

Gabriel Perez

Research Hydrologist

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Research Hydrologist with extensive experience in developing and implementing statistical and numerical models to understand and predict how hydrological systems respond to both natural and human-induced perturbations. My research interests span a wide spectrum, including: Extreme Flood events, Hydrologic modeling; Hydraulic modeling; High-performance computing, Hydroclimate impact assessment, Flood risk estimation; Stochastic modeling; River network structures; Remote sensing; Machine learning; Groundwater modeling; and Hyporheic exchange modeling.

Education

2019

Ph.D. Hydraulics and Water Resources

The University of Iowa - Iowa City, IA, U.S.

Thesis: "Advancing Multiple Aspects of a Nonlinear Geophysical Theory of Floods"

2015

M.Sc. Water Resources

Universidad Nacional de Colombia - Medellin, Colombia

Thesis: "Methodology for Estimating Flood Areas with Scarce Information Through Geomorphometric Descriptors Derived from Digital Elevation Models"

2012

B.S. Civil Engineering

Universidad Nacional de Colombia - Medellin, Colombia

Thesis: "Analysis of the Confluence Dona Maria – Medellin River based on a Hydraulic and Monte Carlo Simulation."

Professional Experience

2023 - Current

Postdoctoral Research Associate – Hydrological modeling

Oak Ridge National Laboratory, Oak Ridge, U.S.

2019 – 2022

Postdoctoral Scholar – Hydrological modeling

Vanderbilt University, Nashville, U.S.

2015 – 2019

Research Assistant – Hydrological modeling

Iowa Flood Center, University of Iowa, Iowa City, U.S.

2012 - 2014

Civil Engineer – Hydrologic and hydraulic studies

Perez Mesa Ingenieros SAS, Medellin, Colombia.

2011

Assistant Civil Engineer – Stormwater design

W&W Ingeniería Ltda, Medellin, Colombia

2010 - 2011

Research Assistant – Hydrologic and Hydraulic studies

Universidad de Antioquia, Medellin, Colombia

Teaching Experience

2022 Spring

Instructor, Water Resources Engineering

Vanderbilt University, Nashville, U.S.

2018 Spring and
Fall

Teaching Assistant, Fluid Mechanics

The University of Iowa, Iowa City, U.S.

2017 Spring and
Fall 2018

Teaching Assistant, Groundwater

The University of Iowa, Iowa City, U.S.

2017 Spring

Teaching Assistant, Water Resources Design

The University of Iowa, Iowa City, U.S.

2012 - 2014

Instructor, Introduction to Geographic Information Systems

The Universidad Nacional de Colombia, Medellin, Colombia.

Publications

Papers in Review

- Mantilla, R., **Perez, G.**, Velasquez, N., Wright, DB., Yu, G., Papalexiou, S., Krajewski, W. F. What Can We Learn about Flood Frequency Estimation at Ungauged Locations from High-resolution Physically-based Hydrologic Simulations? *Water Resources Research* (in review).

Papers Published in Refereed Journals

1. **Perez, G.**, Gomez-Velez, J. D., & Grant, S. B. (2023). The sanitary sewer unit hydrograph model: A comprehensive tool for wastewater flow modeling and inflow-infiltration simulations. *Water Research*, 120997. <https://doi.org/https://doi.org/10.1016/j.watres.2023.120997>
2. **Perez, G.**, Gomez-Velez, J. D., Chen, X., & Scheibe, T. (2023). The directional unit hydrograph model: Connecting streamflow response to storm dynamics. *Journal of Hydrology*, 627, 130422. <https://doi.org/10.1016/j.jhydrol.2023.130422>
3. Krajewski, W. F., Otto, L., Vishwakarma, S., **Perez, G.** (2023). Revisiting Turcotte's approach: flood frequency analysis. *Stochastic Environmental Research and Risk Assessment*, 37(5). <https://doi.org/10.1007/s00477-022-02344-6>
4. Grant, S.B; Rippy, M; Birkland, T; Schenk, T; Rowles, K; Aminpour, P; Kaushal, S; Vikesland, P; Berglund, E; Gomez-Velez, J; Hotchkiss, E; **Perez, G**; Zhang, H;

