# CHARULEKA VARADHARAJAN

Research Scientist, Earth and Environmental Sciences Area
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## RESEARCH INTERESTS

Environmental data science and informatics, water quality, biogeochemistry related to water-energy-carbon nexus.

## EDUCATION

**Lawrence Berkeley National Laboratory (2014)** **Berkeley, CA**
Postdoctoral Fellow, Geochemistry Department, Earth Sciences Division

**Massachusetts Institute of Technology (2009)** **Cambridge, MA**
Ph.D., Department of Civil and Environmental Engineering
Thesis: Magnitude and Spatio-Temporal Variability of Methane Emissions from a Eutrophic Freshwater Lake

**Massachusetts Institute of Technology (2004)** **Cambridge, MA**
Master of Science, Information Technology in Civil and Environmental Engineering
Thesis: A Wavelet-Based System for Event Detection in Online Real-Time Sensor Data

**Indian Institute of Technology, Madras (2001)** **Chennai, India**
Bachelor of Technology, Department of Civil and Environmental Engineering
Thesis: Integrated Coastal Zone Management using Geographic Information Systems (GIS)

## EXPERIENCE

**Lawrence Berkeley National Laboratory** **Berkeley, CA**
*Research Scientist (May 2018-current), Project Scientist (Mar 2014 – Apr 2018)*

Research applies data science methods to understand and predict impacts of natural and anthropogenic perturbations on the environment, and particularly on water resources. Leading development of cyberinfrastructure for data management and model-data integration towards building a knowledgebase to enable management, integration, analysis and modeling of diverse environmental datasets across different semantic, spatial and temporal scales. Applying statistical and machine learning methods to determine patterns and relationships between environmental variables, and predict future changes. Projects include:

- Investigating the impacts of extreme streamflow disturbances (floods/droughts) on water quality using data-driven methods as a new ***DOE BER Early Career Awardee***.
- ***Deputy lead of DOE's ESS-DIVE*** (Environmental Systems Science Data Infrastructure for a Virtual Ecosystem) data repository (http://ess-dive.lbl.gov. Responsibilities include project management and oversight, determining data standards for automated extraction of data from files, leading community engagement including coordination with the environmental science community across several DOE national labs (e.g. PNNL, ORNL, LLNL, ANL, BNL, SLAC), user facilities, and data systems (e.g. EMSL, JGI, KBase, ESGF)
- ***Data management component/task lead for three projects***: DOE's NGEE Tropics (https://ngee-tropics.lbl.gov/), DOE's Watershed Function Sustainable Focus Area (http://watershed.lbl.gov/) and a Fukushima environmental monitoring project in collaboration with the Japanese Atomic Energy Agency. Developed software to acquire, fuse and visualize diverse data from distributed sources, built templates to report metadata for sensor observations, supervised data archival and public release, QA/QC, visualization and model-data integration efforts.
- Investigating the application of surrogate modeling methods (including neural network and other machine learning methods) to predict groundwater levels in partnership with computer scientists. The goal is to enable rapid decision making to assist with the implementation of California's Sustainable Groundwater Management Act.
- Led the development of a pilot model-data integration pipeline using Jupyter notebooks as ***LBNL co-PI of an SBIR Phase 1*** project with Kitware inc.
- Assessed potential environmental impacts of hydraulic fracturing on groundwater quality in California for federal and state agencies. Participated in an expert panel providing recommendations to the California State Water Board for monitoring groundwater near oil and gas wells.

**Lawrence Berkeley National Laboratory** **Berkeley, CA**
*Postdoctoral Fellow (2010-2014) Supervisor: Dr. Peter S. Nico*

Research focused on the biogeochemistry of contaminants in shallow groundwater and sediments.

- Assessed impacts of potential leakage of carbon dioxide from geologic carbon sequestration sites to overlying groundwater aquifers in partnership with the Environmental Protection Agency (EPA), Electric Power Research Institute, Southern Company. Conducted laboratory and spectroscopic analysis of samples from a field experiment injecting carbon dioxide into a shallow groundwater system.
- Evaluated mechanisms and long-term effectiveness of chromium(VI) bioremediation at the DOE's Hanford site using laboratory and synchrotron methods.

