Sara C. Troutman

Ph.D. Candidate
Department of Civil and Environmental Engineering
University of Michigan

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EDUCATION

University of Michigan, Ann Arbor, MI

Ph.D. Environmental Engineering	Anticipated April 2020
M.S.E. Electrical and Computer Engineering	December 2019
Signal & Image Processing and Machine Learning	
M.S.E. Civil Engineering	April 2017
Intelligent Systems	

North Carolina State University, Raleigh, NC

B.S. Environmental Engineering	May 2015
B.S. Mathematics	May 2015
Minor: Spanish	
Valedictorian, *summa cum laude*	

SELECTED ACTIVITIES IN PROGRAMMING

- Proficient programmer in Python, MATLAB, Julia, LaTeX.

- Contributor to `pystorms`, a Python package and stormwater control simulation sandbox that builds on the widely used U.S. EPA Storm Water Management Model (SWMM) simulation engine and PySWMM, a Python wrapper of SWMM. github.com/kLabUM/pystorms

- Contributor to `rrcf`, a Python-based open-source implementation of the robust random cut forest algorithm for anomaly detection on streaming data. github.com/kLabUM/rrcf

RESEARCH AND PROFESSIONAL EXPERIENCE

University of Michigan, Ann Arbor, MI
Graduate Research Assistant

Data-driven, real-time modeling and control of urban water systems   August 2015–Present
- Developing an automated modeling toolchain to predict wet-weather impacts on combined sewer systems and wastewater treatment plant operations and performance
- Establishing coordinated control methodologies to operate distributed sewer assets for system-wide objectives
- Elucidating how dynamic and coupled control sewer and wastewater treatment systems impact operational decisions and regional water quality outcomes

Simulation sandbox and Python package (`pystorms`) for smart stormwater   March 2019–Present
- Creating a library of anonymized stormwater networks and corresponding delineated assessment scenarios
- Constructing a streamlined programming interface for users of the package
- Hosting a web portal with forum and tutorials for broad adoption in stormwater and control communities

Energy-food-water systems   August 2015–April 2017
- Worked within REFRESCH, a University-wide interdisciplinary team, to design an off-grid recirculating aquaculture system, focusing on water, energy, and food budgets

North Carolina State University, Raleigh, NC
Undergraduate Researcher

| **Experimental granular activated carbon studies** | May 2014–May 2015 |

- Designed isotherm experiments for carcinogenic volatile organic compound (cVOC) removal using granular activated carbon (GAC)
- Analyzed relationships between cVOC concentrations, GAC adsorption capacity, temperature, and GAC type

| **Distributed water treatment train modeling and optimization** | January 2013–May 2015 |

- Examined influence of design parameters on effectiveness and costs of water treatment methods, including granular activated carbon, packed tower aeration, and advanced oxidation processes
- Constructed mathematical functions for modeling water conveyance and treatment sequences
- Analyzed monthly pumping data from groundwater wells to determine seasonal demand patterns

Eaton Corporation, Middlesex, NC — January 2012–August 2013*
Environmental, Health, and Safety Co-op — *Three semesters

- Collaborated with engineers and operators for the installation and troubleshooting of water recirculation systems
- Led Green Team monthly meetings to discuss and further environmental projects in industrial plant
- Calculated water and electricity usage and waste generation in industrial plant

PEER-REVIEWED JOURNAL PUBLICATIONS

[4] Rimer, S. P., A. Mullapudi, **S. C. Troutman**, B. Kerkez *et al.* 2020. pystorms: A simulation sandbox for the development and evaluation of stormwater control algorithms. In preparation. open-storm.org/pystorms; github.com/kLabUM/pystorms.

[3] **Troutman, S. C.**, N. G. Love, B. Kerkez. 2020. Balancing water quality and flows in combined sewer systems using real-time control. In review. github.com/stroutm/LBCsewer.

[2] Bartos, M. D., A. Mullapudi, **S. C. Troutman**. 2019. rrcf: Implementation of the Robust Random Cut Forest algorithm for anomaly detection on streams. *Journal of Open Source Software*, **4**(35): 1336. DOI: 10.21105/joss.01336. github.com/kLabUM/rrcf.

[1] **Troutman, S. C.**, N. Schambach, N. G. Love, B. Kerkez. 2017. An automated toolchain for the data-driven and dynamical modeling of combined sewer systems. *Water Research*, **126**: 88–100. DOI: 10.1016/j.watres.2017.08.065. github.com/kLabUM/DRIPS.

MAGAZINE PUBLICATIONS

[1] Ewing, G., A. Mullapudi, **S. C. Troutman**, B. Kerkez, W. Barrott. 2019. Open-Storm Detroit Dynamics: Real-time stormwater controls reduce combined sewer overflows and defer millions in capital investments. *Water Environment & Technology*, **31**(7): 28–35.

ORAL PRESENTATIONS   *presenter*

[12] **Troutman, S. C.***, N. G. Love, B. Kerkez. Real-Time Control of Sewer Systems to Balance Flow and Water Quantity Objectives. Borchardt Conference: 25th Triennial Symposium on Advancements in Water & Wastewater. Ann Arbor, MI, USA. Feb 25–26 2020.

[11] **Troutman, S. C.**, S. P. Rimer*, A. Mullapudi, B. Kerkez. A Benchmarking Library for Making Smart Stormwater Research Accessible. American Geophysical Union Fall Meeting, AGU. San Francisco, CA, USA. Dec 9–13 2019.

