

Andrew D. Gronewold, Ph.D., P.E.

Curriculum Vitae

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CONTACT INFORMATION

University of Michigan
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EDUCATION AND PROFESSIONAL TRAINING

Post-Doctorate Fellow, USEPA (Office of Research and Development)	2008 - 2010
Ph.D., Duke University (Environmental Science and Policy)	2008
B.S., Cornell University (Civil and Environmental Engineering)	1995

PROFESSIONAL APPOINTMENTS

Associate Professor, Univ. Michigan, School for Environment and Sustainability	2019 - present
Associate Professor (courtesy appt.), Univ. Michigan, Earth and Env. Sciences	2019 - present
Associate Professor (courtesy appt.), Univ. Michigan, Civil and Env. Engineering	2019 - present
Graduate faculty, courtesy appointment, University of Toledo	2018 - present
Adjunct Asst. Professor, Univ. Michigan, Civil and Env. Engineering	2013 - 2018
Physical Scientist, NOAA, Great Lakes Environmental Research Laboratory	2010 - 2018
Adjunct Assistant Professor, University of North Carolina - Chapel Hill	2008 - 2013
Instructor, Nicholas School of the Environment, Duke University	2004 - 2009
Research Assistant, Nicholas School of the Environment, Duke University	2005 - 2008
Director of Engineering, Ecological Engineering Group, Inc.	2003 - 2004
Assistant Scientist, Sea Education Association	1998 - 2000
Environmental Engineer, Stearns & Wheeler, LLC	1995 - 2003

COURSES TAUGHT

EAS 635 Multivariate analysis for environmental science (University of Michigan)
EAS 579 Hydrologic cycle and water resources management (University of Michigan)
EAS 538 Natural resource statistics (University of Michigan)
ENVIRON/EARTH 450 Ecosystem science of the Rockies (University of Michigan - Camp Davis)
ENGR 255/355/599 Multidisciplinary engineering project (University of Michigan)
CEE 421 Hydrology and floodplain hydraulics (University of Michigan)
CEE 325 Fluid mechanics (University of Michigan)
ENV 335 Water quality modeling (Duke University)
ENV 236 Water quality management (Duke University)
MTH 160 Basic statistics (Washtenaw Community College)

SCHOLARLY PUBLICATIONS (STUDENTS UNDERLINED, POST-DOCTORATE FELLOWS DOUBLE-UNDERLINED)

Submitted manuscripts

1. Rueda, V., M. Moore, F. Lara-Valencia, **A.D. Gronewold**. Adapting transboundary water treaties for resilience: Hydrosolidarity in sister-cities and the U.S.-Mexico 1944 water treaty (submitted to *Environmental Science and Policy*).
2. Jones, D., Liu, J, S. Steinschneider, L. Fry, L. Mason, A. Vander Woude, J. Wang, W. Currie, S. Newell, N. Fox, W. Pringle, M. Phanikumar, Y. Hong, A. Kiledal, L. Fitzpatrick, S. Shin, **A.D. Gronewold**, S. Osborne, D. Wright, D. Titze, P. Roebber, H. Abdelhady, A. Young, J. Smith, S. Brunner, J. Langan, P. Xue, 2025. A Vision for Machine Learning and Artificial

- Intelligence in Great Lakes Research and Management (under invited revision with *Artificial Intelligence for Earth Systems*).
3. Shin, S., Y. Mei, H. Xuan, **A.D. Gronewold**, L. Mason, D. Wang. Evaluation of terrestrial water and energy budget components over the Great Lakes - St. Lawrence River Basin (submitted).
 4. VanDeWeghe, A., **A.D. Gronewold**. Advancing seasonal water supply forecasting for lakes and reservoirs using copulas (under invited revision with *Journal of Hydrology*).
 5. Fuller, J., E. Rowan, A. Landgraf, K. Alofs, J. Foufopoulos, **A.D. Gronewold**. Waterbird colony collapses under climate driven lake-level rise and anthropogenic stressors (under invited revision with *Ecological Applications*).
 6. Hong, Y., L. Fry, S. Orendorf, J. Ward, B. Mroczka, D. Wright, **A.D. Gronewold**. A daily hydro-meteorological dataset for the world's largest system of lakes (submitted).
 7. Hille, M., M. Clark, **A.D. Gronewold**, A. West, D. Zekkos, D. Chamlagain. Orographic influence on extreme rainfall and rainfall-triggered landsliding (under revision).
 8. Do, Hong X., P. Vo, H. Pham, Y. Mei, **A.D. Gronewold**. Observed response of tropical river streamflow to climate change - evidence from a national database (submitted).
 9. Mei, Yiwen, C. Stephens, H. Do., Y. Hong, H. Pham, P. Vo, **A.D. Gronewold**, E. Nikolopoulos (Submitted). Large catchment storage capacity slows down the propagation from meteorological to hydrological drought (submitted).

Accepted or in press

79. Ombadi, M., L. Nguyen, S. Gaur, **A.D. Gronewold**, P. Reich. Increased dependency on extreme precipitation in a warmer climate. Accepted with *Water Resources Research*.

Published journal articles

78. Dang, H., Y. Pokhrel, **A.D. Gronewold**. 2026. Climate-induced hydrological changes and agricultural implications in the Laurentian Great Lakes region, *Science of the Total Environment*, 1014, 181355.
77. (*Editor's choice award*) Rueda, V., **A.D. Gronewold**. 2026. Evaluating historical and future compliance with the 1944 US-Mexico Water Treaty under changing climate and use conditions. *Journal of Water Resources Planning and Management*, 152(1), 04025067.
76. (*Cover article*) Anderson, E., **A.D. Gronewold**. 2025. Does ice cover cap evaporation in large lakes? *Geophysical Research Letters*, 52(19), e2025GL117112.
75. Memari, S., E.J. Anderson, M.S. Phanikumar, **A.D. Gronewold**. 2025. Quantifying the impact of groundwater in ice formation in the Great Lakes. *Water Resources Research*, 61(9), e2025WR040581.
74. Gossard, A., M. Venumuddula, A. VanDeWeghe, C. Wegener, **A.D. Gronewold**. 2025. Differentiating diversions and drought to understand drivers of water loss from a North American terminal lake. *Journal of Water Resources Planning and Management*, 151(10).
73. Abdelhady, H., D. Cannon, A. Fujisaki-Manome, **A.D. Gronewold**, J. Wang, 2025. The spatiotemporal dynamics of heatwaves and cold-spells in Earth's largest freshwater systems. *Geophysical Research Letters*, 52(14), e2025GL116548.
72. Abdelhady, H., A. Fujisaki-Manome, D. Cannon, **A.D. Gronewold**, J. Wang, 2025. Climate change-induced amplification of extreme temperatures in large lakes. *Nature - Communications Earth & Environment*, 1(375).

71. Shin, S., **A.D. Gronewold**, L. Fry, Y. Hong, D. Cannon, A. Fujisaki-Manome, 2025. Long-term hydroclimate trends in the Great Lakes basin: are there hotspots of regional change? *Journal of Hydrology: Regional Studies*, 59, 102347.
70. Jones, D., S. Steinschneider, P. Roebber, S. Osborne, L. Fry, L. Mason, A. Vander Woude, M. Phanikumar, N. Fox, W. Currie, S. Newell, J. Wang, A. Young, L. Fitzpatrick, Y. Hong, H. Abdelhady, W. Pringle, E. Kiledal, **A.D. Gronewold**, 2025. Mapping out how machine learning and artificial intelligence will change Great Lakes observations, modeling, and forecasting in the coming decade. *Bulletin of the American Meteorological Society*, 106(2).
69. Calappi, T., J.M. Waddell, M.A. McClerren, **A.D. Gronewold**, J.E. McNinch, J.P. Selegean, 2025. Evaluation of repeat bathymetric surveys on water surface elevations on the Saint Clair River. *Journal of Great Lakes Research*, 51(6), 102403.
68. Kessler, J., E. Espey, A. VanDeWeghe, **A.D. Gronewold**, T. Sorensen, B. Khazaei, E. James, T. Smirnova, M. Casali, D. Yates, N. Omani, J. Kelley, M. Barlage, S. Benjamin, E. Anderson, 2025. Depth matters: Lake bathymetry selection in numerical weather prediction systems. *Journal of Geophysical Research - Atmospheres*, 130(2), e2024JD04179.
67. Austin, J., E.J. Anderson, **A.D. Gronewold**, S. Ruberg, C. Stow, M. Wells, 2025. Winter thermal structure across the Laurentian Great Lakes. *Journal of Great Lakes Research*, 51(3), 102550.
66. O'Brien, N., F. Seglenieks, L. Fry, D. Fielder, A. Temgoua, J. Bruxer, V. Fortin, D. Durnford, **A.D. Gronewold**, 2024. Historical datasets (1950-2022) of monthly water balance components for the Laurentian Great Lakes. *Nature Scientific Data*, 11, 1243.
65. Venumuddula, M., K. Kirchner, A. Chen, R. Rood, **A.D. Gronewold**, 2024. Combining satellite, teleconnection, and in situ data to improve understanding of multi-decadal coastal ice cover dynamics on Earth's largest lakes. *Earth and Space Science*, 11(12), e2024EA003845.
64. **Gronewold, A.D.**, J. Bednar, M. Cort, V. Rueda, M. Moore, J. Allan, 2024. Can continental transboundary compacts hold water? *Nature Communications*, 15, 7087. doi: 10.1038/s41467-024-51456-w.
63. Shin, S., **A.D. Gronewold**, L.M. Fry, A. Dugger, J. Kessler, 2024. Evaluating surface and subsurface fluxes in hydrological models to advance basin-scale operational long-term water supply forecasting in the Great Lakes basin. *Hydrological Sciences Journal*, 69(11), 1539-1556.
62. Zuo, C., R. Wang, Y. Hong, Y. Zhou, Y. He, **A.D. Gronewold**, 2024. The influence of road network topology on street flooding in New York City - a social media data approach. *Journal of Hydrology*, 638, 131471.
61. Sorensen, T., E. Espey, J.G.W. Kelley, J. Kessler, **A.D. Gronewold**, 2024. A database of *in situ* water temperatures for large inland lakes across the coterminous United States. *Nature Scientific Data*, 11, 282.
60. Polidori, J., H. Paulson, **A.D. Gronewold**. Assessing trends in urban municipal water use across the Great Lakes basin, 2024. *Journal of Great Lakes Research*, 50(1), 102243.
59. (*Highly-cited paper award*) Mei, Y., J. Mai, H. Do, **A.D. Gronewold**, H. Reeves, S. Eberts, R. Niswonger, S. Regan, R. Hunt, 2023. Can hydrologic model calibration benefit from global gridded soil moisture, evapotranspiration, and runoff products? *Water Resources Research*, 59(2), e2022WR032064.
58. Shriberg, M., R. Norton, A. Steiner, S. Hughes, J. Overpeck, G. Dick, K. Whyte, **A.D. Gronewold**, J. Allan, D. Porter, J. Read, O. Salim. 2023. Leadership for the next generation of Great Lakes stewardship. *Journal of Great Lakes Research*. 49(5), 1211-1213.

57. Yao, D., Y. Huang, L. Xue, Y. Fu, **A.D. Gronewold**, J. Fox, 2022. Seismicity around Southern Lake Erie during 2013-2020 in relation to lake water level. *Seismological Research Letters*, 93(4), 2268-2280.
56. Phillips, D., P. Jamwal, M. Lindquist, **A.D. Gronewold**, 2022. Assessing catchment-scale performance of in-stream Green Infrastructure interventions using SWMM-based TOPSIS. *Landscape and Urban Planning*, 226, 104448. 10.1016/j.landurbplan.2022.104448
55. Benjamin, S. G., T. Smirnova, E. James, E. Anderson, A. Fujisaki-Manome, J. Kelley, G. Mann, **A.D. Gronewold**, P. Chu, S. Kelley, 2022. Inland lake temperature initialization via coupled cycling with atmospheric data assimilation. *Geoscientific Model Development*, 15(7), 6659-6676.
54. VanDeWeghe, A., Lin, V., Jayaram, J., **A.D. Gronewold**, 2022. Changes in large lake water level dynamics in response to climate change. *Frontiers in Water*, 4, 805143.
53. Hong, Yi, H. Do, J. Kessler, L. Fry, L. Read, A. Rafieei-Nasab, **A.D. Gronewold**, L. Mason, E. Anderson, 2022. Evaluation of gridded precipitation datasets over international basins and large lakes. *Journal of Hydrology*, 607, 127507.
52. Fry, L., **A.D. Gronewold**, F. Seglenieks, S. Minallah, D. Apps, J. Ferguson, 2022. Navigating Great Lakes hydroclimate data. *Frontiers in Water*, 4, 803869.
51. (*NOAA Outstanding Scientific Paper Award*) Anderson, E.J., C.A. Stow, **A.D. Gronewold**, L.A. Mason, M. McCormick, S. Qian, S.A. Ruberg, K. Beadle, S.A. Constant, N. Hawley, 2021. Seasonal overturn and stratification changes drive deep-water warming in one of Earth's largest lakes. *Nature Communications*, 12(1), 1-9.
50. **Gronewold, A.D.**, H.X. Do, Y. Mei, C.A. Stow, 2021. A tug-of-war within the hydrologic cycle of a continental freshwater basin. *Geophysical Research Letters*, 48(4), e2020GL090374.
49. Do, Hong X., Y. Mei, **A.D. Gronewold**, 2020. To what extent are changes in flood magnitude related to changes in precipitation extremes? *Geophysical Research Letters*, 47(18), e2020GI088684.
48. Do, Hong X., J. Smith, L.M. Fry, **A.D. Gronewold**, 2020. Seventy-year long record of monthly water balance estimates for Earth's largest lake system. *Nature Scientific Data*, 7(276).
47. Labuhn, K., **A.D. Gronewold**, T. Calappi, Alison MacNeil, C. Brown, E.J. Anderson, 2020. Towards an operational flow forecasting system for the Upper Niagara River. *Journal of Hydraulic Engineering*, 146(9), 05020006.
46. **Gronewold, A.D.**, J. Smith, L. Read, J. Crooks, 2020. Reconciling the water balance of large lake systems. *Advances in Water Resources*, 137, 103505.
45. Apps, D., L.M. Fry, **A.D. Gronewold**, 2020. Operational seasonal water supply and water level forecasting for the Laurentian Great Lakes. *Journal of Water Resources Planning and Management*, 146(9), 04020072.
44. Fujisaki-Manome, A., E. Anderson, J. Kessler, P. Chu, J. Wang, **A.D. Gronewold**, 2020. Simulating impacts of precipitation on ice cover and surface water temperature across large lakes. *Journal of Geophysical Research - Oceans*, 125(5), e2019JC015950.
43. Quinn, F.H., A.H. Clites, **A.D. Gronewold**, 2020. Evaluating estimates of channel flow in a continental-scale lake-dominated basin. *Journal of Hydraulic Engineering*, 146(3), 05019008.
42. Ji, Xiaolong, **A.D. Gronewold**, H. Daher, R.B. Rood, 2019. Modeling seasonal onset of coastal ice cover. *Climatic Change*, 154(1-2), 125-141.