**Parsons Laboratory for Environmental Science and Engineering, MIT** **Cambridge, MA**
*Graduate Student (2004-2009) Thesis Advisor: Prof. Harold F. Hemond*

Examined contribution of methane emissions from freshwater lakes. Designed and conducted a 3-year field and laboratory study of methane cycle and emissions from a lake, focused on bubbling. Analyzed time-series sensor data of methane bubbling using statistical approaches, and a novel, wavelet-based method. Results indicated that methane bubbling was triggered by changes in hydrostatic pressure, and that lakes should be considered important natural sources in the global methane budget contributing to climate change.

**Department of Civil and Environmental Engineering, MIT** **Cambridge, MA**
*Teaching Assistant (2005-2008)*

Taught "Introduction to Computers and Engineering Problem Solving" (Java programming)
Instructed a total of ~100 students over 3 years. Collaborated with a team of 5-8 teaching assistants and 2 professors to create and review course material, and to conduct tutorials and office hours.

**Center for Educational Computing and Initiatives, MIT** **Cambridge, MA**
*Research Assistant*

- **i-Labs project** (2003-2005)
  Programmed web services in C#, created a SQL Server database, and designed APIs and web pages for software used by universities to create online real-time laboratories.
- **Jewish Women's Archive** (2001-2003)
  Designed and maintained a Java-based website and a backend Oracle database.

**Department of Civil and Environmental Engineering, IIT Madras** **Chennai, India**
*Undergraduate Student (2000-2001)*

Worked on a decision support system based on systems analysis for integrated coastal zone management in the Gulf of Kachchh, India. Created a GIS based tool in Visual Basic to assess the impacts of industrialization and urbanization on ecological features of the coast.

## AWARDS, HONORS & MEDIA

- DOE Early Career Research Award (2019; link to news article)
- Senior Fellow at Berkeley Institute of Data Sciences (2016)
- News article: Berkeley Lab-Developed Digital Library is a Game Changer for Environmental Research (link)
- News article: To Pump or Not to Pump: New Tool Will Help Water Managers Make Smarter Decisions (link)
- Earth and Environmental Sciences Area Spot Awards, LBNL (2018, 2016, 2014, 2011)
- MIT Linden Earth System Fellow (2008-09)
- National Science Foundation Doctoral Dissertation Research Improvement Grant (2007)
- Geological Society of America Graduate Student Research Grant (2007)
- MIT Martin Family Society Fellow for Sustainability (2005-06)
- MIT Department of Civil & Environmental Engineering, Trond Kaalstad Award for leadership, community building and academic excellence (2005)
- Institute Blues for exceptional extra-curricular and organizational abilities, IIT Madras (2001)
- National Talent Search Award for academic excellence, National Council of Educational Research & Training, Government of India (1995)

