

KEVIN R. ROCHE

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EDUCATION

Ph.D., Environmental Engineering, Northwestern University, September 2017
Thesis Title: Transport Processes at the Sediment-Water Interface
Advisor: Aaron I. Packman
B.S., Chemical Engineering, Purdue University, May 2004

PROFESSIONAL EXPERIENCE

Fulbright Research Scholar, Institute of Environmental Assessment and Water Research,
Spanish National Research Council, Barcelona, Spain, Oct 2019 - Present
Postdoctoral Research Associate, University of Notre Dame, Aug 2017 – Oct 2019
Youth and Family Development Advocate, Peace Corps, Costa Rica, Mar 2010 – Jun 2012
Physics Teacher, Peace Corps, Guinea, Jun 2009 – Sep 2009
Process Control Engineer, Eli Lilly and Company, Indianapolis, IN, Jun 2004 – Jun 2009

AWARDS & FELLOWSHIPS

Fulbright Junior Scholar Award (Barcelona, Spain), 2019 – 2020
Water Resources Research Editor's Choice Award, 2018
Terminal Year Fellowship, Northwestern University, 2016 – 2017
Outstanding Student Presentation Award, AGU Fall Meeting, 2015
NSF Graduate Research Fellowship, 2013 – 2016
Walter P. Murphy Graduate Fellowship, Northwestern University, 2012
Freshman Engineering Merit Scholarship, Purdue University, 2001
James W. and Betty Dye Scholarship (Full Tuition), Purdue University, 2000 – 2004

PEER-REVIEWED PUBLICATIONS (*corresponding author)

16. Roche, K.R., Müller-Itten*, M., Dralle, D., Bolster, D., & Müller, M.F.* (2020). "Climate change and the opportunity cost of conflict." *Proceedings of the National Academy of Sciences*, 117 (4) 1935-1940.
15. Ward, A.S.* et al. (2019). "Spatial and temporal variation in river corridor exchange across a 5th-order mountain stream network." *Hydrol. Earth Syst. Sci.*, 23, (12), 5199-5225.
14. Bolster, D.*, Roche, K.R., Morales, V.L. (2019). "Recent advances in anomalous transport models for predicting contaminants in natural groundwater systems." *Current Opinion in Chemical Engineering* 26, 72-80.

13. Ward, A.S.* , et al. (2019). "Co-located contemporaneous mapping of morphological, hydrological, chemical, and biological conditions in a 5th-order mountain stream network, Oregon, USA." *Earth System Science Data*, 11(4), 1567-1581.
12. Kim, J., **Roche, K.R.**, Bolster, D., & Doudrick, K.* (2019). "Transport of Food- and Catalytic-Grade Titanium Dioxide Nanoparticles in Controlled Field Streams with Varying Streambed and Biofilm Conditions." *Environmental Science: Nano* 6 (11), 3454-3466.
11. Riis, T.* , Reisinger, A.J., Aubeneau, A., **Roche, K.R.**, et al. (2019). "Riverine macrophytes control seasonal nutrient uptake via both physical and biological pathways." *Freshw Biol.*, 00, 1-15.
10. **Roche, K.R.*** , Li, A., Bolster, D., Wagner, G., & Packman, A.I. (2019). "Effects of turbulent hyporheic mixing on reach-scale transport." *Water Resources Research*, 55.
9. Sherman, T.* , **Roche, K.R.**, Richter, D., Packman, A.I., & Bolster, D. (2019). "A dual domain stochastic model for predicting transport in open channels with hyporheic exchange." *Advances in Water Resources*, 125, 57-67.
8. **Roche, K.R.*** , Shogren, A., Aubeneau, A.F., Tank, J.T., & Bolster, D. (2019). "Modeling benthic vs. hyporheic uptake in unshaded streams with varying substrates." *JGR-Biogeosciences*, 124(2), 367-383.
7. Lian, Y.P., Dallmann, J., Sonin, B., **Roche, K.R.**, Liu, W.K., Packman, A.I., Wagner, G.J.* (2019). "Large eddy simulation of turbulent flow over and through a rough permeable bed." *Computers and Fluids*, 180, 128-138.
6. **Roche, K.R.*** , Blois, G., Best, J.L., Christensen, K.T., Aubeneau, A.F., & Packman, A.I. (2018). "Turbulence links momentum and solute exchange in coarse-grained streambeds." *Water Resources Research*, 54 (Editor's Choice Award; Featured in Eos)
5. Aquino, T.* , **Roche, K.R.**, Aubeneau, A.F., Packman, A.I., & Bolster, D. (2017). "A Process-based model for bioturbation-induced mixing." *Scientific Reports*, 7 (1), 14287.
4. **Roche, K.R.*** , Drummond, J.D., Boano, F., Packman, A.I., Battin, T.J., & Hunter, W.R. (2016). "Benthic Biofilm Controls on Fine Particle Dynamics in Streams." *Water Resources Research*, 53, 222–236.
3. **Roche, K.R.*** , Aubeneau, A.F., Xie, M., Aquino, T., Bolster, D., & Packman, A.I. (2016). "An Integrated Experimental and Modeling Approach to Predict Sediment Mixing from Benthic Burrowing Behavior." *Environmental Science and Technology*, 50 (18), 10047–10054.
2. Stonedahl, S. H.* , **Roche, K.R.**, Stonedahl, F., & Packman, A. I. (2015). "Visualizing hyporheic flow through bedforms using dye experiments and simulation." *Journal of Visualized Experiments*, (105), e53285-e53285.

