

# NEELARUN MUKHERJEE

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## RESEARCH INTERESTS

Groundwater hydrology, flow and reactive transport in porous media

## EDUCATION

2021 – Present	Ph.D. Candidate, Hydrology	<b>The University of Texas at Austin</b> <i>Dissertation Topic:</i> Flow and transport processes in supra-permafrost aquifers in the Arctic <i>Committee:</i> Dr. M. Bayani Cardenas, Dr. Jingyi Chen, Dr. Daniel O. Breecker, Dr. Ethan T. Coon, Dr. Pin Shuai, Dr. George W. Kling
2016 – 2021	M.S. and B.S., Geophysics	<b>Indian Institute of Technology (IIT), Kharagpur</b> Specialization in Fluid Mechanics and Microfluidics <i>Thesis:</i> Numerical modeling of seawater intrusion considering diurnal head changes of seawater and matrix compression and rebound. <i>Advisors:</i> Dr. Abhijit Mukherjee & Dr. Aditya Bandopadhyay

## ACADEMIC EXPERIENCES

Summer 2025	Visiting Student	<b>Oak Ridge National Laboratory</b> Oak Ridge, TN, USA Mentor: Dr. Scott L. Painter <i>Flow and Reactive Transport in Supra-permafrost Aquifers</i> Integrated reactive transport using PFLOTRAN into ATS-integrated thermal hydrological model with freeze-thaw.
Fall 2020	UARE Fellow	<b>University of Alberta</b> Alberta, Edmonton, Canada Advisor: Dr. Peichun Amy Tsai <i>Low-Capillary-Number Microfluidic Emulsions</i> Investigated low-Capillary-number Taylor flows of CO <sub>2</sub> emulsions in microchannels using high-resolution pore scale simulations.
Summer 2020	Intern	<b>Sorbonne Université</b> Paris, France Advisor: Dr. Damien Jougnot <i>Rayleigh Taylor Instabilities in porous media with geoelectrics</i> Developed a coupled flow, transport and geoelectric solver in OpenFOAM for Rayleigh-Taylor instabilities.
Summer 2019	CNRS Scholar	<b>Université de Rennes</b> Rennes, France Advisor: Dr. Yves Meheust <i>Numerical simulations and Experimental study of CO<sub>2</sub> sequestration in deep aquifers</i> Developed an OpenFOAM solver for designing Rayleigh Taylor instability of miscible fluids in porous media
2018 – 2019	Research Assistant	<b>IIT Kharagpur</b> Kharagpur, WB, India Advisor: Dr. Saibal Gupta <i>Thermal Transport in Connected Aquifers</i> Modeling mineral mixing rates from transport of a radiogenic heat source using a coupled groundwater flow and heat transport model.
2019 – 2020	Team Mentor, 2017 – 2019 Subsystem Lead	<b>TeamKART Motorsports</b> Kharagpur, WB, India PI: Dr. A.R. Mohanty, Dr. C.S. Kumar, Dr. S.K. Panda <i>Design of Vehicle Dynamics for Formula SAE</i> Suspension and aero design for FSAE cars K4 (2019) and K5 (2020), securing P6 and P10, Formula Bharat

## TECHNICAL SKILLS

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**Languages:** Python, MATLAB, Julia, C++, C, Shell,  $\text{\LaTeX}$

