

Hailun Ni

Professional Summary

November 6, 2024

Business address: The University of Texas at Austin
Bureau of Economic Geology
10100 Burnet Rd., Bldg. 130
Austin, TX 78758
Telephone: (512) 471-0338
E-mail address: hailun.ni@beg.utexas.edu

Professional Preparation

Academic Background

Ph.D., Energy Resources Engineering, Stanford University, September 2020
M.S., Energy Resources Engineering, Stanford University, June 2015
B.S., with Distinction, Energy Resources Engineering, Stanford University, January 2015

Professional Appointments

Research Associate, Gulf Coast Carbon Center, Bureau of Economic Geology, The University of Texas at Austin (February 2023-Present)
Postdoctoral Fellow, Gulf Coast Carbon Center, Bureau of Economic Geology, The University of Texas at Austin (September 2020-Present)

Dissertations

Quantifying CO₂ capillary heterogeneity trapping through experiments, data analysis, and simulation, Stanford University, 2020.

Areas of Expertise

Areas of Expertise

Data analysis and machine learning
Geologic carbon storage
Multiphase flow coreflooding and sandtank experiments
Reservoir numerical simulations

Awards

Awards and Honorary Societies

2024 Tinker Family BEG Publication Award, Exemplary Publication of Scientific or Economic Impact, for timely and foundational work toward CO₂ storage security, 2024
Young Scientist Award, CO₂CRC CCUS Symposium, 2023
Annual Research Review Poster Presentation 3rd Place, Stanford School of Earth, Energy & Environmental Sciences, 2017
Dean's Award for Undergraduate Academic Achievement, Stanford University, 2015
Phi Beta Kappa Honor Society, Stanford University, 2015
Frank G. Miller Fellowship Award for High Academic Achievement, Energy Resources Engineering Department, Stanford University, 2014

Teaching and Advising

University Courses Taught

GEO 371T /391: CO2 Injection and Storage in Geological Formations: presented to The University of Texas at Austin, Austin, Tex., January 9-May 1, 2023.

Geo 371T/391: CO2 injection and storage in geological formations: presented to The University of Texas at Austin, Austin, Tex., January 18-May 14, 2022.

Geo 371C: Guided research project: presented to The University of Texas at Austin, Austin, Tex., January 18-May 11, 2022.

PGE 376: Special problems in petroleum and geosystems engineering: presented to The University of Texas at Austin, Austin, Tex., January 18-May 11, 2022.

Student Committee Participation

Reader, M.S., Thesis Committee, Angela Luciano, Leveraging Class I Wells as an Analog for Class VI in the Gulf Coast, The University of Texas at Austin, 2023

Activities of a Professional Nature

Professional Societies

American Geophysical Union

Society of Petroleum Engineers

Service

Published Interviews

Ni, H., and Meckel, T., 2021, Experimental work on carbon dioxide migration and trapping under strongly gravity- and capillary-dominated flow regimes [exclusive video interview of Ni and Meckel]: Digital Rocks Portal Newsletter, issue for December 2021, <https://us16.campaign-archive.com/?u=5062e94dc37c7490120fe65ae&id=d5dd77a71c>.

Proposal Review Panels Participation

Fuel (Article), 2023

International Journal of Greenhouse Gas Control (Article), 2023

SPE Journal (Article), 2022

Water Resources Research (Article), 2022

AAPG International Conference & Exhibition (ICE) 2022 (Abstract), 2021

German-Israeli Foundation for Scientific Research and Development (Proposal), 2021

SPE Journal (Article), 2021

Advances in Water Resources (Article), 2020

Water Resources Research (Article), 2020

Applied Energy (Article), 2019

Publications

Peer Reviewed Journal Articles

Mishra, A., Ni, H., Mortazavi, S. A., and Haese, R. R., 2024, Graph theory based estimation of probable CO2 plume spreading in siliciclastic reservoirs with lithological heterogeneity: Advances in Water Resources, v. 189, no. 104717, 17 p., <http://doi.org/10.1016/j.advwatres.2024.104717>.

Ni, H., Bump, A. P., and Bakhshian, S., 2024, An experimental investigation on the CO₂ storage capacity of the composite confining system: *International Journal of Greenhouse Gas Control*, v. 134, no. 104125, 10 p., <http://doi.org/10.1016/j.ijggc.2024.104125>.

Ren, B., Littlefield, J., Jia, C., Ni, H., and Duncan, I., 2024, Impact of pressure-dependent interfacial tension and contact angle on capillary heterogeneity trapping of CO₂ in storage aquifers: *Society of Petroleum Engineers Journal*, v. 29, no. 8, p. 4442-4458, <http://doi.org/10.2118/214925-PA>.

Bakhshian, S., Bump, A. P., Pandey, S., Ni, H., and Hovorka, S. D., 2023, Assessing the potential of composite confining systems for secure and long-term CO₂ retention in geosequestration: *Scientific Reports*, v. 13, no. 21022, 14 p., <http://doi.org/10.1038/s41598-023-47481-2>.