1. **Roche, K.** & Douce, L. (2007)*. "Synthesis of Mesomorphic 3,5-Bis(3,4,5-trialkyloxybenzoylamino)-4-methylbenzoates Involving Intermolecular Hydrogen Bonding." *Journal of the Iranian Chemical Society*, Vol. 4, No. 4., 402-407.

SUBMITTED PUBLICATIONS

Lian, Y.P., Dallmann, J., Sonin, B., **Roche, K.R.**, Liu, W.K., Packman, A.I., Wagner, G.J.* "Double averaging analysis applied to a large eddy simulation of coupled turbulent overlying and pore-water flow." (*In review*)

Grant, S.B*, Gomez-Velez, J.D., Ghisalberti, M., Guymer, I., Boano, F., **Roche, K.R.**, Harvey, J.D. "Turbulent mixing in the benthic biolayer of streams." (*in revision*)

ADDITIONAL PUBLICATIONS (NON-PEER REVIEWED)

Roche, K.R., Marshall, A.M., Paiwonsky, P., Yan, J., Brenner, L., & Saia, S.M. (2019). "The value of early-career mentoring through AGU." *Eos*, 100.

PUBLICATIONS IN PREPARATION

Müller, M.* , **Roche, K.R.**, Dralle, D. "Catchments as modulators of climate variability."

Müller, M.* , **Roche, K.R.**, Bolster, D., Rinaldo, A. "On the topological drivers of network resilience."

Roche, K.R.*, McNew, C.P., Shogren, A., Dahlke, H., & Bolster, D. "Particle size determines residence times in experimental streams: insights from DNA-labeled particulate tracers."

Sund, N.* , Drummond, J.D., **Roche, K.R.**, Baeumer, B., & Schumer, R. "Reach-scale modeling of transport and reaction due to aerobic respiration in streams."

Roche, K.R.*, Aquino, T., Sherman, T., Bolster, D., Dentz, M. "A dual continuum analytical model for solute transport in coarse-grained streams."

Roche, K.R.*, Hixson, J., González-Pinzón, R., Herzog, S., Ward, A., Dentz, M. & Bolster, D. "Benthic biofilm growth controls reach-scale respiration rates in open canopy streams."

