# Tyler W. Davis

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## EDUCATION

2012 Ph.D., Civil and Environmental Engineering, University of Pittsburgh
2011 M.S., Civil and Environmental Engineering, University of Pittsburgh
2007 B.S., Civil and Environmental Engineering, University of Pittsburgh

## PROFESSIONAL APPOINTMENTS

2019–present Lecturer, Center for Geospatial Analysis & Data Science, William & Mary, Williamsburg, VA
2017–2019 Visiting Assistant Professor, Environment & Sustainability, Catawba College, Salisbury, NC
2015–2017 Research Physical Scientist, USDA-ARS, Plant, Soil and Nutrition Research Unit, Ithaca, NY
2013–2015 Research Associate in Carbon and Water Cycle Modeling, Life Sciences, Imperial College London, Ascot, United Kingdom

## AWARDS AND HONORS

2011 Outstanding Research Assistant Award, Dept. Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA
2009 Outstanding Student Paper Award, Hydrology Section, 2009 American Geophysical Union Joint Assembly, Toronto, Ontario
2009 Outstanding Teaching Assistant Award, Dept. Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA

## SERVICE AND LEADERSHIP

Research Proposal Panelist, National Science Foundation (NSF) Networking Technology and Systems (NeTS)
Journal Peer Reviewer, International Journal of Environmental Research and Public Health
Journal Peer Reviewer, IEEE Sensors Journal
Journal Peer Reviewer, Nature Geoscience
Journal Peer Reviewer, Plant Methods
Journal Peer Reviewer, Remote Sensing
Journal Peer Reviewer, Sensors
Journal Peer Reviewer, Water
Journal Peer Reviewer, Water Resources Research
2013–2018 American Geophysical Union Fall Meeting, OSPA Judge
2017–2018 Rowan Helping Ministries' Food for Thought, Volunteer
2018 Catawba House of Pancakes, Volunteer
2018 McCorkles & ENVS Merit Scholarship Competition, Judge
2018 LandTrust for Central North Carolina's Hardwood Restoration, Volunteer
2017 Rowan Day of Caring, Volunteer
2015 Empire Farm Days, USDA-ARS Representative
2010–2012 University of Pittsburgh Freshman Engineering Conference, Chair
2007–2011 Carnegie Science Center National Engineers Week, ASCE Representative

