Antoine B. Jacquey

Postdoctoral Scholar

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Research interests

My research interests lie primarily in the dynamics controlling the deformation of porous reservoir rocks at various scales. Understanding the deformation induced by anthropogenic activities in engineered geological reservoirs 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 but also to design innovative engineering techniques to target unconventional geological resources such as supercritical geothermal reservoirs. My multidisciplinary approach combines fundamental theoretical and modeling techniques to describe the multiphysics coupling controlling the deformation of porous rocks in response to anthropogenic forcing conditions at various pressure and temperature conditions as relevant to develop strategies for mitigating induced hazards.

Academic positions

Mar. 2021–present	**Postdoctoral Scholar** *Fluid-induced seismicity and aseismic slip* Advisor: Prof. Robert Viesca	**Tufts University**, USA
Mar. 2020–Feb. 2021	**Postdoctoral Associate** *Multiphase flow poromechanics for induced seismicity problems* Advisor: Prof. Ruben Juanes	**Massachusetts Institute of Technology**, USA
Aug. 2019–Nov. 2019	**Visiting Scholar** *Thermomechanics for deriving constitutive mechanical models for porous rocks* Advisor: Prof. Klaus Regenauer-Lieb	**University of New South Wales**, Australia
Apr. 2019–Jun. 2019	**Visiting Scholar** *Regularization techniques for strain localization problems* Advisor: Prof. Manolis Veveakis	**Duke University**, USA
Feb. 2017–Feb. 2020	**Postdoctoral Fellow** *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	**GFZ German Research Center for Geosciences**
Feb. 2014–Jan. 2017	**Doctoral Student** *Numerical modeling of Thermo-Hydro-Mechanical processes in faulted geothermal reservoirs* Advisors: Prof. Magdalena Scheck-Wenderoth and Prof. Florian Wellmann	**GFZ German Research Center for Geosciences** **RWTH Aachen University**, Germany
Sep. 2013–Jan. 2014	**Research intern** *Numerical modeling of heat transfer within a geothermal sedimentary reservoir.* Advisor: Prof. Nina Simon	**Institute for Energy Technology**, Norway

Education

2017	**Doctoral degree** (Dr.-Ing.) in 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*	**RWTH Aachen University**, Germany **GFZ German Research Center for Geosciences**
2014	**Engineer degree** (M.Sc.) in Energy & Process Eng. Including 1 year exchange at the Technical University of Berlin M.Sc. thesis: *Numerical modeling of heat transfer within a geothermal sedimentary reservoir* Advisors: Prof. Nina Simon, Prof. Daniel Garcia	**École des Mines de Saint-Étienne**, France
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

2019	Guest lecture, "Geothermal Engineering" (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

2021	Multiphysics Geomechanics Laboratory, Duke University (scheduled)
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

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)

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, and R Juanes (in prep.). Slip stability regimes of dilatant creeping faults.

Open-source software

1. **Jacquey, A. B.** (2020). *LEMUR (muLtiphysics of gEomaterials using MUltiscale Rheologies)*. DOI: 10.5281/zenodo.4073943.
2. **Jacquey, A. B.** and M Cacace (2019). *LYNX: Lithosphere dYnamic Numerical toolboX, a MOOSE-based application*. DOI: 10.5281/zenodo.3355376.
3. **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	*Geophysical Research Letters*; *Transport in Porous Media* ; *Geophysical Journal International* ; *Geofluids* *Journal of Hydrology* ; *International Journal of Rock Mechanics and Mining Sciences* ; *Geophysics* *Computers & Geosciences* ; *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
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