Bump, A. P., Bakhshian, S., Ni, H., Hovorka, S. D., Olariu, M. I., Dunlap, D., Hosseini, S. A., and Meckel, T. A., 2023, Composite confining systems: Rethinking geologic seals for permanent CO₂ sequestration: *International Journal of Greenhouse Gas Control*, v. 126, no. 103908, 12 p., <http://doi.org/10.1016/j.ijggc.2023.103908>.

Ni, H., Bakhshian, S., and Meckel, T. A., 2023, Effects of grain size and small-scale bedform architecture on CO₂ saturation from buoyancy-driven flow: *Scientific Reports*, v. 13, no. 2474, 13 p., <http://doi.org/10.1038/s41598-023-29360-y>.

Ni, H., and Meckel, T. A., 2021, Characterizing the effect of capillary heterogeneity on multiphase flow pulsation in an intermediate-scale beadpack experiment using time series clustering and frequency analysis: *Water Resources Research*, v. 57, no. 11, article no. e2021WR030876, 17 p., <http://doi.org/10.1029/2021WR030876>.

Ni, H., Møyner, O., Kurtev, K. D., and Benson, S. M., 2021, Quantifying CO₂ capillary heterogeneity trapping through macroscopic percolation simulation: *Advances in Water Resources*, v. 155, no. 103990, 17 p., <http://doi.org/10.1016/j.advwatres.2021.103990>.

Ni, H., and Benson, S. M., 2020, Using unsupervised machine learning to characterize capillary flow and residual trapping: *Water Resources Research*, v. 56, no. 8, article no. e2020WR027473, 19 p., <http://doi.org/10.1029/2020WR027473>.

Ni, H., Boon, M., Garing, C., and Benson, S. M., 2019, Predicting CO₂ residual trapping ability based on experimental petrophysical properties for different sandstone types: *International Journal of Greenhouse Gas Control*, v. 86, p. 158-176, <http://doi.org/10.1016/j.ijggc.2019.04.024>.

Patents

Zhang, S., Brumbaugh, G. D., Ni, H., Bardy, G. P. L., and Walters, H. G., Simulating hydraulic fracturing geometry propagation using a differential stress and pattern-based model: WO2020226647, received November 12, 2020.

Non Peer Reviewed Journal Articles

Bump, A., Bakhshian, S., Ni, H., Hovorka, S. D., Dunlap, D. B., Olariu, M. I., Hosseini, S. A., and Meckel, T., 2022, Composite confining systems: rethinking geologic seals for permanent CO₂ sequestration: 16th Greenhouse Gas Control Technologies Conference, 23-27 October, Lyon, France, <http://doi.org/10.2139/ssrn.4286411>.

Ni, H., and Meckel, T., 2022, Effects of flow pulsation on CO₂ buoyant migration and capillary trapping: 16th Greenhouse Gas Control Technologies Conference, 23-27 October, Lyon, France, <http://doi.org/10.2139/ssrn.4273191>.

Ni, H., Braganca, R., Tisato, N., and Meckel, T., 2022, Monitoring CO₂ plume migration with lab-scale ultrasonic experimental setup: 16th Greenhouse Gas Control Technologies Conference, 23-27 October, Lyon, France, <http://doi.org/10.2139/ssrn.4273218>.

Boon, M., Ni, H., and Benson, S. M., 2021, Observations of the impact of mm-cm scale lamination on the migration and trapping of CO₂ in reservoir rocks: Proceedings, 15th International Conference on Greenhouse Gas Control Technologies, GHGT-15, March 15-18, Abu Dhabi, United Arab Emirates, 14 p., <http://doi.org/10.2139/ssrn.3820447>.

Ni, H., Dasari, G., Teletzke, G., and Saris, A., 2021, Evaluating technical feasibility of gigaton scale CO₂ storage using produced water disposal data in US Gulf Coast: 15th Greenhouse Gas Control Technologies Conference 15-18 March 2021, Abu Dhabi, United Arab Emirates, <https://ssrn.com/abstract=3903753>.

Boon, M., Ni, H., Garing, C., and Benson, S. M., 2019, Effect of capillary induced flow on CO₂ residual trapping: 14th Greenhouse Gas Control Technologies Conference 21-26 October, Melbourne, Australia, <http://doi.org/10.2139/ssrn.3365823>.

Ni, H., Boon, M., Garing, C., and Benson, S. M., 2019, Effects of correlation length and lamination direction on CO₂ residual trapping ability for different sandstone types: 14th Greenhouse Gas Control Technologies Conference, October 21-26, Melbourne, Australia, <https://ssrn.com/abstract=3366071>.

Published Abstracts

Boon, M., Ni, H., and Benson, S. M., 2019, The impact of small scale rock heterogeneity on CO₂ plume migration and residual trapping (abs.): AGU Fall Meeting, December 9-13, San Francisco, Calif., no. H23M-2082, 1 p.

Ni, H., and Benson, S. M., 2019, A novel clustering workflow to do data mining on CO₂/water coreflooding data (abs.): AGU Fall Meeting, December 9-13, San Francisco, Calif., no. H34B-07, 1 p.

Published Datasets

Ni, H., and Meckel, T., 2021, Drainage experiment in an intermediate-scale beadpack: Digital Rocks Portal, <http://doi.org/10.17612/QXXK-WE31>.