## PEER-REVIEWED PUBLICATIONS

***Researcher Id is S-4238-2019; h-index: web of science 11, google scholar 13***

1. Hubbard, SS, **Varadharajan, C**, Wu, Y, Wainwright, H, Dwivedi, D. Emerging technologies and radical collaboration to advance predictive understanding of watershed hydrobiogeochemistry. Hydrological Processes. 2020; 1– 8. https://doi.org/10.1002/hyp.13807
2. Chadwick KD, Brodrick P, Grant K, Goulden T, Henderson A, Falco N, Wainwright H, Williams KH, Bill M, Breckheimer I, Brodie EL, Steltzer H, Williams CFR, Blonder B, Chen J, Dafflon B, Damerow J, Hancher M, Khurram A, Lamb J, Lawrence C, McCormick M, Musinksky J, Pierce S, Polussa A, Porro MH, Scott A, Singh HW, Sorensen PO, **Varadharajan C**, Whitney B, Maher K (accepted in Methods in Ecology and Evolution), "Integrating airborne remote sensing and field campaigns for ecology and Earth system science"
3. Mueller, J.; Park, J.; Sahu, R.; **Varadharajan, C.**; Arora, B.; Faybishenko, B.; Agarwal, D. (2020), Surrogate Optimization of Deep Neural Networks for Groundwater Predictions. Journal of Global Optimization. DOI: 10.1007/s10898-020-00912-0.
4. **C. Varadharajan** *et al*., "Challenges in Building an End-to-End System for Acquisition, Management, and Integration of Diverse Data From Sensor Networks in Watersheds: Lessons From a Mountainous Community Observatory in East River, Colorado," in *IEEE Access*, vol. 7, pp. 182796-182813, 2019. doi: 10.1109/ACCESS.2019.2957793
5. Koven C., Knox R., Fisher R., Chambers J.,Christoffersen B., Davies S., Detto M., Dietze M., Faybishenko B., Holm J., Huang M., Kovenock M., Kueppers L., Lemieux G., Massoud E., McDowell N., Muller-Landau H., Needham J., Norby R., Powell T., Rogers A., Serbin S., Shuman J., Swann A., Varadharajan C., Walker A., Wright J., and Xu C., (2020) (Biogeosciences), Benchmarking and Parameter Sensitivity of Physiological and Vegetation Dynamics using the Functionally Assembled Terrestrial Ecosystem Simulator (FATES) at Barro Colorado Island, Panama
6. Grossiord C, Christoffersen B, Alonso-Rodríguez AM, Anderson-Teixeira K, Asbjornsen H, Aparecido LMT, Berry ZC, Baraloto C, Bonal D, Borrego I, Burban B, Chambers JQ, Christianson DS, Detto M, Faybishenko B, Fontes CG, Fortunel C, Gimenez BO, Jardine KJ, Kueppers LM, Miller GR, Moore GW, Negron-Juarez R, Stahl C, Swenson NG, Trotsiuk V, **Varadharajan C**, Warren JM, Wolfe BT, Wei L, Wood TE, Xu C, McDowell NG (2019). Precipitation mediates sap flux sensitivity to evaporative demand in the neotropics, *Oecologia* **191,** 519–53. https://doi.org/10.1007/s00442-019-04513-x
7. Gimenez, B.O., Jardine, K.J., Higuchi, N., Negrón-Juárez, R.I., Sampaio-Filho, I. de J., Cobello, L.O., Fontes, C.G., Dawson, T.E., **Varadharajan, C.**, Christianson, D.S., Spanner, G.C., Araújo, A.C., Warren, J.M., Newman, B.D., Holm, J.A., Koven, C.D., McDowell, N.G., Chambers, J.Q., (2019). Species-Specific Shifts in Diurnal Sap Velocity Dynamics and Hysteretic Behavior of Ecophysiological Variables During the 2015-2016 El Niño Event in the Amazon Forest. Front. Plant Sci. 10, 830. https://doi.org/10.3389/fpls.2019.00830
8. Varadharajan, C., S. Cholia, C. Snavely, V. Hendrix, C. Procopiou, D. Swantek, W. J. Riley, and D. A. Agarwal (2019), Launching an accessible archive of environmental data*, Eos,* 100, https://doi.org/10.1029/2019EO111263
9. Hubbard, S. S., K. H. Williams, D. Agarwal, J. Banfield, H. Beller, N. Bouskill, E. Brodie, R. Carroll, B. Dafflon, D. Dwivedi, N. Falco, B. Faybishenko, R. Maxwell, P. Nico, C. Steefel, H. Steltzer, T. Tokunaga, P. A. Tran, H. Wainwright, and **C. Varadharajan** (2018). The East River, Colorado, Watershed: A Mountainous Community Testbed for Improving Predictive Understanding of Multiscale Hydrological–Biogeochemical Dynamics. Vadose Zone J. 17:180061. doi:10.2136/vzj2018.03.0061.
10. **Varadharajan C.**, Tinnacher R.M., Zheng L., Dafflon B., Wu Y., Reagan M.T., Birkholzer J., Trautz R., Carey J.W. (2018). *Chapter 15: A review of studies examining the potential for groundwater contamination from CO2 sequestration* in AGU Monograph on Caprock integrity, Wiley Blackwell, doi:10.1002/9781119118657.
11. Christianson D.C., **Varadharajan C.***, Christoffersen B., Detto M., Faybishenko B., Jardine K.J., Negron-Juarez R., Gimenez B.O., Pastorello G.Z., Powell T.L., Warren J.M., Wolfe B.T., Chambers J.Q., Kueppers L.M., McDowell N.G., Agarwal D (2017). A metadata reporting framework (FRAMES) for synthesis of earth system observations, *Ecological Informatics.* https://doi.org/10.1016/j.ecoinf.2017.06.002. (*Corresponding author)
12. **Varadharajan, C.**, Beller, H. R., Bill M., Brodie E.L., Conrad M.E., Han, R. Y., Irwin C., Larsen J.T., Lim H., Rafa S.M., Steefel C.,Van Hise A., Yang, L., and P.S. Nico (2017), Re-oxidation of chromium(III) products formed under different biogeochemical regimes, *Environmental Science and Technology*, *51* (9), 4918-4927
13. Stringfellow W.T., Camarillo M.K., Domen J.K., Sandelin W.L., **Varadharajan C.**, Jordan P.D., Reagan M.T., Cooley H., Heberger M.G., Birkholzer J.T. (2017), Identifying chemicals of concern in hydraulic fracturing fluids used for oil production, *Environmental Pollution*, Volume 220, Part A, Pages 413-420, ISSN 0269-7491.

