September 2023

ADAM J. HAWKINS, PH. D.

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Ithaca, New York 14853

PROFESSIONAL EDUCATION AND TRAINING

Postdoctoral Fellow 2019-present
Robert Fredrick Smith School of Chemical and Biomolecular Engineering
College of Engineering
Cornell University
Host: Jefferson W. Tester, Cornell Energy Institute

TomKat Center Postdoctoral Fellow in Sustainable Energy 2017-2019
Energy Resources Engineering
School of Earth, Energy & Environmental Sciences
Stanford University
Host: Roland N. Horne, Stanford Geothermal Program

Ph. D. Geological Sciences 2013-2017
College of Engineering
Cornell University
"Reactive Tracers for Characterizing Fractured Geothermal Reservoirs"
Committee: Jefferson W. Tester, Lawrence M. Cathles, III, Donald L. Koch

M. S. Geology 2010-2013
College of Natural Sciences & Mathematics
California State University, Long Beach,
"Measurement of the Spatial Distribution of Heat Exchange in a Geothermal Analog Bedrock Site using Fiber-Optic Distributed Temperature Sensing"
Advisor: Matthew W. Becker

B. S. Geology 2005-2009
College of Letters & Science
University of California, Davis

HONORS AND AWARDS

Geothermal Design Challenge 2021
3rd place - "Big Red Heat Team"
Hosted by the *Department of Energy – National Renewable Energy Laboratory (NREL)*

Best ePoster Award (Okoroafor et al., 2020) 2020
"Geomechanical considerations in modeling heat extraction from enhanced geothermal systems"
Geothermal Resources Council Annual Meeting

Editor's Choice Award (Hawkins et al., 2018) 2018
"Inert and adsorptive tracer tests for field measurement of flow-wetted surface area"
Water Resources Research – Awarded to "~1% of published articles"

Excellence in Research 2017
Earth and Atmospheric Sciences, Cornell University

TomKat Center Postdoctoral Fellowship in Sustainable Energy 2016
TomKat Center for Sustainable Energy
Stanford University

NSF Fellowship – Earth Energy Systems 2013
National Science Foundation's (NSF) Integrative Graduate Education and Research Traineeship (IGERT), Cornell University, PI: Jefferson W. Tester

Graduate Student Honors 2013
California State University, Long Beach, Department of Geological Sciences

Research Scholarship 2011
Groundwater Research Association of California

Academic Scholarship 2009
Scholarship in Geology and Natural Sciences (SIGNS), University of California, Davis

PUBLICATIONS

Peer-reviewed Journal Publications

[18] Rangel-Jurado, N., **Hawkins, A. J.**, Fulton, P. M. (2023) Influence of extreme fracture flow channels on the thermal performance of open-loop geothermal systems at commercial scale. *Geothermal Energy*, 11, https://doi.org/10.1186/s40517-023-00261-7.

[17] Zhang, Y., Dekas, A. E., **Hawkins, A. J.**, Carlo Primo, J., Gorbatenko, O. (2022b) Comparison of microbial profiling and tracer testing for the characterization of injector-producer interwell connectivities. *Water*, 14, 2921. https://doi.org/10.3390/w14182921.

[16] Zhang, Y., Horne, R. N., **Hawkins, A. J.**, Carlo Primo, J., Gorbatenko, O., Dekas, A. E. (2022a) Geological activity shapes the microbiome in deep-subsurface aquifers by advection. *Proceedings of the National Academy of Sciences*, 119, e2113985119.

[15] Suzuki, A., Bjarkason, E. K., Yamaguchi, A., **Hawkins, A. J.**, Hashida, T. (2022) Estimation of flow-channel structures with uncertainty quantification: Validation by 3D-printed fractures and field application. *Geothermics*, 105, 102480.

[14] Beckers, K., Rangel-Jurado, N., Chandraskear, H., **Hawkins, A. J.**, Fulton, P. M., Tester, J. W. (2022) Techno-Economic Performance of Closed-Loop Geothermal Systems for Heat Production and Electricity Generation, *Geothermics*, 100, 102318, https://doi.org/10.1016/j.geothermics.2021.102046.

