

# Bhavna Arora

Energy Geosciences Division  
Lawrence Berkeley National Laboratory  
1 Cyclotron Road, MS 74-327R  
Berkeley, CA-94720  
Phone: (510) 495-2163  
E-mail: [barora@lbl.gov](mailto:barora@lbl.gov)

## Education

---

<b>Texas A&amp;M University, College Station, TX</b> Ph. D., Water Management & Hydrologic Sciences	2012
<b>Indian Institute of Technology (IIT), Kharagpur, India</b> M. Tech., Water Resources Development & Management B.Tech. (Hons), Agricultural & Food Engineering Minor, Mathematics & Computing	2006

## Professional Positions

---

Geological Research Scientist, <b>Lawrence Berkeley National Laboratory</b>	Present
Postdoctoral Fellow, <b>Lawrence Berkeley National Laboratory</b>	2017
Graduate Research & Teaching Assistant, <b>Texas A&amp;M University</b>	2012
Intern, <b>Jumbo International</b>	2004
Intern, <b>Indian Agricultural Research Institute</b>	2003

## Grants & Proposals

---

Co-I, Laboratory Directed Research and Development (LDRD) Grant, Lawrence Berkeley National Laboratory (\$280,000). Collaborators: Deb Agarwal (PI), Juliane Mueller, Charuleka Varadharajan, and Boris Faybishenko	2018-Present
Collaborator, Small Business Innovation Research (SBIR) Phase I Grant, DOE Office of Science (\$150,000). PI: Stefan Finsterle	2018-Present
PI, Laboratory Directed Research and Development (LDRD) Grant, Lawrence Berkeley National Laboratory (\$190,000). Collaborators: Sergi Molins (Co-PI), David Trebotich, Jonathan Ajo-Franklin and Carl Steefel	2015-2017
Graduate Student Research and Presentation Grant, Office of Graduate Studies, Texas A&M University (\$500)	2010
TWRI Mills Scholarship, Texas Water Resources Institute (\$1,500)	2009-2010
Graduate Student Council Travel Grant, Texas A&M University (\$500)	2009

## Honors & Awards

---

AAAS/Science Program for Excellence in Science Membership Award, American Association for the Advancement of Science	2012-2014
Biological & Agricultural Engineering Graduate Scholarship, Texas A&M University	2012
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&amp;M University</i>	2011
Outstanding Student Paper Award, AGU Fall Meeting	2010
Regents' Scholarship, Texas A&M University	2010-2011
2 <sup>nd</sup> place, Oral Session, Student Research Week, Texas A&M University <i>Also presented with Interdisciplinary Research Recognition Ribbon</i>	2009
Regents' Scholarship, Texas A&M University	2008-2009
1 <sup>st</sup> place, Poster Session, Student Research Week, Texas A&M University	2007
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>	2006
Certificate of Recognition, Drip Irrigation Project, Government of India	2003
Vinod Gupta Leadership Award, IIT Kharagpur	2003
Certificate of Merit, National Scholarship Scheme, India	1999
Certificate of Excellence, Senior Mathematical Olympiad	1998

## Publications

---

### Peer-reviewed

- [24] **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.
- [23] 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, 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.
- [22] Engelbrekton, 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.