14. Preheim, S. P.; Olesen, S. W.; Spencer, S. J.; Materna, A.; **Varadharajan, C.**; Blackburn, M.; Friedman, J.; Rodríguez, J.; Hemond, H.; Alm, E. J. (2016), Surveys, simulation and single-cell assays relate function and phylogeny in a lake ecosystem. *Nature Microbiology*, *1*, 16130.
15. Zheng, L., Spycher, N., Bianchi M., Pugh, J.D., **Varadharajan, C.**, Tinnacher, R.M., Nico, P.S., Trautz, R.C. (2016), Impacts of Elevated Dissolved $CO_2$ on a Shallow Groundwater System: Reactive Transport Modeling of a Controlled-Release Field Test, *Chemical Geology*, 447, 117-132.
16. **Varadharajan, C.**, Han, R. Y., Beller, H. R., Yang, L., Marcus, M. A., Michel, M., Nico, P. S. (2015), Characterization of Chromium Bioremediation Products in Flow-Through Column Sediments Using Micro-X-ray Fluorescence and X-ray Absorption Spectroscopy, *Journal of Environmental Quality*, 44 (3), 729-738.
17. Zheng, L., Spycher, N., **Varadharajan, C.**, Tinnacher, R.M., Pugh, J.D., Bianchi, M., Nico, P.S., Trautz, R.C. (2015), On the mobilization of metals by $CO_2$ leakage into shallow aquifers: exploring release mechanisms by modeling field and laboratory experiments, *Greenhouse Gases: Science and Technology*, 5, 1-16.
18. Stringfellow W. T., Cooley H., **Varadharajan C.**, Heberger M., Reagan M., Domen J. K., Sandelin W., Camarillo M. K., Jordan P., Donnelly K., Nicklisch S., Hamdoun A. and Houseworth J. (2015), Chapter 2: Impacts of Well Stimulation on Water Resources. In An Independent Scientific Assessment of Well Stimulation in California, Volume II: Generic and Potential Environmental Impacts of Well Stimulation Treatments, Chapter 2 California Council on Science and Technology, Lawrence Berkeley National Laboratory, and the Pacific Institute. Available at: http://ccst.us/projects/hydraulic_fracturing_public/SB4.php
19. CCST (California Council on Science and Technology), Lawrence Berkeley National Laboratory, Pacific Institute. (2014), Advanced Well Stimulation Technologies in California: An Independent Review of Scientific and Technical Information. Retrieved from http://ccst.us/publications/2014/2014wst.pdf
20. Beller H.R., Yang L., **Varadharajan C.**, Han R., Lim H.C., Karaoz U., Molins S., Marcus M.A., Brodie E.L., Steefel C.I. and P.S. Nico (2014), Divergent Aquifer Biogeochemical Systems Converge on Similar and Unexpected Cr(VI) Reduction Products, *Environmental Science and Technology,* 48, (18), 10699-10706.
21. **Varadharajan C**, Tinnacher R.M., Pugh J.D., Trautz R.C., Zheng L., Spycher N.F., Birkholzer J.T., Castillo-Michel H., Esposito R.A., and P.S.Nico (2013), A laboratory study of the initial effects of dissolved carbon dioxide ($CO_2$) on metal(loid) release from shallow sediments, *International Journal for Greenhouse Gas Control,* 19: 183-211.
22. Trautz R.C., Pugh J.D., **Varadharajan C.**, Zheng L., Bianchi M., Nico P.S., Spycher N.F., Newell D.L., Esposito R.A., Wu Y., Dafflon B., Hubbard S.S., and J.T. Birkholzer (2013), Effect of Dissolved $CO_2$ on a Shallow Groundwater System: A Controlled Release Field Experiment, *Environmental Science and Technology, 47(1)*
23. **Varadharajan, C.** and H.F. Hemond (2012). Time -series analysis of high-resolution ebullition fluxes from a stratified, freshwater lake, *Journal of Geophysical Research, Biogeosciences, 117,* G02004. **Selected as Editors' highlight (April 2012).**
24. Scandella, B.P., **Varadharajan, C.**, Hemond H.F., Ruppel C., and R. Juanes (2011), A conduit dilation model of methane venting from lake sediments, *Geophysical Research Letters, 38,* L06408
25. **Varadharajan C.**, Hermosillo R. and Hemond H.F (2010). A low-cost automated trap to measure bubbling gas fluxes, *Limnology and Oceanography Methods* 8:363-375.
26. Harward, V.J., del Alamo, J.A., Lerman, S.R., Bailey, P.H., Carpenter, J., DeLong, K., Felknor, C., Hardison, J., Harrison, B., Jabbour, I., Long, P.D., Tingting Mao, Naamani, L., Northridge, J., Schulz, M., Talavera, D., **Varadharajan, C.,** Shaomin Wang, Yehia, K., Zbib, R., Zych, D. "The iLab Shared Architecture: A Web Services Infrastructure to Build Communities of Internet Accessible Laboratories," *Proceedings of the IEEE*, vol.96, no.6, pp.931-950, June 2008