[13] **Hawkins, A. J.**, Bender, J. T., Grooms, R., Schissel, C. J., Tester, J. W. (2021) Temperature-responsive smart tracers for field-measurement of inter-well thermal evolution: Heterogeneous kinetics and field demonstration, *Geothermics*, 92, 102046, https://doi.org/10.1016/j.geothermics.2021.102046.

[12] Tester, J., Beckers, K., **Hawkins, A. J.**, Lukawski, M. (2021) The evolving role of geothermal energy for decarbonizing the United States, *Energy & Environmental Science*, 14, 6211-6241, doi:10.1039/d1ee02309h

[11] Wu, H. Fu, P., **Hawkins, A. J.**, Tang, H., Morris, J. P. (2021b) Predicting thermal performance of an enhanced geothermal system from tracer tests in a data assimilation framework, *Water Resources Research*, 57, https://doi.org/10.1029/2021.

[10] Zhang, Y., Hartung, M., **Hawkins, A. J.**, Dekas, A. E., Li, K., Horne, R. N. (2021) DNA tracer transport through porous media – The effect of DNA length and adsorption, *Water Resources Research*, 57, 1-15, e2020WR028382, https://doi.org/10.1029/2020WR028382.

[9] Wu, H., Fu, P., Morris, J. P., Mattson, E. D., Neupane, G., Smith, M. M., **Hawkins, A. J.**, Zhang, Y., Kneafsey, T., the EGS Collab Team (2021a) Characterization of flow and transport in a fracture network at the EGS Collab field experiment through stochastic modeling of tracer recovery, *Journal of Hydrology*, 593, https://doi.org/10.1016/j.jhydrol.2020.125888.

[8] **Hawkins, A. J.**, Fox, D. B., Koch, D. L., Becker, M. W., Tester, J. W. (2020) Predictive inverse model for advective heat transfer in a short-circuited fracture: Dimensional analysis, machine learning, and field demonstration, *Water Resources Research*, 56, e2020WR027065. https://doi.org/10.1029/2020WR027065.

[7] Zhang, Y., Dekas, A. E., **Hawkins, A. J.,** Parada, A. E., Gorbatenko, O., Li, K., Horne, R. N. (2020) Microbial community composition in deep-subsurface reservoir fluids reveals natural interwell connectivity. *Water Resources Research*, 56, doi:/10.1029/2019WR025916.

[6] Sinclair, L., Brown, J., May, D., Guilvaiee, B., **Hawkins, A.**, Cathles, L. (2020) Optimization of fluorescence and surface adsorption of citric acid/ethanolamine carbon nanoparticles for subsurface tracers, *Carbon*, doi: https://doi.org/10.1016/j.carbon.2020.07.024.

[5] Schoenball, M., Ajo-Franklin, J. B., Blankenship, D., Chai, C., Chakravarty, A., Dobson, P., **et al.** (2020) Creation of a mixed-mode fracture network at mesoscale through hydraulic fracturing and shear stimulation, *Journal of Geophysical Research: Solid Earth*, 125, e2020JB019807. https://doi.org/10.1029/2020JB019807.

[4] Beentjes, I., Bender, J. T., **Hawkins, A. J.**, Tester, J. W. (2019) Chemical dissolution drilling of Barre granite using a sodium hydroxide enhanced supercritical water jet, *Rock Mechanics and Rock Engineering*, https://doi.org/10.1007/s00603-019-01912-7.

[3] **Hawkins A. J.**, Becker, M. W., Tester, J. W. (2018) Inert and adsorptive tracer tests for field measurement of flow-wetted surface area, *Water Resources Research*, 54, doi: 10.1029/2017WR021910. (**Winner – Editor's Choice Award)**

[2] **Hawkins A. J.**, Becker, M., Tsoflias, G. (2017b) Evaluation of inert tracers in a bedrock fracture using ground penetrating radar and thermal sensors, *Geothermics*, 67, doi: 10.1016/j.geothermics.2017.01.006.

[1] **Hawkins, A. J.**, Fox, D, Becker, M., Tester, J. (2017a) Measurement and simulation of heat exchange in fractured bedrock using inert and thermally degrading tracers, *Water Resources Research*, 53, doi: 10.1002/2016WR019617.

Book Chapters

Hawkins, A. J., Tester, J. W. (2016) *Geothermal Systems*. In: White W. (ed) Earth Sciences Series: Encyclopedia of Geochemistry, Version 2. Springer, Switzerland.