41. **Gronewold, A.D.**, E.J. Anderson, J. Smith, 2019. Evaluating operational hydrodynamic models for real-time simulation of evaporation from large lakes. *Geophysical Research Letters*, 46(6), 3263-3269.
40. Mason, L., **A.D. Gronewold**, M. Laitta, D. Gochis, K. Sampson, E. Klyszejko, J. Kwan, L. Fry, K. Jones, P. Steeves, A. Pietroniro, M. Major, 2019. A new transboundary hydrographic dataset for advancing regional hydrological modeling and water resources management. *Journal of Water Resources Planning and Management*, 145(6), 06019004.
39. **Gronewold, A.D.** and R. Rood, 2019. Recent water level changes across Earth's largest lake system and implications for future variability. *Journal of Great Lakes Research*, 45(1), 1-3.
38. Charusombat, U., A. Fujisaki-Manome, **A.D. Gronewold**, Brent Lofgren, Eric J. Anderson, Peter Blanken, Christopher Spence, John Lenters, Chuliang Xiao, Lindsay Fitzpatrick, Gregory Cutrell, 2018. Evaluating and improving modeled turbulent heat fluxes across the North American Great Lakes. *Hydrology and Earth System Sciences*, 22(10), 5559-5578.
37. **Gronewold, A.D.**, V. Fortin, R. Caldwell, J. Noel, 2018. Resolving hydrometeorological data discontinuities along an international border. *Bulletin of the American Meteorological Society*, 99(5), 899-910.
36. Fujisaki-Manome, A., L. Fitzpatrick, **A.D. Gronewold**, E.J. Anderson, B.M. Lofgren, C. Spence, J. Chen, C. Shao, D. Wright, C. Xiao, 2017. Turbulent heat fluxes during an extreme lake effect snow event. *Journal of Hydrometeorology*, 18(2), 3145-3163.
35. Gaborit, E., V. Fortin, X. Xu, F. Seglenieks, B. Tolson, L.M. Fry, T. Hunter, F. Anctil, **A.D. Gronewold**, 2017. A hydrological prediction system based on the SVS land-surface scheme: effective calibration of GEM-Hydro for streamflow simulation over the Lake Ontario basin. *Hydrology and Earth System Sciences*, 21(9), 4825-4839.
34. **Gronewold, A.D.**, K. McMahan, M. Sobsey, 2017. The compartment bag test (CBT) for enumerating fecal indicator bacteria: basis for design and interpretation of results. *Science of the Total Environment*, 587, 102-107.
33. Bolinger, R., **A.D. Gronewold**, K. Kompoltowicz, L. Fry. 2017. Application of the NMME in the Development of a New Regional Seasonal Climate Forecast Tool. *Bulletin of the American Meteorological Society*, 98(3), 555-564.
32. Gaborit, E., V. Fortin, B. Tolson, L. Fry, T. Hunter, **A.D. Gronewold**, 2017. Great Lakes Runoff Inter-Comparison Project, phase 2: Lake Ontario (GRIP-O). *Journal of Great Lakes Research*, 43(2), 217-227.
31. Bertani, I., D. Obenour, C. Steger, C. Stow, **A.D. Gronewold**, D. Scavia, 2016. Probabilistically assessing the role of nutrient loading in harmful algal bloom formation in western Lake Erie. *Journal of Great Lakes Research*, 42(6), 1184-1192.
30. Mason, L. A., C.M. Riseng, **A.D. Gronewold**, E.S. Rutherford, J. Wang, A. Clites, S. Smith, P. McIntyre, 2016. Fine-scale spatial variation in ice cover and surface temperature trends across the surface of the Laurentian Great Lakes. *Climatic Change*, 138(1-2), 71-83.
29. **Gronewold, A.D.**, J. Bruxer, D. Durnford, J. Smith, A. Clites, F. Seglenieks, T. Hunter, S. Qian, V. Fortin, 2016. Hydrological drivers of record-setting water level rise on Earth's largest lake system. *Water Resources Research*, 52(5), 4026-4042.
28. Smith, J.P, T.S. Hunter, A.H. Clites, C.A. Stow, T. Slaweki, G.C. Muhr, **A.D. Gronewold**, 2016. An expandable web-based platform for visually analyzing basin-scale hydro-climate time series data. *Environmental Modelling & Software*, 78, 97-105.
27. **Gronewold, A.D.**, E.J. Anderson, B. Lofgren, P.D. Blanken, J. Wang, J. Smith, T. Hunter, G. Lang, C.A. Stow, D. Beletsky, J. Bratton, 2015. Impacts of extreme 2013-2014 winter conditions on Lake Michigan's fall heat content, surface temperature, and evaporation. *Geophysical Research Letters*, 42(9), 3364-3370.

26. (Cover article) **Gronewold, A.D.**, A.H. Clites, J. Bruxer, K. Kompoltowicz, J.P. Smith, T. Hunter, C. Wong, 2015. Great Lakes water levels surge. *Eos, Transactions of the American Geophysical Union*, 96(1), 14-17.
25. Hunter, T., Clites, A., Campbell, K., **Gronewold, A.D.**, 2015. Development and application of a monthly hydrometeorological database for the North American Great Lakes - Part I: precipitation, evaporation, runoff, and air temperature. *Journal of Great Lakes Research*, 41(1), 65-77.
24. Fry, L., **Gronewold, A.D.**, V. Fortin, S. Buan, A. Clites, C. Luukkonen, D. Holtschlag, L. Diamond, T. Hunter, F. Seglenieks, D. Durnford, M. Dimitrijevic, C. Subich, E. Klyszejko, K. Kea, P. Restrepo, 2014. The Great Lakes runoff intercomparison project - Phase I: Lake Michigan (GRIP-M). *Journal of Hydrology*, 519 (Part D), 3448-3465.
23. Kult, J., Fry, L., **Gronewold, A.D.**, Choi, W., 2014. Regionalization of hydrologic response in the Great Lakes basin: considerations of temporal scales of analysis. *Journal of Hydrology*, 519 (Part B), 2224-2237.
22. Obenour, D., **Gronewold, A.D.**, Stow, C., Scavia, D., 2014. Using a Bayesian hierarchical model with a gamma error distribution to improve Lake Erie cyanobacteria bloom forecasts. *Water Resources Research*, 50(10), 7847-7860.
21. Clites, A.H., J. Smith, T. Hunter, **Gronewold, A.D.**, 2014. Visualizing relationships between hydrology, climate, and water level fluctuations on Earth's largest system of lakes. *Journal of Great Lakes Research*, 40(3), 807-811.
20. Clites, A.H., Wang, J., Campbell, K. B., **Gronewold, A.D.**, Assel, R.A., Bai, X., Leshkevich, G.A., 2014. Cold water and high ice cover on Great Lakes in spring 2014. *Eos, transactions of the American Geophysical Union*, 95(34), 305-306.
19. **Gronewold, A.D.** and C.A. Stow, 2014. Water loss from the Great Lakes. *Science*, 343(6175), 1084-1085.
18. **Gronewold, A.D.** and C.A. Stow, 2014. Unprecedented seasonal water level dynamics on one of the earth's largest lakes. *Bulletin of the American Meteorological Society*, 95(1), 15-17.
17. Wu, J., **A.D. Gronewold**, R.A. Rodriguez, J.R. Stewart, M.D. Sobsey, 2014. Integrating quantitative PCR and Bayesian statistics in quantifying human adenoviruses in small volumes of source water. *Science of the Total Environment*, 470, 255-262.
16. Lofgren, B.M. and **A.D. Gronewold**, 2013. Reconciling alternative approaches to projecting hydrologic impacts of climate change. *Bulletin of the American Meteorological Society*, 94(10), ES133-ES135.
15. Lofgren, B.M., **A.D. Gronewold**, A. Acciaioli, J. Cherry, A. Steiner, D. Watkins, 2013. Methodological approaches to projecting the hydrologic impacts of climate change. *Earth Interactions*, 17(22), 1-19.
14. **Gronewold, A.D.**, V. Fortin, B. Lofgren, A. Clites, C.A. Stow, F. Quinn, 2013. Coasts, water levels, and climate change: A Great Lakes perspective. *Climatic Change*, 120(4), 697-711.
13. **Gronewold, A.D.**, A.H. Clites, J.P. Smith, T.S. Hunter, 2013. A dynamic graphical interface for visualizing past, present, and future surface water elevations of the earth's largest lakes. *Environmental Modelling & Software*, 49, 34-39.
12. Fry, L., Hunter, T., Mantha, P., Fortin, V., **Gronewold, A.D.**, 2013. Identifying stream-gage networks for maximizing the effectiveness of large scale water balance modeling. *Water Resources Research*, 49(5), 2689-2700.

11. **Gronewold, A.D.**, C.A. Stow, K. Vijayavel, M.A. Moynihan, D.R. Kashian, 2013. Differentiating *Enterococcus* concentration spatial, temporal, and analytical variability in recreational waters. *Water Research*, 47(1), 2141-2152.
10. **Gronewold, A.D.** and V. Fortin, 2012. Advancing Great Lakes hydrological science through targeted binational collaborative research. *Bulletin of the American Meteorological Society*, 93(12), 1921-1925.
9. **Gronewold, A.D.**, C. Stow, J. Crooks, T. Hunter, 2012. Quantifying parameter uncertainty and assessing the skill of exponential dispersion rainfall simulation models. *International Journal of Climatology*, 33(3), 746-757.
8. **Holman, K., A.D. Gronewold**, M. Notaro, A. Zarrin, 2012. Improving historical precipitation estimates over the Lake Superior basin. *Geophysical Research Letters*, 39, L03405.
7. **Gronewold, A.D.**, A. Clites, T. Hunter, C. Stow, 2011. An appraisal of the Great Lakes advanced hydrologic prediction system. *Journal of Great Lakes Research*, 37, 577-583.
6. **Gronewold, A.D.**, L. Myers, J.L. Swall, R.T. Noble, 2011. Addressing uncertainty in fecal indicator bacteria dark inactivation rates. *Water Research*, 45(2), 652-664.
5. **Gronewold, A.D.**, M.E. Borsuk, 2010. Improving water quality assessments through a hierarchical Bayesian analysis of variability. *Environmental Science & Technology*, 44(20), 7858-7864.
4. **Gronewold, A.D.**, M.E. Borsuk, 2009. A software tool for translating deterministic model results into probabilistic assessments of water quality standard compliance. *Environmental Modelling & Software*, 24(10), 1257-1262.
3. **Gronewold, A.D.**, S.S. Qian, R.L. Wolpert, and K.H. Reckhow, 2009. Calibrating and validating bacterial water quality models: A Bayesian approach. *Water Research*, 43(10), 2688-2698.
2. (Cover article) **Gronewold, A.D.**, M.E. Borsuk, R.L. Wolpert, and K.H. Reckhow, 2008. An assessment of fecal indicator bacteria-based water quality standards. *Environmental Science & Technology*, 42(13), 4676-4682.
1. **Gronewold, A.D.**, R.L. Wolpert, 2008. Modeling the relationship between most probable number (MPN) and colony-forming unit (CFU) estimates of fecal coliform concentration. *Water Research*, 42(13), 3327-3334.

Book chapters

6. **Gronewold, A.D.** and R.B. Rood, 2023. Climate change is driving rapid shifts between high and low water levels on the Great Lakes. In: *The Conversation on Water*, Andrea K. Gerlak ed., Johns Hopkins University Press.
5. **Gronewold, A.D.**, 2016. The North American Great Lakes System. In: *Handbook of Applied Hydrology*, V.P. Singh ed., McGraw-Hill.
4. Lofgren, B. and **A.D. Gronewold**, 2014. Water Resources. In: *Climate Change in the Midwest: A Synthesis Report for the National Climate Assessment*, J.A. Winkler, J.A. Andresen, J.L. Hatfield, D. Bidwell, and D. Brown, eds., Island Press, 224-237.
3. Fortin, V. and **A.D. Gronewold**, 2012. Water balance of the Laurentian Great Lakes. *Encyclopedia of Lakes and Reservoirs*, Springer, 864-869.
2. **Gronewold, A.D.**, D.A. Vallero, 2010. New applications of Bayes' theorem for predicting environmental damage. *Yearbook of Science and Technology, McGraw-Hill Professional*, 18-22.

1. Loarie, S.R., S. Chakraborty, K. Dexter, A. Fleming-Davies, **A.D. Gronewold**, J. Liu, A. McBride, E. Pollina, 2007. Density dependence and population growth: evaluating classical and Bayesian approaches to parameter estimation and model selection. In J.S. Clark, “Statistical computation for environmental sciences in R”. Princeton University Press.

FUNDED RESEARCH

Externally funded projects (Gronewold PI or co-PI): 2019 to present

National Science Foundation (NSF; \$4,970,000), in partnership with Natural Sciences and Engineering Research Council (NSERC) and Social Sciences and Humanities Research Council (SSHRC) of Canada (additional \$2,600,000 in US dollars); Global Center for Understanding Climate Change Impacts on Transboundary Waters (2024-2028).

National Oceanic and Atmospheric Administration, NOAA (\$2,800,000); Development of a next-generation prediction system for Great Lakes water levels and lake management decisions (2022-2027).

Office of Naval Research (\$400,096); Geospatial data analytics to enhance water security in the Indo-Pacific region (2024-2026).

NOAA (\$314,326); Advanced modeling to support probabilistic projections of total water levels in Great Lakes coastal areas under climate scenarios: Development of next-generation prediction system (2022-2025).

US Army Corps of Engineers (\$173,778); Phase II - Investigating uncertainty associated with the Great Lakes water balance (2022-2024).

United States Geological Survey (USGS) - Powell Center (\$100,000); Improving representation of groundwater in foundational Great Lakes hydrologic and hydrodynamic models and data sets (2021-2024).

NOAA Joint Technology Transfer Initiative (\$499,936); An optimized lake-treatment strategy for improved land-surface modeling and weather prediction in the Unified Forecast System (UFS), (2021-2023).

NOAA Climate Program Office (\$49,843); addressing inequitable impacts of flooding on communities in the Great Lakes (2022-2023).

Council of Great Lakes Governors and Premiers (\$27,000); Great Lakes Compact Symposium and Gala (2023).

Great Lakes Higher Education Consortium (\$35,000); Building the Great Lakes Basin green/blue infrastructure design research and practice network (2021-2023).

NSF (\$75,000); Forecast advancement initiative, improvement to Great Lakes forecast products (2021-2022).

Great Lakes Protection Fund (\$46,503); Understanding potential impacts of plausible climate change scenarios on Great Lakes water levels and ecosystem health (2021-2022).

New York Sea Grant (\$16,281); Using social science and hydroclimate modeling to enhance flood resilience on Lake Ontario through the Climate Smart Communities Program (2020-2022).

USGS (\$10,000); Reflecting water quality measurement variability and uncertainty in decision support systems (2021-2022).

Macomb County Department of Planning and Development (\$5,000); North Branch Greenway Plan

implementation land use evaluation (2021-2022).

Great Lakes Protection Fund (\$314,000) with the Conference of Great Lakes and St. Lawrence Governors and Premiers. Building the Great Lakes Impact Investment Platform, Phase II (2020-2021).

Conference of Great Lakes St. Lawrence Governors and Premiers (\$11,700). Assessment of water use rates and drivers across the Great Lakes basin (2020-2021).