## OTHER PUBLICATIONS

1. U.S. DOE (2019). Open Watersheds by Design. Available at https://doesbr.org/documents/Open_Watersheds_By_Design_DRAFT.pdf
2. Hendrix, V.C, Christianson D.S., Hubbard, S.S., Agarwal D.A., and Varadharajan, C., BASIN-3D: Reducing the data processing burden for earth scientists, Science Gateways 2019
3. Esser B. K., Beller H.R., Carroll S., Cherry J. A., Gillespie J., Jackson R., Jordan P. D., Madrid V., Morris J., Parker B., Stringfellow W. T., **Varadharajan C.** and Vengosh A. (2015), Recommendations on Criteria for Groundwater Sampling, Testing, and Monitoring of Oil and Gas Development in California, Lawrence Livermore National Laboratory LLNL-TR-669645. www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/index.shtml
4. Tinnacher, R. M.; Dwivedi D.; Houseworth J. E.; Reagan, M. T.; Stringfellow, W. T.; **Varadharajan, C.**; Birkholzer, J. T. (2016), Chapter 4: Hydraulic Fracturing from the Groundwater Perspective. Book Chapter in Groundwater Assessment, Modelling and Management, Taylor & Francis, ISBN 9781498742849.
5. **Varadharajan, C.**, Birkholzer J.T., Kraemer S., Porse S., Carroll S., Wilkin R., Maxwell R., Bachu S., Hovorka S., Daley T., Digiulio D., Carey W., Strasizar B., Huerta N., Gasda S., and W. Crow (2012), Summary Report on $CO_2$ Geologic Sequestration & Water Resources Workshop, LBNL Report, LBNL-5346E, January 2012.

6. Trautz R.C., Pugh J.D., Zheng L., Spycher N.F., Nico P.S., **Varadharajan C.**, Dafflon B., Wu Y., Newell D.L., Esposito R.A., Hubbard S.S., Birkholzer J.T., Tinnacher R.M., Bianchi M., Evaluation of dissolved $CO_2$-induced metals mobilization in groundwater using a controlled release experiment. Proceedings for 1$^{1th}$ International Conference on Greenhouse Gas Technologies (GHGT), November 2012, Japan.
7. Hardison J., Zych D., Del Alamo J. A., Harward V. J., Lerman S. R., **Varadharajan C.**, Wang S. M.,Yehia K., "The Microelectronics Weblab 6.0 – An Implementation Using Web Services and the iLab Shared Architecture", *Proceedings of the iNEER Conference for Engineering Education and Research*, Taiwan March 2005
8. Harward J., del Alamo J., de Long K., Hardison J., Lerman S., Northridge J., **Varadharajan C.**, Wang S., Yehia K., Zych D., "iLab: A Scalable Architecture for Sharing Online Experiments", *Proceedings of International Conference on Engineering Education*, Florida October 2004

