# Erin L. Towler, Ph.D.

National Oceanic & Atmospheric Administration
Physical Sciences Laboratory
Boulder, CO, 80305
erin.towler@noaa.gov


## EDUCATION:

Ph.D. in Civil Engineering (Water Resources), University of Colorado at Boulder, 2010
*Dissertation Title:* Understanding and modeling the impacts of climate change on source water quality and utility planning
Advisors: Dr. Balaji Rajagopalan & Dr. R. Scott Summers

M.S. in Civil Engineering (Water Resources), University of Colorado at Boulder, 2006
*Thesis title*: Characterizing and incorporating uncertainty in water quality and treatment
Advisors: Dr. Balaji Rajagopalan & Dr. R. Scott Summers
Certification: *Graduate Teacher Program*, 2006

B.S. in Environmental Technology Systems, Cornell University, 2002
Magna Cum Laude

## PROFESSIONAL EXPERIENCE:

2023-present *Research Physical Scientist*: Physical Sciences Laboratory (PSL), NOAA
- Lead and contribute to research using NOAA operational atmospheric and/or hydrologic models to enhance understanding of hydrometeorological processes and predictions.
- Apply research advances to improve NOAA services.

2018-2023 *Project Scientist II*: Capacity Center for Climate & Weather Extremes, MMM, NCAR
- Plan, lead, and manage research to assess hydrologic availability and risks in the context of weather and climate variability.
- Develop and demonstrate frameworks and techniques to evaluate and enhance hydrologic forecasts, using both statistical and dynamical approaches, independently and in partnership with scientists and water planners.

2012-2018 *Project Scientist I:* Regional Climate Group, MMM, NCAR
- Performed statistical downscaling of global climate model projections to regional drought and worked with social scientist to increase the usability of drought information.
- Incorporated recurring weather pattern projections into statistical extreme-value analysis to predict precipitation extremes in the US Southwest.

2010-2012 *Postdoctoral PACE Fellow:* UCAR Visiting Scientists Program, NCAR and US Geological Survey, Bozeman, MT
- Assessed hydrologic risks to terrestrial and aquatic ecosystems from climate variability and change in collaboration with scientists from NCAR and the USGS Northern Rocky Mountain Science Center (Bozeman, MT).
- Communicated and transferred research findings to advance the incorporation of climate predictions into ecological applications and adaptation, specifically for environmental flows and forest management.

2008-2010 *Graduate Research Assistant:* Research Applications Laboratory, NCAR

- Developed lake water temperature module for the Water Evaluation and Planning (WEAP) model.

2007-2010 *Research Assistant (Doctoral):* University of Colorado at Boulder

2005-2006 *Research Assistant (Masters):* University of Colorado at Boulder

2004-2005 *Teaching Assistant:* University of Colorado at Boulder

2002-2004 *Project Engineer and Analyst:* Aquacraft, Inc., Water Engineering and Management, Boulder, CO

## PUBLICATIONS:

### *Refereed Articles*

32. Simeone C, Foks S, **Towler E**, Hodson T, Thomas Over T (submitted), Evaluating Hydrologic Model Performance for Characterizing Streamflow Drought in the Conterminous United States, *Journal of Hydrology*.

31. **Towler E**, Done JM, Ge M, Gilleland E, Prein AF (submitted), Seasonal predictability of the frequency of precipitation-based weather types over the United States, *Weather and Forecasting*.

30. **Towler E**, Foks SS, Dugger AL, Dickinson JE, Essaid HI, Gochis D, Viger RJ, and Zhang Y (2023), Benchmarking high-resolution hydrologic model performance of long-term retrospective streamflow simulations in the contiguous United States, *Hydrol. Earth Syst. Sci.*, 27, 1809-1825, https://doi.org/10.5194/hess-27-1809-2023.

29. **Towler E,** Woodson D, Baker S, Ge M, Prairie J, Rajagopalan B, Shanahan S, Smith R (2022), Incorporating mid-term temperature predictions into streamflow forecasts and operational reservoir projections in the Colorado River Basin, *Journal of Water Resources Planning and Management (ASCE)*, 148(4), doi: 10.1061/(ASCE)WR.1943-5452.0001534.

28. Prein A, **Towler E**, Ge M, Llewellyn D, Baker S, Tighi S, Barrett L (2022). Sub-seasonal predictability of North American Monsoon precipitation. *Geophysical Research Letters,* 49(9), https://doi.org/10.1029/2021GL095602. Press release: https://news.ucar.edu/132841/new-method-can-predict-summer-rainfall-southwest-months-advance

27. Bruyère CL, Buckley B, Jaye AB, Done, JM, Leplastrier M, Aldridge J, Chan P, **Towler E**, Ge M (2022), Using large climate model ensembles to assess historical and future tropical cyclone activity along the Australian east coast, *Weather and Climate Extremes*, https://doi.org/10.1016/j.wace.2022.100507

26. Woodson D, Rajagopalan B, Baker S, Smith R, Prairie J, **Towler E**, Ge M, Zagona E (2021), Stochastic decadal projections of Colorado River streamflow and reservoir pool

elevations conditioned on temperature projections, *Water Resources Research*, https://doi.org/10.1029/2021WR030936.