- [21] 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**)
- [20] Wainwright, H. M., **B. Arora**, B. Faybishenko, S. Molins, 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.
- [19] **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.
- [18] 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.
- [17] **Arora, B.**, Y. Cheng, E. King, N. Bouskill, and E. Brodie (2017), *Chapter 27: Modeling microbial energetics and community dynamics*, in the Handbook of Metal-Microbe Interactions and Bioremediation, CRC Taylor and Francis Group.
- [16] Grant, R. F., Z. A. Mekonnen, W. J. Riley, **B. Arora**, and M. S. Torn (2017), Microtopography determines how CO<sub>2</sub> and CH<sub>4</sub> exchange respond to changes in temperature and precipitation at an arctic polygonal tundra site: Mathematical modelling with ecosys, *JGR-Biogeosciences*, DOI: 10.1002/2017JG004037.
- [15] Yabusaki, S. B., M. J. Wilkins, Y. Fang, K. H. Williams, **B. Arora**, J. Bargar, H. Beller, et al. (2017), Water Table Dynamics and Biogeochemical Cycling in a Shallow, Variably-Saturated Floodplain, *Environmental Science and Technology*, DOI:10.1021/acs.est.6b04873.
- [14] Dwivedi, D., C. I. Steefel, **B. Arora**, and G. Bisht (2017), Impact of intra-meander hyporheic flow on nitrogen cycling, *Procedia Earth and Planetary Science*, DOI: 10.1016/j.proeps.2016.12.102.
- [13] **Arora, B.**, D. Dwivedi, N. F. Spycher, and C. I. Steefel (2017), On modeling CO<sub>2</sub> dynamics in a flood plain aquifer, *Procedia Earth and Planetary Science*, DOI: 10.1016/j.proeps.2016.12.103.
- [12] **Arora, B.**, and B. P. Mohanty (2017), Influence of spatial heterogeneity and hydrological perturbations on redox dynamics: A column study, *Procedia Earth and Planetary Science*, DOI: 10.1016/j.proeps.2017.01.046.
- [11] Dwivedi, D., B. Dafflon, **B. Arora**, H. M. Wainwright, and S. Finsterle (2016), *Chapter 20: Spatial analysis and geostatistical methods*, in the Handbook of Applied Hydrology, V. P. Singh (ed.), McGraw-Hill.
- [10] **Arora, B.**, N. F. Spycher, C. I. Steefel, S. Molins, M. Bill, M. E. Conrad, W. Dong, B. Faybishenko, T. K. Tokunaga, J. Wan, K.H. Williams and S. B. Yabusaki (2016), Influence of

Hydrological, Biogeochemical and Temperature Transients on Subsurface Carbon Fluxes in a Flood Plain Environment, *Biogeochemistry*, DOI: 10.1007/s10533-016-0186-8.

- [9] **Arora, B.**, D. Dwivedi, S. S. Hubbard, C. I. Steefel, and K. H. Williams (2016), Identifying geochemical hot moments and their controls on a contaminated river floodplain system using wavelet and entropy approaches, *Environmental Modelling & Software*, DOI: 10.1016/j.envsoft.2016.08.005.
- [8] Dwivedi, D., **B. Arora**, S. Molins, and C. I. Steefel (2016), *Chapter 19: Benchmarking Reactive Transport Codes for Subsurface Environmental Problems*, in Groundwater Research on Exploration, Assessment, Modelling and Management of Groundwater Resources and Pollution, D. Thangarajan and V. P. Singh (eds.), CRC Taylor and Francis Group.
- [7] **Arora, B.**, S. S. Sengör, N. F. Spycher, and C. I. Steefel (2015), A reactive transport benchmark on heavy metal cycling in lake sediments, *Computational Geosciences*, DOI: 10.1007/s10596-014-9445-8.
- [6] **Arora, B.**, B. P. Mohanty, and J. T. McGuire (2015), An integrated Markov Chain Monte Carlo algorithm for upscaling hydrological and geochemical parameters from column to the field scale, *Science of the Total Environment*, DOI:10.1016/j.scitotenv.2015.01.048.
- [5] Steefel, C. I., C. A. J. Appelo, **B. Arora**, D. Jacques, T. Kalbacher, O. Kolditz, V. Lagneau, P. C. Lichtner, K. U. Mayer, J. C. L. Meussen, S. Molins, D. Moulton, H. Shao, J. Simunek, N. Spycher, S. B. Yabusaki, and G. T. Yeh (2015), Reactive transport codes for subsurface environmental simulation, *Computational Geosciences*, DOI:10.1007/s10596-014-9443-x.
- [4] Mayer, K. U., P. Alt-Epping, D. Jacques, **B. Arora**, and C. I. Steefel (2015), Benchmark problems for reactive transport modeling of the generation and attenuation of acid rock drainage, *Computational Geosciences*, DOI: 10.1007/s10596-015-9476-9.
- [3] **Arora, B.**, B. P. Mohanty, J. T. McGuire, and I. M. Cozzarelli (2013), Temporal dynamics of biogeochemical processes at the Norman Landfill site, *Water Resources Research*, 49, 1-18, doi: 10.1002/wrcr.20484.
- [2] **Arora, B.**, B. P. Mohanty, and J. T. McGuire (2012), Uncertainty in dual permeability model parameters for structured soils, *Water Resources Research*, 48, W01524, doi: 10.1029/2011WR010500. (**Note: This publication was featured as the most accessed article for Jan-Feb 2012 in Water Resources Research**)
- [1] **Arora, B.**, B. P. Mohanty, and J. T. McGuire (2011), Inverse estimation of parameters for multidomain flow models in soil columns with different macropore densities, *Water Resources Research*, 47, W04512, doi: 10.1029/2010WR009451. (**Note: This publication was a featured article in EOS, Transactions of the American Geophysical Union**)