United States Army Corps of Engineers (\$86,000); Phase I - Investigating uncertainty associated with the Great Lakes water balance.

Macomb County Department of Planning and Development (\$8,000). Development of a conceptual hydrologic model for the north branch of the Clinton River (2019-2020).

Michigan Department of Transportation, MDOT (\$49,900); Investigation of impacts of lake water level and inland hydrology on coastal infrastructure (2019-2020).

Great Lakes Protection Fund (\$74,335) with the Conference of Great Lakes and St. Lawrence Governors and Premiers. Building the Great Lakes Impact Investment Platform, Phase I (2019-2020).

Internally (UM) funded projects

College of Literature, Science, and the Arts (LSA) Meet the Moment grant (\$249,855); Balancing water needs amidst climate change: Mono Lake as a case study for communities and watersheds in the US (2023-2025).

University of Michigan Water Center (\$200,000); Assessment of pumped hydro-energy storage potential throughout the Great Lakes (2023-2025).

SEAS Theme Award (\$28,000); Advancing coordinated transboundary climate and water resources research (2025).

Center for Sustainable Systems, Olmstead Fellowship (\$40,000); Improving stormwater infrastructure planning (2022-2024).

Undergraduate Research Opportunities Program - supplemental student funding (\$1,500); Understanding Great Lakes water level variability (2024).

Joint funding from Graham Institute, Water Center, Urban and Regional Planning, CEE, SEAS, and Erb Institute (\$4,500), in partnership with external funding from Council of Great Lakes Governors and Premiers (see above); Great Lakes Compact symposium and gala (2023).

Office of the Vice President for Research, Bold Challenges Program Nurture Phase (\$75,000); Resolving gradients in water availability across North America: the need for revised governance and public awareness of the problems of abundance and scarcity (2022-2023).

MCubed Program (\$60,000); Simulating and visualizing foundational basin-scale hydrologic data (2019-2021).

SEAS Theme Award (\$80,000); Advancing the University's leadership role in addressing pressing water issues with new hydrologic data assessment and modeling capabilities (2019-2021).

SEAS Internal Funding (\$15,000); Analysis of water balance and forecasting needs for the African Great Lakes (2019)

Externally funded projects: prior to 2019

United States Army Corps of Engineers (with CIGLR, \$82,000); improving seasonal operational

forecasting protocols and implementation (2017).

National Center for Atmospheric Research (NCAR) Postdocs Applying Climate Expertise (PACE) program (\$240,000) with New York Power Authority and Ontario Power Generation; Forecasting improvements project for regional hydropower management (2016-2017).

International Joint Commission (IJC) International Watersheds Initiative (\$53,000); closing the water balance of the Great Lakes: developing a new historical record reconciling bias and uncertainty (2016-2017).

NOAA Coastal Storms Program (\$260,000); Improving estimates of evaporation over the North American Great Lakes (2015-2016).

United States Army Corps of Engineers (\$25,000); Providing updated climate and water budget projections for long-term coastal water level infrastructure planning (2015).

United States Army Corps of Engineers (\$40,000); improving modeling-based estimates of evaporation over the North American Great Lakes (2014).

University of Michigan Water Center (\$50,000); experimental buoy and drifter sensor project for improving estimates of over-lake evaporation (2014).

United States Great Lakes Restoration Initiative (GLRI); administered by USEPA (\$850,000); near-shore focus area monitoring and modeling improvements (2013-2014).

International Joint Commission (\$46,000); Great Lakes Runoff Intercomparison Project (GRIP) for Lake Ontario (2013-2014).

University of Michigan CILER (now CIGLR) post-doctoral fellowship support (\$120,000); Improving estimates of runoff in the Great Lakes basin (2013).

International Joint Commission (\$10,000); Improving historical estimates of runoff in the Great Lakes basin (2012).

National Center for Atmospheric Research (NCAR) and Pacific Institute for the Mathematical Sciences (\$4,000): International Graduate Summer School on Statistics and Climate Modeling (2008).

North Carolina Department of Environmental Health and Natural Resources (NCDEHNR) Contract No. EW05049 (\$555,000), with Kenneth Reckhow (PI), Rachel Noble, and Nancy White: Developing Fecal Coliform TMDLs Using Bayesian Modeling and Novel Molecular Monitoring Techniques (2005-2008).

INVITED TALKS, KEYNOTE LECTURES, AND PANELS

The list below includes seminars and presentations to the public, academia, and government agencies for which Dr. Gronewold was an invited keynote speaker, lecturer, or panelist. Dr. Gronewold has been a lead presenter or co-presenter on over multiple additional conference presentations (see list further below).

- Great Lakes water levels: historical and future trends. Environmental Law and Policy Center speaker series. May 2026.
- Advancing hydroclimate research to support management and governance of global transboundary waters (Invited). University of Michigan CLASP seminar series. April 2026.
- Viewing the Great Lakes from a global transboundary perspective. Presented at the Bayview Yacht Club (Detroit, MI). January 2026.
- The Great Lakes and other global transboundary waters: Lessons learned, and lessons shared. Presented at the Annual CIGLR All Partners Meeting. January 2026.

- Coordinating and Advancing Multinational Monitoring and Modeling Systems for Global Transboundary Water Resources Management (Invited). Presented at the 2025 AGU Annual Meeting. December 2025.
- Hydroclimate Modeling and Data Needs for Collaborative Management and Governance of Global Transboundary Waters (Invited). Presented at Colorado School of Mines Seminar Series. December 2025.
- Hydroclimate science for transboundary water policy and water resources management. Presented at the University of Michigan SEAS faculty seminar series. November 2025.
- Water Security and Sustainability Across Earth’s Largest Freshwater Bodies: A Great Lakes Perspective (Invited). Sustainability Symposium morning plenary. Hope College, Holland, MI. October 2025.
- Understanding Changes Across Global Transboundary Waters: Implications for Sustainable Water Resources Management (Invited). Sustainability Symposium evening lecture. Hope College, Holland, MI. October 2025.
- Understanding water level fluctuations on large lakes: Science supporting water resources management. Presented at the Great Lakes Coalition Annual Membership Meeting. August 2025.
- Preserving and Modernizing Multi-Institution Strategies for Coordinating Transboundary Water Management Data and Tools (Invited). AccelNet Peer2Peer Workshop, Dar es Salaam, Tanzania. June 2025.
- Convergent Applications in Lake Modeling Across Spatial and Temporal Scales (Invited). Presented to the Great Lakes Integrated Science and Assessment (GLISA) Center at their annual Modeling Workshop. June 2025.
- The current state of Great Lakes water levels. Keynote presenter for the Environmental Law and Policy Center. Chicago, IL. May 2025.
- Great Lakes hydrologic modeling. Invited (remote) presentation to the Pacific Northwest National Laboratory (PNNL). February 2025.
- Advancing knowledge and action on the global water crisis across transboundary regions. Invited (remote) presenter for the National Academies of Science, Engineering, and Medicine Peer2Peer Seminar Series. February 2025.
- NOAA Science Advisory Board meeting. Invited panelist for session on Science Infrastructure for Rapidly Changing Great Lakes Ecosystems. Ann Arbor, MI. July 2024.
- Strategies for achieving resilience and adaptation. Invited panelist for AccelNet Peer2Peer workshop on Lessons for Managing Transboundary Water Resource Vulnerabilities, National Academies of Science, Engineering, and Medicine. Irvine, CA. June 2024.
- The current state of Great Lakes water levels. Keynote presenter for the Environmental Law and Policy Center. Chicago, IL. May 2024.
- Science and data for transboundary waters: a continental, multinational perspective. Invited lecture, Western Michigan University seminar series. Kalamazoo, MI. April 2024.
- “Big Blue” gets warmer: another impact of climate change. Invited lecture, speaker Series of South Haven, Michigan. April 2024.
- Ethical engagement with traditional ecological knowledge. Panel moderator at the Dedwasnyeha’ Dwano:ha’ Ohwejade “We Will Take Care of Mother Earth” Traditional Ecological Knowledge Summit. Six Nations of the Grand River. March 2024.
- Data, models, and governance in transboundary waters: a continental perspective. Invited lecture, Bowling Green State University Seminar series. March 2024.

- Data, models, and governance in transboundary waters: a continental perspective. Invited lecture, Bayview Yacht Club, Detroit, MI. March 2024.
- Protecting and restoring the Great Lakes through multinational and capacity-building research and engagement. Invited presentation (remote) to the Great Lakes Funders Collaboration. February 2024.
- The Global Center for Understanding Climate Change Impacts on Transboundary Waters. Invited presentation (remote) to the Council of Great Lakes Governors and Premiers Science Council. February 2024.
- Climate change impacts on water supplies in the Great Lakes. Invited presentation for the COMPASS (Coastal Observations, Mechanisms, and Predictions across Systems and Scales) Project. Ann Arbor, MI. September 2023.
- The current state of Great Lakes water levels. Invited presentation (remote) for the Environmental Law and Policy Center. Chicago, IL. June 2023.
- Understanding changes in the water balance of large lake systems and implications for future water resources management planning. Invited lecture, Michigan State University Department of Earth & Environmental Sciences Seminar Series. March 2023.
- Great Lakes water levels. Invited keynote (remote) presentation, Coastal Leadership Academy - Resilience Summit, Michigan Office of Environment, Great Lakes, and Energy (EGLE). November 2022.
- Water level models and forecasting. Invited keynote for the Environmental Law and Policy Center (ELPC) Confluence Conference. October 2022.
- The current state of Great Lakes water levels. Invited seminate (remote) to the Environmental Law and Policy Center. Chicago, IL. May 2022.
- Variability in Great Lakes water supplies and water levels: past, present, and future. Invited presentation at the West Michigan Sustainable Business Forum (WMSBF). April 2022.
- Water level variability and extremes. Invited keynote presentation at the Michigan State University Institute for Water Research (IWR) Annual Great Lakes Conference. Lansing, MI. March 2022.
- A history of water accumulation and loss in the Great Lakes. Invited lecture (remote) for the Osher Lifelong Learning Institute. Ann Arbor, Michigan. February 2022.
- Perspectives on climate change, water quantity and quality, and communities. Invited panelist, Urban Land Institute (ULI) panel on Water Interdependency - How Water Connects Everything. November 2021.
- A Great Lakes perspective on climate change and coastal water level variability. Invited lecture, University of Chicago, Department of Geophysical Sciences Seminar Series. Chicago, IL. November 2021.
- The ups and downs of Great Lakes water levels. Invited lecture, Save the River Seminar Series. Clayton, NY. September 2021.
- Water abundance across the Great Lakes. Invited lecture, Ann Arbor Rotary Club. August 2021.
- Understanding lake level changes. Invited keynote, Great Lakes and St. Lawrence Cities Initiative Seminar Series: Understanding climate change and physical changes in the region over the next century. August 2021.
- Understanding Great Lakes water level variability. Invited (remote) presentation, to the One Water Regional Team. June 2021.

- Current state of Great Lakes water levels. Invited (remote) presentation to the Environmental Law and Policy Center, 2021.
- Understanding Great Lakes water level variability. Invited lecture, presented at ‘Water at Wayne’, Wayne State University seminar series. April 2021.
- The hydrologic cycle of the Laurentian Great Lakes: connections to policy, management, and research priorities. Invited lecture, University of Wisconsin-Milwaukee seminar water series. April 2021.
- Fluctuations in hydrologic extremes across large lake systems. Invited lecture (remote) for the University of Colorado Boulder water research seminar series. March 2021.
- The rise and fall of Great Lakes water levels. Invited presentation (remote) at Annual Meeting of the Wisconsin DNR drinking water and groundwater program. February 2021.
- The Great Lakes hydrologic cycle. Invited lecture (remote) for Ann Arbor Trout Unlimited. January 2021.
- Great Lakes water level: science overview. Invited plenary (remote), Georgian Bay Forever and Georgian Bay Association water levels symposium. October 2020.
- Hydrologic science issues surrounding the Line 5 pipeline. Invited presentation (remote) on behalf of the Bay Mills Indian Community at the Joint Consultation Forum. October 2020.
- Great Lakes water supply forecasting: Recent NYPA and OPG collaborations and future research. Invited presentation to the New York Power Authority and Ontario Power Generation. Niagara Falls, NY. September 2020.
- Drivers of recent and historical water level variability across the Great Lakes. Invited plenary, Annual Lake Huron Conference. September 2020.
- Great Lakes water level variability: past, present, and future. Invited keynote, Beaver Island High Water Summit. August 2020.
- The science behind water level fluctuations. Invited lecture, Tip of the Mitt Watershed Council. July 2020.
- The science behind water level variability across the Great Lakes. Invited lecture, Institute for Journalism and Natural Resources. Chicago, IL. June 2020.
- Forecasting Great Lakes water levels across multiple time scales. Invited (remote) presentation for the Council of Great Lakes Governors and Premiers. June 2020.
- Rising water levels across the Great Lakes. Invited presentation (remote) for the Great Lakes Coalition. May 2020.
- Rising water levels across the Great Lakes. Invited presentation (remote) for the Environmental Law and Policy Center (ELPC). April 2020.
- Water levels and the water balance of the Great Lakes. Invited lecture, Bayview Yacht Club, Detroit, MI. March 2020.
- Understanding drivers of Great Lakes water level variability. Invited plenary, Save the River Conference, Clayton, NY. February 2020.
- Hydrologic science and water level changes across the Great Lakes region. Invited presentation (remote) to the Lake Superior Partnership. February 2020.
- Understanding the Great Lakes hydrologic cycle. Invited presentation (remote) at the NOAA Climate Program Office (CPO) Seminar Series. December 2019.
- Understanding Great Lakes water level variability. Invited plenary, Pennsylvania Lake Erie Environmental Forum. Erie, PA. October 2019.

- Understanding Great Lakes water level variability. Invited plenary, St. Clair County Workshop on Planning for Coastal Resilience. Goodells, MI. October 2019.
- Climate change impacts on Michigan and the Michigan economy. Invited plenary, Edward Jones Continuing Professional Education Seminar. Hudsonville, MI. September 2019.
- Climate change impacts on northern regions: a perspective from the Great Lakes. Invited lecture, Annual FinnFest Symposium. Detroit, MI. September 2019.
- Hydrology of the Great Lakes. Invited plenary, Coastal Wetlands Symposium. Maumee Bay, OH. September 2019.
- Differentiating variability and uncertainty in environmental systems. Invited lecture, Bowling Green State University Biological Sciences Department Seminar Series. Bowling Green, OH, September 2019.
- Connections between water level variability and urban water systems planning. Invited plenary, Reimagining Urban Water: Linking Sustainable Urban Water Systems in the Great Lakes Basin Interdisciplinary Workshop. Milwaukee, WI. July 2019.
- Perspectives on water supplies in the Great Lakes basin. Invited lecture, National Wildlife Federation pre-debate briefing. Detroit, MI. July 2019.
- Great Lakes water level fluctuations. Invited seminar speaker, Ann Arbor Kiwanis Club. Ann Arbor, MI. June 2019.
- A new look at models, data, and analytical tools for supporting water resources management. Invited speaker, Duke University, Department of Civil and Environmental Engineering Seminar Series. Durham, NC. March 2019.
- Hydrologic science and uncertainty assessment: supporting water resources management planning and forecasting. Invited lecturer, University of Wisconsin-Milwaukee Seminar Series. February 2019.
- Regional water resources management: A Great Lakes perspective. Invited lecture, Science Saturday at University of Toledo. February 2019.
- Hydrologic science and uncertainty assessment. Invited speaker, Smith Lecture at the University of Michigan, Department of Earth and Environmental Science. February 2019.
- Models, data, and analytical tools for water resources management. Invited lecture, Michigan State University. February 2019.
- Great Lakes water levels and the hydrologic cycle. Invited speaker, Bayview Yacht Club seminar series. Detroit, MI. February 2019.
- Changes in the Great Lakes Hydrologic Cycle and Impacts on Lake St. Clair Water Levels and Channel Flows. Invited plenary, 8th binational Lake St. Clair Conference. Harrison Township, MI. November 2018.
- Great Lakes water levels: past, present, and future. Invited keynote, Lake Huron Conference, “Is the Coast Clear?”, Grand Bend, Ontario. May 2018.
- Great Lakes water levels and impacts of recent rebound. Invited speaker, Michigan Sea Grant Freshwater Summit. Traverse City, MI. October 2018.
- Developing models, data, and analytical tools for improving water resources management. Invited seminar speaker, Cornell University Department of Civil and Environmental Engineering. Ithaca, NY. October 2018.
- Models and data for studying water quality and climate change. Invited keynote for Grand Valley State University Year of Water and Big Data Month initiatives. September 2018.

