

Bhavna Arora

Energy Geosciences Division
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EDUCATION:

2012 Texas A&M University - Ph. D., Water Management & Hydrologic Sciences
2006 IIT Kharagpur - M. Tech., Water Resources Development & Management
- B.Tech. (Hons), Agricultural & Food Engineering
- Minor, Mathematics & Computing

PROFESSIONAL POSITIONS:

2022-Present Program Lead, Carbon Removal and Mineralization, Lawrence Berkeley National Laboratory
2017- Present Earth Research Scientist, Lawrence Berkeley National Laboratory
2012-2017 Postdoctoral Fellow, Lawrence Berkeley National Laboratory
2006-2012 Teaching & Research Fellowships, Texas A&M University
2004 Intern, Jumbo International
2003 Intern, Indian Agricultural Research Institute

RESEARCH INTERESTS:

Biogeochemical cycling: Numerical approaches to advance fundamental understanding of the evolution of biogeochemical reactions in the vadose zone, groundwater, river and estuarine environments under changing environmental conditions
Reactive Transport Modeling: Numerical investigations with a focus on negative emissions of CO₂, environmental remediation and management of agricultural soils.
Inverse modeling and optimization techniques: Approaches to identify minimum but sufficient parameters, processes and feedbacks to accurately represent critical zone processes.
Identification of biogeochemical hot spots and hot moments: Using data-mining, wavelet and other approaches to quantify the complex interactions between hydrological and biogeochemical processes, and specifically how these interactions are shaped by spatial (subsurface) heterogeneity and temporal variability across scales.
Networking and synthesis in critical zone science: Making connections and creating opportunities for synthesizing information across critical zone networks and watershed sites.

HONORS & AWARDS:

2020a,b Spot Recognition Award, Earth & Environmental Sciences Area, Lawrence Berkeley National Laboratory
^aFor outstanding achievement in the organization of the Critical Zone Network-of-Networks Workshop at the AGU Fall Meeting; and
^bIn recognition of significant contributions as a mentor
2019 Spot Recognition Award, Earth & Environmental Sciences Area, Lawrence Berkeley National Laboratory
2019 DOE-SBR Travel Fellowship, AGU Fall Meeting

2012-2014	AAAS/Science Program for Excellence in Science Membership Award, American Association for the Advancement of Science
2011	Bill and Rita Stout International Graduate Student Achievement Award, Texas A&M University <i>Awarded each year to a graduate student for outstanding achievement in academics and leadership at Texas A&M University</i>
2010	Outstanding Student Paper Award, AGU Fall Meeting
2010	Graduate Student Research and Presentation Grant, Office of Graduate Studies, Texas A&M University
2009	2 nd place, Oral Session, Student Research Week, Texas A&M University <i>Also presented with Interdisciplinary Research Recognition Ribbon</i>
2008-09 & 2010-11	Regents' Scholarship, Texas A&M University
2007	1 st place, Poster Session, Student Research Week, Texas A&M University
2006	Institute Silver Medalist, IIT Kharagpur <i>Awarded each year to a graduating student who secures the highest grade point among peers</i>
2006	A. A. Hakim Memorial Endowment Prize, IIT Kharagpur <i>Awarded each year to a graduate student for outstanding performance in Water Resources Development and Management</i>
2003	Certificate of Recognition, Drip Irrigation Project, Government of India
2003	Vinod Gupta Leadership Award, IIT Kharagpur
1999	Certificate of Merit, National Scholarship Scheme, India
1998	Certificate of Excellence, Senior Mathematical Olympiad

Awards received by student mentee:

2021	Touyee Thao: Best presentation award, Universities fighting world hunger summit
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FUNDED GRANTS/PROJECT EXPERIENCE:

2022-2025	Collaborator, Coastal Wetland Restoration a Nature Based Decarbonization Multi-Benefit Climate Mitigation Solution, UC National Lab Fees (\$3.6M). Collaborators: several with Adina Paytan as PI
2022-2025	Co-PI, Quantify and model overlooked pathways of nitrogen loss from organic inputs across contrasting soil types, CDFA FREP Grant (\$223,568). Collaborators: Timothy Bowles (PI), Eric Brennan and Hannah Waterhouse
2021-Present	PI, Enhanced weathering via soil amendments for negative C emissions, LBNL's Laboratory Directed Research and Development (LDRD) Grant (\$400,000). Collaborators: Hang Deng, Ricardo Alves, Hanna Breunig, Eoin Brodie, Peter Nico and Kateryna Zhalnina
2020-2023	Co-PI, Linking Nutrient Reactivity and Transport in Subsurface Flowpaths along a Terrestrial-Estuarine Continuum, DOE Subsurface Biogeochemical Research (\$599,939). Collaborators: Margaret Zimmer (PI), Anna Braswell, Erin Seybold, Corianne Tatariw, and Ate Visser
2019-Present	Water Crosscut Lead, Watershed Function Science Focus Area, DOE-BER (\$21M). Collaborators: several with Susan Hubbard as PI

2019-2021	Lab Lead Collaborator, Developing an Automated Uncertainty Quantification Tool to Improve Watershed-Scale Predictions of Water and Nutrient Cycling, DOE Small Business Technology Transfer (STTR) Phase II Grant (\$700,000). Collaborators: Stefan Finsterle (PI) and Michael Kowalsky
2018-2020	Co-I, Enabling Water-Energy Decision Support Using Watershed-scale Surrogate Models, LBNL's Laboratory Directed Research and Development (LDRD) Grant (\$460,000). Collaborators: Juliane Mueller (PI), Deb Agarwal, Charuleka Varadharajan, and Boris Faybishenko
2018-2019	Collaborator, Developing an Automated Uncertainty Quantification Tool to Improve Watershed-Scale Predictions of Water and Nutrient Cycling, DOE Office of Science Small Business Innovation Research (SBIR) Phase I Grant (\$150,000). PI: Stefan Finsterle
2015-2017	PI, Multi-Scale Modeling of Geochemical Impacts on Fracture Evolution, LBNL's Laboratory Directed Research and Development (LDRD) Grant (\$680,000). Collaborators: Sergi Molins (Co-PI), David Trebotich, Jonathan Ajo-Franklin and Carl Steefel
2009-2010	TWRI Mills Scholarship, Texas Water Resources Institute (\$1,500)
2009	Graduate Student Council Travel Grant, Texas A&M University (\$500)

MENTORSHIP & SUPERVISION:

Postdoctoral Fellow(s):

- Lucien Stoltze: 2021-Present

Graduate students:

- Adam Haynes (UC Santa Cruz): 2021-Present
- Emilio Grande (UC Santa Cruz): 2021-Present
- Touyee Thao (UC Merced): Spring 2021-Present
- Swathi Venkatesh (Amrita Vishwa Vidyapeetham): 2020-2021
- Hannah Waterhouse (UC Davis): 2019-2020
- Jiancong Chen (UC Berkeley): 2017-2020

Undergraduate students:

- Jessee Steele (Duke University): Summer 2021
- Maya Franklin (UC Berkeley): 2020-2021
- Tadewos Getachew (University of Michigan): Summer 2019
- Dhristi Patel (West Los Angeles College): Fall 2018
- Olivia Terry (University of Wyoming): Summer 2018
- Madison Burrus (Stony Brook University): 2017-2018

PROFESSIONAL SERVICE & ACTIVITIES (SELECT):

Editorships:

- Associate Editor, Earth's Future, 2022-Present
- Guest Editor, Water Resources Research & Earth's Future, Special Issue on "The Future of Critical Zone Science: Towards Shared Goals, Tools, Approaches and Philosophy", 2021

- Associate Editor, *Frontiers in Water*, Water and Hydrocomplexity Section, 2019-Present. Also, Guest Editor for Special Issue on “Women in Science: Water and Hydrocomplexity”

Proposal Reviewer:

- Panelist, NASA Water Resources Applied Research Program, 2021
- Panelist, DOE Subsurface Biogeochemical Research Program, 2017 and 2019
- Panelist, GEM Fellowship Program, 2018
- Ad-hoc reviewer, NSF Geosciences program
- Ad-hoc reviewer, Stanford Synchrotron Radiation Lightsource (SSRL).