## INVITED OR PLENARY TALKS/PANELS

1. (Plenary Talk) Varadharajan C., et al. (2020 May). ESS-DIVE Update: New Features, Standards and Community Activities. DOE ESS Virtual PI Meeting. (~400 participants attended the session in the virtual meeting).
2. (Invited Talk) Utilizing Diverse Data in Scientific Analysis and Modeling for Water Resource Management. American Geophysical Union Fall Meeting, December 2019
3. (Plenary, Invited Talk) Open Science by Design – Data, Codes, and Interoperability. Integrated HydroTerrestrial Modeling (IHTM) Workshop, Sep 2019.
4. (Plenary Talk) Open Science By Design- Making it Happen: People and Resources. Synthesis presentation of workshop breakouts. IHTML Workshop, Sep 2019. Members in audience included Tim Petty (Asst. Secretary for Interior and member of water subcabinet), and to heads of several federal agencies.
5. (Plenary Talk) Varadharajan C., Agarwal D., Cholia S, Snavely C, Hendrix V, O'Brien F, Elbashandy A, Gunter D, Riley W, Ong Y, Jones C, Jones M, Budden AE, Vieglais D, Whitenack K. (2019 April). ESS-DIVE Data Archive Update. DOE ESS PI Meeting, Washington DC
6. (Panel Discussion) Invited panelist at California Safe Drinking Water Challenge Launch with co-panelists Felicia Marcus, chair of California Water Board and Thomas Harter, Prof. UC Davis (link to video)
7. (Plenary Talk) Varadharajan C., Agarwal D., Cholia S, Snavely C, Hendrix V, O'Brien F, Elbashandy A, Gunter D, Riley W, Ong Y, Jones C, Jones M, Budden AE, Vieglais D, Whitenack K. Environmental System Science - Data Infrastructure for a Virtual Ecosystem (ESS-DIVE) Data Archive Update. DOE 13$^{th}$ Annual PI Meeting, May 2018.

## OTHER FIRST AUTHOR CONFERENCE TALKS

- Varadharajan C., Hendrix V., and Agarwal D. *A brokering approach to integrate diverse environmental datasets for online visualization, modeling and analysis*. American Geophysical Union Fall Meeting, December 2018.
- Varadharajan C., Faybishenko B., Versteeg R., Agarwal D. and S. Hubbard. *Management and assimilation of diverse, distributed watershed datasets*. American Geophysical Union Fall Meeting, December 2016.
- Varadharajan C., Cooley H., Jordan P., Heberger M., Reagan M., Camarillo M.K., Domen J., and Stringfellow W.T. *Impacts of Hydraulic Fracturing on Water Quality in California*. 13th IWA Special Conference on Watershed and River Basin Management, September 2014.
- Varadharajan C., Beller H., Han R., Marcus M.A, Steefel C., Yang L., Nico P.S. *Spectroscopic studies of chromium bioremediation products in flow-through column sediments*. American Chemical Society Meeting, March 2012.
- Varadharajan C., Nico P.S., Yang L., Marcus M.A, Han, R., Bill, M., Larsen, J.T., Van Hise, A., Molins, S. Steefel C., Conrad, M., Brodie E and Beller H.R. *Evaluation of chromium reductive immobilization and oxidative remobilization in flow-through aquifer sediment columns*. Goldschmidt, August 2011.
- Varadharajan C., Birkholzer J.T., Esposito, R., Hubbard, S., Nico, P.S., Pugh, J., Spycher, N., Trautz R., Wu, Y., and Zheng, L. *Evaluating the effects of $CO_2$ intrusion on trace metal mobility in freshwater aquifers*, Annual Carbon Capture and Sequestration Conference, May 2011.
- Varadharajan C., Tcaciuc A.P., Borja E., and Hemond H.F. *Methane export from a eutrophic temperate freshwater lake.* ASLO/NABS Summer Meeting, June 2010.

## FIRST/PRESENTING AUTHOR POSTER PRESENTATIONS

- (Poster) Varadharajan C., A Community-Centered Approach to Managing Environmental Data in Repositories", AGU Fall Meeting, Dec 2019
- Petela V., Varadharajan C.*, Jordan P.. Analysis of TDS Concentration in Relation to Oil and Gas Produced Water Disposal Ponds in Kern County, California. AGU Fall Meeting, Washington DC, Dec 2018.