- Quantifying variability in environmental systems to improve management, planning, and policy development. Invited seminar, Grand Valley State University, Department of Biology Seminar Series. September 2018.
- Great Lakes water levels: past, present, and future. Invited speaker (via webinar) for the Great Lakes Islands Coalition. August 2018.
- Great Lakes water levels and the hydrologic cycle. Invited lecture (webinar) for Electric Power Research Institute (EPRI) and the Great Lakes Interest Group (GRIG). December 2017.
- Great lakes hydrological modeling. Invited lecture for the regional United States Geological Survey team. Lansing, MI. November 2016.
- Reconciling hydrologic and climate data inconsistencies across Earth's largest freshwater surfaces. Invited lecture, City College of New York. New York, NY. November 2016.
- Great Lakes water levels: past, present, and future. Invited seminar, Tip of the Mitt Division of the US Power Squadron. Petoskey, MI. October 2016.
- Climate change and water resources across the Great Lakes. Invited lecture, Northwestern University Climate Forum. Evanston, IL. October 2016.
- Great Lakes water levels: past, present, and future. Invited seminar, Flint Division of the US Power Squadron. Flint, MI. September 2016.
- Hydrological forecasting from a Great Lakes perspective. Invited keynote, presented at the HEPEX (Hydrological Ensemble Prediction Experiment) bi-annual meeting. Quebec City, Quebec. June 2016.
- Great Lakes water levels: past, present, and future. Invited lecture, Lansing Division of the US Power Squadron. Lansing, MI. May 2016.
- Great Lakes water levels: past, present, and future. Invited keynote, District 9 of the US Power Squadron. Dearborn, MI. April 2016.
- Data analysis, inference, and model development for improving water resources management. Invited speaker, North Carolina State University, Department of Civil and Environmental Engineering Seminar Series. Raleigh, NC. November 2015.
- Communicating long-term Great Lakes water budget and water level information. Invited keynote, Traverse City water level information workshop "Great Lakes water level fluctuations - what does the future hold?", Northwestern Michigan College, Traverse City, MI. May 2015.
- Communicating long-term Great Lakes water budget and water level information. Invited speaker, Rochester Hills Rotary Club. Rochester, Hills, MI. May 2015.
- Understanding Great Lakes water level fluctuations. Invited speaker, Restore Our Waters International (ROWI) Seminar Series. Ann Arbor, MI. May 2015.
- Monitoring and modeling the water budget and water levels of Earth's largest lake system. Invited lecturer, University of Michigan CILER seminar series. Ann Arbor, MI. May 2015.
- Great Lakes water levels: trends, anomalies, and projections. Invited lecture, University of Toledo. Toledo, OH. October 2014.
- Climate change and the news: impacts in the Great Lakes. Invited lecture, Metcalf Institute for Marine and Environmental Reporting. Chicago, IL. September 2014.
- Drivers of water level change on Earth's largest lake system. Invited speaker, Computations in Science Seminar Series, James Franck Institute, University of Chicago. September 2014.
- Great Lakes water levels: Past, present, and future. Invited lecture, Great Lakes and Inland Waters Committee of the State Bar of Michigan Environmental Law Section, Wayne State University. July 2014.

- Great Lakes water levels; past, present, and future. Invited seminar, Advisory Council of the Alpena Marine Sanctuary. Alpena, MI. May 2014.
- Great Lakes water levels; past, present, and future. Invited speaker, Ann Arbor Rotary Club. Ann Arbor, MI. April 2014.
- State of the Science: Great Lakes water levels. Invited speaker, 2014 Science-Policy Confluence Conference on Great Lakes water levels. Ann Arbor, MI. March 2014.
- Differentiating drivers of water loss to prioritize water resource management planning. Keynote speaker, 2014 Borchardt conference. Ann Arbor, MI. February 2014.
- Great Lakes water levels. Invited lecture, Council of Great Lakes Industries Water Use and Quality Work Group. Ann Arbor, MI. February 2014.
- Invited briefing on Great Lakes water levels to representatives from Union of Concerned Scientists, Meridian Institute, World Resources Institute, Energy Foundation, and Michigan League of Conservation Voters. (Via remote broadcast) Washington, D.C. December 2013.
- Great Lakes water levels. Invited panelist at sixth annual freshwater summit. Traverse City, MI. November 2013.
- Great Lakes water levels. Invited lecture, Corinthian Yacht Club. Chicago, IL. May 2013.
- Low Great Lakes water levels: understanding the causes and potential consequences. Invited lecturer, CILER-GLERL Great Lakes Seminar Series. Ann Arbor, MI. May 2013.
- Great Lakes water level dynamics. Presented at the Michigan State University, Institute of Water Research, Great Lakes Conference - The Great Lakes: Science and Stewardship, East Lansing, MI. March 2013.
- Overview of the Center of Excellence for Great Lakes and Human Health. Invited briefing to the Great Lakes National Program Office, EPA. Chicago, IL. February 2013.
- Great Lakes hydrologic forecasting and data needs. Invited speaker, public forum on Great Lakes research. Northern Michigan University, Marquette, MI. August 2012.
- Climate change impacts on Great Lakes water levels. Invited keynote, The Ohio State University Stone Laboratory seminar series. Put-in-Bay, OH. August 2011.
- Climate change impacts on Great Lakes water levels. Invited speaker, The Ohio State University Climate Change Outreach program webinar series. May 2011.
- Propagating uncertainty into water resource management decisions. Invited lecture, Grand Valley State University (Annis Water Resources Institute). Muskegon, MI. March 2011.
- Uncertainty and Variability in Hydrological and Water Quality Models. Invited lecture, Western Michigan University (Department of Geography Colloquium Series). Kalamazoo, MI. February 2011.

CONFERENCES AND (NON-REVIEWED) ABSTRACTS (IN ADDITION TO INVITED SPEAKING ENGAGEMENTS LISTED ABOVE)

- Global Center for Understanding Climate Change Impacts on Transboundary Waters. Presented at University of Michigan President's Symposium for Research Impact and Policy Leadership. March 2026.
- Hoops, R., among others. Supporting advancements in Lake Malawi water resources management. Presented at the 2025 AGU Fall Meeting (December 2025).
- Anderson, E., Memari, S., Phanikumar, M., **A.D. Gronewold**. Groundwater's role in modulating ice formation and thermal stratification in the Laurentian Great Lakes. Presented at the 2025 AGU Fall Meeting (December 2025).

- Abdelhady, H., Fujisaki-Manome, A., D. Cannon, **A.D. Gronewold**, J. Wang. Long-term intensification and spatial heterogeneity of Great Lakes temperature extremes. Presented at the 2025 AGU Fall Meeting (December 2025).
- Gaur, S., L. Nguyen, **A.D Gronewold**, M. Ombadi, P. Reich. Changes in extreme and annual precipitation under global warming. Presented at the 2025 AGU Fall Meeting (December 2025).
- Zafar, M., Memari, S., E. Anderson, **A.D Gronewold**, M. Phanikumar. Analyzing groundwater-lake interactions and their influence on summer circulation and thermal structure in the Great Lakes. Presented at the 2025 AGU Fall Meeting (December 2025).
- Saint Louis, B., **A.D. Gronewold**. Integrating a hydrodynamic and lagrangian particle tracking framework for HAB dynamics in western Lake Erie. Presented at the 2025 AGU Fall Meeting (December 2025).
- Beachler, C., A. Gossard, **A.D. Gronewold**, Understanding Lake Abert water level variability. University of Michigan UROP Symposium. April 2024.
- Mei, Y., **A.D. Gronewold**, Drought and storage capacity. MUSE Annual Meeting. February 2021.
- Garcia, H., S. Brines, B. Wong, C. Brown, **A.D. Gronewold**, Coastal Water Level Variability, Inundation, and Impacts on Nearshore Infrastructure. MUSE Annual Meeting. February 2021.
- Do, H., J. Smith, L. Fry, **A.D. Gronewold**, Developing a new estimate for the water balance of the Laurentian Great Lakes. MUSE Annual Meeting. February 2021.
- Anderson, E., **A.D. Gronewold**. Three decades of subsurface water temperature measurements reveal warming trends and deep water dynamics in Lake Michigan. American Geophysical Union (AGU) Annual Meeting. December 2020.
- Huang, Y., **A.D. Gronewold**, others. Identification of earthquakes and anthropogenic events around the southern Great Lakes. American Geophysical Union (AGU) Annual Meeting. December 2020.
- Mei, Y., **A.D. Gronewold**, Evaluation of Terrestrial Water and Energy Budget Components over the Laurentian Great Lakes Basin. American Geophysical Union (AGU) Annual Meeting. December 2020.
- Sherwin, J., A. VandeWeghe, **A.D. Gronewold**, Modes of variability in the Great Lakes water balance. American Geophysical Union (AGU) Annual Meeting. December 2020.
- J. Jayaram, **A.D. Gronewold**, Copula-Based Water Supply Forecasting. American Geophysical Union (AGU) Annual Meeting. December 2020.
- Garcia, H., S. Brines, B. Wong, C. Brown, **A.D. Gronewold**, Coastal Water Level Variability, Inundation, and Impacts on Nearshore Infrastructure. American Geophysical Union (AGU) Annual Meeting. December 2020.
- Do, H., J. Smith, L. Fry, **A.D. Gronewold**, Developing a new estimate for the water balance of the Laurentian Great Lakes. American Geophysical Union (AGU) Annual Meeting. December 2020.
- **Gronewold, A.D.**, H. Do., L. Briley, R. Rood. Research needs to address hydrologic impacts of climate change. Presented at the International Association of Great Lakes Research (IAGLR) Annual Meeting. June 2020.
- Do, H., **A.D. Gronewold**, L. Fry, J. Smith. Impacts of hydro-climate variability to the recent surge of water levels across the Laurentian Great Lakes. Presented at the International Association of Great Lakes Research (IAGLR) Annual Meeting. June 2020.

- Garcia, H., S. Brines, B. Wong, C. Brown, **A.D. Gronewold** Incorporating remote-sensing data to improve conceptual floodplain modeling in Southeast Michigan. Presented at the International Association of Great Lakes Research (IAGLR) Annual Meeting. June 2020.
- **Gronewold, A.D.** Hydrologic science and water level changes across the Great Lakes region. Presented remotely to the Lake Superior Partnership. February 2020.
- Chen, Z., Do, H., M. Mulumpwa, G. Chavula, C. Ngongondo, **A.D. Gronewold**. Reconstructing and forecasting the water balance of Lake Chilwa. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Askar, M., J. Jayaram, Chen, Z., Do, H., M. Mulumpwa, G. Chavula, C. Ngongondo, **A.D. Gronewold**. Customizing an interactive hydroclimate dashboard for large lakes in Africa. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Do, H., **A.D. Gronewold**. Evaluating the capacity of the National Water Model streamflow reanalysis in simulating flood hazards. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Garcia, H., S. Brines, C. Brown, **A.D. Gronewold**. Improving Models to Understand the Impacts of Coastal and Inland Flooding in Southeast Michigan. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Vandeweghe, A., **A.D. Gronewold**. Understanding water balance component variability across the Great Lakes. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Do, H., **A.D. Gronewold**. Understanding drivers of recent record-high water levels across the Laurentian Great Lakes. Presented at the University of Michigan MUSE Conference. Ann Arbor, MI. February 2020.
- Askar, M., J. Jayoram, Z. Chen, H. Do, **A.D. Gronewold**, M. Mulumpwa, C. Ngongondo, G. Chavula. Customizing an interactive hydroclimate dashboard for large lakes in Africa. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Brown, C., **A.D. Gronewold**, T. Calappi, S. Brines, K. LaBuhn. Enhancing river discharge forecasting in the Niagara River: an integrated approach to utilizing multi-source remote sensing data for bathymetry maps. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Kirchner, K., J. Jorns, R. Rood, **A.D. Gronewold**. Novel statistical modeling tools for identifying thresholds and phase shifts in coastal ice cover. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Fry, L., D. Apps, **A.D. Gronewold**. Employing ensemble prediction to enhance the value of Great Lakes seasonal water supply and water level forecasts. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Mai, J., **A.D. Gronewold**, among many others. The runoff model inter-comparison project over Lake Erie and the Great Lakes. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Read, L., D. Yates, **A.D. Gronewold**, K. Sampson, D. Gochis. Parameterizing waterbodies in a level pool scheme: a National Water Model application. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Beletsky, D., J. Feyen, L. Mason, C. Xiao, **A.D. Gronewold**, D. Titze, H. Hu, E. Anderson, P. Chu, L. Read, W. Saunders. Developing a hydrologic-hydrodynamic flood forecasting system for Lake Champlain. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.