Workshop, Town hall and Session Organizer:

- Workshop Organizer, Toward an International Critical Zone Network-of-Networks for the Next Generation through Shared Science, Tools, Data and Philosophy, AGU Fall Meeting 2019-21.
- Town Hall Organizer, Transforming Critical Zone Research through Shared Science, Tools, Data and Philosophy, AGU Fall Meeting 2021.
- CUAHSI Cyberseminar Series Organizer, Tools for integrating and synthesizing data from CZOs and watershed sites, Fall 2021.
- CUAHSI Cyberseminar Series Organizer, Critical Zone (CZ) Observatories and Watershed Sites, Fall 2021.
- Workshop Organizing Committee Member, 3rd ISMC Conference — Advances in Modeling Soil Systems, 2021.
- Session Chair, Characterizing Spatial and Temporal Variability of Hydrological and Biogeochemical Processes across Scales, AGU Fall Meeting, 2014-Present.
- Other session organization: GSA Annual Meeting (2021), Goldschmidt Conference (2019-21), ICRW7 (2020), NAWI Alliance Spring Meeting (2021), Watershed Function SFA Retreat (2014-21)

Service to the Division, Area and the Laboratory:

- Program Lead, Carbon Removal and Mineralization, Lawrence Berkeley National Laboratory
- Invited participant, Coastal & Land modeling Breakout Groups, DOE AI4ESP Workshop, Oct-Nov 2021.
- Selected participant, inaugural LBNL Stewardship Summit, 2021
- Lead, Biogeochemical Cycling Group, Energy Geosciences Division, 2017-Present.
- Search Committee Member, Watershed Hydrologist Research Scientist position, Energy Geosciences Division, 2017.
- Department Representative, Distinguished Scientist Seminar Series committee, Earth & Energy Sciences Area, Lawrence Berkeley National Laboratory, 2015-Present.

Other Service:

- Critical Zone Expert, eLTER Research Infrastructure Coordination, 2021-Present
- Member at large, Executive Board, The International Soil Modeling Consortium, 2020-Present
- Member, AGU Ecohydrology Technical Committee, 2018-Present.
- Presentation Judge, Outstanding Student Paper Awards, AGU Fall Meeting, 2013-Present.

- Education and Outreach Volunteer, Lawrence Berkeley National Laboratory, 41st Annual Solano Avenue Stroll, 2015, 2014.

INVITED AND FIRST-AUTHOR PRESENTATIONS ONLY:

- 2022 **Invited Address** “Impact of Sustainable Groundwater Management Strategies on Nitrate Loading”, International Symposium on Water Sustainability: Challenges, Technologies, and Opportunities (IWSS 2022), Amrita Vishwa Vidyapeetham University, March 23, 2022
- 2022 **Invited Seminar** “Capturing shifts in nitrogen hot moments under different environmental settings”, UC Merced Enviro-Lunch Seminar Series, March 7, 2022
- 2022 **Invited Address** “Building a community of practice through shared science, tools, data and philosophy”, ISMC Executive Board Meeting, February 28, 2022
- 2022 **Invited Address** “Nitrates in groundwater: The good and the bad of managed aquifer recharge”, Midday Science Café, February 17, 2022
- 2021 “Identifying the Causes for and Distribution of Nitrogen Hotspots under Different Environmental Settings”, AGU Fall Meeting, December 15, 2021.
- 2021 “Wavelets for identifying geochemical hot moments”, CUAHSI Cyberseminar Fall Series, November 11, 2021.
- 2021 **Invited Address** “Toward an International Critical Zone Network-of-Networks for the Next Generation through Shared Science, Tools, Data and Philosophy”, ESIP Soil Ontologies and Informatics Cluster, October 20, 2021.
- 2021 **Invited Address** “A combined statistical and reactive transport modeling approach to demystifying the terrestrial aquatic interface”, 2021 Goldschmidt Conference, July 8, 2021.
- 2021 **Invited Address** “New approaches to identify, interrogate and model “hot” zones of water contamination”, Amrita Vishwa Vidyapeetham University International Symposium, March 24, 2021.
- 2021 **Invited Address** “Toward an Early Career Research Coordination Network”, Critical Zone Collaborative Network PI Meetings, January 7, 2021.
- 2020 “Differential C-Q Analysis: A New Approach to Inferring Lateral Transport and Hydrologic Transients within Multiple Reaches of a Mountainous Headwater Catchment”, AGU Fall Meeting, December 9, 2020.
- 2020 **Invited Address** “Wavelet and entropy approaches for improved characterization of geochemical hot moments”, Interagency Conference on Research in the Watersheds (ICRW7), November 18, 2020
- 2020 **Invited Seminar** “Changes in Water and Nitrogen Fluxes in a Mountainous Watershed as Affected by Warming in Recent Decades”, LBL Geochemistry Department Seminar, September 10, 2020.
- 2020 **Invited Address** “A Hillslope Scale Model for Quantifying Fluxes of Weathered Elements in a Mountainous Headwater Catchment”, 2020 Goldschmidt Conference, June 25, 2020
- 2020 **Invited Seminar** “Biogeochemical Cycling In The Critical Zone: A Focus on Team Science & Collaborative Research”, Workforce Development & Education Internships Brown Bag Series, March 20, 2020