- Varadharajan C., Versteeg R., Faybishenko B., Hendrix V., Henderson M., and D. Agarwal. *LBNL Watershed SFA Data Management and Assimilation*. DOE 13th Annual PI Meeting, May 2018.
- Varadharajan C , Pasterello G ,Faybishenko B ,Christianson DS , Hendrix VC , Robles E., Christoffersen B, Jardine KJ ,Negron-Juarez R ,Gimenez BO, Powell TL, Warren JM, Wolfe BT, Chambers JQ, Kueppers LM, McDowell NG, Agarwal D. (2019 April). NGEE Tropics Data Management and Synthesis. DOE ESS PI Meeting, Wash. DC.
- Varadharajan C., Agarwal D., Cholia S, Snavely C, Hendrix VC, O'Brien F, Elbashandy A, Gunter D, Riley W, Ong Y, Jones C, Jones M, Budden AE, Vieglais D, Whitenack K. *ESS-DIVE Publishing Lifecycle and Community Outreach*. DOE 13th Annual PI Meeting, May 2018.
- Varadharajan C , Pasterello G ,Faybishenko B ,Christianson DS , Hendrix VC , Christoffersen B, Detto M, Jardine KJ ,Negron-Juarez R ,Gimenez BO, Grossiord C, Powell TL, Warren JM, Wolfe BT, Chambers JQ, Kueppers LM, McDowell NG, Agarwal D. *NGEE Tropics Data Management and Products*. DOE 13th Annual PI Meeting, 2018.
- Varadharajan C., Versteeg R., Faybishenko B., and D. Agarwal. *Agile data management and synthesis for heterogeneous, multiscale watershed datasets*. DOE 11th Annual PI Meeting, April 2016.
- Varadharajan C., Pastorello G., Christianson D.S., Faybishenko B., Hu P., Devarakonda R., Crow M., Killeffer T., Hook L., Boden T., and Agarwal D., *Development and management of tropical forest datasets for model simulation and benchmarking*, DOE 11th Annual PI Meeting, Apr 2016.
- Varadharajan C., T., Cooley H., Heberger, Stringfellow W.T., M., Domen J. K., Sandelin W., Camarillo M. K., Jordan P., Reagan M., Donnelly K., Birkholzer J.T., and J. Long. *Characteristics and management of flowback/produced water from hydraulically fractured wells in California - findings from the California SB 4 assessment*. American Geophysical Union Fall Meeting, December 2015.
- Varadharajan C., Faybishenko B., Versteeg R. and D. Agarwal. *Agile data management and synthesis for heterogeneous, multiscale watershed datasets*. American Geophysical Union Fall Meeting, December 2015.
- Varadharajan C., Versteeg R., Faybishenko B., and D. Agarwal. *Genomes to Watershed Data Management and Assimilation*. DOE 10th Annual PI Meeting, May 2015.
- Varadharajan C., Versteeg R., Faybishenko B., and D. Agarwal. Sustainable Systems SFA Data Management and Assimilation. DOE 9th Annual PI Meeting, May 2014.
- Varadharajan C., R. Han, S. Molins, M. Conrad, J. Christensen, M. Bill, C. Steefel, J. Larsen, L. Yang, E. L. Brodie, H. R. Beller, P. S. Nico. *Competing evidence for enzymatic versus abiotic reduction of Cr(VI) in Hanford 100H flow-through columns.* DOE Subsurface Biogeochemical Research 7th Annual PI Meeting, April 2012.
- Varadharajan C., Nico P.S., Yang L., Han, R., Bill, M., Larsen, J.T., Van Hise, A., Molins, S. Steefel C., Conrad, M., Lim H., Brodie E.L. and Beller H.R. *Evaluating the risk of chromium reoxidation in aquifer sediments following a reductive bioremediation treatment*. American Geophysical Union Fall Meeting, December 2011.
- Varadharajan C., Nico P.S., Yang L., Marcus M.A, Steefel C., Larsen J.T., Beller H.R., Brodie E. *Spectroscopic analysis of chromium bioremediation products*. American Geophysical Union Fall Meeting, December 2010.
- Varadharajan C., Nico P.S., Pugh J.D., Zheng L., Spycher N., Birkholzer J.T., and Trautz R. *Evaluating the effects of $CO_2$ intrusion on trace metal mobility in freshwater aquifers*, Geological Society of America Meeting, Oct 2010.
- Varadharajan C. and Hemond H.F. *Analysis of high-temporal-resolution methane ebullition fluxes from a eutrophic, dimictic, freshwater lake*. American Geophysical Union Fall Meeting, December 2009.
- Varadharajan C., Borja E., Tcaciuc A.P. and Hemond H.F. *High-temporal-resolution measurement of methane ebullition from a stratified, eutrophic lake*. European Geosciences Union General Assembly, April 2009.
- Varadharajan C., Borja E., Tcaciuc A.P. and Hemond H.F. *Temporal and spatial variation in methane bubbling from a stratified, eutrophic lake*. American Geophysical Union Fall Meeting, December 2008.
- Varadharajan C. and Hemond H.F. *Magnitude and spatio-temporal variability of methane export from a seasonally stratified, eutrophic lake*. American Geophysical Union Fall Meeting, December 2007.