- Do, H., **A.D. Gronewold**, L. Fry, J. Smith. Understanding drivers of recent record-high water levels across the Laurentian Great Lakes. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Chen, Z., H. Do., **A.D. Gronewold**, M. Mulumpwa, G. Chavula, C. Ngongondo. Reconstructing and forecasting the water balance of Lake Chilwa (Malawi). Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Chu, P., T. Hunter, L. Fry, L. Mason, K. Sampson, L. Read, **A.D. Gronewold**, D. Gochis, A. Rafieenasab, L. Karsten. Enhancing total water prediction for the Great Lakes through calibration of the National Water Model in Canadian watersheds. Presented at the American Geophysical Union (AGU) Annual Fall Meeting. December 2019.
- Chen, Z., H. Do., **A.D. Gronewold**, M. Mulumpwa, G. Chavula, C. Ngongondo. Reconstructing and forecasting the water balance of Lake Chilwa (Malawi). Presented at the University of Michigan STEM V Africa Conference. October 2019.
- Fujisaki-Manome, A., **A.D. Gronewold**. Impacts of precipitation on ice cover and water temperature in the Great Lakes. To be presented at the annual meeting of the International Association of Great Lakes Research. June 2019, Brockport, NY (USA).
- Nummer, S., Qian, S., **A.D. Gronewold**. Understanding the response of Great Lakes ice coverage to climate change using a hockey stick model. To be presented at the annual meeting of the International Association of Great Lakes Research. June 2019, Brockport, NY (USA).
- **Gronewold, A.D.**. Reconciling the water balance of large lake systems. University of Michigan, Department of Civil and Environmental Engineering. Water Resources Engineering Seminar Series. April 2019.
- **Gronewold, A.D.**, L. Fry, V. Fortin, J. Noel. Strengthening cross-agency bi-national partnerships to improve water prediction and management capabilities. Presented at the American Geophysical Union Annual Meeting, December 2018, Washington, D.C.
- Smith, J.P., **A.D. Gronewold**, S. Steinschneider. Quantifying data uncertainty and bias in a Bayesian model for large lake systems. Presented at the American Geophysical Union Annual Meeting, December 2018, Washington, D.C.
- Anderson, E.J., Fujisaki-Manome, A., **A.D. Gronewold**, L. Fitzpatrick, B. Lofgren, R. Muzzi, K. Beadle, P. Blanken, C. Fairall, L. Bariteau, C. Spence, J. Lenters, G. Mann, P. Chu. Propagating novel turbulent heat flux measurements into extreme lake weather event and water supply forecasting systems. Presented at the American Geophysical Union Annual Meeting, December 2018, Washington, D.C.
- **Gronewold, A.D.**, L. Read, D. Gochis, L. Mason, K. Sampson, B. Cosgrove, K. FitzGerald, A. Dugger, J. McCreight, C. Xiao, E. Anderson. Customizing the National Water Model to meet regional needs for water prediction. Presented at the American Geophysical Union Annual Meeting, December 2018, Washington, D.C.
- Fry, L.M., **Gronewold, A.D.**, From research to operation decisions: hydroclimatic forecasting advancements for application to regulation of Lake Superior outflow and water resources management in the Great Lakes. Presented at the American Geophysical Union Annual Meeting, December 2018, Washington, D.C.
- Fry, L., Z. Miller, **A.D. Gronewold**, K. Kompoltowicz. Advances in operational seasonal to inter-annual Great Lakes water level forecasting. Presented at the International Association of Great Lakes Research Conference, Toronto, Ontario. June 2018.
- Smith, J., S. Steinschneider, J. Bruxer, **A.D. Gronewold**. Capturing the Great Lakes water balance in a Bayesian network. Presented at the International Association of Great Lakes Research Conference, Toronto, Ontario. June 2018.

- Blanken, P., J. Lenters, C. Spence, **A.D. Gronewold**, C. Fairral, R. Muzzi. Vessel-based observations of meteorological and evaporation gradients on the Laurentian Great Lakes. Presented at the International Association of Great Lakes Research Conference, Toronto, Ontario. June 2018.
- Fitzpatrick, L., Fujisaki-Manome, A., **A.D. Gronewold**, B. Lofgren, E. Anderson, P. Blanken, C. Spence, J. Lenters, U. Charusombat, C. Xiao, G. Cutrell. Validating modeled turbulent heat fluxes across the Great Lakes. Presented at the International Association of Great Lakes Research Conference, Toronto, Ontario. June 2018.
- Mai, J., B. Tolson, H. Shen, E. Gaborit, N. Gasset, V. Fortin, M. Abrahamowicz, D. Durnford, Y.L. Shin, L.M. Fry, T. Hunter, **A.D. Gronewold**, others. Status report on the Great Lakes Runoff Intercomparison Project for Lake Erie (GRIP-E). Presented at the 2018 Global Water Futures Conference. Hamilton, Ontario. June 2018.
- **Gronewold, A.D.** Regional customization of the National Water Model. National Water Center showcase. Tuscaloosa, AL. March 2018.
- Xiao, C., B. Lofgren, **A.D. Gronewold**, D. Gochis, L. Mason, L. Pei, K. Sampson. Implementing the WRF-Hydro Modeling System in the Great Lakes Region. Presented at 2018 American Meteorological Society Annual Meeting. Austin, TX, January 2018.
- Fujisaki-Manome, A. **A.D. Gronewold**, B. Lofgren, E. Anderson, L. Fitzpatrick, P. Blanken, C. Spence, J. Lenters, U. Charusombat, C. Xiao, G. Cutrell. Validating modeled turbulent heat fluxes across large freshwater surfaces. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- Smith, J., **Gronewold, A.D.** A Bayesian network for the Laurentian Great Lakes water balance. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- Pei, L., **A.D. Gronewold**, D. Gochis, L. Mason, K. Sampson, A. Dugger, L. Read, J. McCreight, C. Xiao, B. Lofgren, E. Anderson, P. Chu. Customizing WRF-Hydro for the Laurentian Great Lakes basin. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- Channell, K., **A.D. Gronewold**, R. Rood, C. Xiao, B. Lofgren, T. Hunter. Sensitivity of hydrologic response to climate model debiasing procedures. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- LaBuhn, K., T. Calappi, A. MacNeil, **A.D. Gronewold**. An operational short-term forecasting system for regional hydropower management. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- Apps, D., L. Fry, R. Bolinger, **A.D. Gronewold**. Application of the North American Multi-Model Ensemble (NMME) to seasonal water supply forecasting in the Great Lakes basin through the use of the Great Lakes seasonal climate forecast tool. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- **Gronewold, A.D.**, F. Seglenieks, J. Bruxer, V. Fortin, J. Noel. Improving regional climate and hydrological forecasting following the record-setting flooding across the Lake Ontario - St. Lawrence River system. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- Fry, L., **A.D. Gronewold**, T. Hunter, L. Pei, J. Smith, H. Lucier, R. Mueller. Assessment of a new seasonal to inter-annual operational Great Lakes water supply, water levels, and connecting channel flow forecasting system. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.

- Fitzpatrick, L., A. Fujisaki-Manome, **A.D. Gronewold**, E. Anderson, C. Spence, J. Chen, C. Shao, D. Posselt, D. Wright, B. Lofgren, D. Schwab. Reconstructing heat fluxes over Lake Erie during the lake effect snow event of November 2014. Presented at 2017 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, USA. December 2017.
- **Gronewold, A.D.** Resources for Supporting the Indiana Dunes Climate Change Adaptation Plan. Presented via Webinar. August 2017.
- Xiao, C., B. Lofgren, **A.D. Gronewold**, D. Gochis, L. Mason, L. Pei. Implementing the WRF-Hydro modeling system in the Great Lakes region. IAGLR Annual Conference. Detroit, MI. May 2017.
- Smith, J., L. Mason, S. Qian, **A.D. Gronewold**. MCMC modeling with JAGS and applications in the Great Lakes. IAGLR Annual Conference. Detroit, MI. May 2017.
- Quinn, F., A. Clites, **A.D. Gronewold**. Reconciling discontinuity of temporal flow measurements for the Detroit River. IAGLR Annual Conference. Detroit, MI. May 2017.
- Pei, L., T. Hunter, R. Bolinger, **A.D. Gronewold**. Applying climate change projections in Great Lakes regional water management decisions. IAGLR Annual Conference. Detroit, MI. May 2017.
- Noel, J., B. Hall, L. Stoecker, **A.D. Gronewold**, L. Fry, F. Seglenieks, V. Fortin. New website supporting bi-national coordination of precipitation over the Great Lakes. IAGLR Annual Conference. Detroit, MI. May 2017.
- Mason, L., K. Sampson, A. Dugger, D. Gochis, C. Riseng, **A.D. Gronewold**. Development of a new geospatial hydrofabric to support advanced hydrological modeling. IAGLR Annual Conference. Detroit, MI. May 2017.
- Labuhn, K., T. Calappi, **A.D. Gronewold**, E. Anderson, P. Kowalski. Optimizing water levels in the Grass Island Pool for hydropower production on the Niagara River. IAGLR Annual Conference. Detroit, MI. May 2017.
- Ji, X., R. Rood, H. Daher, **A.D. Gronewold**. Simulating and forecasting seasonal ice cover. IAGLR Annual Conference. Detroit, MI. May 2017.
- **Gronewold, A.D.**, J. Smith. Great Lakes water budget modeling and uncertainty estimation under a Bayesian MCMC framework. IAGLR Annual Conference. Detroit, MI. May 2017.
- Fry, L., **A.D. Gronewold**, R. Bolinger, R. Mueller. Assessment of probabilistic 5-year forecasts of Great Lakes water levels and outflows for hydropower. IAGLR Annual Conference. Detroit, MI. May 2017.
- Fitzpatrick, L., A. Fujisaki-Manome, **A.D. Gronewold**, E. Anderson, C. Spence, J. Chen, C. Shao, D. Posselt, D. Wright, B. Lofgren, D. Schwab. Reconstructing evaporation over Lake Erie during the historic November 2014 lake effect snow event. IAGLR Annual Conference. Detroit, MI. May 2017.
- Chu, P., E. Anderson, B. Lofgren, **A.D. Gronewold**, J. Wang, C. Stow, G. Lang, T. Hunter, A. Clites. Towards an integrated environmental modeling system for the Great lakes. IAGLR Annual Conference. Detroit, MI. May 2017.
- Channell, K., **A.D. Gronewold**, C. Xiao, R. Rood, B. Lofgren. Implications of model debiasing methods on lake level projections. IAGLR Annual Conference. Detroit, MI. May 2017.
- Fujisaki-Manome, A., L.E. Fitzpatrick, **A.D. Gronewold**, E.J. Anderson, C. Spence, J. Chen, C. Shao, D. Wright, C. Xiao. Turbulent heat fluxes during an extreme lake effect snow event: direct measurements and model ensemble. JpGU-AGU joint meeting. Japan. May 2017.

- Hall, B., L.A. Stoecker, J. Noel, **A.D. Gronewold**. A new precipitation product for reconciling discrepancies across the US-Canadian border. 2017 Climate Prediction Applications Science Workshop. Anchorage, Ak. May 2017.
- Channell, K., **A.D. Gronewold**, C. Xiao, B. Lofgren, T. Hunter, R. Rood. Variability of Great Lakes water levels due to bias correction of climate model projections. 2017 Michigan Geophysical Union. Ann Arbor, MI. April 2017.
- Fitzpatrick, L.E., A. Manome, **A.D. Gronewold**, E.J. Anderson, C. Spence, J. Chen, C. Shao, D.M. Wright, B.M. Lofgren, C. Xiao, D.J. Posselt, D.J. Schwab. Reconstructing evaporation over Lake Erie during the historic November 2014 lake effect snow event. Annual AMS conference. Seattle, WA. January 2017.
- Anderson, E.J., **A.D. Gronewold**, L. Pei, C. Xiao, L.E. Fitzpatrick, B.M. Lofgren, P.Y. Chu, T. Hunter, D.J. Gochis, K. Sampson, A Dugger. Linking hydrologic and coastal hydrodynamic models in the Great Lakes. Annual AMS conference. Seattle, WA. January 2017.
- Gates, O.C., K. Channell, D. Brown, W. Baule, D.J. Schwab, C. Riseng, and **A.D. Gronewold**. The Great Lakes adaptation data suite: providing a coherent collection of climate data for the Great Lakes region. Annual AMS conference. Seattle, WA. January 2017.
- Pei, L., **A.D. Gronewold**, D.J. Gochis, K. Sampson, A. Dugger, C. Xiao, L. Mason, B.M. Lofgren, P.Y. Chu. Applying WRF-Hydro in the Great Lakes basin: offline simulations in the seasonal hydrological responses. Annual AMS conference. Seattle, WA. January 2017.
- Xiao, C., B.M. Lofgren, J. Wang, P.Y. Chu, **A.D. Gronewold**. Projecting water levels of the Laurentian Great Lakes in the 21st century from a dynamical downscaling perspective. Annual AMS conference. Seattle, WA. January 2017.
- Charusombat, U., C. Chiu, K. Byun, A.F. Hamlet, B.M. Lofgren, **A.D. Gronewold**. An overview of the Great Lakes hydroclimate scenarios project (GLHSP). Annual AMS conference. Seattle, WA. January 2017.
- Ji, X., H. Daher, R. Bolinger, **A.D. Gronewold**, R.B. Rood. Simulating and forecasting seasonal ice cover. Annual AMS conference. Seattle, WA. January 2017.
- Pei, L., **A.D. Gronewold**, T. Hunter, R. Bolinger. Regional hydrological response from statistically downscaled future climate projections in the 21st century. Annual AMS conference. Seattle, WA. January 2017.
- **Gronewold, A.D.**. Improving NOAA's Great Lakes forecasting models with off-shore monitoring platforms. Presented at the University of Michigan Great Lakes Adaptation Forum. Ann Arbor, MI (USA). October 2016.
- Charusombat, U., B.M. Lofgren, **A.D. Gronewold**, T. Hunter, E.J. Anderson, J.D. Lenters, C. Spence, P.D. Blanken, A.F. Manome. Validation of Lake Evaporation in NOAA-GLERL's physical models. 59th annual conference on Great Lakes research. Guelph, Ontario. June 2016.
- **Gronewold, A.D.**. [Invited] Understanding drivers of rapid water level changes on the Great Lakes. Presented at the annual American Water Works Association (AWWA) conference. Chicago, IL (USA). June 2016.
- Lofgren, B.M., **Gronewold, A.D.**, C. Xiao, L. Pei, U. Charusombat. WRF-Hydro and atmosphere-land coupled modeling at the NOAA Great Lakes Environmental Research Laboratory. 59th annual conference on Great Lakes research. Guelph, Ontario. June 2016.
- **Gronewold, A.D.**. Changing Great Lakes water levels: current conditions and future projections. Presented to the University of Michigan Water Level Integrated Assessment Program. Ann Arbor, MI (USA). May 2016.