**Open-source Numerical Codes:** Amanzi-ATS, PFLOTRAN, OpenFOAM, Basilisk (Gerris)

**Other Software:** COMSOL, SolidWorks, Fluent, ArcGIS, ParaView, VisIt, FreeCAD, Affinity Designer

**Lab/Field Equipment:** Levelloggers, Total Stations, Benchtop KSAT, Hyprop, Chemetrics, ABEM Terrameter

## PEER-REVIEWED PUBLICATIONS

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- [4] Mukherjee, N., Gao, B., Shuai, P., Coon, E. T., Hill, D., Neilson, B. T., Kling, G. W., and Cardenas, M. B. *The effects of extreme weather variability on supra-permafrost hydrology*. [Under Preparation]
- [3] Mukherjee, N., Gao, B., Shuai, P., Coon, E. T., Hill, D., Chen, J., Neilson, B. T., Kling, G. W., and Cardenas, M. B. *The effects of 40 years of recent warming on supra-permafrost hydrology*. (Under Review in Science Advances). Preprint: <https://doi.org/10.48550/arXiv.2512.19860>
- [2] Mukherjee, N., Chen, J., Neilson, B. T., Kling, G. W., and Cardenas, M. B. (2024). *Water and carbon fluxes from a supra-permafrost aquifer to a stream across hydrologic states*. Journal of Hydrology, 645, 132285. <https://doi.org/10.1016/j.jhydrol.2024.132285>
- [1] Virappane, S., Azadi, R., Mukherjee, N., and Tsai, P. A. (2024). *Three-dimensional simulations of two-phase plug flow in a microfluidic channel*. Physics of Fluids, 36(10). *Editors' Choice*. <https://doi.org/10.1063/5.0220101>

## CONFERENCE PROCEEDINGS

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- [17] Mukherjee, N.\*, Gao, B., Shuai, P., Coon, E., Hill, D., Neilson, B. T., Cory, R. M., Kling, G. W., Chen, J., and Cardenas, M. B. (2025). *The Effects of Weather Variability on Supra-Permafrost Thermal Hydrology*. AGU Fall Meeting, New Orleans.
- [16] Mukherjee, N.†, Gao, B., Shuai, P., Coon, E., Hill, D., Neilson, B. T., Cory, R. M., Kling, G. W., Chen, J., and Cardenas, M. B. (2025). *Hydrologic and Thermal Changes in Supra-Permafrost Soils and Aquifers Over the Last Four Decades of Warming*. AGU Fall Meeting, New Orleans.
- [15] Hill, D.†, Mukherjee, N., Cardenas, M. B., Gao, B., Shuai, P., Coon, E., Neilson, B. T., Cory, R. M., Kling, G. W., and Neilson, B. T. (2025). *Hydrologic Observations Across the Hillslope-to-River Corridor of an Arctic Tundra Watershed*. AGU Fall Meeting, New Orleans.
- [14] Mukherjee, N.\*, Gao, B., Shuai, P., Coon, E., Hill, D., Neilson, B. T., Cory, R. M., Kling, G. W., Chen, J., and Cardenas, M. B. (2025). *Using a fully calibrated and validated model to unravel hidden unfrozen layers inside a frozen ground due to warming winters*. [Invited Talk]. ATS Short Course, Knoxville, Tennessee
- [13] Mukherjee, N.†, Gao, B., Shuai, P., Coon, E., Hill, D., Neilson, B. T., Cory, R. M., Kling, G. W., Chen, J., and Cardenas, M. B. (2025). *Impacts of changing hydrologic conditions on groundwater flow and reactive solute transport in supra-permafrost aquifers*. Department of Energy: Earth System Sciences PI Meeting, Reston, Virginia.
- [12] Hill, D.†, Mukherjee, N., Neilson, B. T., Shuai, P., Cory, R. M., Kling, G. W., Gao, B., Coon, E., and Cardenas, M. B. (2025). *Hydrologic Observations Across the Hillslope-to-River Corridor of an Arctic Tundra Watershed*. Department of Energy: Earth System Sciences PI Meeting, Reston, Virginia.
- [11] Cardenas, M. B., Mukherjee, N.†, Hill, D.†, Neilson, B. T.†, Shuai, P., Cory, R. M., Kling, G. W.†, Gao, B., Coon, E. (2025). *Advancing Understanding of Flow and Reactive Transport Processes Across the Hillslope-to-River Corridor of Arctic Watersheds*. Department of Energy: Earth System Sciences PI Meeting, Reston, Virginia.
- [10] Mukherjee, N.\*, Shuai, P., Gao, B., Coon, E., Chen, J., Hill, D., Neilson, B., Kling, G.W., Chen, J., and Cardenas, M. B. (2024). *Impacts of climate conditions on groundwater flow and reactive solute transport in supra-permafrost aquifers*. AGU Fall Meeting, Washington DC.

[9] Villaruel, S.<sup>†</sup>, Mukherjee, N., Hill, D., Cardenas, M., Shuai, P., Gao, B., Coon, E., Chen, J., Neilson, B., Kling, G.W., and Cardenas, M. B. (2024). *Hydro-stratigraphy of the active layer in riparian valley bottoms of an arctic watershed*. AGU Fall Meeting, Washington DC.

