

# MATT BARTOS

## Ph.D. Candidate

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## OBJECTIVE

My goal is to build the next generation of **smart** urban water systems by combining my passion for water resources with the latest advances in low-power sensing, signal processing, and dynamic control.

## AT A GLANCE

- 🏗 Multidisciplinary focus that combines embedded electronics, signal processing, control theory, and hydrodynamics.
- 📄 Proven track record of research with 9 refereed publications in journals such as *Nature Climate Change* and *Scientific Reports*.
- 🎓 Experienced in mentoring, lecturing, and developing innovative classroom curricula.
- ⚡ Creator and maintainer of popular open-source scientific libraries averaging several hundred downloads per month.

## EDUCATION

### Ph.D. in Civil Engineering

#### University of Michigan

📅 Sept 2015 – Ongoing

📍 Ann Arbor, MI

- Thesis: *Advancing Urban Flood Resilience with Smart Water Infrastructure*

### M.S. in Electrical and Computer Engineering

#### University of Michigan

📅 Sept 2015 – May 2019

📍 Ann Arbor, MI

- Focus in *Signal & Image Processing and Machine Learning*
- **Selected courses:** machine learning · estimation, filtering and detection · matrix methods · probability and random processes · linear systems theory

### M.S.E. in Civil Engineering

#### University of Michigan

📅 Sept 2015 – May 2019

📍 Ann Arbor, MI

- Focus in *Intelligent Systems*
- **Selected courses:** control systems analysis and design · sensing for civil infrastructure · open channel flow · physical processes of land surface hydrology

### B.S.E. in Environmental Engineering

#### Arizona State University

📅 Sept 2007 – Dec 2013

📍 Tempe, AZ

### B.A. in English Literature

#### Arizona State University

📅 Sept 2007 – Dec 2013

📍 Tempe, AZ

## HONORS

### Fellowships

- J. Robert Beyster Computational Innovation Fellow (2018)
- *Earth Science Information Partners* Community Fellow (2017)
- Henry Earle Riggs Fellow (2015)
- President's Scholarship (2007)

### Grants

- Lab Incubator Awardee, *Earth Science Information Partners* (2018)
- Funding Friday Winner, *Earth Science Information Partners* (2017)

### Professional Associations

- Media Relations Officer, *Chi Epsilon*, Arizona State University Chapter (2012)

### Certifications

- Engineer-in-Training, State of Arizona (2014)

## TEACHING & SERVICE

### Graduate Student Instructor

#### University of Michigan

📅 Sept 2018 – Dec 2018

- Co-instructor for *ENGR100: Robots, Sensors, and Smart Water*.
- Developed lab curriculum focused on embedded systems programming and web development for water resources applications.

### Workshop Instructor

#### Open Storm Workshop

📅 Aug 2017 & Aug 2019

- Taught firmware programming and web infrastructure at two workshops sponsored by the *Consortium of Universities for the Advancement of Hydrologic Science*.

### Research Mentor

#### University of Michigan

📅 Aug 2016 – Dec 2019

- Mentored 5 students through the *Undergraduate Research Opportunities Program*.
- Research projects focused on developing sensor firmware, web applications, and continuous integration services.