EMPLOYMENT EXPERIENCE

Postdoctoral Fellow 2019-present
Smith School of Chemical and Biomolecular Engineering, Cornell University

Consultant 2017-present
Heateon: Renewable Energy Solutions, Ghent, Belgium (HQ)

TomKat Center Postdoctoral Fellow in Sustainable Energy 2017-2019
TomKat Center for Sustainable Energy, Stanford University

Research Assistant 2015-2017
Smith School of Chemical and Biomolecular Engineering, Cornell University

Teaching Assistant 2014
Smith School of Chemical and Biomolecular Engineering, Cornell University

NSF IGERT Fellow 2013-2015
Earth Energy IGERT, PI: Jefferson W. Tester, Cornell University

Staff Geologist 2012-2013
AMEC, Irvine, California

Research Assistant 2010-2012
Department of Geological Sciences, California State University, Long Beach

Staff Geologist 2010
AEI Consultants, Walnut Creek, California

INVITED LECTURES AND TEACHING EXPERIENCE

"Active Tracers for Hydraulic Control of Cooled Short Circuits: Bench-Scale Demonstration and Forward Modeling," **Society of Petroleum Engineers Geothermal Workshop**, Galveston, Texas, August 15, 2023.

"Fires from the Deep: Earth's Internal Heat as a Solution to the Global Energy Problem," **Public Works Invited Talk**, Ithaca, New York, July 5th, 2023.

CHEME 6663: Energy Module Series: Geothermal Energy, **Cornell University**, March 1st – 31st, 2023.

"Earth's Internal Heat as a Solution to the Global Energy Problem," DSOC 3150: **Climate Change & Global Development: Living in the Anthropocene**, Cornell University, November 15th, 2022.

CHEME 6679: Energy Module Series: Energy Storage, **Cornell University**, October 10th – November 9th, 2022.

"Geothermal Energy and Cornell's Earth Source Heat," 2022 Nature-Society Workshop, **Department of Global Development**, Cornell University, October 8th, 2022.

CHEME 6663: Energy Module Series: Geothermal Energy, **Cornell University**, March 7th – April 1st, 2022.

CHEME 6663: Energy Module Series: Geothermal Energy, **Cornell University**, April 7th – 21st, 2021.

"Beneath our Feet: Geothermal Energy and its Transformative Potential for Heating Homes, Campuses and Entire Cities," **New Bedford Science Café**, New Bedford, Massachusetts, June 9th, 2020.

"Reservoir Characterization and Predictive Models," CHEME 6680: Earth Source Heat at Cornell, **Cornell University**, April 15th, 2020.

"Fluid Flow and Heat Transfer in Porous Media," CHEME 6680: Earth Source Heat at Cornell, **Cornell University**, April 13th, 2020.
"The Role of Earth's Subsurface in a Low-carbon World," Department of Energy and Mineral Engineering, **Pennsylvania State University**, State College, Pennsylvania, February 27th, 2020.
"Unknown Interfacial Surface Area at Low Reynolds Number," Institute of Fluid Science, **Tohoku University**, Sendai, Miyagi, Japan, December 16th, 2019.
"Earth's Internal Heat as a Sustainable Energy Resource," **Rainbow Mansion Technical Talk**, Cupertino, California, July 14, 2019.
"Heat and Reactive Transport Theory for Fractured Crystalline Rocks: Implications for Geothermal, Nuclear, and the Energy-Water-Environment Nexus," **TomKat Center for Sustainable Energy**, Stanford University, June 12th, 2019.
"Tracer Testing in Geothermal Reservoirs," Energy 269: Geothermal Reservoir Engineering, Energy Resources Engineering, **Stanford University**, May 28-30, 2019.
"Bridging the Scale-gap in Geothermal Reservoir Engineering," Civil Engineering and Geosciences, **Delft University of Technology**, Delft, Netherlands, February 1st, 2019.
"A Summary of Tracer and Thermal Tests Conducted at the Altona Field Laboratory," Institute of Fluid Science, **Tohoku University**, Sendai, Miyagi, Japan, December 21st, 2018.
"Reactive Tracers for Characterizing Fractured Geothermal Reservoirs," **SUPRI-B**, Energy Resources Engineering, Stanford University, November 7th, 2018.
"Earth's Heat as a Sustainable Energy Resource," **TomKat Center for Sustainable Energy**, Stanford University, January 22nd, 2018.
"Reactive Tracers for Characterizing Fractured Geothermal Reservoirs," **Lawrence Berkeley National Laboratory**, July 26th, 2017.
"Lecture 8: Geothermal Reservoir Stimulation, Characterization, and Modeling," CHEME 6663, Chemical and Biomolecular Engineering, **Cornell University**, October 20th, 2016
"Meso-Scale Field Testing of Reactive Tracers in a Model Geothermal Reservoir," **Reykjavik Energy**, Reykjavik, Iceland, May 9th, 2016.

