karrech, O Gaede, T Blach, H Roshan, and **Jacquey, A. B.** (2021). Cross-diffusion waves resulting from multiscale, multi-physics instabilities: theory. *Solid Earth*. DOI: 10.5194/se-12-869-2021.
5. Regenauer-Lieb, K, M Hu, C Schrank, X Chen, SP Clavijo, U Kelka, A Karrech, O Gaede, T Blach, H Roshan, **Jacquey, A. B.**, P Szymczak, and Q Sun (2021). Cross-Diffusion Waves as a trigger for multiscale, multiphysics Instabilities: application to earthquakes. *Solid Earth*. DOI: 10.5194/se-12-1829-2021.
6. **Jacquey, A. B.** and M Cacace (2020). Multiphysics Modeling of a Brittle-Ductile Lithosphere: 1. Explicit Visco-Elasto-Plastic Formulation and Its Numerical Implementation. *Journal of Geophysical Research: Solid Earth*. DOI: 10.1029/2019JB018474.
7. **Jacquey, A. B.** and M Cacace (2020). Multiphysics Modeling of a Brittle-Ductile Lithosphere: 2. Semi-brittle, Semi-ductile Deformation and Damage Rheology. *Journal of Geophysical Research: Solid Earth*. DOI: 10.1029/2019JB018475.
8. Blöcher, G, C Kluge, H Milsch, M Cacace, **Jacquey, A. B.**, and J Schmittbuhl (2019). Permeability of matrix-fracture systems under mechanical loading — constraints from laboratory experiments and 3D numerical modelling. *Advances in Geosciences*. DOI: 10.5194/adgeo-49-95-2019.
9. Blöcher, G, M Cacace, **Jacquey, A. B.**, A Zang, O Heidbach, H Hofmann, C Kluge, and G Zimmermann (2018). Evaluating Micro-Seismic Events Triggered by Reservoir Operations at the Geothermal Site of Groß Schönebeck (Germany). *Rock Mechanics and Rock Engineering*. DOI: 10.1007/s00603-018-1521-2.
10. **Jacquey, A. B.**, L Urpi, M Cacace, G Blöcher, G Zimmermann, and M Scheck-Wenderoth (2018). Far field poroelastic response of geothermal reservoirs to hydraulic stimulation treatment: Theory and application at the Groß Schönebeck geothermal research facility. *International Journal of Rock Mechanics and Mining Sciences*. DOI: 10.1016/j.ijrmms.2018.08.012.
11. Cacace, M and **Jacquey, A. B.** (2017). Flexible parallel implicit modelling of coupled thermal-hydraulic-mechanical processes in fractured rocks. *Solid Earth*. DOI: 10.5194/se-8-921-2017.
12. **Jacquey, A. B.**, M Cacace, and G Blöcher (2017). Modelling coupled fluid flow and heat transfer in fractured reservoirs: Description of a 3D benchmark numerical case. *Energy Procedia*. DOI: 10.1016/j.egypro.2017.08.227.
13. **Jacquey, A. B.**, M Cacace, G Blöcher, H Milsch, F Deon, and M Scheck-Wenderoth (2017). Processes Responsible for Localized Deformation within Porous Rocks: Insights from Laboratory Experiments and Numerical Modeling. *Poromechanics 2017 - Proceedings of the 6th Biot Conference on Poromechanics*. DOI: 10.1061/9780784480779.225.
14. **Jacquey, A. B.**, M Cacace, G Blöcher, N Watanabe, E Huenges, and M Scheck-Wenderoth (2016). Thermo-poroelastic numerical modelling for enhanced geothermal system performance: Case study of the Groß Schönebeck reservoir. *Tectonophysics*. DOI: 10.1016/j.tecto.2015.12.020.
15. Klitzke, P, M Luzi-Helbing, JM Schicks, M Cacace, **Jacquey, A. B.**, J Sippel, M Scheck-Wenderoth, and JI Faleide (2016). Gas Hydrate Stability Zone of the Barents sea and Kara sea Region. *Energy Procedia*. DOI: 10.1016/j.egypro.2016.10.005.
16. **Jacquey, A. B.**, M Cacace, G Blöcher, and M Scheck-Wenderoth (2015). Numerical Investigation of Thermoelastic Effects on Fault Slip Tendency during Injection and Production of Geothermal Fluids. *Energy Procedia*. DOI: 10.1016/j.egypro.2015.07.868.