## PUBLICATIONS

### Journal Articles

- **Bartos, M.** & Kerkez, B. (2019c). Hydrograph peak-shaving using a graph-theoretic algorithm for placement of hydraulic control structures. *Advances in Water Resources*, 127, 167–179. doi:10.1016/j.advwatres.2019.03.016
- **Bartos, M.**, Mullapudi, A., & Troutman, S. (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
- **Bartos, M.**, Park, H., Zhou, T., Kerkez, B., & Vasudevan, R. (2019). Windshield wipers on connected vehicles produce high-accuracy rainfall maps. *Scientific Reports*, 9(1). doi:10.1038/s41598-018-36282-7
- Habibi, H., Dasgupta, I., Noh, S., Kim, S., Zink, M., Seo, D.-J., ... Kerkez, B. (2019). High-resolution flash flood forecasting for very large urban areas. *Journal of Hydroinformatics*, 21(3), 441–454. doi:10.2166/hydro.2019.100
- **Bartos, M.**, Wong, B., & Kerkez, B. (2018). Open storm: a complete framework for sensing and control of urban watersheds. *Environmental Science: Water Research & Technology*, 4(3), 346–358. doi:10.1039/c7ew00374a
- Mullapudi, A., **Bartos, M.**, Wong, B., & Kerkez, B. (2018). Shaping streamflow using a real-time stormwater control network. *Sensors*, 18(7). doi:10.3390/s18072259
- **Bartos, M.**, Chester, M., Johnson, N., Gorman, B., Eisenberg, D., Linkov, I., & Bates, M. (2016). Impacts of rising air temperatures on electric transmission ampacity and peak electricity load in the United States. *Environmental Research Letters*, 11(11), 114008. doi:10.1088/1748-9326/11/11/114008
- **Bartos, M.** & Chester, M. (2015). Impacts of climate change on electric power supply in the western United States. *Nature Climate Change*, 5(8), 748–752. doi:10.1038/nclimate2648
- **Bartos, M.** & Chester, M. (2014b). The conservation nexus: valuing interdependent water and energy savings in Arizona. *Environmental Science & Technology*, 48(4), 2139–2149. doi:10.1021/es4033343

### Working Manuscripts

- **Bartos, M.** & Kerkez, B. (2019a). *Guided sensor placement in drainage networks using Gramian optimization*. Water Resources Research (in preparation).
- **Bartos, M.** & Kerkez, B. (2019d). *Real-time digital twinning of urban stormwater systems using an implicit hydraulic solver with Kalman filtering*. Environmental Modelling & Software (in preparation).

### Selected Talks

- **Bartos, M.** & Kerkez, B. (2019b). Hydrograph peak attenuation using a graph-theoretic algorithm for optimal placement of hydraulic control structures. World Environmental & Water Resources Congress 2018, Pittsburgh, PA.
- Burgess, A., **Bartos, M.**, & Tan, A. (2019). Increasing the use and value of earth science information. Amazon Web Services Public Sector Summit, Washington DC.

## EMPLOYMENT

### Research Scientist

#### Arizona State University

 Dec 2013 – Aug 2015

Supervisor: Dr. Mikhail Chester

- Full-time researcher for the *Sustainable Urban Systems Lab*.
- Performed research in life-cycle assessment, climate modeling, hydrologic modeling, and risk analysis.
- Authored and published three articles in high-impact journals.

### Lab Assistant

#### SILC Learning Support Services

 June 2008 – Jan 2013

Supervisor: Dr. Andrew Ross

- Provided technical assistance to students in the *School of International Letters and Cultures* at Arizona State University.

## SOFTWARE



#### pysheds

Simple and fast watershed delineation in python.

★ 176    📄 50    👁 14

Available at:

[github.com/mdbartos/pysheds](https://github.com/mdbartos/pysheds)



#### rrcf

Implementation of the *Robust Random Cut Forest* algorithm for anomaly detection on streams.

★ 94    📄 31    👁 11

Available at:

[github.com/kLabUM/rrcf](https://github.com/kLabUM/rrcf)



#### perfect-cell

General purpose firmware for cell-enabled PSoC motes.

★ 12    📄 7    👁 5

Available at:

[github.com/open-storm/perfect-cell](https://github.com/open-storm/perfect-cell)



#### superlink

Implementation of the SUPERLINK hydraulic solver.

★ 4    📄 1    👁 1

Available at:

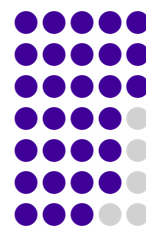
[github.com/mdbartos/superlink](https://github.com/mdbartos/superlink)