- 2019 “Changes in Gross Primary Productivity and Biogeochemical Fluxes in a Mountainous Watershed as Affected by Warming in Recent Decades”, AGU Fall Meeting, December 9, 2019
- 2019 **Invited Seminar** “*In the hot seat: When and where is biogeochemical cycling occurring in the critical zone?*”, Bureau de Recherches Géologiques et Minières (BRGM), September 2, 2019
- 2019 **Invited Address** “Understanding and Predicting Vadose Zone Dynamics”, Goldschmidt Workshop on Reactive Transport in Natural and Engineered Systems, August 18, 2019
- 2019 Invited Keynote “A Data-Model Integration Framework for Understanding Controls on Carbon Cycling in Terrestrial Environments”, 11th International Symposium on Environmental Geochemistry, August 8, 2019
- 2019 **Invited Seminar** “Deciphering spatio-temporal patterns and using reactive transport models to improve process understanding”, University of Waterloo Earth & Environmental Sciences Department Seminar, February 19, 2019
- 2018 **Invited Address** “Linking Snowmelt and Nitrogen Cycling to Vegetation Community Dynamics along a Hillslope Transect”, AGU Fall Meeting, December 12, 2018
- 2018 “Using Sensitivity Analysis as a Tool to Determine the Need for Regeneration of Hydrological and Biogeochemical Predictions”, AGU Fall Meeting, December 14, 2018
- 2018 “Uncertainty-Based Data-Worth Analysis and its Application to a Watershed Management Problem”, TOUGH Symposium, October 9, 2018
- 2018 “Spatial and Temporal Variability in Nitrate”, CA Integrated Water Retreat, October 4, 2018
- 2018 **Invited Seminar** “When and Where is Biogeochemical Cycling Occurring in The Critical Zone?”, Workforce Development & Education Internships Brown Bag Series, June 21, 2018
- 2018 **Invited Seminar** “When and Where is Biogeochemical Cycling Occurring in The Critical Zone: Implications for the Indian Subcontinent”, IIT Kanpur Seminar, January 3, 2018
- 2017 “Identifying factors causing variability in greenhouse gas (GHG) fluxes in a polygonal tundra landscape”, AGU Fall Meeting, December 14, 2017
- 2017 **Invited Address** “Modeling Ecological and Hydrological Controls on Shrubification Using Ecosys”, Watershed Function Science Community Outreach, November 14, 2017
- 2017 “How do perturbations to individual watershed subsystems, including early snowmelt and drought, lead to downgradient export of C, N, & P from that subsystem? A Hillslope Perspective”, Watershed Function SFA Retreat, November 9, 2017
- 2017 **Invited Seminar** “*In the hot seat: When and where is biogeochemical cycling occurring in the critical zone?*”, University of Arizona Hydrologic & Atmospheric Sciences Seminar Series, March 20, 2017
- 2017 **Invited Seminar** “Mineralogical Controls on Carbon Cycling in a Floodplain Environment”, Geochemistry Department Seminar Series, Lawrence Berkeley National Laboratory, Berkeley, March 16, 2017