Ni, H., and Møyner, O., 2021, Code for: quantifying CO₂ capillary heterogeneity trapping through macroscopic percolation simulation (version 2): Mendeley Data, <http://doi.org/10.17632/6gj3rd7ntr.2>.

Ni, H., and Boon, M., 2020, CO₂ residual trapping coreflooding data (version 3): Mendeley Data, <http://doi.org/10.17632/wrgdmhyrps.3>.

Ni, H., 2020, Data for: using unsupervised machine learning to characterize capillary flow and residual trapping (version 2): Mendeley Data, <http://doi.org/10.17632/9rtxgrv9db.2>.

Presentations

Invited Presentations

Using Sand Tank Experiments to Model and De-Risk CO₂ Geological Storage: presented at CO₂CRC CCUS Symposium, Melbourne, Australia, November 22, 2023.

Effects of flow pulsation on CO₂ buoyant migration and capillary trapping: presented to Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK, February 8, 2023.

Presentations

Using Sand Tank Experiments to Model and De-Risk a CO₂ Injection Field Project: presented at University of Texas 7th Conference on Carbon Capture and Storage (UTCCS-7), Austin, Tex., January 23-25, 2024.

Experimental Investigation and Modelling of the Impact of Small-Scale Heterogeneities in Geologic Carbon Storage (poster): presented at AGU Fall Meeting, San Francisco, Calif., December 11-15, 2023.

Using multiphase sand tank experiments to investigate the effect of heterogeneities on CO₂ capillary trapping (eLightening): presented at AGU Fall Meeting, San Francisco, Calif., December 11-15, 2023.

Teaching Teamwork: Project-based Learning in an Interdisciplinary Course Delivered by an Interdisciplinary Teaching Team (poster): presented at Earth Educators Rendezvous, Pasadena, Calif., July 10-14, 2023.

Experimental Investigation of CO₂ Buoyant Flow Saturation in Ripple Bedforms: presented at SPE/AAPG/SEG Carbon Capture, Utilization, and Storage (CCUS) Conference, Houston, Tex., April 25-27, 2023.

Sandbox model results & implications for CO₂ migration and trapping: presented at 2023 Joint Annual GoMCarb - SECARB Offshore Partnerships' Meeting, Austin, Tex., April 5-7, 2023.

Laboratory experiments and modeling to accurately evaluate critical CO₂ saturation for geologic carbon storage: presented at 2022-2023 Energy Seed Grant Program Presentations, UT Energy Week 2023, Austin, Tex., March 28, 2023.

Experimental investigation of CO₂ buoyant flow saturation in ripple bedforms (poster): presented at 12th Annual Jackson School Student Research Symposium, Austin, Tex., February 11, 2023.

Predicting CO₂ gravity-driven drainage saturation using machine learning (poster): presented at AAPG's Carbon Capture, Utilization, and Storage (CCUS) Conference, Houston, Tex., March 29-31, 2022.

Characterizing CO₂ flow and trapping through sand tank experiments: presented at University of Texas Sixth Conference on Carbon Capture and Storage (UTCCS-6), Austin, Tex., January 25-27, 2022.

Predicting CO₂ saturation for heterogeneous domains using machine learning: presented at University of Texas Sixth Conference on Carbon Capture and Storage (UTCCS-6), Austin, Tex., January 25-27, 2022.

Predicting CO₂ gravity-driven drainage saturation using machine learning: presented at AGU Fall Meeting, New Orleans, La., December 13-17, 2021.

Evaluating technical feasibility of gigaton scale CO₂ storage using produced water disposal data in US Gulf Coast: presented at 15th Greenhouse Gas Control Technologies Conference, Abu Dhabi, March 15-18, 2021.

A novel clustering workflow to do data mining on CO₂/water coreflooding data: presented at AGU Fall Meeting, San Francisco, Calif., December 9-13, 2019.

Effects of correlation length and lamination direction on CO₂ residual trapping ability for different sandstone types: presented at 14th Greenhouse Gas Control Technologies Conference, Melbourne, Australia, October 21-26, 2018.

Characterizing CO₂ residual trapping through experiments: presented at InterPore 10th Annual Meeting, New Orleans, La., May 14-17, 2018.

Predicting CO₂ residual trapping ability based on experimental petrophysical properties for different sandstone types: presented at SPE Western Region Student Paper Contest, Garden Grove, Calif., April 23, 2018.

Characterizing CO₂ capillary heterogeneity trapping through macroscopic percolation simulation: presented at InterPore 9th Annual Meeting, Rotterdam, the Netherlands, May 8-11, 2017.

Funding

Research Support

Principal Investigator: Laboratory experiments and modeling to accurately evaluate critical CO₂

saturation for geologic carbon storage, Energy Institute, The University of Texas at Austin (September 1, 2022-August 31, 2023; \$60,000).

Researcher: Laboratory equipment for monitoring CO₂ plume migration and trapping with tank-scale ultrasonic experimental setup, The Jackson School of Geosciences (JSG) Equipment Committee (April 2022; \$2,000).