- **Bartos, M.** (2018). Automated sensor firmware generation using sensorML. Earth Science Information Partners Winter Meeting 2018, Bethesda, MD.
- **Bartos, M.** & Kerkez, B. (2018). Security of smart water systems: challenges, opportunities and best practices. World Environmental & Water Resources Congress 2017, Minneapolis, MN.
- **Bartos, M.**, Park, H., Zhou, T., Kerkez, B., & Vasudevan, R. (2018). Vehicles as ubiquitous precipitation sensors: enhanced rainfall maps using real windshield wiper observations. 13th International Hydroinformatics Conference, Palermo, Italy.
- Kerkez, B., Mullapudi, A., **Bartos, M.**, & Wong, B. (2018). Characterizing a controllable urban watershed: using web services to control and coordinate stormwater flows. 13th International Hydroinformatics Conference, Palermo, Italy.
- **Bartos, M.**, Park, H., Zhou, T., Kerkez, B., & Vasudevan, R. (2017). Vehicles as sensors to improve urban mobility and water infrastructure. Mcubed symposium, Ann Arbor, MI.
- **Bartos, M.** & Ritchie, A. (2017). A graph partitioning approach for controller placement in dendritic networks. Michigan Institute for Data Science Third Annual Symposium, Ann Arbor, MI.
- **Bartos, M.**, Wong, B., & Kerkez, B. (2017a). Open-storm: a wireless platform for real-time sensing and control of urban watersheds. World Environmental & Water Resources Congress 2017, Sacramento, CA.
- **Bartos, M.**, Wong, B., & Kerkez, B. (2017b). High resolution flash flood forecasting using a wireless sensor network in the Dallas—Fort Worth metroplex. American Geophysical Union 50th Annual Fall Meeting, New Orleans, LA.
- **Bartos, M.**, Wong, B., & Kerkez, B. (2016a). An urban flash flood warning system based on real-time sensor data. Consortium for the Advancement of Hydrologic Sciences Biennial Symposium, Shepherdstown, WV.
- **Bartos, M.**, Wong, B., & Kerkez, B. (2016b). High resolution sensing and control of urban water networks. American Geophysical Union 49th Annual Fall Meeting, San Francisco, CA.
- **Bartos, M.**, Chester, M., Johnson, N., Gorman, B., & Eisenberg, D. (2015). Impacts of climate change on electric transmission capacity and peak electricity load in the United States. American Geophysical Union 48th Annual Fall Meeting, San Francisco, CA.
- Chester, M., Fraser, A., **Bartos, M.**, Eisenman, D., Pincetl, S., Bondank, E., ... Tseng, T. (2015). Extreme heat vulnerability and urban energy use. International Society of Industrial Ecology, Surrey, UK.
- **Bartos, M.** & Chester, M. (2014a). Assessing climate change impacts on electric power generation in the western interconnection. American Geophysical Union 47th Annual Fall Meeting, San Francisco, CA.
- Reyna, J., Chester, M., & **Bartos, M.** (2014). Life cycle assessment of ecosystem services: Phoenix building stock. Central Arizona-Phoenix Long-Term Ecological Research Project, 16th Annual All Scientists Meeting, Scottsdale, AZ.
- **Bartos, M.** & Chester, M. (2013). The conservation nexus: valuing interdependent water and energy savings in Phoenix, Arizona. American Geophysical Union 46th Annual Fall Meeting, San Francisco, CA.

## COMPETENCIES

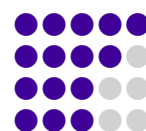
### Core competencies

Signal processing  
Open channel hydraulics  
Surface water hydrology  
Linear algebra  
Control theory  
Embedded systems  
Web infrastructure



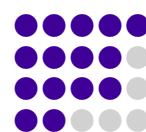
### Programming Languages

Python  
C  
JavaScript  
MATLAB



### Hydrodynamic modeling

EPA SWMM  
EPANET  
VIC  
HEC RAS



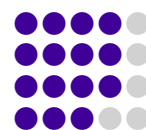
### Embedded Platforms

Cypress PSoC  
Arduino



### Dev Ops

Amazon Web Services  
UNIX Shell  
Git  
Jenkins



## REFERENCES

**Dr. Branko Kerkez**  
@ University of Michigan  
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**Dr. Mikhail Chester**  
@ Arizona State University  
✉ mchester@asu.edu

**Dr. Nancy Love**  
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