## PUBLICATIONS

### Refereed Journal Articles

1. Y. Xu, F.J. Plaza, X. Liang, **T.W. Davis**, J. Nichols, J.K. Fu, and P. Koranchie-Boah (2020) A hydro-thermal-geochemical modeling framework to simulate reactive transport in a waste coal area under amended and non-amended conditions. Heliyon, 6, e02803, doi: 10.1016/j.heliyon.2019.e02803.
2. H. Wang, I.C. Prentice, T.F. Keenan, **T.W. Davis**, I.J. Wright, W.K. Cornwell, … C. Peng (2017) A universal model for carbon dioxide uptake by plants. Nature Plants, 3, 734–741, doi: 10.1038/s41477-017-0006-8.
3. **T.W. Davis**, I.C. Prentice, B.D. Stocker, R.T. Thomas, R.J. Whitley, H. Wang, … W. Cramer (2017) Simple process-led algorithms for simulating habitats (SPLASH v.1.0): robust indices of radiation, evapotranspiration and plant-available moisture. Geosci. Model Dev., 10(2), 689–708, doi: 10.5194/gmd-2016-49.
4. G. Villalba, F. Plaza, X. Zhong, **T.W. Davis**, M. Navarro, Y. Li, … X. Liang (2017) A networked sensor system for the analysis of plot-scale hydrology. Sensors, 17(3), 636, doi: 10.3390/s17030636.
5. H. Wang, I.C. Prentice, **T.W. Davis**, T.F. Keenan, I.J. Wright, and C. Peng (2017). Photosynthetic responses to altitude: an explanation based on optimality principles. New Phytol. 213(3), 976–982, doi: 10.1111/nph.14332.
6. M.A. Piñeros, B.G. Larson, J.E. Shaff, D.J. Schneider, A.X. Falcão, … **T.W. Davis**, … L.V. Kochian (2016). Evolving technologies for growing, imaging, and analyzing 3D root system architecture of crop plants. J. Integr. Plant Biol. 58(3), 230–241, doi: 10.1111/jipb.12456.
7. M. Navarro, **T.W. Davis**, G. Villalba, Y. Li, X. Zhong, N. Erratt, … Y. Liang (2014). Towards long-term multi-hop WSN deployments for environmental monitoring: an experimental network evaluation. J. Sens. Actuator Netw. 4, 297–330, doi: 10.3390/jsan3040297.
8. H. Wang, I.C. Prentice, and **T.W. Davis** (2014). Biophysical constraints on gross primary production by the terrestrial biosphere. Biogeosciences. 11, 5987–6001, doi: 10.5194/bg-11-5987-2014.
9. **T.W. Davis** and X. Liang (2013). The potential use of soil moisture sensors for observing hydraulic redistribution characteristics. J. Water Resour. Hydraul. Eng. 2(3), 84–91.
10. **T.W. Davis**, C.-M. Kuo, X. Liang, and P.-S. Yu (2012). Sap flow sensors: construction, calibration and comparison. Sensors. 12, 954–971, doi: 10.3390/s120100954.
11. **T.W. Davis**, X. Liang, C.-M. Kuo, and Y. Liang (2012). Analysis of power characteristics for sap flow, soil moisture and soil water potential sensors in wireless sensor networking systems. Sensors J. 12(6), 1933–1945, doi: 10.1109/JSEN.2011.2179933.
12. **T.W. Davis**, X. Liang, M. Navarro, D. Bhatnagar, and Y. Liang (2012). An experimental study of WSN power efficiency: MICAz networks with XMesh. Int. J. Distrib. Sens. N. doi: 10.1155/2012/358238.

### Refereed Conference Proceedings

M. Navarro, **T.W. Davis**, Y. Liang, and X. Liang (2013). A study of long-term WSN deployment for environmental monitoring, paper presented at 24th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC 2013, London, United Kingdom, 8–11 Sep., 2093–2097.

### Manuscripts in Preparation

T.W. Davis, B.D. Stocker, X.M.P. Gilbert, T.F. Keenan, H. Wang, … I.C. Prentice. The Global ecosystem Production in Space and Time (GePiSaT) Model of the terrestrial biosphere: Part 1 — Flux partitioning and gap-filling gross primary production. Geosci. Model Dev.

## GRANTS AND FELLOWSHIPS

2019 New Innovations Within Art & Science Technologies. PI: M. Forrest. Department of Art, Georgia College. ($3,000; Jan–Apr 2019)

2016 Next generation root phenotyping to create a genetic toolbox for Rapid Optimization of Crop Root Systems (ROCRS) in multiple environments. PI: D. P. Schachtman, University of Nebraska - Lincoln. Advanced Research Projects Agency-Energy (ARPA-E) Funding Opportunity Announcement DE-FOA-0001565 ROOTS ($10,000,000; declined)

2014 Canopy temperature: from leaf-level measurements to global models. PI: I. C. Prentice, Imperial College London. Natural Environment Research Council (NERC) Standard Grant (£215,378; declined)

2011–2012 ATS-Chester Engineers Fellowship, Chester Engineers, 1555 Coraopolis Heights Road, Moon Township, PA

## PRESENTATIONS

### Invited Talks

2013 X. Liang and T.W. Davis. Challenges for environmental wireless sensor networks. AGU Fall Meeting, 9–13 Dec., San Francisco, United States, abstract IN44A-01.

### Conference and Workshop Talks

2018 M.A. Pierce* and T.W. Davis. Next-generation vegetation models for securing the future of food, water and energy. AGU Fall Meeting 2018, 10–14 Dec., Washington, D.C., Water Sciences Pop-Up Session.