## **Reports and other Non-refereed Work**

- [5] Dafflon, B., E. Léger, Y. Robert, J. Peterson, C. Ulrich, S. Biraud, A. P. Tran, **B. Arora**, H. Wainwright, V. Romanovsky, and S. Hubbard (2018), Quantifying the Interactions Between

Subsurface Hydro-Thermal Characteristics, Permafrost Distribution, Soil Physical Properties and Landscape Structure in an Arctic Watershed, *Proceedings of the 5th European Conference on Permafrost, Chamonix*, 3 pp.

- [4] Wainwright, H. M., B. Faybishenko, S. Molins, J. A. Davis, **B. Arora**, G. Pau, J. Johnson, G. Flach, M. Denham, C. Eddy-Dilek, D. Moulton, K. Lipnikov, C. W. Gable, T. A. Miller, E. Baker, V. Freedman and M. Freshley (2016), Effective Long-term Monitoring Strategies by Integrating Reactive Transport Models and In situ Geochemical Measurements, *16162*.
- [3] **Arora, B.**, D. Dwivedi, N. F. Spycher, and C. I. Steefel (2015), Modeling carbon fluxes from a biogeochemical hotspot in a floodplain aquifer, *Proceedings of the TOUGH Symposium*, Berkeley, CA, pp. 456-463.
- [2] Wainwright, H. M., S. Molins, J. A. Davis, B. Arora, B. Faybishenko, H. Krishnan, S. S. Hubbard, G. Flach, M. Denham, C. Eddy-Dilek, D. Moulton, K. Lipnikov, C. W. Gable, T. A. Miller, and M. Freshley (2015), Using ASCEM modeling and visualization to optimize remediation strategies at F-Area Savannah River site, SC, *Proceedings of MODFLOW and More 2015*, Golden, CO.
- [1] Flach, G., H. M. Wainwright, S. Molins, H. Krishnan, **B. Arora**, J. A. Davis, A. Romosan, B. Faybishenko, S. S. Hubbard, M. Denham, C. Eddy-Dilek, D. Moulton, K. Lipnikov, T. A. Miller, C. W. Gable, and M. Freshley (2015), Advanced Simulation Capability for Environmental Management, Integrated toolsets and simulator to enhance public communication, *15156*, No. SRNL-STI-2015-00027.