## TECHNICAL SKILLS

- Data processing, statistical analysis and software coding: Python, R, MATLAB, Java, C#, Javascript, SQL.
- Environmental sample analysis: Wet-lab chemical methods to analyze gas, metal, nutrient and organic matter concentrations in water and sediment samples. Lab and synchrotron based techniques to determine mineral properties and metal-mineral associations.
- Field skills: Water quality testing, gas and water sample collection, sediment coring, sensor deployment.
- Fabrication of equipment in a machine shop.

## PROFESSIONAL AND COMMUNITY SERVICE ACTIVITES

- Co-Chair, Data Management, DOE Earth System Science Cyberinfrastructure Working Group (2016-2020)
- Member of Science Advisory Committee for SLAC Groundwater Quality SBR SFA, PI: John Bargar
- Member of Science Advisory Board for the National Microbiome Data Collaborative (NMDC; $10 M/yr project funded by BER)
- Member of LBNL Scientific IT Advisory Board (2018-current).
- Technical committee member for Integrated Hydroterrestrial Modeling Workshop (Sep 2019). This was a workshop to develop a national capability for predication and scenario-building of water-related issues bringing together 10 federal agencies (one of ~10 DOE representatives who was chosen to attend). Contributed to report writing.
- Co-organized and co-authored report for "Open and Coordinated Watershed science" DOE SBR workshop (Jan 2019) led by James Stegen, PNNL.
- Participated in two 2017 CCST-DWR workshops for AB1755 implementation at UC Berkeley, and leading efforts to coordinate with the DWR on building testbeds for open water data. Organizer of "Intro to Jupyter for Water Data Analysis" as LBNL representative to the California Safe Drinking Water Challenge in July 2018 (link)
- Participated in multiple LBNL workshops as an environmental data expert including LBNL AI Townhall (2019) EESA's ETA's Energy probe collective workshop for intelligence in Energy technologies (2019), EESA-ETA resilience workshop (2018), EESA's Ecosense workshop (2017), EESA-BIDS data science workshop (2017)
- Participated in developing EESA Strategic Plan for Future Water and Sustainable Earth Grand Challenges (2016).
- Participated in EESA SupEr : Supervisor Enrichment program and leadership training (Summer 2019)
- Mickey Leland Energy Fellow (MLEF) Mentor to Zachary Levinson (2019) and Valerie Petela (2018) investigating the impacts of produced water disposal via ponds on shallow groundwater.
- Session Chair, "Cyberinfrastructure for field work: data standards, computer applications, instrumentation and best practices", 2014 AGU Fall Meeting
- Technical Coordinator, EPA/LBNL CO2 Geologic Sequestration & Water Resources Workshop, Berkeley, Jun 2011. Organized the workshop, which included determining workshop themes and participants, coordinating logistics and writing a report for the EPA.
- Lead, Sustainable Systems SFA Junior Staff Discussion Group, Earth Sciences Division, Lawrence Berkeley National Lab (2010-2012). Organized talks and discussions for ESD early career staff involved in subsurface biogeoscience remediation projects sponsored by DoE.
- Member of hiring committees for multiple EESA research scientists.
- Reviewer for various journals including International Journal of Greenhouse Gas Control, Greenhouse Gases: Science and Technology, Chemical Geology, Water Resources Research, Environmental Pollution, PLOS One, STOTEN, IEEE Access, DOE-SBIR grants