

Yiwei Cheng (Wayne)

Earth Sciences Division, Lawrence Berkeley National Laboratory | yiweicheng@lbl.gov |
<http://www.linkedin.com/in/yiweicheng>

Education

Georgia Institute of Technology, Atlanta, Georgia, 2005 – 2013

Ph.D. in Civil and Environmental Engineering, GPA: 3.9 May 2013
Areas of Concentration: Environmental Water Resource and Fluid Dynamics, Climate Change, Ecosystem Modeling and Management, High Performance Computing for Scientific Simulation
Minor: Geographic Information Systems

M.S. in Computer Science and Engineering, GPA: 3.9 2012
Areas of Concentration: High Performance Computing (GPU), Algorithm Optimization

M.S. in Civil and Environmental Engineering, GPA: 4.0 2009
Areas of Concentration: Environmental Water Resource and Fluid Dynamics, Climate Change, Ecosystem Modeling and Management

B.S. in Civil and Environmental Engineering, GPA: 3.8 (highest honor) 2007
Areas of Concentration: Environmental Engineering

Honors and Awards

- Keith Runcorn Award from European Geosciences Union 2011
- Everglades Foundation Fellowship 2010
- Georgia Institute of Technology International Student Scholarship, 2006 - 2007
- Faculty Honors and Dean's List for academic achievement from Fall 2005 to Spring 2007.

Professional Research Experience

Lawrence Berkeley National Laboratory May 2013 — Present

Position: Geological Postdoc Fellow

1. Microbially Enhanced Hydrocarbon Recovery/Oil Field Souring
 - In collaboration with the Energy Biosciences Institute. Research involves application of biological knowledge to improve hydrocarbon production and energy yields in oil fields.
 - Main modeler in the development and application of column-field reactive-transport model to investigate hydrogen sulfide production and remediation in the oil field.
2. Improve algal-bacterial interactions for biofuel production.
 - In collaboration with Lawrence Livermore National Laboratory.
 - Main modeler in the development and application of microbial dynamics model to study the conditions under which algal-bacterial interactions optimize biofuel production.

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3. Next Generation Ecosystem Experiments - Arctic.

- Development of a mechanistic microbial nitrogen fixation module for coupling to CLM.

Ecohydrological Lab at Georgia Tech

2006 — 2013

Position: Graduate Research Assistant

Advisor – Dr Marc Stieglitz (CEE), Co-Advisor – Dr Greg Turk (Computer Graphics)

Thesis Title: Impacts of Self-Organizing Mechanism and Topography on Wetland (Arctic and Tropical) Ecosystem Dynamics

- Explore how the incorporation of a mechanistic understanding of vegetation self-organization-topography interactions into models, affect predictions of landscape level vegetation patterning, ecosystem carbon-nutrient and water cycling, under changing climate.
- Development and application of a spatially explicit eco-hydrological wetland model in Graphics Processing Unit (GPU, CUDA by NVIDIA) for computational speedup (Speedup: 100X).
- Participated in drafting of proposal to funding agencies (NSF) that resulted in funding of ~\$600,000 for the lab.

Other Projects

1. Arctic Tundra

- Conducted field experiments in Arctic Long Term Ecological Research Station (LTER) to investigate how snow and shrubs independently and interactively affect physical and biological controls over decomposition and soil N dynamics in arctic tundra.
- Developed model to simulate first order processes operating at the land- atmosphere interface to understand the impact of snow on the ground thermal regime in arctic Alaska.

2. Florida Everglades

- Developed an eco-hydrological model in collaboration with National Park Service (NPS) to investigate the impacts of management and climate change on the Florida Everglades.

3. Pacific Northwest Old-growth Forest

- Participated in the development of an eco-hydrological model for Environmental Protection Agency (EPA) to investigate the impacts of clear-cutting and climate change on the old growth coniferous.

International Arctic Research Center Summer School

Aug 2006

- Workshop on arctic terrestrial and freshwater ecosystems with focus on ecosystem interactions with hydrology and climate.

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- Attended lectures and demonstrations by leading scientists from University of Alaska Fairbanks and Marine Biological Laboratory.