2017 T.W. Davis, N.M. Shaw*, Z. Liu, D.J. Schneider, J.E. Shaff, B.G. Larson, … M.A. Piñeros. A pipeline for 3D digital optical phenotyping plant root system architecture. AGU Fall Meeting 2017, 11–15 Dec., New Orleans, LO, abstract B42A-07.

2016 T.W. Davis, N.M. Shaw*, H. Cheng, B.G. Larson, E.J. Craft, J.E. Shaff, … L.V. Kochian. Next generation image-based phenotyping of root system architecture. AGU Fall Meeting 2016, 12–16 Dec., San Francisco, CA, abstract B54D-06.

2015 T.W. Davis, I.C. Prentice, B.J. Evans, H. Wang, T.F. Keenan, and X. Gilbert. The Global ecosystem Production in Space and Time (GePiSaT) project. ISI-MIP Cross-Sectoral Workshop, 2–5 Mar., Laxenburg, Austria.

2014 T.W. Davis, I.C. Prentice, B.J. Evans, H. Wang, and X. Gilbert. The Global ecosystem Production in Space and Time (GePiSaT) model of the terrestrial biosphere. AGU Fall Meeting, 15–19 Dec., San Francisco, CA, abstract H53J-04.

2014 I.C. Prentice and T.W. Davis. Canopy temperature: from leaf-level measurements to global models. Blue Green Dream Workshop, 2 Jul., London, United Kingdom.

2013 T.W. Davis, I.C. Prentice, B.J. Evans, and X. Gilbert. Modeling climate change impacts on primary production by the terrestrial biosphere. AGU Fall Meeting, 9–13 Dec., San Francisco, CA, abstract B13K-02.

2011 **T.W. Davis** and X. Liang. Observations, measurements and best practices for monitoring hydraulic redistribution. AGU Fall Meeting, 5–9 Dec., San Francisco, CA, abstract H31M-04.
2011 X. Liang, **T.W. Davis**, T.P. Hare*, M. Navarro, and Y. Liang. An experimental study of a WSN system for environmental monitoring. AGU Fall Meeting, 5–9 Dec., San Francisco, CA, abstract IN31A-08.

### Posters

2018 M. Pierce*, J. Cline*, M. Elder*, S. Musselwhite*, H. Przelomski*, S. Trotsenko*, and **T.W. Davis**. Looking at litter: A study at Catawba College using GIS and GPS. Catawba Research & Creativity Showcase, 12 Apr., Salisbury, NC, https://arcg.is/0C1mbG.
2015 **T.W. Davis**, D.J. Schneider, H. Cheng, N.M. Shaw*, J.E. Shaff, and L.V. Kochian. Toward a low-cost system for high-throughput image-based phenotyping of root system architecture. AGU Fall Meeting, 14–18 Dec., San Francisco, CA, abstract H43G-1613.
2014 G. Villalba, **T.W. Davis**, and X. Liang. Soil moisture spatial and temporal patterns from a wireless sensor network test bed. AGU Fall Meeting, 15–19 Dec., San Francisco, CA, abstract H11B-0868.
2013 M. Navarro, **T.W. Davis**, Y. Liang, and X. Liang. ASWP: A long-term WSN deployment for environmental monitoring. 12th ACM/IEEE Conference on Information Processing in Sensor Networks, 8–11 Apr., Philadelphia, PA.
2011 C.-M. Kuo, P.-S. Yu, T.-C. Yang, **T.W. Davis**, X. Liang, C.-K. Tseng, … Y.-C. Lin. Regional evapotranspiration estimation by using wireless sap flow and soil moisture measurement systems. AGU Fall Meeting, 5–9 Dec., San Francisco, CA, abstract H33A-1271.
2010 **T.W. Davis**, C.-M. Kuo, H. van Hemmen*, E. Ferris*, A. Aouni*, Y. Liang, and X. Liang. A wireless sensor network field study: Network development, installation, and measurement results. AGU Fall Meeting, 13–17 Dec., San Francisco, CA, abstract H23C-1216.
2010 C.-M. Kuo, **T.W. Davis**, C.-K. Tseng, C.-H. Cheng, X. Liang, and P.-S. Yu. Wireless sap flow measurement system. AGU Fall Meeting, 13–17 Dec., San Francisco, CA, abstract H31F-1056.
2009 **T.W. Davis**, C.-M. Kuo, Y. Liang, and X. Liang. The application of wireless sensor networks for environmental monitoring. AGU Spring Meeting, 24–27 May, Toronto, Canada, abstract H23B-04.