## Invited Talks and First-Author Presentations

---

- [20] **Arora, B.**, E. Brodie, Z. Mekonen, T. Tokunaga, J. Wan, H. Steltzer, Y. Wu and C. Steefel (2018), Linking Snowmelt and Nitrogen Cycling to Vegetation Community Dynamics along a Hillslope Transect, AGU Fall Meeting, Washington, D.C., Dec. 10-14, 2018. (*INVITED*)
- [19] **Arora, B.**, B. Faybishenko and D. Agarwal (2018), Using Sensitivity Analysis as a Tool to Determine the Need for Regeneration of Hydrological and Biogeochemical Predictions, AGU Fall Meeting, Washington, D.C., Dec. 10-14, 2018.
- [18] **Arora, B.**, and S. Finsterle (2018), Uncertainty-Based Data-Worth Analysis and its Application to a Watershed Management Problem, 2018 TOUGH Symposium, Berkeley, Oct. 8-10, 2018.
- [17] **Arora, B.** (2018), Spatial and Temporal Variability in Nitrate, CA Integrated Water Retreat, Berkeley, Oct. 4, 2018.
- [16] **Arora, B.**, E. Brodie, Z. Mekonen, T. Tokunaga, J. Wan and C. Steefel (2018), Linking snowmelt and nitrogen cycling to vegetation community dynamics along a hillslope transect, Computational Methods in Water Resources XXII, Saint-Malo, Jun. 3-7, 2018.
- [15] **Arora, B.** (2018), When and where is biogeochemical cycling occurring in the critical zone: Implications for the Indian Subcontinent, IIT Kanpur, Kanpur, Jan. 3, 2018. (*INVITED*)

- [14] **Arora, B.**, H. M. Wainwright, L. J. S. Vaughn, J. B. Curtis, M. S. Torn, B. Dafflon and S. S. Hubbard (2017), Identifying factors causing variability in greenhouse gas (GHG) fluxes in a polygonal tundra landscape, AGU Fall Meeting, New Orleans, Dec. 11-15, 2017.
- [13] **Arora, B.**, E. Brodie, T. Tokunaga, J. Wan, and C. I. Steefel (2017), Modeling ecological and hydrological controls on shrubification using ecosys, Watershed Function Science Community Outreach, Telecon, Nov. 14, 2017.
- [12] **Arora, B.** and E. Brodie (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, Berkeley, Nov. 9, 2017.
- [11] **Arora, B.**, D. Dwivedi, C. I. Steefel, N. F. Spycher, P. M. Fox and P. S. Nico (2016), Mineralogical Controls on Carbon Cycling in a Floodplain Environment, AGU Fall Meeting, San Francisco, Dec. 12-16, 2016.
- [10] **Arora, B.**, D. Dwivedi, N. F. Spycher, and C. I. Steefel (2016), On modeling CO<sub>2</sub> dynamics in a flood plain aquifer, 15th Water-Rock Interaction International Symposium, Evora, Oct. 16-21, 2016.
- [9] **Arora, B.**, D. Dwivedi, M. Newcomer, E. Woodburn, N. F. Spycher, and C. I. Steefel (2016), Benchmarking integrated surface-subsurface models along a hillslope transect, SeS Bench V, A Coruña, Oct. 13-15, 2016.
- [8] **Arora, B.**, E. L. King, N. F. Spycher, C. I. Steefel, and M. E. Conrad (2016), Genome-informed reactive transport simulations of CO<sub>2</sub> and carbon isotope dynamics in a flood plain aquifer, Goldschmidt Conference, Yokohama, June 26 – July 1, 2016.
- [7] **Arora, B.**, N. F. Spycher, C. I. Steefel, E. King, and M. E. Conrad (2015), Modeling the impact of biogeochemical hotspots and hot moments on subsurface carbon fluxes from a flood plain site, AGU Fall Meeting, San Francisco, Dec. 14-18, 2015.
- [6] **Arora, B.** and H. M. Wainwright (2015), Floodplain functioning – Hotspots/hot moments identification and their utility for predicting system response to perturbations, SFA 2.0 Retreat, Bodega Bay, Oct. 15-16, 2015.
- [5] **Arora, B.**, D. Dwivedi, S. S. Hubbard, C. I. Steefel, and K. H. Williams (2015), Towards improved characterization of geochemical hot moments: A combined wavelet-entropy approach, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Stanford, June 29 – July 2, 2015.
- [4] **Arora, B.** (2014), Upscaling constructs: Approaches to identify, interrogate and model functional zones and biogeochemical reactive transport across scales, SFA 2.0 Retreat, Bodega Bay, Oct. 23-24, 2014.
- [3] **Arora, B.**, K. U. Mayer, C. I. Steefel, N. F. Spycher, S. S. Sengor, D. Jacques, and P. Alt-Apping (2014), Reactive transport benchmarks on heavy metal cycling, Goldschmidt Conference, Sacramento, Jun. 8-13, 2014.
- [2] **Arora, B.**, and B. P. Mohanty (2009), Preferential flow and uncertainty: A hydrological

perspective, Water Management & Hydrologic Sciences Seminar, Texas A&M University, College Station, Feb. 12, 2009.

