

YAO HU

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Education

- 08/2010 – 02/2016 **University of Illinois**, Urbana-Champaign, Illinois, United States
Doctor of Philosophy in Civil and Environmental Engineering
Dissertation: *Agent-based models to couple natural and human systems for watershed management analysis*
- 10/2006 – 10/2008 **Hamburg University of Technology**, Hamburg, Germany
Master of Science, Environmental Engineering
Thesis: *Modeled water flow in the unsaturated zone with Richards Equation and Storage Model*
- 09/2002 – 06/2006 **Huazhong University of Science and Technology**, Wuhan, China
Bachelor of Engineering, Civil Engineering
Bachelor of Science, Computer Science and Technology

Appointments

- 03/2020 – Now
- **Assistant Professor**, Department of Geography & Spatial Sciences (Primary) and Department of Civil & Environmental Engineering, University of Delaware
 - **Affiliated Faculty** with Engineering and Policy Program, Water Science and Policy Program and Data Science Institute, University of Delaware

Research Interests

Coupled Human and Water Systems (Socio-hydrology), Agent-based Modeling, Hydroinformatics, Hydrology and Water Resource Management, Environmental System Analysis and Optimization, Data Science

Research Experience

- 08/2016 – 02/2020 **Postdoctoral Fellow**, University of Michigan, Ann Arbor, MI, U.S.
- 02/2016 – 07/2016 **Postdoctoral Fellow**, National Center for Supercomputing Applications (NCSA), U.S.
- 09/2010 – 01/2016 **Research Assistant**, University of Illinois, Dep. of Civil and Environmental Engineering
Urbana-Champaign, IL, U.S.
- 05/2008 – 08/2010 **Junior Researcher**, UFZ (Environmental Research Centre), Dep. of Computational
Hydrosystems, Leipzig, Germany
- 09/2007 – 11/2007
- 03/2007 – 04/2008 **Research Assistant**, Hamburg University of Technology, Dep. of River and Coastal
Engineering & Dep. of Wastewater Management and Water Protection, Hamburg, Germany

Teaching

New courses introduced at UD

Courses taught at UD

Course #	Course Title	Term
GEOG670	Geographic Information Systems & Sciences	Fa 2020, Sp 2021, Sp 2022
CIEG440	Water Resources Engineering	Fa 2021

Past teaching experience

08/2015 – 12/2015 Teaching Assistant (CEE201: Systems Engineering and Economics), University of Illinois, Dep. of Civil and Environmental Engineering, Urbana-Champaign, IL, U.S.

Ph.D. committee activity

Advisor

Siamak Malakpour-Estalaki	Department of Geography and Spatial Sciences	2021
Steven Beattie	Department of Civil and Environmental Engineering	2021
Pavel Ivanov	Department of Civil and Environmental Engineering	Withdrawn

Co-Advisor

Chirantan Ghosh	Department of Computer & Information Science	2020
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Committee Member

Amina Naliaka Groundwater Sustainability and Climate Adaptation in an Irrigation Agricultural Landscape, Southern Illinois University.

M.S. Students advised/co-advised

Advised

Co-Advised

Undergraduate major projects directed

1. Undergraduate research project: Modularization of an agent-based model for groundwater irrigation. 01/2021-01/2022
2. DENIN undergraduate internship: Development of an agent-based model for groundwater irrigation using NetLogo. 06/2021-08/2022
3. Capstone project: Development of a website for the runoff risk prediction in the Great Lakes region. Group of six undergraduate students from CIS. 09/2021 - now
4. Capstone project: Redevelopment of an agent-based model for groundwater irrigation using Repast Symphony. Group of six undergraduate students from CIS. 09/2021 - now

Outreach related to education

Research

Research programs underway

1. Prediction of runoff risk in Great Lakes region
2. Prediction of Farmers' daily irrigation behavior
3. Modularization of an agent-based model for groundwater irrigation
4. Use of economic experiment to inform the design of agent-based model
5. Design of distributed energy system using agent-based simulation