- Armstrong, K; Bhide, S; Krauss, L; Maas, C; Mendoza, K; Shipman, C; Zhang, Y; Zhong, Y. (2022) "Can Common Pool Resource theory catalyze stakeholder-driven solutions to the freshwater salinization syndrome?" *Environmental Science & Technology*, <https://doi.org/10.1021/acs.est.2c01555>
5. **Perez, G.**, Gomez-Velez, J.D., Chen, X., Scheibe, T., Chen, Y., Bao, J. (2021) Identification of Characteristic Spatial Scales to Improve the Performance of Analytical Spectral Solutions to the Groundwater Flow Equation. *Water Resources Research*, 57(12) <https://doi.org/10.1029/2021WR031044>
 6. **Perez, G.**, Gomez-Velez, J.D., Mantilla, R., Wright, D., Li, Z. (2021) The Effect of Storm Direction on Flood Frequency Analysis. *Geophysical Research Letters*, 48(9):1–10. <https://doi.org/10.1029/2020GL091918>
 7. Quintero, F., Krajewski, W. F., Muste, M., Rojas, M., **Perez, G.**, Johnson, S. J., Anderson, A., Hunemuller, T., Cappuccio, B., & Zogg, J. (2021). Development of synthetic rating curves: A case study in Iowa. *Journal of Hydrologic Engineering*, 1–12. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0002022](https://doi.org/10.1061/(ASCE)HE.1943-5584.0002022)
 8. **Perez, G.**, Mantilla, R., Krajewski, W. F., & Quintero, F. (2019). Examining Observed Rainfall, Soil Moisture, and River Network Variabilities on Peak Flow Scaling of Rainfall-Runoff Events with Implications on Regionalization of Peak Flow Quantiles. *Water Resources Research*, 2019WR026028. <https://doi.org/10.1029/2019WR026028> .
 9. **Perez, G.**, Mantilla, R., Krajewski, W. F., & Wright, D. B. (2019). Using Physically Based Synthetic Peak Flows to Assess Local and Regional Flood Frequency Analysis Methods. *Water Resources Research*, 2019WR024827. <https://doi.org/10.1029/2019WR024827> .
 10. **Perez, G.**, Mantilla, R., & Krajewski, W. F. (2018). Estimation of Historical-Annual and Historical-Monthly Scale-Invariant Flow Duration Curves with Implementation for Iowa. *Journal of Hydrologic Engineering*, 23(12), 05018021. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0001707](https://doi.org/10.1061/(ASCE)HE.1943-5584.0001707) .
 11. **Perez, G.**, Mantilla, R., & Krajewski, W. F. (2018). The Influence of Spatial Variability of Width Functions on Regional Peak Flow Regressions. *Water Resources Research*, 54(10), 7651–7669 <https://doi.org/10.1029/2018WR023509>.

Book Chapters

1. **Perez, G.**, Mantilla, R., & Krajewski, W. F. (2018). Spatial patterns of peak flow quantiles based on power-law scaling in the Mississippi River basin. In A. A. Tsonis (Ed.), *Thirty Years of Nonlinear Dynamics in Geosciences*. Springer. https://doi.org/10.1007/978-3-319-58895-7_23

Data Release

1. Ikard, S.J., Rucker, D.F., Carroll K.C., Adams, R.F., and **Perez, G.**, (2022), Waterborne Self-potential Data, Surface-water Temperature and Conductivity Logging data, and Electric Resistivity Tomography Data Measured at East Fork Poplar Creek, Oak Ridge, Tennessee, January-March 2022, U.S. Geological Survey data release, <https://doi.org/10.5066/P9BAW75G>