Environmental Microbiology Lab at Georgia Tech

May 2005 – Dec 2006

Advisor – Dr Jim Spain

- Photobiological hydrogen production by cyanobacteria: Studied relationship between cyanobacteria and other organisms to develop tools for bioprospecting of cyanobacteria.
- Bioremediation: Isolation and analysis of bacteria capable of degrading natural occurring nitroaromatic compounds from the environment for bioremediation.

Teaching Experience

Teaching Assistant at Georgia Tech

Hydrology for Undergraduates (class size: ~50 students)

Fall 2009, 2010

Physical Hydrology for Graduate (class size: 5 – 15 students)

Spring 2010 - 2012

- Led and developed courses teaching students how to design eco-hydrological models in Processing.
- Conceived and organized class materials, prepared and delivered lectures, guided students through research projects.

Founder and President of X³: Experience, Experiment and Excel

2011 - 2013

- Founded a non-profit educational organization, with Dekalb Path Academy, Georgia.
- Led team in guiding middle school students through creative scientific activities.

Instructor of Georgia Intern Fellowships for Teachers (GIFT)

Summer 2010, 2011

- Taught and developed courses teaching middle – high school teachers to design computer-based educational applications.

Talks

Cheng, Y., Stieglitz, M. *Simulating Watershed Scale Hydrologic Characteristics From Fine Scale Processes*, Arctic LTER Meeting, Woods Hole, MA, USA, Feb 2010.

Stieglitz, M., Cheng, Y., Engel, V., Turk, G. *Scale Dependent Nutrient Feedback as a General Mechanism for Vegetation Patterning and Tree Island Formation in Wetland Ecosystems*. Greater Everglades Ecosystem Restoration, Naples, Florida, USA, July 2010.

Stieglitz, M., Cheng, Y., Engel, V., Turk, G., Chen, J., Ross, J. *GPU Acceleration of an Advection-Diffusion-Reaction Model to Better Understand the Ubiquitous Nature of Nutrient Depletion and the Consequences for Ecosystem Structure*. Florida International University, Miami, Florida, USA, Sept 2011.

Cheng, Y., Stieglitz, M., Turk, G., Ross, J., Engel, V. *Exogenous and Endogenous Controls*

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Impact Evolution and Resilience of Wetland Vegetation Patterns. 9th INTECOL International Wetlands Conference, Orlando, Florida, USA, June 2012.

Cheng, Y., Ajo-Franklin, J., Hubbard, C., Wu, Y., Surasani, V., Bouskill, N., Li, L., Hubbard, S. *Advanced Modeling and Geophysical Monitoring of Microbial Reservoir Souring Processes*. Energy Biosciences Institute Retreat, Urbana-Champaign, Illinois, USA, July 2013.

Stieglitz, M., Cheng, Y., Turk, G., Ross, J., Engel, V. *The Influence of Topography and Vegetation Self-Organization Over Resource Fluxes in Wetland Ecosystems*. European Geophysical Union Conference, Vienna, Austria, April 2014.

Brodie, E., King, E., Karaoz, U., Cheng, Y., Tang, J., Riley, W., Molins, S., Bouskill, N. *Genome informed trait-based models for improved prediction of microbial dynamics and biogeochemical rates*. 2014 EAS Annual Meeting, Sacramento, USA, August 2014.

Cheng, Y., Druhan, J., Wanner, C., Amos, R., Steefel, C., and Ajo-Franklin, J. *Microbially Mediated Kinetic Sulfur Isotope Fractionation: Reactive Transport Modeling Benchmark*. Subsurface Environmental Simulation Benchmarking Workshop, Chateau de Cadrache, France, Oct 2014.

Druhan, J., Arora, B., Cheng, Y., Steefel, C. *Carbon Isotope Partitioning in Natural and Labeled Systems: A Reactive Transport Modeling Benchmark Study*. Subsurface Environmental Simulation Benchmarking Workshop, Chateau de Cadrache, France, Oct 2014.

Dias, F., Gu, Y., Agarwalla, Y., Cheng, Y., Patil, S., Stieglitz, M. and Turk, G. *Rendering Future Vegetation Change Across Large Regions of the US*. AGU Joint Assembly, Montreal, Canada, May 2015.