INVITED LECTURES

Utah State University, Department of Civil Engineering, Logan, UT, Mar 2020

University of Alabama, Department of Civil, Construction, and Environmental Engineering, Tuscaloosa, AL, Mar 2020

George Mason University, Department of Civil Engineering, Fairfax, VA, Feb 2020

Boise State University, Department of Civil Engineering, Boise, ID, Feb 2020

Iowa State University, Department of Civil, Construction, and Environmental Engineering, Ames, IA, Jan 2020

Pennsylvania State University, Department of Geosciences, University Park, PA, Jan 2020

University of Illinois at Chicago, Department of Civil and Materials Engineering,
Chicago, IL, Feb 2019

University of Notre Dame, Environmental Fluid Dynamics Seminar Series,
Notre Dame, IN, Nov 2018

Indiana University, School of Public and Environmental Affairs Seminar Series,
Bloomington, IN, Feb 2018

Northwestern University, Environmental Engineering Seminar Series, Evanston, IL, Feb 2017

Purdue University, Hydraulics/Hydrology Seminar Series, Dept. of Civil Engineering,
W. Lafayette, IN, Sep 2015

PRESENTATIONS

Roche, K.R., Jennifer D. Drummond, Nicole L. Sund, Rina Schumer, Marco Dentz (2020, May). *Reach-scale modeling of reaction cascades and spatially-dependent reactions in the hyporheic zone*. European Geophysical Union, Vienna, Austria. (oral, invited)

Roche, K.R., Müller-Itten, M., Dralle, D., Bolster, D., & Müller, M.F. (2019, Jun). *On climate change, water variability and conflicts*. Gordon Research Conference, Andover, NH. (poster)

Roche, K.R., Shogren, A., Aubeneau, A.F., Tank, J.T., & Bolster, D., (2018, Dec) *Modeling benthic vs. hyporheic nutrient uptake in unshaded streams with varying substrates*. American Geophysical Union Fall Meeting, Washington, DC. (oral)

Müller, M.F., Roche, K.R., Dralle, D., Bolster, D., & Müller-Itten, M (2018, Dec). *On the relation between hydrologic variability and violence*. American Geophysical Union Fall Meeting, Washington, DC. (poster)

Roche, K.R., Shogren, A., Aubeneau, A.F., Tank, J.T., & Bolster, D., (2018, Jun) *Stochastic modeling of reactive transport in experimental streams*. International Symposium on Environmental Hydraulics, Notre Dame, IN. (oral)

Roche, K.R., Li, A., Bolster, D., & Packman, A.I., (2017, Dec) *Effects of turbulent hyporheic mixing on reach-scale solute transport*. American Geophysical Union Fall Meeting, New Orleans, LA. (oral)

Roche, K.R., S. Dutta, K. Mittal, Fischer, P., Drummond, J.D., Boano, F., Packman, A.I., Battin, T.J., and Hunter, W.R., (2017, Jun) *Benthic biofilm structure alters fine particle deposition and resuspension in streams*. HydroEco 2017, Birmingham, UK. (oral)

Roche, K.R., Drummond, J.D., Boano, F., Packman, A.I., Battin, T.J., and Hunter, W.R. (2016, Dec) *Benthic biofilm controls on fine particle dynamics in streams*. American Geophysical Union Fall Meeting, San Francisco, CA. (poster)

Roche, K.R., Aubeneau, A.F., and Packman, A.I. (2015, Dec). *Turbulent hyporheic exchange in highly permeable sediments*. American Geophysical Union Fall Meeting, San Francisco, CA. (oral, Outstanding Student Presentation Award)