Papers in Preparation

- **Perez, G.**, Coon, E., Rathore, S., Le, Phong, Wright, D; Persad, G., Nduka, I.C., Passalacqua, P. Projected Increase in Intensity of Rare Rainfall Events for Extended Storm Durations in a Changing Climate. In preparation for *Nature Communications*.
- **Perez, G.**, Coon, E., Rathore, S., Le, Phong. Advancing Flood Frequency Analysis with a Fully Integrated Surface-Subsurface Model and Realistic Stochastic Storm Catalogs. In preparation for the *Journal of Hydrology*.
- **Perez, G.**, Coon, E., Rathore, S., Le, Phong. The Effect of “Rare Events” on Flood Frequency Analysis. A Comparative Analysis Between Observations and Physic-Based Hydrological Simulations. In preparation for the *Journal of Hydrology*.
- **Perez, G.**, Gomez-Velez. J.D., Chen, X., Scheibe, T., Chen, Y., Bao, J. Spectral solutions of the groundwater flow equation for the characterization of hyporheic exchange: How accurate is the pumping model? In preparation for *Water Resources Research*.
- Gomez-Velez, J. D., **Perez, G.**, Y. Zhang, S. B. Grant. Water Mixing in Sanitary Sewer Systems: Implications for the Interpretation of Water Quality Observations. In preparation for *Environmental Science & Technology*.

Honors and Awards

- Nomination to STAHY Best Paper Award (2021).
- Best Case Study Award – Journal of Hydrologic Engineering (2020).
- Graduate College Post-Comprehensive Research Award (Spring 2018 semester).
- CEE Outstanding TA for Water Resources Engineering (Fall 2017 semester).
- Outstanding Student Scholarship – Universidad Nacional de Colombia – M.Sc. Hydraulic resources (2012-2014).

Conference and Seminar Presentations

- **Perez, G.**, Coon, E., Rathore, S., Le, Phong. Advancing Flood Frequency Analysis through a Fully Integrated Hydrological Model and High-Performance Computing – NUG Annual Meeting 2023.
- **Perez, G.**, Gomez-Velez, J., Chen, X., Scheibe, T., Chen, Y., & Bao, J. A Systematic Assessment of the Pumping Model as a Tool to Understand and Upscale Hyporheic Exchange Processes - AGU Fall Meeting 2022.
- **Perez, G.**, Mantilla, R., Krajewski, W., & Gomez-Velez, J. Insights on Physical Controls and Statistical Effects on the Interpretation of Peak Flow Scaling from a Mesoscale Basin to the Mississippi River Basin - AGU Fall Meeting 2022.