- 2016 “Mineralogical Controls on Carbon Cycling in a Floodplain Environment” AGU Fall Meeting, December 14, 2016
- 2016 “Evaluating Temporal Controls on Greenhouse Gas (GHG) Fluxes at the Barrow site: An Entropy-based Approach”, NGEE-Arctic All-Hands Meeting, December 10-11, 2016.
- 2016 “Benchmarking integrated surface-subsurface models along a hillslope transect”, SeS Bench V, October 14, 2016
- 2016 “On modeling CO₂ dynamics in a flood plain aquifer”, 15th Water-Rock Interaction International Symposium, October 18, 2016
- 2016 “Genome-informed reactive transport simulations of CO₂ and carbon isotope dynamics in a flood plain aquifer”, Goldschmidt Conference, June 27, 2016
- 2016 “Flood Plain Modeling: Hydrological, Biogeochemical, and Microbial Controls on Carbon and Nitrogen Fluxes”, 2016 Environmental System Science (PI) Meeting, April 26-27, 2016
- 2016 **Invited Seminar** “Modeling the impact of biogeochemical hot spots and hot moments on carbon fluxes from a flood plain site: Implications for the River Ganges cleanup”, IIT Kanpur, January 12, 2016
- 2015 “Modeling the impact of biogeochemical hotspots and hot moments on subsurface carbon fluxes from a flood plain site”, AGU Fall Meeting, December 14-18, 2015
- 2015 “Floodplain functioning – Hotspots/hot moments identification and their utility for predicting system response to perturbations”, SFA 2.0 Retreat, October 15-16, 2015
- 2015 “Modeling CO₂ and carbon isotope dynamics in a floodplain aquifer”, Goldschmidt Conference, August 16 – 21, 2015.
- 2015 “Towards improved characterization of geochemical hot moments: A combined wavelet-entropy approach”, SIAM Conference on Mathematical and Computational Issues in the Geosciences, June 29 – July 2, 2015.
- 2014 “Modeling the biogeochemical response of a flood plain aquifer impacted by seasonal temperature and water table variations”, AGU Fall Meeting, December 15-19, 2014.
- 2014 **Invited Address** “Modeling CO₂ dynamics at the Rifle site: Implications of thermal-hydrological-biogeochemical processes”, Rifle Science Community Outreach Telecon, November 20, 2014
- 2014 “Upscaling constructs: Approaches to identify, interrogate and model functional zones and biogeochemical reactive transport across scales”, SFA 2.0 Retreat, October 23-24, 2014
- 2014 “Reactive transport benchmarks on heavy metal cycling”, Goldschmidt Conference, June 8-13, 2014.
- 2014 “Characterizing biogeochemical hot spots and hot moments in a floodplain system”, 2014 TES SBR PI Meeting, May 6-7, 2014.
- 2013 “A benchmarking study on heavy metal cycling in lake sediments”, SS Bench III-Subsurface Environmental Simulation Benchmarking Workshop, November 11-13, 2013
- 2013 “Predicting upscaling relationships for heterogeneous flow and reactive transport at the Savannah river site”, AGU Fall Meeting, December 9-13, 2013.

