

# NEELARUN MUKHERJEE

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## RESEARCH INTERESTS

Groundwater hydrology, flow and reactive transport in porous media

## EDUCATION

|                |                               |   |
|----------------|-------------------------------|---|
| 2021 – Present | Ph.D. Candidate,<br>Hydrology | <b>The University of Texas at Austin</b><br><i>Dissertation Topic:</i> Flow and transport processes in supra-permafrost aquifers in the Arctic<br><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.,<br>Geophysics  | <b>Indian Institute of Technology (IIT), Kharagpur</b><br>Specialization in Fluid Mechanics and Microfluidics<br><i>Thesis:</i> Numerical modeling of seawater intrusion considering diurnal head changes of seawater and matrix compression and rebound.<br><i>Advisors:</i> Dr. Abhijit Mukherjee & Dr. Aditya Bandopadhyay |

## ACADEMIC EXPERIENCES

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

## TECHNICAL SKILLS

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

**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.<sup>\*</sup>, 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.<sup>†</sup>, 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.<sup>†</sup>, 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.<sup>\*</sup>, 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.<sup>†</sup>, 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.<sup>†</sup>, 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.<sup>†</sup>, Hill, D.<sup>†</sup>, Neilson, B. T.<sup>†</sup>, Shuai, P., Cory, R. M., Kling, G. W.<sup>†</sup>, 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.<sup>\*</sup>, 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.<sup>\*</sup>, 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.<sup>\*</sup>, 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., Cabraal, S. A., Schmidt, L., Turetaia, 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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### **Cold-regions Hydro-biogeochemical Processes**

Amount: \$1M (3y)

Environmental System Science Program (ESS), Department of Energy (DOE)

*Team:* 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.)

### **Future Investigators in NASA Earth and Space Science and Technology**

Amount: \$135,000 (3y)

National Aeronautics and Space Administration (NASA)

*Team:* J. Chen (PI), M. B. Cardenas (Col), Y. Wu (FI), N. Mukherjee (FI), UT Austin

## TEACHING

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|-------------------|-----------------------|---|
| Summer 2024, 2026 | Teaching Assistant    | <b>GEO376L: Hydro Field Camp</b>   UT Austin<br>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<br>Led graduate sessions in groundwater hydrology   |
| Spring 2023       | Teaching Assistant    | <b>GEO 401: Introduction to Geology</b>   UT Austin<br>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<br>Instructed over 150 hours of lab and in-class sessions (90 freshmen across various disciplines) |

## FIELD EXPERIENCES

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

### Outreach:

|             |                   |   |
|-------------|-------------------|---|
| May 2022    | Volunteer         | <b>Kiker Elementary School, Austin, TX</b><br>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><br>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