[8] Clark, Z.<sup>†</sup>, Chiu, C. Y.<sup>†</sup>, Mukherjee, N., deFabry, C. M., Nachimuthu, S., Herrera, R. G., Gonzalez, R. M., Bennett, P. C., Shanahan, T. M., and Cardenas, M. B. (2024). *Characteristics of the Coastal Groundwater of Celestún, Mexico on the West Coast of the Yucatan Peninsula for Extreme Conditions During the Dry Season*. AGU Fall Meeting, Washington DC.

[7] Mukherjee, N.\*., Chen, J., Neilson, B., Kling, G. W., and Cardenas, M. B. (2024). *Groundwater dominates fluxes of water and organic carbon in a permafrost watershed across hydrologic states*. Department of Energy: Earth System Sciences PI Meeting, Reston, Virginia.

[6] Cardenas, M. B.<sup>†</sup>, Neilson, B. T., Shuai, P., Cory, R. M., Kling, G. W., Mukherjee, N., Gao, B., and Coon, E. (2024). *Dynamics of interconnected surface-subsurface flow and reactive transport processes across the hillslope-riparian zone river corridor continuum of cold, high-latitude watersheds*. Department of Energy: Earth System Sciences PI Meeting, Reston, Virginia.

[5] Mukherjee, N.<sup>†</sup>, Shuai, P., Gao, B., Coon, E., Chen, J., Hill, D., Neilson, B., Kling, G.W., and Cardenas, M. B. (2023). *Investigating Groundwater Flow and Thermal Transport in Arctic Supra-Permafrost Aquifers Using Field Observation Driven Integrated Hydrologic Models*. AGU Fall Meeting, San Francisco, California.

[4] Mukherjee, N.\*., Cardenas, M. B., Chen, J., Neilson, B., and Kling, G. W. (2022). *Supra-permafrost groundwater's contribution to stream flow and organic matter chemistry in the Arctic: estimation using combined mechanistic and statistical approaches*. AGU Fall Meeting, Chicago, Illinois.

[3] Keith, D. G.<sup>†</sup>, Mukherjee, N., deFabry, C. M., Cabral, S. A., Schmidt, L., Turetcaia, A., Nguyen, W. D., Bennett, P. C., Shanahan, T. M. and Cardenas, M. B. (2022). *Hydrologic, Geophysical, and Geochemical Characterization of an Aquifer along the Beach of a Barrier Island*. AGU Fall Meeting, Chicago, Illinois.

[2] Mukherjee, N.<sup>†</sup>, Dhar, J., Jougnot, D., and Méheust, Y. (2021). *Characterizing Rayleigh Taylor Instability and Convection in a Porous Medium with Geoelectric Monitoring*. AGU Fall Meeting, New Orleans, Louisiana.

[1] Mukherjee, N., Dhar, J.<sup>†</sup>, Nadal, F., Le Borgne, T., Meunier, P., and Meheust, Y. (2019). *Gravitational instability and convection in a granular porous medium: pore scale experimental study and implications for solubility trapping of CO<sub>2</sub>*. AGU Fall Meeting, San Francisco, California.

Talks\* & Posters<sup>†</sup>

## AWARDS AND SCHOLASTIC ACHIEVEMENTS

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2024, 2025	Travel Grant, Earth System Science (ESS) PI Meeting, Dept. of Energy
2024	Outstanding Student Presentation Award (OSPA), AGU Fall Meeting
2024	First Place, Geoscience Hackathon on Computational Reproducibility, UT Austin
2023	Travel Grant, Reactive Transport Workshop using PFLOTRAN, CUAHSI
2023	Jackson School Summer Off-Campus Research Grant, UT Austin
2021	Dean's List, IIT Kharagpur
2021	Prof. Supriya Mohan Sengupta Memorial Award, Best Masters' Thesis, IIT Kharagpur
2021	Best Undergraduate Project Award, IIT Kharagpur
2020	University of Alberta Research Experience (UARE) Award
2019	Indo-French Summer Research Scholarship, CNRS
2016	Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellowship, Govt. of India
2016	All India Rank 6193 (out of 1.2 million aspirants) in Joint Entrance Examination (JEE)