- Roche, K.R (2015, Dec). *Time(scale) to relax*. Hydrology Student Pop-Up Presentations, American Geophysical Union Fall Meeting, San Francisco, CA. (oral)
- Roche, K.R., Aubeneau, A.F., and Packman, A.I. (2015, Oct). *Turbulent hyporheic exchange in highly permeable sediments*. American Geophysical Union Chapman Conference: The MADE Challenge for Groundwater Transport in Highly Heterogeneous Aquifers. Valencia, Spain (poster)
- Roche, K.R., Aubeneau, A.F., and Packman, A.I. (2015, May). *turbulent hyporheic exchange in highly permeable sediments*. Society for Freshwater Sciences Annual Meeting, Milwaukee, WI. (oral)
- Roche, K.R., Hunter, W.R., Drummond, J.D., Battin, T.J., Boano, F., and Packman, A.I. (2014, Jul). *Biofilm complexity controls fine particle dynamics in streams* Consortium of Universities Allied for Water Research (CUAHSI) Biennial Meeting, Shepherdstown, WV. (oral and poster)
- Roche, K.R., Xie, M., Aubeneau, A., and Packman, A.I. (2013, Dec). *Anomalous sediment mixing by bioturbation*. American Geophysical Union Fall Meeting, San Francisco, CA. (poster)

VISITING APPOINTMENTS

- WasserCluster Lunz, Lunz, Austria, Apr – May, 2014
Faculty mentor, Tom Battin

GRANTS

- Fulbright Junior Scholar Award, Spain (\$23,400), 2019-2020
Notre Dame Linked Experimental Ecosystem Facility experiment grant (\$1,500), 2018
AGU Chapman Conference on Groundwater Transport travel grant (\$2,000), 2015
CUAHSI Pathfinder Travel Grant (\$5,000), 2014
NSF Graduate Research Fellowship (\$132,000), 2013 – 2016

PROFESSIONAL SERVICE ACTIVITIES

Technical Committees

- CUAHSI Diversity, Equity, and Inclusion Subcommittee, Jun 2019 – present
AGU Hydrology Section Student Subcommittee, Feb 2015 – Jan 2017
AGU Student Conference Planning Subcommittee, Feb 2015 – Dec 2016

Conference Sessions Chaired

- Finding the Fringes: A first conversation in interdisciplinary Fulbright research, Fulbright Spain Research Conference, Nov 2019
Social Dimensions Pop-Ups, AGU Fall Meeting, Dec 2015
Hydrology Section Student Pop-Ups, AGU Fall Meeting, Dec 2016

Journals Refereed

Earth-Science Reviews, Geophysical Research Letters, Hydrological Processes, JGR-Biogeosciences, Journal of Hydrology, npj Biofilms and Microbiomes, PLOS One, Water Resources Research

EDUCATION AND OUTREACH

Teaching Assistant, Environmental Transport Processes (CIV-ENV 440), Northwestern University, 2013, 2015

Subject Matter Expert and Facilitator, Climate Change and Sustainability Workshop for Chicago-Area STEM Teachers, Aug 2015

“Hallway Conversations” interview series founder and contributor, Young Hydrologic Society, 2015 – 2016

Lab outreach and demonstrations (Packman lab); National Student Leadership Conference, Career Day for Girls, Chicago Public Schools, Take Your Sons and Daughters to Work Day, 2012 – 2017

PROFESSIONAL AFFILIATIONS

American Geophysical Union (AGU)

European Geophysical Union (EGU)

SCHOLARLY WORKSHOPS AND SHORT COURSES

National Socio-Environmental Synthesis Center (SESYNC) – “Social-Environmental Approaches to Watershed Management and Governance”, SESYNC Headquarters (2020, participant)

NCED Summer Institute – “Subsurface to Surface: recovering surface dynamics from stratigraphic records”, University of Minnesota (2013, participant)

STUDENTS MENTORED

Northwestern University: Andrea Salus (undergraduate, 2013), Daniel Russman (undergraduate, 2013), Toritseju Eshedagho (graduate, 2013), Kimberly Huynh (undergraduate, 2014), Liliana Hernandez (undergraduate, 2014), Dingyuan Duan (graduate, 2015-2016); Thomas Sherman (graduate, 2017-2019); Junyeol Kim (graduate, 2018-present)