- Gaborit, E., B. Tolson, V. Fortin, **A.D. Gronewold**, L.M. Fry, T. Hunter. The Great Lakes Runoff Intercomparison Project (GRIP): Phase II, Lake Ontario. April 2016. European Geosciences Union (EGU) General Assembly. Austria, Vienna.
- **Gronewold, A.D.**. Great Lakes water levels, ice, and climate change: practical application of models. Presented at the School of Natural Resources, University of Michigan. Ann Arbor, MI (USA). January 2016.
- Lofgren, B.M., A.D. Gronewold, C. Xiao, and R.A. Bolinger. Integration of Great Lakes Water Resources into National and Continental Systems for Weather and Climate Prediction. American Meteorological Society Annual Meeting, New Orleans, LA. January 2016.
- Blanken, P., C. Spence, J.D. Lenters, **A.D. Gronewold**, B. Kerkez, P. Xue, N. Froelich. The Dynamics of Laurentian Great Lakes Surface Energy Budgets. December 2015. American Geophysical Union Fall Meeting, San Francisco, CA (USA).
- **Gronewold, A.D.**, J. Bruxer, J. Smith, T. Hunter, V. Fortin, A.H. Clites, D. Durnford, F. Seglenieks. Aggregating hydrometeorological data from international monitoring networks across Earth's largest lake system. December 2015. American Geophysical Union Fall Meeting, San Francisco, CA (USA).
- Gaborit, E., B. Tolson, V. Fortin, **A.D. Gronewold**, L.M. Fry, T. Hunter. The Great Lakes Runoff Intercomparison Project (GRIP): Phase II, Lake Ontario. December 2015. American Geophysical Union Fall Meeting, San Francisco, CA (USA).
- R.A. Bolinger, L.M. Fry, K. Kompoltowicz, **A.D. Gronewold**. Using NMME in Region-Specific Operational Seasonal Climate Forecasts. December 2015. American Geophysical Union Fall Meeting, San Francisco, CA (USA).
- **Gronewold, A.D.**, E. Anderson, B. Lofgren, P. Blanken, J. Wang, J. Smith, T. Hunter, D. Beletsky, G. Lang, C. Stow, May 2015. Impact of regional climate perturbations on Lake Michigan's heat content. 2015 Annual Conference on Great Lakes Research, Burlington, Vermont (USA).
- Hunter, T. J. Smith, S. Qian, **Gronewold, A.D.**, May 2015. Improving the historical record of the Great Lakes water budget. 2015 Annual Conference on Great Lakes Research, Burlington, Vermont (USA).
- **Gronewold, A.D.**, P.D. Blanken, C. Spence, J. Lenters, B. Kerkez, W. Leger, K. Paige, T. Slawewski, F. Seglenieks, V. Fortin, N.J. Froelich, S.A. Ruberg, D. Wolfe, C.W. Fairall, J. Chen, January 2015. Improving estimates of evaporation from Earth's largest lake system. 2015 American Meteorological Society Annual Meeting, Phoenix, AZ, USA.
- Bolinger, R., K. Kompoltowicz, T. Hunter, **A.D. Gronewold**, January 2015. Improving Great Lakes regional operational water budget and water level forecasting. 2015 American Meteorological Society Annual Meeting, Phoenix, AZ, USA.
- Bolinger, R., K. Kompoltowicz, **A.D. Gronewold**, January 2015. Quantification of temperature and precipitation variability over the Great Lakes. 2015 American Meteorological Society Annual Meeting, Phoenix, AZ, USA.
- Bolinger, R., C. Olheiser, B. Krumweide, **A.D. Gronewold**, December 2014. Comparing measurements, simulations, and forecasts of snow water equivalent across the Great Lakes basin. 2014 American Geophysical Union Fall Meeting, San Francisco, CA, USA.
- Obenour, D.R., **A.D. Gronewold**, C.A. Stow, I. Bertani, C.E. Steger, S.A. Ruberg, D. Scavia. December 2014. Probabilistic forecasting of harmful algal blooms in western Lake Erie (poster). 2014 American Geophysical Union Fall Meeting, San Francisco, CA, USA.
- **A.D. Gronewold**, Understanding changes in the water cycle. December 2014. Young Scientist Workshop at the 2014 American Geophysical Union Fall Meeting, San Francisco, CA, USA.

- **A.D. Gronewold**, E.J. Anderson, B.M. Lofgren, P.D. Blanken, J. Wang, J.P. Smith, T.S. Hunter, G.A. Lang, C.A. Stow. December 2014. Modeling transitions in the hydrologic and thermal regimes of Earth's largest lake system. 2014 American Geophysical Union Fall Meeting, San Francisco, CA, USA.
- Obenour, D.R, **Gronewold, A.D.**, C.A. Stow, D. Scavia, May 2014. Exploring Lake Erie's increasing susceptibility to Cyanobacteria blooms through probabilistic modeling. Joint Aquatic Sciences Meeting. Portland, Oregon, United States.
- Obenour, D.R, **Gronewold, A.D.**, C.A. Stow, D. Scavia, May 2014. A decision support model for Cyanobacteria blooms in the western basin of lake Erie. 2014 Annual Conference on Great Lakes Research, Hamilton, Ontario, Canada.
- **A.D. Gronewold** and Alan Steinman, May 2014. Common drivers behind long-term water level variability and ecosystem function along Earth's longest freshwater coast. 2014 Annual Conference on Great Lakes Research, Hamilton, Ontario, Canada.
- Fry, L., E.J. Anderson, A.A. Ritzenthaler, K.B. Campbell, E.L. Kramer, and **A.D. Gronewold**. Representation of spatial and temporal variability in beach water quality using a bacteria-hydrology-hydrodynamics modeling framework. State of Lake Michigan-Great Lakes Beach Association Conference, Sheboygan, WI, October 2013.
- Ritzenthaler, A.A., E.L. Kramer, L.M. FRY, **A.D. Gronewold**, and E.J. Anderson. Spatial, temporal, and analytical variability in nearshore water quality and its implications on management decisions. State of Lake Michigan-Great Lakes Beach Association Conference, Sheboygan, WI, October 2013.
- **A.D. Gronewold**, July 2013. Great Lakes water level dynamics. Upper Midwest and Great Lakes climate forum: seasonal outlooks. Ann Arbor, Michigan, United States.
- **A.D. Gronewold**, July 2013. Great Lakes water level dashboard. Shoreline Change Virtual Workshop 2013: perspectives on the Great Lakes.
- A. Ritzenthaler, L. Fry, E. Anderson, K. Campbell, and **A.D. Gronewold**, June 2013. Development of a multi-model framework linking a pathogen loading model to a hydrodynamics model for beach water quality forecasting. 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.
- A. Paine, A. Ritzenthaler, E. Kramer, and **A.D. Gronewold**, June 2013. Monitoring and analysis of Escherichia coli in the nearshore waters of Lake St. Clair. 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.
- E. Kramer, A. Ritzenthaler, A. Paine, and **A.D. Gronewold**, June 2013. Spatial, temporal, and analytical variability in near-shore water quality and its implications on management decisions. 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.
- **A.D. Gronewold**, C.A. Stow, K. Campbell, T. Hunter, June 2013. Climate change impacts on the water budget and water level dynamics of the Great Lakes basin. 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.
- L. Fry, **A.D. Gronewold**, V. Fortin, S. Buan, A. Clites, C. Luukkonen, D. Holtschlag, L. Diamond, T. Hunter, F. Seglenieks, D. Durnford, E. Klyszejko, K. Kea, P. Restrepo. June 2013. The Great Lakes runoff intercomparison project Phase I (Lake Michigan): Summary of results and plans for Phase II (Lake Ontario). 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.
- Clites, A., E. Kramer, L. Fry, E. Anderson, and **A.D. Gronewold**. June 2013. Implications of an improved hydrologic model for understanding near-shore hydrodynamics: impacts of the Clinton River spillway on predicting beach water quality. 2013 Annual Conference on Great Lakes Research, West Lafayette, Indiana, United States.

- **A.D. Gronewold**, May 2013. Understanding drivers of Great Lakes water levels. University of Michigan Water Center, CILER, and NOAA-GLERL joint seminar. Ann Arbor, Michigan, United States.
- Gill, S., **A.D. Gronewold**, and T. Landon, May 2013. Great Lakes Economies and Ecosystems: will extreme low water levels leave them high and dry? NOAA Central Library Brown Bag Seminar Series. Silver Spring, Maryland, United States.
- Bratton, J.F., J. Wang, **A.D. Gronewold**, B.M. Lofgren, and M. Colton. Tools for prediction and management of climate change impacts on natural resources in the Great Lakes and the Arctic. 11th Annual Climate Prediction Applications Science Workshop, Climate Information for Natural Resource Management, Logan, UT, April 23-25, 2013.
- Kult, J., Fry, L., **Gronewold, A.D.**, Choi, W., 2013. Effects of inter-annual and seasonal variability in regionalization of hydrologic response in the Great Lakes basin. Presented at the 6th International Conference on Water Resources and Environmental Research. Koblenz, Germany.
- **Gronewold, A.D.**, A. Ritzenthaler, L.M. Fry, E.J. Anderson. Forecasting recreational water quality standard violations with a linked hydrologic-hydrodynamic modeling system. Presented at 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2012.
- **Gronewold, A.D.**, V. Fortin, L.M. Fry. The Great Lakes Runoff intercomparison project (GRIP). Presented at 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2012.
- Hunter, T.S., L.M. Fry, **Gronewold, A.D.**, J. Kult. Assessment of differences in physical watershed characteristics between gaged and ungaged portions of the Great Lakes basin. Presented at 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2012.
- Kult, J.M., L.M. Fry, **Gronewold, A.D.**. Accounting for inter-annual and seasonal variability in regionalization of hydrologic response in the Great Lakes basin. Presented at 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2012.
- Fry, L.M., T.S. Hunter, M.S. Phanikumar, V. Fortin, **Gronewold, A.D.**. Assessment of the Area Ratio Method and the value of gages for predicting runoff in intermittently gaged portions of the Great Lakes basin. Presented at 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2012.
- Ritzenthaler, A.A., E.J. Anderson, L.M. Fry, and **A.D. Gronewold**. Development of a process model-based bacterial water quality forecasting system. 12th Annual Great Lakes Beach Association Conference, Mackinac Island, MI, October 2012.
- Ritzenthaler, A., Kramer, E., Anderson, E., Fry, L., **A.D. Gronewold**, November 2012. Progress in Forecasting Threats to Beach Health. 6th binational Lake St. Clair conference. Harrison Township, Michigan, United States.
- **A.D. Gronewold** and Lofgren, B. October 2012. Technical input to the 2014 National Climate Assessment on climate change impacts on regional water resources. GLISA Symposium, University of Michigan, Ann Arbor, Michigan, United States.
- **A.D. Gronewold**. September 2012. Introducing the Great Lakes water level dashboard. NOAA Climate Connection Seminar Series.
- Rockwell, D.C., Campbell, K., Schwab, D.J., Mann, G.E., Wagenmaker, R., Joshi, S.J., Lang, G.A. and **A.D. Gronewold**. Beach Water Quality Management Decision Support Systems for Forecasting Probability of Exceeding E. coli Levels. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.

- Fry, L.M. and **A.D. Gronewold**. Development of a Regional Parameter Estimation Model for a Basin-Wide Recalibration of the Large Basin Runoff Model. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.
- Clites, A., Smith, J., Hunter, T., **A.D. Gronewold**. May 2012. A Web-Based Portal for Understanding Great Lakes Water Level Dynamics and Climate Variability. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.
- Crooks, J., Hunter, T., Stow, C., **A.D. Gronewold**. May 2012. Accommodating Precipitation Estimate Bias and Uncertainty in Large-Lake Dominated Basins. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.
- Ritzenthaler, A., Alameddine, I., Campbell, K., **A.D. Gronewold**. May 2012. Developing bacterial watershed fate and transport models in data-limited tributaries. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.
- **A.D. Gronewold** and R.L. Wolpert. May 2012. Moving Beyond the MPN and CFU: Novel Applications of Statistical Models. 2012 Annual Conference on Great Lakes Research, Cornwall, Ontario, Canada.
- Fry, Lauren, **A.D. Gronewold** April 2012. Employing state-of-the-art hydrological modeling tools to improve historical estimates and forecasts of Great Lakes basin runoff. Presented as part of CILER-GLERL seminar series, Ann Arbor, Michigan, United States.
- **Gronewold, A.D.**. April 2012. Great Lakes water level dynamics. Presented at the Frankfort Rotary Club, Frankfort, Michigan, United States.
- **Gronewold, A.D.**, V. Fortin. March 2012. Leveraging binational collaborative research to advance Great Lakes hydrological science and improve operational forecasting. Presented at the 20th U.S. - Canadian Great Lakes Operational Meteorology Workshop, Chicago, Illinois, United States.
- **Gronewold, A.D.**. January 2012. Great Lakes water level dynamics. Presented at the Inland Seas Education Association, Suttons Bay, Michigan, United States.
- **Gronewold, A.D.**. November 2011. Great Lakes hydrological modeling. Presented to visiting scientists and students from Wayne State University at NOAA GLERL, Ann Arbor, Michigan, United States.
- **Gronewold, A.D.**. September 2011. Great Lakes Water Levels. Coastal Habitat Conservation in a Changing Climate: Strategies and Tools for the Great Lakes Region, Ypsilanti, Michigan, United States.
- **Gronewold, A.D.**. August 2011. A Perspective on the Climate and Water Connection from the Great Lakes. NOAA National Weather Service, Silver Spring, Maryland, United States.
- **Gronewold, A.D.**. August 2011. A Great Lakes Perspective on the Climate and Water Connection. NOAA Climate Prediction Center, Camp Springs, Maryland, United States.
- **Gronewold, A.D.** and T.S. Hunter. June 2011. Novel models for quantifying spatial variability in daily precipitation estimates. 2011 Annual Conference on Great Lakes Research, Duluth, Minnesota, United States.
- Moynihan, M.A., K. Kannapan, D. Kashian, C.A. Stow, **A.D. Gronewold**. June 2011. *E. coli* and *Enterococci* concentrations in Great Lakes Beaches: Implications of small scale sampling variability on perceived threats to human health. 2011 Annual Conference on Great Lakes Research, Duluth, Minnesota, United States.
- Clites, A.H., T.S. Hunter, **A.D. Gronewold** and C.A. Stow. June 2011. An appraisal of the Great Lakes Advanced Hydrologic Prediction System (AHPS). 2011 Annual Conference on Great Lakes Research, Duluth, Minnesota, United States.

- T.S. Hunter and **Gronewold, A.D.**. June 2011. Variability and uncertainty in Great Lakes runoff estimates. 2011 Annual Conference on Great Lakes Research, Duluth, Minnesota, United States.
- **Gronewold, A.D.** Hydrological modeling. November 2010. GLERL Science Program Review, Ann Arbor, Michigan, USA.
- **Gronewold, A.D.** Addressing Uncertainty and Variability in Hydrological and Water Quality Models. November 2010. Michigan Technological University Seminar (Department of Civil and Environmental Engineering), Houghton, Michigan, USA.
- **Gronewold, A.D.** and C.A. Stow. Precipitation and evaporation (overview of GLERL's data resources). October 2010. Great Lakes Water Resources Manager's Initiative Technical Workshop, Chicago, IL. Council of Great Lakes Governors.
- **Gronewold, A.D.** Predicting Flows in Ungauged Basins: A probabilistic comparison of alternative regionalization schemes. CILER-GLERL Seminar Series, August 2010, Ann Arbor, Michigan, USA.
- **Gronewold, A.D.** and I.M. Alameddine. Propagating Data Uncertainty and Variability into Flow Predictions in Ungauged Basins. July 2010. Presented at 2010 International Congress on Environmental Modeling and Software, Ottawa, Canada.
- **Gronewold, A.D.**, M. B. Nevers, R. L. Whitman. June 2010. Improving Recreational Water Quality Assessments through Novel Approaches to Quantifying Measurement Uncertainty. Presented at 2010 Annual Conference on Great Lakes Research, Toronto, Canada.
- **Gronewold, A.D.**, T. Hunter, C. Stow. June 2010. Novel Modeling Tools for Propagating Climate Change Variability and Uncertainty into Hydrodynamic Forecasts. Presented at 2010 Annual Conference on Great Lakes Research, Toronto, Canada.
- **Gronewold, A.D.**, I.M. Alameddine, 2010. Propagating Data Uncertainty and Variability into Flow Predictions in Ungauged Basins. In conference proceedings, International Congress on Environmental Modeling and Software, Ottawa, Canada, 1795–1802.
- **Gronewold, A.D.**, I.M. Alameddine, R. Anderson. A Bayesian Hierarchical Modeling Approach to Predicting Flow in Ungauged Basins. Presented at 2009 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA. December 2009.
- **Gronewold, A.D.**, I.M. Alameddine, R. Anderson, Novel Probabilistic and Bayesian Modeling Tools for Predicting Flow in Ungauged Basins. Networking and Leadership Training Organization (NLTO), United States Environmental Protection Agency, Research Triangle Park, North Carolina, USA. December 2009.
- **Gronewold, A.D.**, Propagating Uncertainty and Variability into Ecosystem Forecasts. University Program in Ecology Seminar Series, Nicholas School of the Environment, Duke University, Durham, North Carolina, USA. October 2009.
- **Gronewold, A.D.**, Building and Applying Network Models of Pollutant Fate and Transport Processes in Coastal Watersheds. United States Environmental Protection Agency, Research Triangle Park, North Carolina, USA. August 2009.
- **Gronewold, A.D.**, Uncertainty and Variability in Environmental Resource Management Decisions. USEPA Landscape Ecology Branch Seminar Series, Research Triangle Park, North Carolina, USA. March 2009.
- **Gronewold, A.D.**, I.M. Alameddine, R. Anderson, R.L. Wolpert, K.H. Reckhow. Simulating the Effect of Alternative Climate Change Scenarios on Pollutant Loading Reduction Requirements for Meeting Water Quality Standards Under USEPA's Total Maximum Daily Load Program. Presented at 2008 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA.