## GRANTS

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<b>Cold-regions Hydro-biogeochemical Processes</b>	Amount: \$1M (3y)
Environmental System Science Program (ESS), Department of Energy (DOE)	
<i>Team:</i> M. B. Cardenas (PI, UT Austin), B. T. Neilson (Col, Utah State Univ.), P. Shuai (Col, Utah State Univ.), R. M. Cory (Col, Univ. of Michigan), G. W. Kling (Col, Univ. of Michigan), E. T. Coon (Col, Oak Ridge Nat. Lab.), N. Mukherjee (Grad Student, UT Austin), D. Hill (Grad Student, Utah State Univ.)	
<b>Future Investigators in NASA Earth and Space Science and Technology</b>	Amount: \$135,000 (3y)
National Aeronautics and Space Administration (NASA)	
<i>Team:</i> J. Chen (PI), M. B. Cardenas (Col), Y. Wu (FI), <u>N. Mukherjee</u> (FI), UT Austin	

## TEACHING

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Summer 2024, 2026	Teaching Assistant	<b>GEO376L: Hydro Field Camp</b>   UT Austin Instructed a field class of 21 students where we spent three weeks spanning Texas and Yucatan, Mexico
Fall 2023, 2024	Substitute Instructor	<b>GEO 382S: Physical Hydrology</b>   UT Austin Led graduate sessions in groundwater hydrology
Spring 2023	Teaching Assistant	<b>GEO 401: Introduction to Geology</b>   UT Austin Instructed over 150 hours of lab sessions (100 freshmen across various disciplines)
Fall 2022	Teaching Assistant	<b>COE 301: Introduction to Computer Programming</b>   UT Austin Instructed over 150 hours of lab and in-class sessions (90 freshmen across various disciplines)

## FIELD EXPERIENCES

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2022-2024 (12 weeks)	<b>Imnavait Creek, North Slope, Alaska, USA</b> Investigations on groundwater flow and reactive transport in supra-permafrost aquifers
2023, 2024	<b>Austin, Texas, USA</b> Understanding tidal response of a river to groundwater flows in Lower Colorado river
June 2024	<b>Celestun, Mexico</b> Groundwater survey to understand seawater-freshwater mixing along a beach
June 2024	<b>Anillo de Cenotes, Mexico</b> Groundwater survey to understand Karst geochemistry and hydrodynamics of seawater groundwater mixing
Dec 2019	<b>Purulia, West Bengal, India</b> 2-D electrical Resistivity tomography to understand confined groundwater aquifer hydrologic stratification
Dec 2018	<b>Kharagpur, West Bengal, India</b> Geophysical interpretation via 12 channel seismic data acquisition
Oct 2017	<b>Balasore and Chandipore beach, Orissa, India</b> Coastal hydrogeology basics

## MENTORSHIP

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2023 – 2024	Sydney R Villaruel	Undergraduate Student @UT Austin. Currently pursuing MS @ University of South Carolina
2022 – 2024	Chengwei Zhang	PhD Student @ UT Austin
2021 – 2023	Santhosh Virappane	Masters Student @Univ. of Alberta. Currently Scientist-Engineer @ RWDI

## PROFESSIONAL SERVICE

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### Reviewer:

- Catena (2025 @1)
- Journal of Hydrology (2025 @2)
- AGU Fall Meeting OSPA Judge (2023, 2024)

### Conference:

2025	Convener	Barret Kurylyk, Michelle Walvoord, David Rudolph, Cansu Demir, <b>Neelarun Mukherjee</b> . Hydrology and hydrogeology of thawing cold regions. <i>GSA Connects 2025</i> , San Antonio, Texas. October 2025
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### Outreach:

May 2022	Volunteer	<b>Kiker Elementary School, Austin, TX</b> Created engaging and interactive modules to introduce elementary school students to basic hydrogeology
2016 – 2017	Community Service	<b>National Service Scheme, Government of India</b> Elementary maths teacher in primary school, repaired roads and organized health awareness camps in rural areas

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Curriculum Vitae as of January 2026