- [1] **Arora, B.**, and B. P. Mohanty (2009), Parameterization and modeling of preferential flow and transport in soil columns, Dept. of Biological & Agricultural Engineering Seminar, Texas A&M University, College Station, Sept. 7, 2009.

## Society & Honorary Memberships

---

- American Geophysical Union
- Geological Society of America
- Alpha Epsilon

## Service & Synergistic Activities

---

### 1. Editorial and Reviewer Activities:

- Review Editor, *Frontiers in Water*, 2019-Present.
- Reviewed >30 papers for a variety of journals including *Applied Geochemistry*, *Nature Geoscience* and *Water Resources Research*.
- Link to my Publons reviewer profile ([here](#))

### 2. Proposal Reviewer:

- Panelist, GEM Fellowship Program (60 proposals), Alexandria, VA, Nov 14-16, 2018
- Panelist, DOE Subsurface Biogeochemical Research Program (11 proposals), Washington D.C., May 15-16, 2017
- Ad-hoc reviewer, NSF Geosciences program
- Ad-hoc reviewer, Stanford Synchrotron Radiation Lightsource (SSRL).

### 3. Conference Session Organizer:

- Primary convener, Characterizing Spatial and Temporal Variability of Hydrological and Biogeochemical Processes across Scales, AGU Fall Meeting, 2018-14. Co-convener: Haruko Wainwright (LBL).
- Session Co-chair, Modeling the Critical Zone: Integrating Processes and Data Across Disciplines and Scales, AGU Fall Meeting, 2018-17. Co-conveners: Li Li (Penn State), Harry Vereecken (IBG), and Praveen Kumar (UIUC).
- Primary convener, Near Surface Processes, 2018 TOUGH Symposium, Oct. 8-10, 2018.
- Café Topic Lead, Bedrock Controls on Eco-Hydrology and Watershed Exports, Watershed

Science Collaboration Workshop, Sept. 23-25, 2018. Co-convenor: Ben Gilbert (LBL).

- Breakout Session Lead, Upscaling constructs: approaches to identify, interrogate and model functional zones and associated biogeochemical reactive transport across the genome, plot, floodplain, watershed and basin scales, SFA 2.0 Retreat, Oct. 22-24, 2014.
- Session Co-Chair, Soil organic matter dynamics in the Anthropocene, AGU Fall Meeting, Dec. 9-13, 2013. Co-conveners: Kate Lajtha (Oregon State University), Dipankar Dwivedi (LBL), and William Riley (LBL).

#### **4. Service to the Division, Area and the Laboratory:**

- Early Career Representative, EESA Awards Committee, Apr. 2018-Present.
- Lead, Biogeochemical Cycling Group, Energy Geosciences Division, May 2017-Present.
- Department Representative, Distinguished Scientist Seminar Series committee, Earth & Energy Sciences Area, Lawrence Berkeley National Laboratory, 2015-Present
- Working Group Member, Diversity and Inclusion Council, Earth and Environmental Sciences Area, Sept. 2015-Present.
- Search Committee Member, Watershed Hydrologist Research Scientist position, Energy Geosciences Division, Spring 2017.
- Early Career Participant, Round table lunch discussion with the Expert Assessment Committee, Director's Review of EESA, Feb. 21, 2017.
- Poster presenter, DOE-ASCAC review of LBNL's LDRD program, Lawrence Berkeley National Laboratory, Jan. 4, 2017.

#### **5. Other Service:**

- 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, 41<sup>st</sup> Annual Solano Avenue Stroll, 2015, 2014.