(*) supervised undergraduate student researchers

## TEACHING EXPERIENCE

### William & Mary, Center for Geospatial Analysis | Data Science, Williamsburg, VA

Advanced GIS Analysis and Programming (Spring 2020)
Introduction to GIS (Fall 2019; Spring 2020)
Spatial Data Discovery (Fall 2019; Spring 2020)

### Catawba College, Environment & Sustainability, Salisbury, NC

Air, Energy, and Climate Change (Spring 2018; Spring 2019)
Land Management and Ecology (Fall 2017; Spring 2018; Fall 2018)
Water Management and Ecology (Spring 2018; Spring 2019)
Environmental Field & Skills Lab (Fall 2018)
Geographical Information Systems (Fall 2017; Fall 2018)
Intermediate GIS and Field GPS (Spring 2018; Spring 2019)

Topics: Green Energy & Design (Spring 2019)

Blueprint Summer Programs, Charlottesville, VA

Careers in Engineering (Summer 2018)

Demonstrator, Imperial College London, Life Sciences, London, United Kingdom

Computing in Python: Computational Methods in Ecology and Evolution (Fall 2014)
Statistical Modeling with R in Ecology and Ecosystems (Spring 2014)
Geographical Information Systems in Environmental Policy (Spring 2014)
Statistics in Ecology, Evolution and Conservation (Summer 2013)

Teaching Assistant, University of Pittsburgh, Civil and Environmental Engineering, Pittsburgh, PA

Water Resources Engineering (Fall 2011–12; Spring 2008–10; Summer 2007–08)
Hydrology and Water Resources (Fall 2008)
Computer Methods (Spring 2008)
Groundwater Hydrology (Spring 2008)

## RESEARCH EXPERIENCE

2013–present GLOBAL ECOSYSTEM PRODUCTION IN SPACE AND TIME (GEPISAT) MODEL
PI: Colin Prentice (Imperial College London)
Created an open-source modeling framework (Python with PostGreSQL) for global hindcasting and analysis of spatial and temporal patterns in terrestrial gross primary production. Online: https://bitbucket.org/labprentice/gepisat

2015–2019 PLANT ROOT IMAGING AND DATA ACQUISITION (PRIDA) FRAMEWORK
PI: Miguel A. Piñeros (USDA-ARS) and Leon V. Kochian (GIFS)
Developed an open-source hardware and software (Python with Qt graphical user interface) framework for efficient imaging, visualizing, analyzing, and managing (using HDF5) 2D and 3D crop root system architecture. Online: http://www.plantmineralnutrition.net/software/prida/

2017–2019 LAKE LEVEL MONITORING
PI: Tamlin Pavelsky (University of North Carolina at Chapel Hill)
Maintained and monitored a lake level gauge in the Fred Stanback, Jr. Ecological Preserve at Catawba College, Salisbury, NC as a research tool for undergraduate students and citizen scientists to better understand the changing volume of water in lakes over time. Online: http://lakelevel.org

2013–2017 SIMPLE PROCESS-LED ALGORITHMS FOR SIMULATING HABITATS
PI: Colin Prentice (Imperial College London)
Updated and improved a process-based model (C++, FORTRAN, Python and R) for simulating water and energy fluxes (net radiation, evapotranspiration, and plant-available moisture). Online: https://bitbucket.org/labprentice/splash