- 2013 “A benchmarking study on heavy metal cycling in lake sediments”, GSA Annual Meeting, October 27-30, 2013.
- 2012 “Upscaling geochemical and hydrologic parameters using a novel depth fragmented approach”, AGU Fall Meeting, December 3-7, 2012.
- 2011 “Spatio-temporal evolution of biogeochemical processes at a landfill site”, AGU Fall Meeting, December 5-9, 2011.
- 2011 “Effect of soil structure and spatial heterogeneity on biodegradation processes”, ASA-CSSA-SSSA International Annual Meetings, October 16-19, 2011.
- 2010 “Hydrologic perturbations drive biogeochemical processes in experimental soil columns from the Norman Landfill site”, AGU Fall Meeting, December 13-17, 2010. (***This presentation won an Outstanding Student Paper Award***)
- 2010 “Modeling biogeochemical processes in a contaminated aquifer-wetland system using ANN-HP1”, Interpore Conference and Annual Meeting, March 14-17, 2010.
- 2009 “Quantifying linkages between biogeochemical processes in a contaminated aquifer-wetland using multivariate statistics and HP1”, AGU Fall Meeting, December 14-18, 2009.
- 2009 **Invited Seminar** “Parameterization and modeling of preferential flow and transport in soil columns”, Texas A&M University Biological & Agricultural Engineering Departmental Seminar, September 7, 2009
- 2009 “Use of ‘effective’ domain parameters in structured soils: An uncertainty analysis”, 12th Annual Student Research Week, Texas A&M University, March 23, 2009. (***This presentation was awarded 2nd prize.***)
- 2009 **Invited Seminar** “Preferential flow and uncertainty: A hydrological perspective”, Texas A&M University Water Management & Hydrologic Sciences Seminar, February 12, 2009
- 2008 “Quantifying redox geochemistry within homogeneous and layered vadose zone using regression techniques”, AGU Fall Meeting, December 15-19, 2008.
- 2008 “Uncertainty in estimation of dual permeability model parameters for flow and tracer transport in laboratory soil columns”, ASA-CSSA-SSSA International Annual Meetings, October 6, 2008.
- 2008 “Evaluating Two-Domain Models for Physical Non-Equilibrium Flow and Transport in Three Different Column Setups”, ASA-CSSA-SSSA-GSA Joint Annual Meeting, October 8, 2008.
- 2007 “Comparison of two-domain models for simulating bromide transport in three different column setups”, ASA-CSSA-SSSA International Annual Meetings, November 7, 2007.
- 2007 “Biogeochemical cycling of contaminants in the vadose zone”, 10th Annual Student Research Week, Texas A&M University, March 27, 2007. (***This presentation was awarded 1st prize***)

PUBLICATIONS:

Peer-reviewed (* indicates student or post-doctoral advisee author):

41. **Arora, B.**, A. Currin, D. Dwivedi, M. I. N. Fru, N. Kumar, C. L. McLeod, and D. C. Roman, Volcanology, Geochemistry, and Petrology Perspectives on Integrated, Coordinated, Open,