Cheng, Y., Li Li, Bouskill, N., Hubbard, C.G., Molins, S., Zheng, L., Karoz, U., Engelbrekton, A., Coates, J.D and Ajo-Franklin, J. *Omic Driven Reservoir Souring Model*. 5th International Symposium on Applied Microbiology and Molecular Biology in Oil Systems, Stavanger, Norway, Jun 2015.

Conference Presentations (most recent 15)

Cheng, Y., Stieglitz, M., Turk, G., Engel, V. *Flow Field and Nutrient Dynamics Governing the Formation of Parallel Vegetation Patterns in the Florida Everglades*, American Geophysical Union Conference, San Francisco, USA, Dec 2009.

Cheng, Y., Stieglitz, M., Turk, G., Engel, V. *Parallel Vegetation Stripe Formation Through Hydrologic Interactions*, European Geophysical Union Conference, Vienna, Austria, May 2010.

Abdelnour, A., S. Patil, M. Stieglitz, R. McKane, F. Pan, and Y. Cheng. *Catchment hydro-biogeochemical response to climate change and future land-use*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2010.

Cheng, Y., Stieglitz, M., Turk, G., Engel, V. *The Ubiquitous Nature of Nutrient Depletion and*

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the Consequences for Ecosystem Structure, European Geophysical Union Conference, Vienna, Austria, April 2011.

Cheng, Y., Stieglitz, M., Turk, G., Engel, V. *Demonstrating the Power of GPU Simulations for an Advection-Reaction-Diffusion Model*, European Geophysical Union Conference, Vienna, Austria, April 2011.

Cheng, Y., Ajo-Franklin, J., Hubbard, C., Wu, Y., Surasani, V., Bouskill, N., Li, L., Hubbard, S. *Advanced Modeling and Geophysical Monitoring of Microbial Reservoir Souring Processes*. Energy Biosciences Institute Retreat, Urbana-Champaign, Illinois, USA, July 2013.

Pan, J., Stieglitz, M., Cheng, Y., Pan, Y. *Predicting real-time soil carbon fluxes in Alaska at High Spatial Resolution*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2013.

Cheng, Y., Ajo-Franklin, J., Hubbard, C., Wu, Y., Surasani, V., Bouskill, N., Li, L., Engelbrekton, A., Coates, J., Hubbard, S. *Understanding Microbial Reservoir Souring and Desouring Processes Using Reactive Transport Modeling*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2013.

Hubbard, C., Cheng, Y., Ajo-Franklin, J., Druhan J., Li, L., Engelbrekton, A., Coates, J., Conrad, M. *Interpreting isotopic analyses of microbial sulfate reduction in oil reservoirs*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2013.

Karaoz, U., Cheng, Y., Bouskill, N., Tang, J., Beller, H., Brodie, E., Riley, W. *Genome informed trait based models*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2013.

King, E., Karaoz, U., Cheng, Y., Tang, J., Riley, W., Molins, S., Bouskill, N., Brodie, E. *Trait-based approaches to modeling the microbial biogeochemistry from terrestrial to aquatic ecosystems*. Goldschmidt, Sacramento, USA, June 2014.

Cheng, Y., Tang, J., Riley, W., Bouskill, N. *A Trait-based Model for Understanding Rates, Patterns, and Ecological Consequences of Microbial Nitrogen Fixation in High-latitude Terrestrial Ecosystems*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2014.

Cheng, Y., Li Li, Bouskill, N., Hubbard, C.G., Molins, S., Zheng, L., Engelbrekton, A., Coates, J.D and Ajo-Franklin, J. *Integrated Microbial Trait Based-Reactive Transport Modeling Approach Towards Understanding Microbial Reservoir Souring/Desouring*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2014.

Cheng, Y., Druhan, J., Wanner, C., Amos, R., Steefel, C., and Ajo-Franklin, J. *Microbially Mediated Kinetic Sulfur Isotope Fractionation: Reactive Transport Modeling Benchmark*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2014.

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Bouskill, N., Riley, W., Cheng, Y., Tang, J. *A Microbial Model of Nitrous Oxide Production That Differentiates Nitrification and Denitrification Production Across Spatial and Temporal Scales*. American Geophysical Union Fall Meeting, San Francisco, USA, Dec 2014.