- Anderson, R., **Gronewold, A.D.**, I.M. Alameddine, K.H. Reckhow. A Probabilistic Model for Propagating Ungauged Basin Runoff Prediction Variability and Uncertainty into Estuarine Water Quality Dynamics and Water Quality-based Management Decisions. Presented at 2008 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA.
- O'Banion, R., I.M. Alameddine, **A.D. Gronewold**, K.H. Reckhow. PyLIDEM: A Python-Based tool to Delineate Coastal Watersheds Using LIDAR Data. Presented at 2008 American Geophysical Union (AGU) Fall Meeting, San Francisco, California, USA.
- **Gronewold, A.D.**, M.E. Borsuk, R.L. Wolpert, K.H. Reckhow. Uncertainty and Variability in Fecal Indicator Bacteria-Based Water Quality Standard Compliance and Impacts on Pollutant Loading Reduction Estimates. Presented at 2008 American Water Resources Association (AWRA) Annual Conference in New Orleans, Louisiana, USA, November 2008.
- **Gronewold, A.D.**, K.H. Reckhow, D.A. Vallero. Improving Human and Ecological Exposure Assessments: A Bayesian Network Modeling Approach. Presented at 2008 International Society for Exposure Analysis (ISEA) Joint Annual Conference in Pasadena, California, USA, October 2008.
- **Gronewold, A.D.**, K.H. Reckhow, R.L. Wolpert, M.E. Borsuk. Acknowledging Fecal-Indicator Bacteria Concentration Measurement Uncertainty and Variability in Water Resource Management Decisions. Presented at 2008 Water Resource Research Institute (WRRI) Annual Conference in Raleigh, North Carolina, USA, October 2008.
- **Gronewold, A.D.**, R.L. Wolpert, K.H. Reckhow. Propagating Water Quality Analysis Uncertainty into Resource Management Decisions Through Probabilistic Modeling. Presented at 2007 AGU Fall Meeting in San Francisco, California, USA, December 2007.
- **Gronewold, A.D.** Stormwater Management Uncertainty and Variability. Presented at Institute of the Environment, University of North Carolina - Chapel Hill, Morehead City Field Site Seminar Series, USA, October 2007.
- **Gronewold, A.D.** with K.H. Reckhow and D.A. Vallero. Application of Multimedia Models for Human and Ecological Exposure Analysis. Presented at the 17th Annual Conference of the International Society of Exposure Analysis in Durham, North Carolina, USA, October 2007.
- **Gronewold, A.D.**, A.D. Coulliette, R.T. Noble, R.L. Wolpert, K.H. Reckhow. Simple Bayesian network models for water resources management. Presented at Water Resources Research Institute (WRRI) annual meeting in Raleigh, North Carolina, USA, March 2007.
- A.D. Coulliette, **Gronewold, A.D.**, E. Money, M. Serre, R.T. Noble, 2007. Examining the relationship between wet weather and fecal contamination in a North Carolina estuary. In conference proceedings, Water Environment Federation Specialty Conference - TMDL 2007, Bellevue, Washington, USA, 1019–1031.
- **Gronewold, A.D.**, K.H. Reckhow, 2007. Developing a Bayesian network model for bacteriologically impaired surface waters. In conference proceedings, WaterMatex, Washington, D.C., USA.
- **Gronewold, A.D.**, A.D. Coulliette, R.T. Noble, R.L. Wolpert, K.H. Reckhow, 2007. Pollutant-specific TMDLs: Developing a Bayesian network model for supporting fecal coliform TMDL assessments. In conference proceedings, Water Environment Federation Specialty Conference - TMDL 2007, Bellevue, Washington, USA, 1032–1041.
- **Gronewold, A.D.**, R.L. Wolpert, K.H. Reckhow, W. Kirby-Smith. Simple Bayesian network models for supporting bacteria TMDLs. Poster presented at WEFTEC, Dallas, Texas, USA, October 2006.
- **Gronewold, A.D.**, R.L. Wolpert, K.H. Reckhow. Improving parameter estimation in bacteria water quality models. Poster presented at Statistical and Applied Mathematical Sciences Institute (SAMSI) Program on Development, Assessment and Utilization of Complex Computer Models, Research Triangle Park, North Carolina, USA, September 2006.

- **Gronewold, A.D.**, K.H. Reckhow, R.L. Wolpert. Monitoring environmental outcomes in adaptive management. Presented at 3rd Biennial Meeting of the International Environmental Modelling and Software Society, Burlington, Vermont, USA, July 2006.
- **Gronewold, A.D.**, K.H. Reckhow, R.L. Wolpert. Bayesian network models supporting TMDL implementation in shellfishing resource areas. 3rd Biennial Meeting of the International Environmental Modelling and Software Society, Burlington, Vermont, USA, July 2006.

SERVICE (TO ACADEMIC, GOVERNMENT, OR PROFESSIONAL ORGANIZATIONS)

Academic service to the University of Michigan School for Environment and Sustainability (SEAS)

Executive Committee, September 2021 to December 2023.

Great Lakes Integrated Sciences and Assessment (GLISA), with NOAA, Great Lakes Ensemble Science Advisory Committee, 2015 - present.

SEAS “Ask an Expert” video series, contributor, 2024.

SEAS Junior Faculty Mentoring Team (two mentees), 2020 - 2024.

Cooperative Institute for Great Lakes Research (CIGLR) Research Scientist (Hydrodynamics) search committee, 2023.

CIGLR Atmospheric Scientist search committee, 2023.

CIGLR Stakeholder Engagement Specialist hiring committee, 2022.

Michigan Sea Grant (MISG) Director search committee, 2022.

3rd year review select committee, served as committee chair 3 times; 2019, 2021, 2022.

CIGLR Director Search Committee, Chair. 2021.

Michigan Sea Grant (MISG) Research Program Manager Search Committee, 2021.

SEAS tenure track Landscape Architecture search committee, 2019 - 2020.

SEAS Landscape Architecture Prof. of Practice search committee, 2019 - 2020.

MISG Research Project Proposals and Fellowship Applications, reviewer 2019.

University of Michigan CILER (now CIGLR) Management Council, 2015-2017

University of Michigan CILER (now CIGLR) Council of Fellows, 2012-2015

Academic service to the University of Michigan-at-large

Undergraduate Research Opportunities Program (UROP), Annual Mentor, 2019 - present.

Elec. Engr. and Computer Science undergraduate job placement program, Member. 2019 - present.

Rackham Interdisciplinary Workshop (RIW): Michigan University-Wide Sustainability and Environment (MUSE), Faculty sponsor. 2020 - present.

Great Lakes Compact 15th Anniversary Symposium, Chair. 2023.

Summer Research Opportunities Program (SROP), Mentor. 2021.

Graham Institute, Dow Sustainability Fellows Program Reviewer. 2020.

CEE Faculty Evaluation Committee, evaluator. 2019.

UROF Career Exploration Seminar (Invited Speaker). 2011.

Government and Non-Governmental Organization (NGO) service

International Joint Commission (IJC), Science Advisory Board (Science Priority Committee). 2022 to present.

IJC, Science Advisory Board (Science Priority Committee). 2020 to 2022.

National Aeronautics and Space Administration (NASA), Technical advisor to DEVELOP program student project, "Niagara Falls and Lake Ontario flooding assessment". 2018-2019.

IJC, Great Lakes Adaptive Management Committee (U.S. Liaison), 2015-2017.

IJC, Great Lakes Adaptive Management Task Team (U.S. Secretary), 2013.

Member, Adaptive Management and Hydroclimate Working Group, International Upper Great Lakes Study, 2013.

Coordinating Committee on Great Lakes Basic Hydrologic and Hydraulic data (*ad hoc* group of federal agency representatives meeting bi-annually to review and coordinate Great Lakes data), 2011-2019.

Service to professional organizations

American Geophysical Union (AGU) Water Science Conference (WaterSciCon) 2024. Session Co-Convenor, "The role of groundwater in Great Lakes hydrological processes". June 2024.

American Geophysical Union (AGU) Fall Meeting. Session Co-Chair, "Lakes and Inland Water Bodies" (following success in December 2021, session was again divided into five sub-sessions; 3 oral and 2 poster sub-sessions). December 2022.

American Geophysical Union (AGU) Fall Meeting. Session Co-Chair, "Lakes and Inland Water Bodies" (due to high participation, session was broken in to five sub-sessions; 3 oral (8 presenters in each) and 2 posters (dozens in each). December 2021.

American Geophysical Union (AGU) Fall Meeting. Session Co-Chair, "Lakes and Inland Water Bodies". December 2020.

American Geophysical Union (AGU) Fall Meeting. Session co-chair, "Using new data and technology to better understand freshwater and lake systems: end-to-end remote sensing and regional modeling approaches". December 2017.

American Geophysical Union (AGU) Fall Meeting. Session co-chair, "Recent advances in understanding the hydrology of the Great Lakes region". December 2012.

International Association of Great Lakes Research Annual Meeting. Session co-chair, "Regional water management: development and application of modeling and data for decisions". June 2017.

International Association of Great Lakes Research Annual Meeting. Session co-chair, "Interactions between large lakes and regional climate". June 2016.

International Association of Great Lakes Research Annual Meeting. Session co-chair, "Hydroclimatic variability in the Great Lakes region and its impact on aquatic ecosystems". June 2014.

International Association of Great Lakes Research Annual Meeting. Session co-chair, "Advances in monitoring, analytical methods, data management, and forecasting beach nearshore water quality". June 2013.

International Association of Great Lakes Research Annual Meeting. Session co-chair, "Interactions

between climate and the energy and water balance of lakes and their watersheds”. June 2012.

International Association of Great Lakes Research Annual Meeting. Session co-chair, “Assessing dynamics of the Great Lakes water budget”. June 2011

HONORS AND AWARDS

Outstanding UROP Mentor (Nominated; 2025, University of Michigan)
Superior Teaching Award, 2024 (University of Michigan SEAS)
NOAA Bronze Medal, 2019
Department of Commerce Sustainability, Energy, and Environmental (SEE) Ambassador, 2018
NOAA Bronze Medal, 2016
USEPA National Leadership Training Award, 2009
Outstanding Paper Award (Hydrology), AGU Fall Meeting, 2007
North Carolina Association of Environmental Professionals: Graduate Scholarship, 2007
Water Environment Federation: Canham Graduate Scholarship, 2006
Quantitative Environmental Analysis, LLC: Graduate Scholarship, 2006
Duke University: Teaching Award, Nicholas School of the Environment, 2005
Cornell University: Student Life Distinguished Service Award, 1995
Cornell University: Cornell Club of Boston Scholar, 1993
Cornell University: Albert J. Kaneb Scholar, 1992

PRESS AND PUBLIC MEDIA - CONTRIBUTIONS AND RECOGNITION

The following list includes a summary (in chronological order starting in 2019) of articles and other public media content in which Dr. Gronewold has been quoted or to which he provided technical content expertise. Representative highlights of his contributions to the press and public media prior to 2019 are listed below.

- WTOP-FM News (Washington’s Top News; Washington, DC), “Professor Drew Gronewold on the record high water levels of Lake Superior” (May 2019)
- WJIM 1240 AM, Interview for The Steve Gruber Show, “Wave of flooding a wake up call (May 2019)
- Glen Arbor (MI) Sun, “High water levels: negotiating between Lake Michigan and Lake Leelanau” (June 2019)
- Michigan Public Radio, “Rising Great Lakes water levels fuel worry about damage to shoreline structures” (June 2019)
- WEMU (Eastern Michigan University), Issues of the Environment. “Climate change to cause more flooding in the Great Lakes region” (on-air interview; June 2019)
- Wisconsin Public Radio, The Morning Show (June 2019)
- North Country Public Radio, “It’s happened before: the long history of flooding on Lake Ontario” (July 2019)
- Bulletin of the Atomic Scientists, “Researchers think they know what’s causing record water levels on and flooding around the Great Lakes: climate change” (September 2019)
- TVO (formerly TV Ontario), The Agenda (September 2019)
- Esquire magazine (October 2019)
- St. Ignace News, “Local impacts felt from rising lakes” (October 2019)
- St. Ignace News, “Rapid lake level changes could be more frequent” (October 2019)

- GlacierHub (Columbia University), “Why Lake Superior is rising and what that means for the City of Duluth” (December 2019)
- Natural Resources Defense Council (NRDC), “Great Lakes water levels are rising - a sign of things to come?” (December 2019)
- National Public Radio, All Things Considered and Morning Edition, “Water levels, high winds erode Lake Michigan shoreline” (December 2019)
- Chicago Tribune, “How bitter cold winter blasts and a warming planet will chew up the Lake Michigan shoreline” (January 2020)
- Holland (Michigan) Sentinel, “Wreaking havoc: High water on Great Lakes swamping communities” (February 2020)
- New York Times, Opinion by Peter Annin, “Along the Great Lakes, it’s time to prepare for extremes” (February 2020)
- Wisconsin Public Radio, The Morning Show (February 2020)
- WWNY News (Watertown, NY), “Expert: wet climate is to blame for high water levels” (February 2020)
- Wall Street Journal, “On rising Great Lakes, backyards are disappearing overnight” (February 2020)
- Chicago Tribune “With little ice on Lake Superior, access to Apostle Islands ice caves is unlikely this year” (February 2020)
- MLive, “As the Great Lakes surge to record heights, coastal areas face a time of reckoning” (March 2020)
- WCBN (University of Michigan student radio), *It’s Hot in Here* (March 2020)
- Canadian Broadcasting Corporation (CBC) News London (Ontario), “What will lake levels look like this summer?” (April 2020)
- Alliance for the Great Lakes, Great Lakes Water Levels Q&A (April 2020)
- Columbia University, International Research Institute for Climate and Society, Live Webcast (May 2020)
- Scientific American, “Torrent Breaks Michigan Dam and Reveals Climate Risks” (May 2020)
- Interlochen Public Radio, “Water levels in Great Lakes approach a record high” (June 2020)
- Toledo Blade, “High water for Great Lakes results in angst, adaptation” (June 2020)
- Chicago Tribune, “A quick primer on Great Lakes water levels” (July 2020)
- Newsletter of the International Joint Commission (September 2020)
- Kramer, David (2020), “The Great Lakes are filled to their brims, with no signs of receding”, *Physics Today*, **70**(10), 26-29.
- Wisconsin Public Radio, “Under threat high water Great Lakes cities, property owners strive to become more resilient” (September 2020)
- Unsalted (podcast), “Great Lakes water levels” (November 2020)
- Concordia University (Canada), Institute for Investigative Journalism (November 2020)
- Rochester Democrat & Chronicle, “Armored homes, rising water: what to know about Great Lakes flood patterns” (December 2020)
- Manitoulin Expositor, “Climate change clear driver of Lake Huron’s high water, long-term forecast uncertain” (January 2021)