PROFESSIONAL AFFILIATIONS AND ACADEMIC SERVICE

American Geophysical Union
Member, 2015-Present

Society of Exploration Geophysicists
Member, 2016-Present

Geothermal Rising
Member, 2015-Present
Student Committee Member, 2015

Earth Energy Club, Cornell University
Founding Member, 2016
Treasurer, 2016

Journal referee for:

1. *Energy and Environmental Science (IF: 38.53)*
2. *Earth-Science Reviews (Elsevier) (IF: 12.4)*
3. *Renewable and Sustainable Energy Reviews (Elsevier) (IF: 12.1)*
4. *Applied Energy (Elsevier) (IF: 8.6)*
5. *Energy (Elsevier) (IF: 7.1)*
6. *Process Safety and Environmental Protection (IF: 6.2)*
7. *Communications Engineering* (*Nature*)*(IF: n/a)*
8. *Water Resources Research (AGU) (IF: 4.3)*
9. *Journal of Geophysical Research: Solid Earth (AGU) (IF: 3.8)*
10. *Geothermics (Elsevier) (IF: 3.7)*
11. *Advances in Water Resources (Elsevier) (IF: 3.7)*
12. *Journal of Hydrology (Elsevier) (IF: 3.7)*
13. *Journal of Fluid Mechanics (Cambridge Core) (IF: 3.4)*
14. *Water (MDPI) (IF: 3.1)*
15. *Energies (MDPI) (IF: 3.0)*
16. *Geothermal Energy (Springer) (IF: 2.7)*
17. *Geophysical Journal International (Oxford Academic) (IF: 2.5)*
18. *Arabian Journal of Geosciences (IF:1.8)*
19. *Geofluids (Hindawi) (IF: 1.4)*

WEBSITES

- *Heateon: Renewable Energy Solutions*, Our team. https://heateon.com/About/.
- *TomKat Center for Sustainable Energy*, *Stanford University*, Postdoctoral Fellow Profile. https://tomkat.stanford.edu/postdoc/adam-hawkins.
- *Researchgate Profile*, https://www.researchgate.net/profile/Adam_Hawkins2
- *Linkedin Profile*, https://www.linkedin.com/in/adam-hawkins-7485a285
- https://research.cornell.edu/research/reducing-cost-deep-source-geothermal-energy

MEDIA

- FlowCam Blog Post (2023) FlowCam Helps Cornell University Expand Geothermal Heating Solutions. *Yokogawa Fluid Imaging Technologies*, https://www.fluidimaging.com/blog/flowcam-helps-cornell-university-expand-geothermal-heating-solutions.
- Cornell Research & Innovation (2023) Reducing the Cost of Deep-Source Geothermal Energy. *Cornell Research & Innovation*, https://research.cornell.edu/research/reducing-cost-deep-source-geothermal-energy.
- Thompson, Joanna (2022) Geologic Activity Lets Microbes Mingle Deep Underground. *Scientific American*, November 1, 2022, https://www.scientificamerican.com/article/geologic-activity-lets-microbes-mingle-deep-underground/.
- Keller, Megan (2022) The science behind Cornell's new sustainable energy initiative: Earth Source Heat. *Cornell Daily Sun*, August 31, 2022, https://cornellsun.com/2022/08/31/the-science-behind-cornells-new-sustainable-energy-initiative-earth-source-heat/.
- Broberg, Erin L. (2022) What lives where? And why? Stanford University study at SURF sheds light on the makeup of subsurface microbial communities. *Sanford Underground Research Facility News & Events*, August 22, 2022, https://sanfordlab.org/article/what-lives-where-and-why-stanford-university-study-surf-sheds-light-makeup-subsurface-0.
- Tucker, Danielle T. (2022) Stanford researchers show how geological activity rapidly changes deep microbial communities. *Stanford News*, July 14, 2022, https://news.stanford.edu/2022/07/14/geological-activity-can-rapidly-change-deep-microbial-communities/?fbclid=IwAR1jetVrVwgxnWVhDOmkV8u6jt6-7bBZSWFM0e18-urL-mUA6ZzpSI3xPzQ.