Dias, F., Gu, Y., Agarwalla, Y., Cheng, Y., Patil, S., Stieglitz, M. and Turk, G. *Rendering Future Vegetation Change Across Large Regions of the US*. European Geophysical Union Conference, Vienna, Austria, April 2015.

Publications

Book Chapter

Cherry, J., Déry, S., Cheng, Y., Stieglitz, M., Pan, F. 2014. *Climate and Hydrometeorology of the Toolik Lake Region and the Kuparuk River Basin: Past, Present and Future*. In: *Alaska's Changing Arctic: Ecological Consequences for Tundra, Streams, and Lakes* [J.E. Hobbie and G. W. Kling (eds)]. Oxford University Press, New York, NY, USA.

Journals

Cheng, Y., Stieglitz, M., Pan, F. 2010. *Simple Method to Evolve Daily Ground Temperatures From Surface Air Temperatures in Snow Dominated Regions*. *Journal of Hydrometeorology*. **11**, 1395 – 1404.

Cheng, Y., Stieglitz, M., Turk, G., Engel, V. 2011. *Effects of Anisotropy on Pattern Formation in Wetland Ecosystems*. *Geophysical Research Letter*. Doi: 10.1029/2010GL046091.

Abdelnour, A., McKane, R., Stieglitz, M., Pan, F., Cheng, Y., 2013. *Effects of Harvest on Carbon and Nitrogen Dynamics in a Pacific Northwest Forest Catchment*. *Water Resource Research*, **49**, 1 - 22. Doi: 10.1029/2012WR020038.

Hubbard, C., Cheng, Y., Ajo-Franklin, J., Druhan J., Li, L., Engelbrektson, A., Coates, J., Conrad, M. 2014. *Isotopic insights into microbial sulfur cycling in oil reservoirs*. *Front. Microbiol.* 5:480. Doi: 10.3389/fmich.2014.00480.

Cheng, Y., Li Li, Bouskill, N., Hubbard, C.G., Molins, S., Zheng, L., Engelbrektson, A., Coates, J.D and Ajo-Franklin, J. *Understanding Microbial Reservoir Souring and Remediation: A Comprehensive Reactive Transport Model of Sulfur Cycling and Isotope Fractionation as Impacted by Nitrate and Perchlorate Treatments*. (In Prep)

Cheng, Y., Tang, J., Riley, W., Bouskill, N. *A Trait-based Model for Understanding Rates, Patterns, and Ecological Consequences of Microbial Nitrogen Fixation in High-latitude Terrestrial Ecosystems*. (In Prep)

Research Interests

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- Multi-scale modeling and systems approach solutions to environmental and energy problems
- Geochemical elemental (C, N, P, isotope) and hydrologic cycling within ecosystems
- Responses of terrestrial ecosystems to climate change
- High performance computing for scientific simulation
- Advanced techniques for scientific visualization

Memberships

- Member of Society of Petroleum Engineers
- Member of Arctic Long Term Ecological Research Station
- Member of American Geophysical Union
- Member of European Geosciences Union
- Member of The Chi Epsilon and Tau Beta Phi

Professional Activities

- Session Chair, Biogeochemical and Isotopic Characterization and Modeling of Biologically Mediated Processes Across Scales, AGU Fall Meeting 2014.
- Reviewer of *Geophysical Research Letters*, *Journal of Theoretical Biology* and *Journal on Water Quality Exposure and Health, Hydrological Processes, Geology*.
- Session Chair in European Geosciences Union General Assembly 2011. Led and organize a session in the EGU Assembly 2011.

Skills

- Fluent in English, Mandarin and Hokkien (Chinese Dialect)
- Strong analytical and problem solving skills.
- Strong statistical analysis of data and technical writing.
- Proficient in the following computing language: NVIDIA CUDA, C++, Processing (open source), Matlab, Mathematica, JAVA, javascript, fortran
- Proficient in software: JMP (by SAS, statistics), ESRI ArcGIS (Geographic Information System), ERDAS IMAGINE (Remote sensing), HEC-RAS (Hydraulics)