Current grants and contracts

1. NOAA and University of Michigan. Workflow Demonstration: Daily Runoff Risk Prediction in the Great Lakes Region. 09/2022 – 8/2023, Sub PI: Yao Hu, \$50,000 ~ \$65,000.
2. DOD. Developing Engineering practices using Ecosystem Design Solutions for Future Army (Military DEEDS Project), 01/2022 – 12/2025, Co-I: Yao Hu (Funding for a PhD student for four years, ~\$240,000)

Pending grants and contracts

1. Delaware Solid Waste Authority (DSWA). Interpretable, Reliable Model for Estimating Hydrogen Sulfide Emissions from Landfills, 02/2022. Yao Hu (PI). Candidate's share: \$60,000.
2. University of Delaware Research Foundation (UDRF). Integration of Groundwater Pumping for Irrigation to the Prediction of Climate Impact on the Groundwater Resource in part of the Ogallala Aquifer, 01/2021. Yao Hu (Single PI). \$38,000.
3. National Science Foundation. Large-scale CoPe: REACCT - REsilient, Adaptable Communities facing Coastal Threats Hub for Integrated Research and Engagement, 12/2021. Yao Hu (Co-I), Candidate's share: \$638,379.
4. National Science Foundation. DISES: Groundwater Sustainability in a Changing Climate: Coupled Hydrologic and Socioeconomic Dynamics in Irrigated Agricultural Landscapes, 11/2021. Total: \$1,599,999, Yao Hu (Co-PI). Candidate's share: \$261,172.
5. Bureau of Reclamation. A decision-support system to evaluate groundwater policies and protect Nebraska's water resources, 04/2021. Yao Hu (Co-PI). 9/2021. Candidate's share: \$52,704.

Past grants and contracts

1. NOAA and University of Michigan. Developing a Decision Support Tool for Agricultural Nutrient Application Timing using the National Weather Service National Water Model Framework. 06/2020 – 12/2021, Sub PI: Yao Hu, \$90,000.

Publication and Scholarly Presentations

Full articles in peer-reviewed journals

(*: Corresponding author; Bold and Underline: Group members)

1. C. M. Ford, **Y. Hu***, **C. Ghosh**, L. M. Fry, **S. Malakpour-Estalaki**, L. Mason, L. Fitzpatrick, A. Mazrooei and D. Goering (2021). Generalization of Runoff Risk Prediction at Field Scales to a Continental-Scale Region Using Cluster Analysis and Hybrid Modeling. *Geophysical Research Letters*. Under Review.
2. **Y. Hu***, L. Fitzpatrick, L. M. Fry, L. Mason, L. K. Read and D. Goering (2021). Edge-of-field Runoff Prediction by a Hybrid Modeling Approach Using Causal Inference. *Environmental Research Communications*.
3. **Y. Hu**, C.M. Long, Y.C. Wang, B. Kerkez and D. Scavia* (2019). Urban Total Phosphorus Loads to the St. Clair-Detroit River System. *Journal of Great Lakes Research*, 45(6), 1142-1149.
4. D. Scavia*, S.A. Bocaniov, A. Dagnew, **Y. Hu**, B. Kerkez, C.M. Long, R.L. Muenich, J. Read, L. Vaccaro, Y.C. Wang (2019). Detroit River Phosphorus Loads: Anatomy of a Binational Watershed. *Journal of Great Lakes Research*, 45(6), 1142-1149.
5. **Y. Hu**, D. Scavia and B. Kerkez* (2018). Are all data useful? Inferring causality to predict flows across sewer and drainage systems using Directed Information and Boosted Regression Trees. *Water Research*, 145, 697-706.
6. **Y. Hu*** and S. Beattie (2018). The Role of Heterogeneous Behavioral Factors in an Agent-based Model of Crop Choice and Groundwater Irrigation. *Journal of Water Resources Planning and Management*, 145(2), 04018100.
7. **Y.Hu***, C. J. Quinn, X. M. Cai and N. W. Garfinkle (2017). Combining human and machine intelligence to derive agents' behavioral rules for groundwater irrigation. *Advances in Water Resources*, 109, 29-40.
8. **Y. Hu***, X. M. Cai and B. DuPont (2015). Design of a web-based application of the coupled multi-agent system model and environmental model for watershed management analysis using Hadoop, *Environmental Modelling & Software*, doi:10.1016/j.envsoft.2015.04.011
9. **Y. Hu***, O. Garcia-Cabrejo, X.M. Cai, A. J. Valocchi and B. Dupont (2015). Global sensitivity analysis for large-scale socio-hydrological models using Hadoop, *Environmental Modelling and Software*, doi:10.1016/j.envsoft.2015.08.015
10. **Y. Hu**, A. J. Valocchi*, S. A. Lindgren, E. A. Ramos and R. A. Byrd (2015). Groundwater Modeling with MODFLOW as a Web Application, *Groundwater*, doi:10.1111/gwat.12372