- Networked (ICON) Science, *Accepted, Earth and Space Science*.
40. **Arora, B.**, M. A. Briggs, J. Zarnetske, J. Stegen, J. Gomez-Valez, D. Dwivedi and C. I. Steefel (2022), Hot Spots and Hot Moments in the Critical Zone: Identification of and Incorporation into Reactive Transport Models, In: Biogeochemistry of the Critical Zone, A. Wymore, W. Yang, W. Silver, B. McDowell, and J. Chorover (Eds.), *In press, Springer-Nature*.
 39. Varadharajan, C., A. Appling, **B. Arora**, D. Christianson, V. C. Hendrix, V. Kumar, A. R. Lima, J. Mueller, S. Oliver, M. Ombadi, T. Perciano, J. Sadler, H. Weierbach, J. Willard, Z. Xu, J. Zwart, Can Machine Learning Accelerate Process Understanding and Decision-Relevant Predictions of River Water Quality?, *In press, Hydrological Processes*.
 38. Dwivedi, D., C. Steefel, **B. Arora**, J. Banfield, M. Boyanov, S. Brooks, X. Chen, S. Hubbard, D. Kaplan, K. Kemner, P. Nico, E. Ó'Loughlin, E. Pierce, S. Painter, T. Scheibe, H. Wainwright, K. Williams, and M. Zavarin, From Legacy Contamination to Watershed Systems Science: A Review of Scientific Insights and Technologies Developed through DOE-Supported Research in Water and Energy Security, *In press, Environmental Research Letters*.
 37. Chen*, J., **B. Arora**, A. Bellin, and Y. Rubin, Statistical Characterization of Environmental Hot Spots and Hot Moments and Applications in Groundwater Hydrology, *Hydrology and Earth System Sciences*, DOI: 10.5194/hess-2020-343.
 36. Venkatesh*, S., **B. Arora**, D. Dwivedi, S. Vezhaperambu and M. V. Ramesh (2021), Temporal Variability of Water Quality Parameters at the Elkhorn Slough Estuary using Wavelets, *IEEE Proceedings on 6th International Conference for Convergence in Technology*, DOI:10.1109/I2CT51068.2021.9418159.
 35. Waterhouse*, H., **B. Arora**, N. F. Spycher, P. S. Nico, C. Ulrich, H. E. Dahlke, W. R. Horwath (2021), Influence of Varying Hydrologic Regimes and Stratigraphic Heterogeneities on Nitrate Reduction in the Deep Subsurface of an Agricultural Field, *Water Resources Research*, DOI:10.1029/2020WR029148.
 34. Newcomer, M. N., N. Bouskill, H. Wainwright, T. Maavara, **B. Arora**, E. Woodburn, D. Dwivedi, K. Williams, C. Steefel, and S. Hubbard, Surface Water Quality Trends across United States Hydrological Basins, *Global Change Biology*, DOI: 10.1029/2020GB006777.
 33. Graham, E. B., C. Averill, B. Bond-Lamberty, **consortium authors*** et al. (2021), Toward a generalizable framework of disturbance ecology through crowdsourced science, *Frontiers in Ecology and Evolution*, DOI: 10.3389/fevo.2021.588940.
 32. Rogers, D. B., M. E. Newcomer, M., J. H. Raberg, D. Dwivedi, D., C. Steefel, N. Bouskill, P. Nico, B. Faybishenko, P. Fox, M. Conrad, M. Bill, E. Brodie, **B. Arora**, B. Dafflon, K. Williams and S. S. Hubbard (2021), Modeling the Impact of Riparian Hollows on River Corridor Nitrogen Exports, *Frontiers in Water: Water and Critical Zone*, DOI: 10.3389/frwa.2021.590314.
 31. Sahu, R. K., J. Müller, J. Park, C. Varadharajan, **B. Arora**, B. Faybishenko, and D. Agarwal (2020), Impact of Input Feature Selection on Groundwater Level Prediction from a Multi-Layer Perceptron Neural Network, *Frontiers in Water: Water and Hydrocomplexity*, DOI: 10.3389/frwa.2020.573034.
 30. **Arora, B.**, M. Burrus*, M. Newcomer, C. Steefel, R. Carroll, D. Dwivedi, K. Williams and S. S. Hubbard, Lateral Storage and Hydrologic Transients within Multiple Reaches of a Mountainous Headwater Catchment: Differential C-Q Analysis, *Frontiers in Water: Water and Critical Zone*, DOI: 10.3389/frwa.2020.00024.
 29. Cheng, Y., **B. Arora**, S. Sengor, J. Druhan, C. Wanner, B. M. van Breukelen, and C. I. Steefel