2007–2017 WIRELESS SENSOR NETWORK FOR ENVIRONMENTAL MONITORING
PI: Xu Liang (University of Pittsburgh)
Designed, deployed, and maintained a long-term outdoor environmental wireless sensor network (MICAz and IRIS) for the spatiotemporal analysis of soil moisture, soil water potential, and sap flow. Online: https://sites.google.com/site/aswpitt/

2013–2015 MEASURING LEAF CANOPY TEMPERATURE
PI: Colin Prentice (Imperial College London)
Designed a top-of-the-canopy leaf temperature monitoring and data logging prototype system based on Arduino architecture.

2011–2012 HYDRAULIC REDISTRIBUTION AND COAL REFUSE MITIGATION
PI: Xu Liang (University of Pittsburgh) and Jaw Fu (ALCOA)
Worked cooperatively with industry to characterize hydrologic and hydraulic properties of coal refuse bioremediation treatments.

2007–2012 THERMOMETRIC SAP FLOW SENSOR DESIGN
PI: Xu Liang (University of Pittsburgh)
Designed, constructed and quality tested thermometric sap flow sensors at 2% commercial cost and built necessary circuitry for integration into wireless networks.

## MEDIA COVERAGE

2019 February 10. Catawba College professor collaborates virtually with Department of Art at Georgia College. *WBTV*. Retrieved from http://www.wbtv.com/2019/02/10/catawba-college-professor-collaborates-virtually-with-department-art-georgia-college/
2019 February 7. Maple [Sugaring] Days return to Catawba College campus. *WBTV*. Retrieved from http://www.wbtv.com/2019/02/08/maple-sugaring-days-return-catawba-college-campus/
2019 January 24. Catawba College students attend meeting in Washington. *The Salisbury Post*. Retrieved from https://salisburypost.com
2018 March 8. Catawba College joins UNC-Chapel Hill lake level monitoring project. *The Salisbury Post*. Retrieved from https://www.salisburypost.com
2018 February 8. Catawba students learn about making syrup during 'maple days.' *The Salisbury Post*. Retrieved from https://www.salisburypost.com

## COMPUTER PROFICIENCIES

### Operating Systems

Linux/UNIX, macOS, TinyOS, Windows 7/8/10

### Programming and Markup Languages

Arcade, Arduino, BASH, C++, CSS, FORTAN, HTML, JSON, LaTeX, MD, MATLAB, Perl, PHP, Python, R, SQL

### Software

Geographic Information Systems (ArcGIS; QGIS; GRASS)
Computer-Aided Design (AutoCAD; SketchUp Make; Fritzing)
Hydrologic Modeling (HEC-HMS; VIC)
Graphical User Interfaces (Qt5, Tk/Tcl)
Version Control, Data Management and Conversion (git, pandoc, R, MySQL, PostgreSQL)
Virtualization (VirtualBox; VMWare; Python virtualenv)

## PROFESSIONAL MEMBERSHIPS

2007–2019 American Geophysical Union

## CERTIFICATIONS

2018 Adult First Aid/CPR/AED, American Red Cross
2007 Engineer in Training, NCEES

## WORKSHOPS AND ENRICHMENT

2015 ARPA-E Phytosequestration Workshop (23–24 Jul.), Rosemont, IL
2015 ISI-MIP Cross-Sectoral Workshop (2–6 Mar.), Laxenburg, Austria
2014 Blue Green Dream Workshop (2 Jul.), London, United Kingdom
2013 AXA Pop Day Multi Risks Workshop (1–3 Jul.), Paris, France
2013 AXA Chair Launch Workshop on Biosphere and Climate Impacts (24–25 Jun.), London, United Kingdom
2013 Engineering Education Research Center Teaching Workshop (4, 11 Jan.), Pittsburgh, PA
2012 Preparing Future Faculty Workshop (9 May), Morgantown, WV