[10] **Troutman, S. C.***, A. Mullapudi, S. P. Rimer, B. Kerkez. A Benchmarking Framework for Evaluating the Performance of Control Algorithms in Smart Stormwater Networks. 17th International Computing & Control for the Water Industry Conference, CCWI. University of Exeter, Exeter, United Kingdom. Sep 1–4 2019.

[9] Mullapudi, A.*, S. P. Rimer, **S. C. Troutman**, B. Kerkez. A Benchmarking Framework for Control of Smart Stormwater Networks. 10th IWA Symposium on Modelling and Integrated Assessment, Watermatex. Copenhagen, Denmark. Sep 1–4 2019.

[8] Rimer, S. P.*, A. Mullapudi, **S. C. Troutman**, B. Kerkez. A Benchmarking Framework for Smart Stormwater Systems. World Environmental & Water Resources Congress, EWRI. Pittsburgh, PA, USA. May 19–23 2019.

[7] **Troutman, S. C.***, A. Mullapudi, B. Kerkez. Open-Storm Detroit Dynamics. Water@Michigan: Urban Water. University of Michigan, Ann Arbor, MI, USA. May 6 2019.

[6] Ewing, G.*, A. Mullapudi, **S. C. Troutman**, B. Kerkez, W. Barrott, C. Nastally. Open-Storm Detroit Dynamics. LIFT Intelligent Water Systems Challenge, WEFTEC. New Orleans, LA, USA. Oct 1–3 2018. **Award: 1st Place.**

[5] **Troutman, S. C.***, N. G. Love, B. Kerkez. Evaluating Market-Based Algorithms for System-Level TSS Control. 13th International Conference on Hydroinformatics, HIC. Palermo, Italy. Jul 1–6 2018.

[4] **Troutman, S. C.***, N. G. Love, B. Kerkez. Market-Based Real-Time Control of TSS across Large Sewer Systems. World Environmental & Water Resources Congress, EWRI. Minneapolis, MN, USA. Jun 4–7 2018.

[3] **Troutman, S. C.***, N. G. Love, B. Kerkez. Controlling a Sewer Network as an Extension of the Wastewater Treatment Plant. AEESP Research and Education Conference: Advancing Healthy Communities through Environmental Engineering and Science. Ann Arbor, MI, USA. Jun 20–22 2017.

[2] **Troutman, S. C.***, N. G. Love, B. Kerkez. Understanding Combined Sewer Flow Dynamics through Data-Driven Modeling. World Environmental & Water Resources Congress, EWRI. Sacramento, CA, USA. May 21–25 2017.

[1] **Troutman, S. C.***, N. Schambach, B. Kerkez, N. G. Love. Predicting Combined Sewer Flow through the Use of Real-Time, City-Scale Sensor Data. World Environmental & Water Resources Congress, EWRI. West Palm Beach, FL, USA. May 22–26 2016.

POSTER PRESENTATIONS *presenter*

[3] Rimer, S. P.*, A. Mullapudi, **S. C. Troutman**, B. Kerkez. A Benchmarking Framework for Control and Optimization of Smart Stormwater Networks. ACM/IEEE International Conference on Cyber-Physical Systems. Montreal, Canada. Apr 16–18 2019.

[2] **Troutman, S. C.***, N. Schambach, B. Kerkez, N. G. Love. Use of Real-Time Sensor Data in City-Scale Water Modeling. Poster presented at three different conferences:

- Borchardt Conference: 24th Triennial Symposium on Advancements in Water & Wastewater, Ann Arbor, MI, USA, Feb 21–22 2017;
- Michigan Institute for Data Science Annual Symposium, University of Michigan, Ann Arbor, MI, USA, Nov 15–16 2016 (Award: Most Likely Health Impact);
- CUAHSI Biennial Symposium, Shepherdstown, WV, USA, Jul 24–27 2016.

[1] **Troutman, S. C.***, D. Knappe, H. Chmielewski, R. Ranjithan. Informing Water Treatment Designs through Mathematical Modeling. Water Resources & Environmental Engineering Graduate Research Symposium, North Carolina State University. Raleigh, NC, USA. Mar 7 2014.

AWARDS AND HONORS

WRF & WEF LIFT Intelligent Water Systems Challenge	2018

Open-Storm Detroit Dynamics Team

Placed 1st out of 19 teams, $25,000 prize

National Science Foundation Graduate Research Fellowship	2016
Scholarly Achievement Senior Award	2015

Department of Civil, Construction, and Environmental Engineering, NCSU

Awarded to one graduating undergraduate student in department each year

Phi Beta Kappa, Honor Society	2014
Tau Beta Pi, Engineering Honor Society	2012

LEADERSHIP AND SERVICE

Member, Graduate Student Advisory Council (CEE, UM)	2017–2019
Secretary, GrEENPEAS (CEE, UM)	2016–2017

(Graduate Environmental Engineering Network of Professionals, Educators, and Students)

Corresponding Secretary, Tau Beta Pi (NCSU)	2013–2014
Cataloger, Tau Beta Pi (NCSU)	2012–2013

PROFESSIONAL ORGANIZATIONS

Society for Industrial and Applied Mathematics, Member	2017–Present
American Society for Civil Engineers, Member	2016–Present
Water Environment Federation, Member	2015–Present

CERTIFICATIONS

Engineer in Training, North Carolina	2015