Refereed conference summaries or abstracts

1. L. Fry, **Y. Hu**, A. Mazrooei, L. Fitzpartick, C. Ford, L. Read, L. Mason, D. Yates and D. Goering (2021). Development of a Framework to Predict Edge-of-Field Runoff Risk Using a Continental Scale Operational Hydrological Model Combined with Data Driven Modeling Approaches. American Geophysical Union (AGU), New Orleans, Louisiana, Dec 13 – 17.
2. Y. Hong, Y.W. Mei, L. Fry, **Y. Hu**, E. J. Anderson and A. Gronewold (2021). Analysis of the Net Basin Supply to a Large Inland Lake with a Coupled Basin-lake Model and Different Climate Forcing. American Geophysical Union (AGU).
3. P. Ivanov and Y. Hu (2021). Uncovering Hidden States of Noisy Irrigation Data to Facilitate Forecasting of Irrigation Behavior. American Geophysical Union (AGU).
4. C.M. Ford, **Y. Hu**, C. Gosh, L. Fry, S. Malakpour-Estalaki, L. Mason, L. Fitzpartick, A. Mazrooei (2021). Hybrid Modeling of Runoff Risk over the Great Lakes Region through Regionalization of National Water Model Output. American Geophysical Union (AGU).
5. S. Beatie and **Y. Hu** (2021). Community Solar Installations and Energy Affordability; Using Agent-Based Simulation for Decision Support in Distributed Energy System Design Considering Local Policy Objectives. American Geophysical Union (AGU).
6. S. Malakpour-Estalaki and **Y. Hu** (2021). Evaluation of Ambient-based Policy and Information Nudge on

- Agricultural Non-point Source Control Using Agent-based Modeling. American Geophysical Union (AGU).
7. L. Fitzpatrick, **Y. Hu**, L. M. Fry, L. Mason, L.K.Read, T. Hunter, A. Thorstensen and D. Goering (2021). Using the National Water Model Configuration of WRF-Hydro to Forecast Runoff at the Edge-of-Field Scale. American Meteorological Society (AMS).
 8. A. Murumkar, J. Martin, M. Kalcic, C. Stow, D. Goering, V. Shedekar, A. Thorstensen, K. King, G. Evenson, J. Kast, A. Apostel, L. Fitzpatrick and **Y. Hu** (2020). Comparing flow predictions of five multi-scale hydrologic models with edge-of-field data in western Lake Erie basin, USA. American Geophysical Union (AGU).
 9. **Y. Hu**, L. Fitzpatrick, L. M. Fry and L. Mason (2020). Use of Causal Inference to Improve Model Predictions. American Geophysical Union (AGU).
 10. C.M. Ford, **Y. Hu**, L. Mason, L. Fitzpatrick and L. M. Fry. (2020). Regionalization of Statistical Forecasts of Field Scale Resolution Runoff Modeling using National Water Model Outputs through Unsupervised Cluster Analysis. American Geophysical Union (AGU).
 11. L. Fitzpatrick, **Y. Hu**, D. Goering, L. Mason, L. M. Fry, L.K. Read and A.R. Thorstensen (2020). Evaluation of High-Resolution Simulated Runoff using the National Water Model. American Geophysical Union (AGU).
 12. Y. Hu and Q.J. Quinn (2020). A Data-driven Tool to Inform Agent-based Modeling of Groundwater Irrigation. 14th International Conference on Hydroinformatics.