25. Done JM, Ge M, Lazrus H, Morss R, **Towler E**, Tye, M, Das T, Munévar A, Hewitt J, Hoeting J, Schafer C, Czajkowski J, Van Zant AB (2021), A prototype research framework to understand and create useable predictive climate information on decadal timescales. *One Earth*, 4(9), https://doi.org/10.1016/j.oneear.2021.08.013.

24. **Towler E**, McCreight J (2021), A wavelet-based approach to streamflow event identification and timing error benchmarking. *HESS*, 25, 2599–2615, https://doi.org/10.5194/hess-25-2599-2021.

23. **Towler E,** Yates D (2021), Incorporating near-term temperature predictions for water resources planning. *Journal of Applied Meteorology and Climatology*, DOI: 10.1175/JAMC-D-20-0134.1, p 171-183.

22. **Towler E,** Llewellyn D, Prein A, Gilleland E (2020), Extreme-value analysis for the characterization of extremes in water resources: A generalized workflow and case study on New Mexico monsoon precipitation. *Weather and Climate Extremes*, doi: 10.1016/j.wace.2020.100260.

21. **Towler E,** Lazrus H, PaiMazumder D (2019), Characterizing the potential for drought action from combined hydrological and societal perspectives, *Hydrology and Earth System Sciences, 23, 1469-1482, https://doi.org/10.5194/hess-23-1469-2019.*

20. Pournasiri Poshtiri M, Pal I, Lall U, Naveau P, **Towler E** (2019), Variability patterns of the annual frequency and timing of low streamflow days across the USA and their linkage to regional and large-scale climate. *Hydrological Processes*, doi: 10.1002/hyp.13422.

19. Clemins PJ, Bucini G, Winter JM, Beckage B, **Towler E**, Betts A, Cummings R, Queiroz HC (2019), An analog approach for weather estimation using climate projections and reanalysis data, *Journal of Applied Meteorology and Climatology (AMS)*, doi: 10.1175/JAMC-D-18-0255.1.

18. Pournasiri Poshtiri M, **Towler E**, Pal, I (2018), Characterizing and understanding the variability of streamflow drought indicators within the United States. *Hydrologic Sciences Journal,* doi: 10.1080/02626667.2018.1534240.

17. Hewitt J, Hoeting JA, Done JM, **Towler E** (2018), Remote effects spatial process models for modeling teleconnections. *Environmetrics*, doi:10.1002/env.2523. **2018 Wiley-TIES Best Environmetrics Paper Award.*

16. **Towler E**, PaiMazumder D, Done J (2018), Towards the Application of Decadal Climate Predictions. *Journal of Applied Meteorology and Climatology (AMS)*, DOI: 10.1175/JAMC-D-17-0113.1.

15. **Towler E**, Lazrus H (2016), Increasing the usability of drought information for risk management in the Arbuckle Simpson Aquifer, Oklahoma, *Clim Risk Manage*, doi:10.1016/j.crm.2016.06.003.

14. **Towler E**, PaiMazumder D, Holland G (2016), A framework for investigating large-scale patterns as an alternative to precipitation for downscaling to local drought, *Climate Dynamics*, doi:10.1007/s00382-016-3116-5.

13. Done JM, PaiMazumder D, **Towler E**, Kishtawal CM (2016), Estimating impacts of North Atlantic tropical cyclones using an index of damage potential, Climatic Change doi: 10.1007/s10584-015-1513-0.

12. Murphy DJ, Wyborn C, Yung L, Cleveland C, Eby L, Dobrowski S, **Towler E,** and Williams DR (2016). Engaging Communities and Climate Change with Multi-scale Iterative Scenario-building in the Western US. *Human Organization*, 75 (1).

11. Pal I, **Towler E,** and Livneh B (2015), How can we better understand low river flows as climate changes?, *Eos, 96,*doi:10.1029/2015EO033875.

10. **Towler E,** Roberts M, Rajagopalan B, Sojda R (2013), Incorporating probabilistic seasonal climate forecasts into river management using a risk-based framework, *Water Resour Res*, 49: 4997–5008, doi:10.1002/wrcr.20378.

9. **Towler E**, Rajagopalan B, Yates D, Rodriguez A, Summers RS (2013), An integrated approach to simulate stream water quality for municipal supply under changing climate, *J Environ Eng*, 139(12): 1432-1440, doi: 10.1061/(ASCE)EE.1943-7870.0000766.

8. **Towler E,** Saab V, Sojda R, Dickinson K, Bruyère C, Newlon KR (2012), A risk-based approach to evaluating wildlife demographics for management in a changing climate: A case study of the Lewis's Woodpecker, *Environ Manage*, 50(6): 1152-1163, doi:10.1007/s00267-012-9953-z.

7. Bruyere CL, Holland GJ, **Towler E** (2012), Investigating the use of a Genesis Potential Index for tropical cyclones in the North Atlantic Basin, *J Climate,* 25(24): 8611-8626, doi:10.1175/JCLI-D-11-00619.1.