- Kacapyr, S. (2022) Swelling colloids could fix short circuits in geothermal wells. *Cornell Chronicle*, April 26, 2022, https://news.cornell.edu/stories/2022/04/swelling-colloids-could-fix-short-circuits-geothermal-wells.
- Vondracek, C. (2018) Sanford Underground Research Facility studying geothermal fracking. *Rapid City Journal*, November 2, 2018, https://rapidcityjournal.com/news/local/sanford-underground-research-facility-studying-geothermal-fracking/article_ba904f05-b921-59d1-95ab-042b894546c0.html.
- Harianja, D. H. (2017) Beneath Our Feet: Geothermal Energy. *Cornell Research: News & Feature*s, https://research.cornell.edu/news-features/beneath-our-feet-geothermal-energy.

MENTEE ACHIEVEMENTS

- Reeby Puthur
  - SABIC & Arkema Best Poster Presentation: CBE Graduate Symposium 2023 – 3rd place – Reeby Puthur. "An Inverse Model for Predicting Thermal Performance of a Short-Circuited Fracture"
  - Marcelo Lippmann Graduate Scholarship Award (2022) - $2500.
  - Current position: Geothermal Engineer, GeothermEx, Richmond, California
- Esuru Rita Okoroafor
  - Best ePoster Award: Geothermal Resources Council Annual Meeting (2023) – 1st place – Esuru Rita Okoroafor. "Geomechanical Considerations in Modeling Heat Extraction from Enhanced Geothermal Systems"
  - Stanford Centennial Teaching Assistant (TA) Award – Esuru Rita Okoroafor (2019)
  - Top Energy Expert in Africa – Esuru Rita Okoroafor (2021)
  - Current position: Assistant Professor, Petroleum Engineering, Texas A&M University
- Jay Takahashi Bender
  - Best Poster Award: 2019 American Institute of Chemical Engineers (AIChE) – 3rd Place – Jay Takahashi Bender. [xx]. Undergraduate Research Category for "Catalysis & Reaction Engineering V"
  - National Science Foundation fellowship – Jay Takahashi Bender (2020)
  - Current position: NSF Graduate Research Fellow, McKetta Department of Chemical Engineering, University of Texas, Austin
- Yuran Zhang
  - Stanford Earth Certificate for Outstanding Achievement in Mentoring – Yuran Zhang (2020)
  - Henry J. Ramey, Jr. Fellowship Award (Outstanding Research) – Yuran Zhang (2019). Energy Resources Engineering (ERE), Stanford Earth, Stanford University.
  - Current position: Associate Professor, Institute of Geology and Geophysics, Chinese Academy of Sciences
- Colette Schissel
  - CAST Best Undergraduate Student Poster Award Winner – 2nd Place - Colette Schissel (2019). Computing & Systems Technology Division (CAS). 2019 American Institute of Chemical Engineers (AIChE). Undergraduate Research Category for "Computing, Simulation and Process Control II"
  - National Science Foundation Fellowship – Colette Schissel (2021)
  - Current position: NSF Graduate Research Fellow, McKetta Department of Chemical Engineering, University of Texas, Austin
- Nico Rangel Jurado
  - Geothermal Design Challenge – 3rd Place – Big Red Heat Team. Hosted by the Department of Energy – National Renewable Energy Laboratory (NREL) (2021)
  - Current position: Ph. D. Student, Geothermal Energy and Geofluids, ETH Zürich

- Harish Chandrasekar
    - Geothermal Design Challenge – 3rd Place – Big Red Heat Team. Hosted by the Department of Energy – National Renewable Energy Laboratory (NREL) (2021)
    - Current position: Project Development and modeling Engineer, GreenFire Energy, Walnut Creek, California