- Gomez-Velez J., **Perez G.**, Grant S., Mendoza, K., Rippy, M., & Vikesland, P. A novel modeling framework to understand the fate and transport of salts in sanitary sewer systems - AGU Fall Meeting 2022.
- Shipman, C., Grant, S., Mendoza, K., Vikesland, P., **Perez, G.**, Gomez-Velez, J., Rippy, M., Schenk T., & Birkland, T. The Potential Contribution of Household Detergents to Inland Freshwater Salinization - AGU Fall Meeting 2022.
- Ayers, J., Jing, W., Chen, M., Daugherty, E., **Perez, G.**, & Gomez-Velez, J., Effects of Nutrient Pollution and Urbanization on Diel Cycles and CO2 Emissions in Two Middle TN Streams - AGU Fall Meeting 2022.
- **Perez, G.**, & Gomez-Velez, J., Development of a Parsimonious Hydrological Model to Evaluate the Effect of Changes in Storm Tracks in Flood Events Under Future Climates. - AGU Fall Meeting 2021.
- **Perez, G.**, Gomez-Velez, J., Chen, Y., Chen, X., Scheibe, T., & Bao, Ji., Analysis of Nested Hyporheic Flow Paths Using Analytical Spectral Solutions. GSA 2021.
- Mantilla, R., Velasquez, N., **Perez, G.**, & Wright, D., Quantifying Sources of Uncertainty in Regional Flood Frequency Analysis Using Physics-based Hydrologic Modeling - AGU Fall Meeting 2021.
- Velasquez, N., Mantilla, R., **Perez, G.**, Wright, D., & Yu, G., A performance index based on hydrograph moments: A descriptor to identify strengths and shortcomings hydrological simulations - AGU Fall Meeting 2021.
- **Perez, G.**, Resonance in hydrologic systems: Detecting critical conditions that can exacerbate extreme floods during current and future climate. Emerging Scholar Seminar, Vanderbilt University, March 2021.
- **Perez, G.**, Gomez-Velez, J., Mantilla, R., Wright, D., & Li, Z., The Effect of Storm Direction on Flood Frequency Analysis Using Physically-Based Streamflow Simulations - AGU Fall Meeting 2020.
- Mantilla, R., **Perez, G.**, Velasquez, N., Wright, D., & Yu, G., Insights from Physics-based Hydrologic Models and Stochastic Storm Transposition into the Underlying Assumptions of Flood Quantile Regionalization Techniques - EGU General Assembly Conference, 2020.
- Mantilla, R., **Perez, G.**, Quintero, F., & Krajewski, W. F., A Physical Interpretation for Peak Flow Scaling of Rainfall-Runoff Events in Nested River Networks with Implications on Peak Flow Regionalization. EGU General Assembly 2019.
- **Perez, G.**, Mantilla, R., & Krajewski, W. F., The influence of spatial variability of width functions on regional peak flow regressions. AGU Fall Meeting Abstracts, Washington D.C. 2018.
- Mantilla, R., **Perez, G.**, & Krajewski, W. F., Comparison of local and regional methods to estimate peak flow quantiles based on synthetic records. AGU Fall Meeting Abstracts, Washington D.C. 2018.
- Krajewski, W. F., Mantilla, R., **Perez, G.**, Comparison of local and regional methods to estimate peak flow quantiles based on synthetic records. STAHY, Australia-Adelaide 2018.

- Krajewski, W. F., Mantilla, R., **Perez, G.**, Temporal and spatial power laws of river peak flows and flood frequency estimation. AGU Fall Meeting Abstracts, New Orleans, 2017.
- Rodriguez-Gaviria, E. M., **Perez, G.**, & Botero-Fernández, V. Methodological design for flood risk assessment at a local level using scare information. 6th International Conference on Flood Management, 1–12. 2011.

Affiliations

- American Geophysical Union
- American Society of Civil Engineers
- Geological Society of America

Participation in Courses and Seminars

- CIROH Training and Developers Conference, Salt Lake, Utah. 2023,
- Certificate in College Teaching, Vanderbilt University, Fall 2021 – Spring 2022
- SMAPVEX16 Research campaign, soil moisture and vegetation sampling, NASA, University of Iowa, August 2016.
- CUAHSI Watershed Science Master Class, University of Arizona's Biosphere 2 facility in Oracle, Arizona. January 2016.
- Course in water quality modeling in rivers and streams and its application to sanitation plans and managing spills. ACODAL, July 2012.
- XIX National seminar of hydraulics and hydrology and the first national forum on safety of dams. Bogota DC Colombia, March 2011.

Technical Skills

- Programming Skills: Python, MATLAB, R, PostgreSQL
- Modeling experience: ATS, WRF-Hydro, HEC-HMS, EPA-SWMM, Hillslope-Link-Model, EPANET, HEC-RAS, HEC-GeoRAS, COMSOL Multiphysics, MODFLOW.
- Research Tools: Linux, GitHub, ArcGIS, QGIS, SAGA GIS, GRASS GIS, AutoCAD.

Community Services and Media

Reviewer service: Journal of Hydrology; Water Resources Research; Hydrology and Earth System Sciences; Advances in Water Resources; Hydrogeology Journal; Water; Journal of the American Water Resources Association.

Conference: Session chair of Groundwater-Surface Water Interactions: Integrating Physical, Biological, and Chemical Patterns and Processes Across Systems and Scales - AGU Fall Meeting 2022

Interviews: Nashville Public Radio interview to discuss Climate Central's report for the month of April 2023. <https://wpln.org/post/nashville-rainstorms-are-getting-wetter-how-much-12-in-the-past-five-decades/>