6. **Towler E**, Raucher B, Rajagopalan B, Rodriguez A, Yates D, Summers RS (2012), Incorporating climate uncertainty in a cost assessment for a new municipal source water, *J. Water Res Pl-ASCE,* 138:396-402, doi:10.1061/(ASCE)WR.1943-5452.0000150.

5. **Towler E**, Rajagopalan B, Gilleland E, Summers RS, Yates D, Katz RW (2010), Modeling hydrologic and water quality extremes in a changing climate: A statistical approach based on extreme value theory**,** *Water Resour Res,* 46, W11504, doi:10.1029/2009WR008876.

4. **Towler E**, Rajagopalan B, Summers RS, Yates D (2010), An approach for probabilistic forecasting of seasonal turbidity threshold exceedance, *Water Resour Res,* 46, W06511, doi:10.1029/2009WR007834.

3. **Towler E**, Rajagopalan B, Summers RS (2009), Using parametric and nonparametric methods to model total organic carbon, alkalinity, and pH after conventional surface water treatment, *Environ Eng Sci,* 26(8):1299-1308.

2. **Towler E**, Rajagopalan B, Seidel C, Summers RS (2009), Simulating ensembles of source water quality using a k-nearest neighbor resampling approach, *Environ Sci Technol*, 43(5): 1407-1411.

1. Mayer PW, Bennett R, DeOreo W, **Towler E** (2006), Third-party billing of multifamily customers presents new challenge to water providers, *J Am Water Works Ass*, 98(8):74.*
* *AWWA Water Conservation Division Best Paper Award, 2006.*

***Non-refereed Articles***

**Towler E** (2022) Characterizing monsoon precipitation patterns and predictability in Arizona (Final Report), prepared for the US Bureau of Reclamation Lower Colorado Basin Region.

**Towler E**, Llewellyn D, Prein A. (2019) Detecting, Interpreting, and Modeling Hydrologic Extremes to Support Flexible Water Management and Planning (Final Report), U.S. Bureau of Reclamation Research and Development Office Science and Technology Program (ST-2019-1782-01).

**Towler E**, Llewellyn D, Barrett L, Young R (2019), Extremes of Opportunity? A generalized approach to identify intersections between changing hydrology and water management. Proceedings of the Federal Interagency Sedimentation and Hydrologic Modeling Conference (SEDHYD), Reno, NV, https://www.sedhyd.org/2019/openconf/modules/request.php?module=oc_program&action=view.php&id=160&file=1/160.pdf

Morss RE, Done JM, Lazrus H, **Towler E**, Tye MR (2018), Assessing and Communicating Uncertainty in Decadal Climate Predictions: Connecting Predictive Capacity to Stakeholder Needs, *US CLIVAR Variations*, vol 16. No 3. Summer 2018.

Pournasiri Poshtiri M, **Towler E**, Llewellyn D, Prein AF (2018), Extremes of Opportunity: Examining Recent Trends in Warm Season Extreme Precipitation for New Mexico River Basins, *86th Western Snow Conference*, Albuquerque, NM, https://westernsnowconference.org/files/PDFs/2018Poshtiri.pdf.

Hewitt J, Hoeting JA, Done JM, **Towler E** (2017) A Geostatistical Approach to Modeling Teleconnections. American Statistical Association's Section on Statistics and the Environment.

Pournasiri Poshtiri M, **Towler E**, Pal I (2017), Streamflow Drought Indicators for the Conterminous United States, *NCAR Technical Note* TN-541+STR, NCAR, 33 pp. (DOI: 10.5065/D65D8QJH).

**Towler E**, Lazrus H, PaiMazumder D (2017). Characterizing drought risks and implications for water management under climate change. *NCAR Technical Note* NCAR/TN-533+STR, 25 pp, doi:10.5065/D6HD7T3N.

***Products***

**Towler E**, Foks SS, Dickinson JE, Dugger AL, Essaid HI, Gochis D, Hodson TO, and Zhang Y (2022), Daily streamflow performance benchmark defined by the standard statistical suite (v1.0) for the National Water Model Retrospective (v2.1) at benchmark streamflow locations: U.S. Geological Survey data release, https://doi.org//10.5066/P9QT1KV7

**Towler E**, Foks SS, Dugger AL, Dickinson JE, Essaid HI, and Hodson TO (2022), Daily streamflow performance benchmark defined by the standard statistical suite (v1.0) for the National Hydrologic Model application of the Precipitation-Runoff Modeling System (v1 byObs Muskingum) at benchmark streamflow locations: U.S. Geological Survey data release, https://doi.org/10.5066/P9DKA9KQ

Foks, S.S., **Towler, E.,** Hodson, T.O., Bock, A.R., Dickinson, J.E., Dugger, A.L., Dunne, K.A., Essaid, H.I., Miles, K.A., Over, T.M., Penn, C.A., Russell, A.M., Saxe, S.W., and Simeone, C.E., 2022, Streamflow benchmark locations for conterminous United States, version 1.0 (cobalt gages): U.S. Geological Survey data release, https://doi.org/10.5066/P972P42Z