- (2020), Microbially Mediated Kinetic Sulfur Isotope Fractionation: Reactive Transport Modeling Benchmark, *Computational Geoscience*, DOI: 10.1007/s10596-020-09988-9.
28. Mueller, J., J. Park, R. Sahu, C. Varadharajan, **B. Arora**, B. Faybishenko, and D. Agarwal (2020), Surrogate Optimization of Deep Neural Networks for Groundwater Predictions, *Journal of Global Optimization*, DOI: 10.1007/s10898-020-00912-0.
 27. Druhan, J., S. Guillon, M. Lincker, and **B. Arora** (2020), Stable and Radioactive Carbon Isotope Partitioning in Soils and Saturated Systems: A Reactive Transport Modeling Benchmark Study, *Computational Geoscience*, DOI: 10.1007/s10596-020-09937-6.
 26. Tague, C. L., S. A. Papuga, C. Gerlein-Safdi, S. Dymond, R. R. Morrison, E. W. Boyer, D. Riveros-Iregui, E. Agee, **B. Arora**, Y. G. Dialynas, A. Hansen, S. Krause, S. Kuppel, et al. (2020), **Invited Perspectives: Adding our Leaves: A community-wide perspective on research directions in ecohydrology**, *Hydrological Processes*, DOI:10.1002/hyp.13693.
 25. Tokunaga, T., J. Wan, K. Williams, W. Brown, A. Henderson, Y. Kim, A. P. Tran, M. E. Conrad, M. Bill, R. W. H. Carroll, W. Dong, Z. Xu, A. Lavy, B. Gilbert, S. Romero, J. N. Christensen, B. Faybishenko, **B. Arora**, E. Woodburn, R. Versteeg, et al. (2019), Depth- and time-resolved distributions of snowmelt-driven hillslope subsurface flow and transport, and their contributions to surface waters, *Water Resources Research*, WRCR24293, DOI: 10.1029/2019WR025093.
 24. **Arora, B.**, D. Dwivedi, B. Faybishenko, R. Jana, and H. M. Wainwright (2019), Understanding and Predicting Vadose Zone Processes, *Reviews in Mineralogy and Geochemistry: Reactive transport in Natural and Engineered System*, 85 (1), DOI: 10.2138/rmg.2019.85.10.
 23. Grant, R. F., Z. A. Mekonnen, W. J. Riley, **B. Arora**, and M. S. Torn (2019), Modeling climate change impacts on an Arctic polygonal tundra: 2. Changes in CO₂ and CH₄ exchange depend on rates of permafrost thaw as affected by changes in vegetation and drainage, *Journal of Geophysical Research: Biogeosciences*, DOI: 10.1029/2018JG004644.
 22. Molins, S., D. Trebotich, **B. Arora**, C. I. Steefel, and H. Deng (2019), Multi-scale model of reactive transport in fractured media: Transport limitations on rates, *Transport in Porous Media*, DOI: 10.1007/s11242-019-01266-2.
 21. **Arora, B.**, H. M. Wainwright, D. Dwivedi, L. J. S. Vaughn, J. B. Curtis, M. S. Torn, B. Dafflon and S. S. Hubbard (2019), Evaluating Temporal Controls on Greenhouse Gas (GHG) Fluxes in an Arctic Tundra Environment: An Entropy-Based Approach, *Science of the Total Environment*, DOI: 10.1016/j.scitotenv.2018.08.251.
 20. Dwivedi, D., C. I. Steefel, **B. Arora**, M. Newcomer, J. D. Moulton, B. Dafflon, B. Faybishenko, P. Fox, P. Nico, N. Spycher, R. Carroll, and K. Williams (2018), Geochemical Exports to River from the Intra-Meander Hyporheic Zone under Transient Hydrologic Conditions: East River Mountainous Watershed, Colorado, *Water Resources Research*, DOI: 10.1029/2018WR023377.
 19. Engelbrektson, A., Y. Cheng, C. G. Hubbard, Y. T. Jin, **B. Arora**, L. Tom, P. Hu, A.-L. Grauel, M. Conrad, G. L. Andersen, J. B Ajo-Franklin, and J. D. Coates (2018), Attenuating Sulfidogenesis in a Soured Continuous Flow Column System with Perchlorate Treatment, *Frontiers in Microbiology*, DOI: 10.3389/fmicb.2018.01575.
 18. Dwivedi, D., **B. Arora**, C. I. Steefel, B. Dafflon, and R. Veersteg (2018), Hot Spots and Hot Moments of Nitrogen in a Riparian Corridor, *Water Resources Research*, DOI: 10.1002/2017WR022346. (**Note: This publication was a featured article on the Water Resources Research website**)
 17. Wainwright, H. M., **B. Arora**, S. Hubbard, K. Lipnikov, D. Moulton, G. Flach, C. Eddy-

- Dilek, and M. Denham (2018), Sustainable Remediation in Complex Geologic Systems, *The Encyclopedia of Inorganic and Bioinorganic Chemistry*, DOI: 10.1002/9781119951438.eibc2562.
16. **Arora, B.**, J. A. Davis, N. F. Spycher, W. Dong, and H. M. Wainwright (2018), Comparison of electrostatic and non-electrostatic models for U(VI) sorption on contaminated sediments and the impact on reactive transport simulation, *Groundwater*, DOI: 10.1111/gwat.12551.
 15. Cheng, Y., C. G. Hubbard, L. Zheng, **B. Arora**, L. Li, J. Ajo-Franklin, and N. Bouskill (2018), New generation modeling of microbial souring – Parameterization through genomic information, *International Biodeterioration and Biodegradation*, DOI:10.1016/j.ibiod.2017.06.014.
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