Conference presentations and posters

1. Evaluation of Ambient-based Policy and Information Nudge on Agricultural Non-point Source Control Using Agent-based Modeling, University of Delaware, Newark, Delaware, March, 2022
2. Use of Causal Inference to Derive Agents' Behavioral Rules for Groundwater Irrigation - A Socio-hydrology Study (Invited talk). International Symposium on Social Simulation 2020, Wuhan, China.
3. Assessing Runoff Risk to Support Nutrient Application Timing Using a Hybrid of Physically-based and Statistical Models—an Application of National Water Model (poster), American Geophysical Union (AGU), San Francisco, California, Dec 9 – 13, 2019
4. Modeling flows across combined sewer systems using Directed Information and Boosted Regression Trees, 11th International Conference on Under Drainage Modelling (UDM), Palermo, Italy, Sep 23 – 26, 2018
5. A data-driven approach to model flows across combined sewer systems. World Environment and Water Resources Congress (EWRI), Minneapolis, Minnesota, June 3 – 7, 2018
6. Deriving agents' behavioral rules using directed information graph (Invited talk). Eastlake Forum, Huazhong University of Science and Technology, Wuhan, China, Dec, 26, 2016.
7. Combining human and machine intelligence to derive agents' behavioral rules for groundwater irrigation (poster). American Geophysical Union (AGU), Dec 14 – 18, 2015
8. Design of a web-based application of the coupled multi-agent system model and environmental model for watershed management analysis using Hadoop (Invited talk). Dalian University of Technology, Dalian, China, Mar 2 – 3, 2015
9. Global sensitivity analysis for large-scale socio-hydrological models using Hadoop (poster). American Geophysical Union (AGU), San Francisco, US, Dec 14 – 19, 2014
10. A software tool to couple agent-based decision-making model and groundwater simulation model for understanding environmental changes in a river basin context. World Environment and Water Resources Congress (EWRI), Cincinnati, Ohio, US, May 19 –23, 2013
11. Integrating agent-based model and groundwater simulation model to understand the environmental changes in Republican River basin. World Environment and Water Resources Congress (EWRI), Albuquerque, New Mexico, US, May 20 – 24, 2012
12. Estimation of root water uptake as a sink term by inverse modeling (poster). European Geosciences Union (EGU), Vienna, Austria, May 02 – 07, 2010

Outreach directly related to research

1. Supervised two master students through the Colombian Research Program at the University of Delaware, 06/2022 – 08/2022.
2. Mentor and supervisor. Mentor and supervise a Ph.D. student from Michigan State University to work on a research project, 05/2020 – 02/2021.

Service

Service to Department, College and University

1. Department Academic Program Review (APR) Committee
2. Geography and Spatial Sciences Seminar (2020). Use of Causal Inference to Derive Agent's Behavioral Rules for Groundwater Irrigation - A Socio-hydrology Study

Service to government or professional organizations, and service on review board/study panels

1. Guest Editor. Special issue of *Frontiers in Climate* on Coastal Flooding: Modeling, Monitoring, and Protection Systems, 2020 – 2022
2. Advisory Committee. 1st Smart Agriculture Creative Contest 2021, Wuhan, China
3. Conference Committee. International Symposium on Social Simulation (ISSS) 2020, August 6th, Wuhan, China.
4. Reviewer, Journal Reviews, *Water Research* (2021), *Environmental Modeling and Software* (2021-2022, 2017), *Water Resources Research* (2021), *Journal of Hydrology* (2021), *Agricultural Water Management* (2021), *Resources, Conservation & Recycling* (2020), *Water Research* (2020), *Journal of Water Resources Planning and Management* (2019 – 2020), *Science of the Total Environment* (2019), *IEEE Access* (2019).

Contribution to diversity, equity, and inclusion

Others

1. Interviewer, Postdoc Interview: join in committees to interview postdocs for two positions (2019 - 2020)
2. Proposal Reviewer: review one proposal submitted in response to NSF 20-547: Division of Behavioral and Cognitive Sciences: Human-Environment and Geographical Sciences (2020)