- Michigan Public Radio - Stateside, “The future of Lake Superior with climate disruption” (February 2021)
- Milwaukee Journal Sentinel, article on Lake Michigan temperatures (March 2021)
- WWJ Newsradio AM 950, Detroit (May 2021)
- PBS Disaster Series, “How do we cope with more floods? Here’s what happens when the dam breaks” (May 2021)
- Downtown Magazine, “Warming waters: lakes signal climate change” (June 2021)
- New York Times, “A battle between a Great City and a Great Lake” (feature article printed on cover of Sunday New York Times by Dan Egan; July 2021)
- West Life Magazine, “Change is only certainty on Great Lakes” (July 2021)
- NBC News, video story on Lake Michigan volatility (August 2021)
- Wisconsin Watch, “The water always wins: calls to protect shorelines as volatile Lake Michigan inflicts heavy toll” (October 2021)
- Barron’s Magazine, “Living on the Great Lakes - A dream threatened by climate change” (November 2021)
- Dutch Financial Daily, “Ieder voor zich in gevecht met her water in Holland (To each their own while fighting water in Holland)” (January 2022)
- Chicago Tribune, “Lake Michigan ice coverage may be nearing its peak as lake levels continue to drop” (February 2022)
- WZZM 13 (Grand Rapids), “Further concern remains at the lakeshore as water levels vary” (May 2022)
- Chicago Agent Magazine and South Florida Agent Magazine, “Rising sea levels and fluctuating lake levels are threatening coastal communities” (June 2023)
- Michigan Public Radio - Stateside, “Why are the Great Lakes Low?” (June 2023)
- PBS NOVA, NOVA Science Studio, and WKAR News, “The Great Lakes and Drought” (June 2023)
- Borderless Magazine, “Inundation and Injustice: Flooding presents and formidable threat to the Great Lakes region” (August 2023)
- Michigan Public Radio - Statewide (with Lester Graham), “University of Michigan awarded \$5 million to establish climate change research center” (September 2023)
- Michigan Daily, “UMich wins grant to establish new climate change research center” (October 2023)
- Detroit News, “Experts warn of protecting Great Lakes from diversions as climate warms” (coverage of Great Lakes Compact Symposium, for which Dr. Gronewold served as chair; December 2023)
- Great Lakes Echo, “Water consumption drops in Great Lakes cities, study finds” (December 2023)
- Wane 15, via SciLine and American Association for the Advancement of Science (AAAS), “Warmer winters don’t mean an end to big snowstorms” (February 2024)
- Toledo Blade, “Great Lakes water levels are now being kept in check by climate change ‘tug-o-war’ - but for how long?” (May 2024)
- Die Zeit (Hamburg, Germany), “Chicago: Eine Stadt kämpft gegen den Regen (Chicago: A City fights against the rain)” (September 2024)

- WBEZ Chicago and Michigan Advance, “Chicago’s beach season is over...or is it? Lake Michigan temps are breaking records” (October 2024)
- Michigan Daily, “How UMich researchers are addressing climate change” (December 2024)
- Michigan Daily, “UMich leads climate research in transboundary water regions” (December 2024)
- Teach me About the Great Lakes (podcast), “All of the gauges we have” (January 2025)

Representative highlights of contributions to the press and public media prior to 2019.

- Xploration Awesome Planet (with host Philippe Cousteau), “Exciting Waterways” (December 2015).
- National Public Radio (The Environment Report), “Upper Great Lakes water levels are up. Here’s why” (December 2014).
- National Public Radio (All Things Considered), “Why are the Great Lakes on the rise?” (October 2014).
- New York Times, “Creeping up on unsuspecting shores: The Great Lakes, in a welcome turnaround” (June 2014),
- National Public Radio (The Environment Report), “What all the snow and ice will mean for Great lakes water levels” (February 2014).
- NBC Nightly News, Evening news feature story on Great Lakes water levels (June 2013).

PROFESSIONAL SOCIETY MEMBERSHIPS

Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI):
 University of Michigan Liaison, 2020 - present
 American Geophysical Union (AGU), 2007-present
 International Association of Great Lakes Research (IAGLR), 2010-2018
 American Water Resources Association (AWRA), 2008-2015
 International Environmental Modelling and Software Society (iEMSs), 2006-2012
 North Carolina Water Resources Association (NCWRA), 2005-2010
 Water Environment Federation (WEF), 1996-2010
 Sigma Xi, 2006-2009
 American Academy of Environmental Engineers (AAEE - Associate), 2000-2002
 American Water Works Association (AWWA), 1996-2000

MENTORSHIP

Post-doctorate

Lauren Fry (CILER Fellow, 2012-2014)
 Daniel Obenour (2013-2014) Co-supervised with Don Scavia
 Margaret Kalcic (2013-2014) Co-supervised with Don Scavia
 Becky Bolinger (UCAR PACE Fellow, 2014-2016) Co-supervised with Keith Kompoltowicz
 Lisi Pei (UCAR PACE Fellow, 2015-2017)
 Hong Do (SEAS Fellow, 2019-2021)
 Yiwen Mei (SEAS, USGS Powell, and MCubed Fellow, 2020-2022) with A. Steiner and R. Rood
 Satbyeol Shin (CIGLR Fellow, 2022-2024)
 Anne Fetrow (2023-2025) with N. Levin and B. Passey

Hazem Abdelhady (CIGLR Fellow, 2024-2025) with D. Cannon and A. Fujisaki Manome

Doctorate students

Yasuyuki Akita (UNC-Chapel Hill, 2010) Dissertation committee member
Katie Holman (CILER Fellow, 2011)
Kevin Fries (UM CEE, 2014-2018) Diss. committee member, with B. Kerkez
Dennis Sugrue (UM CEE, 2018-2020) Diss. committee member, with Peter Adriaens
Abhiram Mullapudi (UM CEE, 2020-2021) Diss. committee member, with B. Kerkez
Daniel Phillips (UM SEAS, 2019-2021) Diss. committee member, with Joan Nassauer
Kirk Townsend (UM EES, 2020-2021) Diss. committee member, with Marin Clark
Stephanie Nummer (U. Toledo, 2020-2021) Diss. committee member, with Song Qian
Chloe Whicker (UM CLASP, 2021-2023) Diss. committee member, with Mark Flanner
Jade Zhang (UM EES, 2020-2023) Diss. committee member, with Sierra Peterson
Yuanqui Feng (UM SEAS, 2019-present) Diss. committee member, with Joan Nassauer
Sarah Katz (UM EES, 2020-2024) Diss. committee member, with Naomi Levin
Vianey Rueda (UM SEAS, 2022-present) Primary supervisor
Sam Schurkamp (UM SEAS, 2024-present) Primary supervisor
Belinda Saint Louis (UM SEAS, 2024-present) Primary supervisor
Lisa Nguyen (UM CLASP, 2024-present) Diss. committee member, with Mohammed Ombadi
Jungpyo Hong (UM EES, 2024-present) Diss. committee member, with Ben Passey
Jada Langston (UM EES, 2024-present) Diss. committee member, with Naomi Levin

Master's students

Thidavisuth Chunkruea (MS, Duke University, 2005) Co-supervised with Ken Reckhow
Ryan O'Banion (MS, Duke University, 2006) Co-supervised with Ken Reckhow
Jonathan Kult (MS, CILER Fellow, 2012) Co-supervised with Lauren Fry
Anthony Accioilli (MS, CILER Fellow, 2012) Co-supervised with Brent Lofgren
Bryan Comer (MS, CILER Fellow, 2013) Co-supervised with Lauren Fry
Nathan Kelly (MS, CILER Fellow, 2013) Co-supervised with Lauren Fry and Kent Campbell
Scott Loeffler (MS, CILER Fellow, 2015) Co-supervised with Becky Bolinger
Carlos Wah-Gonzalez (MS, NOAA EPP Fellow, 2015)
Houraa Daher (MS, UM AOSS, 2015-2016) Co-supervised with Becky Bolinger and Ricky Rood
Xiaolong Ji (MS, UM CLASP, 2016-2017) Co-supervised with Ricky Rood
Kim Channell (MS, UM CLASP, 2016-2017) Co-supervised with Ricky Rood
Christine Brown (MS, UM SEAS, 2019-2020) Master's thesis committee member
Zihao Chen (MS, UM SEAS, 2019-2020)
Meiye Wang (MS, UM SEAS, 2019-2020)
Helena Garcia (MS, UM SEAS, 2019-2021)
Jennifer Fuller (MS, UM SEAS, 2020-2021) Master's thesis committee member
Drew Pappas (MS, UM Communications, 2020-2021) Research supervisor
Danielle Cohn (MS, UM SEAS 2019-2021) Research supervisor
Ryan Armbrustmacher (MS, UM CEE 2021) Research supervisor
Yifan Luo (MS, UM SEAS, 2021-2022) Practicum and research project supervisor
Hannah Paulson (MS, UM SEAS, 2021-2022) Research project supervisor
Eamon Espey (MS, UM SEAS, 2021-2023) Research project supervisor
Sage Paris (MS, UM CEE, 2022-2023) Research supervisor
April Kim (MS, UM SEAS, 2021-2023) Research supervisor
Marjorie Cort (MS, UM SEAS, 2021-2023) Research supervisor
Mikela Dean (MS, UM SEAS, 2021-2023) Research supervisor
Caleb Wegener (MS, UM SEAS and CEE, 2022-2024) Research supervisor
Taylor Mitchell (MS, UM SEAS, 2022-2024) Thesis supervisor
Bhavarth Shah (MS, UM SEAS, 2022-2024) Thesis supervisor
Maya Morgan (MS, UM SEAS, 2022-2024) Thesis supervisor
Alexander Vandeweghe (MS, CEE, 2023-2024) Research supervisor

Yilun Zhao (MLA, UM SEAS, 2023-2024) Thesis co-reader
Trece Hopp (MS, UM SEAS, 2023-2025) Thesis supervisor
Annie Wisner (MS, UM SEAS, 2023-2025) Research supervisor
Anna Gossard (MS, UM CEE, 2024-2025) Research supervisor
Yolanda Ming (MS, UM CEE, 2024-2025) Research supervisor
Macy Gustafson (MS, UM SEAS, 2025-present) Research supervisor
Hunter Wilkes (MS, UM SEAS, 2025-present) Research supervisor
George Edison (MS, UM SEAS, 2025-present) Research supervisor
Hery Lapuimakuni (MS, UM SEAS, 2025-present) Research supervisor

Undergraduate (collaboration through fellowship, funded research position, or independent study)

Molly Moynihan (Hollings Fellow, 2010) Co-supervised with Craig Stow
Joseph Smith (Hollings Fellow, 2010) Co-supervised with Craig Stow
Kandace Kea (EPP Fellow, 2012)
Andrea Paine (UROP Fellow, 2012-2013) Co-supervised with Alicia Ritzenthaler
Cameron Carpenter (UM CEE, 2014-2015) Co-supervised with Becky Bolinger
Hannah Rockwell (UM CEE, 2015) Co-supervised with Becky Bolinger
Micki Johns (UM CEE, 2015)
Hannah Jones (UM CEE, 2015)
Eric Chapman (UROP Fellow, 2015-2016)
Jing Xu (Data Science, 2019)
Mairna Askar (Computer Science, 2019-2021)
Karl Kirchner (Mathematics, 2019-2020)
Mutaman Alnaseri (UROP Fellow, 2019-2020)
Jenna Sherwin (UROP Fellow, 2020-2021)
Jessica Zenas (UROP Fellow, 2020-2021)
Anika Satish (UROP Fellow, 2020-2021)
Sydney Swider (UM Computer Science, 2020-2021)
Jennani Jayaram (Mathematics, 2019-2022)
Austin Chen (UM Data Science, 2021-2022)
Ashleigh Craig (UM Information Analysis, 2021-2022)
Samriddhi Gupta (UM Data Science; 2021-2022)
Victor Lin (UM Data Science; 2021-2022)
Alexander Vandeweghe (UROP Fellow, 2019-2022)
Iain Robb (UM Computer Science; 2021)
Ari Basch (UM Computer Science, 2021-2023)
Troy Sorensen (UM Data Science; 2021-2023)
Camila Castenada (SROP Fellow, 2023)
Anna Gossard (UROP Fellow; UM CEE, 2021-2024)
Manish Venumuddula (UROP Fellow, 2020-2024)
Caroline Beachler (UROP Fellow, 2023-2024)
Rachel (Rubanguka) Hoops (SROP Fellow; 2021-present)
Lara Tobias-Tarsh (UM CLaSP; 2021-2025)
Rohan Athreya (UM Data Science; UROP fellow and research scientist; 2023-present)

CERTIFICATIONS

Licensed Professional Engineer (Civil - Massachusetts)
Certified Soil Evaluator (Massachusetts: 2000 – 2010)

TECHNICAL REPORTS

Consulting engineering project team leader or contributing author on the following reports:

Evaluation of Water and Wastewater Disinfection Alternatives, City of Manchester, Connecticut

(2004). Stearns & Wheler, LLC.

Stormwater Disposal Study - Manomet Avenue, Town of Plymouth, Massachusetts (2003). Stearns & Wheler, LLC.

Fecal Coliform Evaluation and Mitigation Planning for the Allen's Harbor Watershed, Town of Harwich, Massachusetts (2002). Stearns & Wheler, LLC.

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OTHER PROFESSIONAL ACTIVITIES

Editorial Board: Environmental Modelling & Software (2010 - 2015)

Reviewer: Advances in Water Resources, Canadian Journal of Fisheries and Aquatic Sciences, Climatic Change, Earth Interactions, Ecological Engineering, Ecological Indicators, Environmental Engineering Science, Environmental Health Perspectives, Environmental Management, Environmental Modelling & Software, Environmental Monitoring and Assessment, Environmental Science & Technology, Hydrological Processes, Journal of the American Water Resources Association, Journal of Climate, Journal of Environmental Management, Journal of Experimental Marine Biology and Ecology, Journal of Geophysical Research - Solid Earth, Journal of Great Lakes Research, Journal of Hydrology, Journal of Hydrologic Engineering, Journal of Hydrometeorology, Journal of Water Resources Planning and Management, Marine Environmental Research, Science of the Total Environment, Water Research, Water Resources Research, Weather and Forecasting