17. **Jacquey, A. B.**, M Cacace, G Blöcher, N Watanabe, and M Scheck-Wenderoth (2015). Hydro-Mechanical Evolution of Transport Properties in Porous Media: Constraints for Numerical Simulations. *Transport in Porous Media*. DOI: 10.1007/s11242-015-0564-z.

PAPERS IN PREPARATION

1. **Jacquey, A. B.**, M Veveakis, RC Viesca, and R Juanes (in prep.). Stability regimes of fault slip controlled by dissipative and dilatant deformation.

OPEN-SOURCE SOFTWARE

1. **Jacquey, A. B.** (2022). *ajacquey/DDMFrictionalSlip.jl: v1.0.0*. DOI: 10.5281/zenodo.6987094.
2. **Jacquey, A. B.** (2020). *LEMUR (muLtiphysics of gEomaterials using MUltiscale Rheologies)*. DOI: 10.5281/zenodo.4073943.
3. **Jacquey, A. B.** and M Cacace (2019). *LYNX: Lithosphere dYnamic Numerical toolboX, a MOOSE-based application*. DOI: 10.5281/zenodo.3355376.
4. **Jacquey, A. B.** and M Cacace (2017). *GOLEM, a MOOSE-based application for modelling coupled Thermo-Hydro-Mechanical processes in faulted geothermal reservoirs*. DOI: 10.5281/zenodo.999401.

PH.D. THESIS

1. **Jacquey, A. B.** (2017). "Coupled thermo-hydro-mechanical processes in geothermal reservoirs: a multiphysic and multiscale approach linking geology and 3D numerical modelling". PhD thesis. RWTH Aachen University. DOI: 10.18154/RWTH-2017-09790.

PROFESSIONAL SERVICE

Convener	EGU General Assembly 2018 EGU General Assembly 2017 EGU General Assembly 2016
Reviewer	*Communications Earth & Environment* ; *Geophysical Research Letters* ; *Geophysical Journal International* *Transport in Porous Media* ; *Geofluids* ; *Journal of Hydrology* ; *Geophysics* ; *Computers & Geosciences* *International Journal of Rock Mechanics and Mining Sciences* ; *Rock Mechanics and Rock Engineering* *Geothermal Energy* ; *Environmental Earth Sciences* ; *Energy Procedia* ; *Applied Energy*.

PROFESSIONAL ASSOCIATIONS

2015–present	European Geosciences Union
2018–present	American Geophysical Union

LANGUAGE SKILLS

English (fluent), French (native), German (professional working proficiency)

REFERENCES

Prof. Robert Viesca
Department of Civil & Environmental Engineering,
Tufts University, USA
https://engineering.tufts.edu/people/faculty/robert-viesca
✉: robert.viesca@tufts.edu

Prof. Manolis Veveakis
Multiphysics Geomechanics Laboratory,
Civil and Environmental Engineering Department,
Duke University, USA
https://mglab.pratt.duke.edu
✉: manolis.veveakis@duke.edu

Prof. Ruben Juanes
Department of Civil & Environmental Engineering,
Department of Earth, Atmospheric and Planetary Sciences,
Massachusetts Institute of Technology, USA
http://juanesgroup.mit.edu
✉: juanes@mit.edu

Prof. Magdalena Scheck-Wenderoth
Section 4.5: Basin Modelling,
Department 4: Geosystems,
GFZ Potsdam, German Research Centre for Geosciences, Germany
RWTH Aachen University, Germany
https://www.gfz-potsdam.de/en/staff/magdalena-scheck-wenderoth/sec40/
✉: magdalena.scheck-wenderoth@gfz-potsdam.de

Dr. Mauro Cacace
Section 4.5: Basin Modelling,
Department 4: Geosystems,
GFZ Potsdam, German Research Centre for Geosciences, Germany
https://www.gfz-potsdam.de/en/staff/mauro-cacace/
✉: mauro.cacace@gfz-potsdam.de

Prof. Florian Wellmann
Computational Geoscience and Reservoir Engineering,
Georesources and Materials Engineering,
RWTH Aachen University, Germany
https://www.cgre.rwth-aachen.de/
✉: florian.wellmann@cgre.rwth-aachen.de