



NATHAN GELDNER

Applied Mathematician

Nathan Geldner, Ph.D., is focused on the design and analysis of probabilistic, statistical, and simulation models of environmental risk with applications in public policy and decision support under uncertainty. His experience is principally in surge and wave-driven as well as compound flooding from tropical cyclones, but he's also interested in application domains ranging from more directly related climate and meteorological hazards such as inland pluvial flooding and water resource management to more diverse areas such as environmental health, emissions policy, and ecological management.

COMPANY ROLE

Applied Mathematician

PROJECT ROLE / FOCUS AREAS

Statistical analysis

Environmental risk
modeling

Compound flood
modeling

Decision support under
uncertainty

EDUCATION

Ph.D., Industrial
Engineering, Purdue
University, 2023

B.S., Mathematics,
Harvey Mudd College,
2016.

PROFESSIONAL MEMBERSHIPS

Society of Risk
Analysis

Decision Making under
Deep Uncertainty
(DMDU) Society

Geldner's previous work includes creating methods improvements for Louisiana's 2023 Coastal Master Plan as well as probabilistic model development for the Louisiana Watershed Initiative, addressing coastal surge and wave-driven risk modeling and joint surge/riverine flood hazard modeling respectively. He also has experience working with decision-making under deep uncertainty, a family of methodological frameworks for tackling hard problems of public policy when there is uncertainty of what the future holds and analysts can't confidently put probability distributions to the problem.

Geldner believes it is crucial that applied research tackling complex environmental challenges addresses not only the questions being asked by decision makers, but also questions of equity to help ensure that the work protects the people who need it most.

PROFESSIONAL EXPERIENCE

2023-Present: Applied Mathematician, The Water Institute

2018-2023: Research Assistant, Purdue University

2016-2018: ORISE Statistics Fellow, Centers for Disease Control and Prevention, Tobacco and Volatiles Branch

2015-2016: Project Manager, Harvey Mudd College NOAA Clinic Team

June 2015-August 2015: Undergraduate Researcher, UCLA Applied Mathematics REU 2015



SELECTED PROJECTS

Advances in Coastal Flood Risk Analysis. Ph.D. Thesis. (2018-2023). The first chapter extends the JPM-OS statistical model of surge- and wave-driven coastal flooding to account for rainfall and riverine dynamics via Monte Carlo sampling of rainfall and riverine drivers and k-means clustering of hydrologic and surge features. The second chapter attempts to optimize the net present value of adaptive and static, structural and nonstructural protection measures in the Larose to Golden Meadow protection system in a multi-objective sense across many sea level rise trajectories in order to quantify the value of adaptivity in protection planning. The third chapter investigations the extent to which traditional benefit-cost analysis harms socioeconomically disadvantaged communities and the extent to which an alternative risk measure may mitigate those harms, ultimately proposing the use of hybrid metrics with favorable tradeoffs.

Coastal Compound Flood Hazard Modeling for the Louisiana Watershed Initiative. (2021-Present).

Ongoing methods development for probabilistic modeling of coastal compound flood hazard.

Model Improvements for the 2023 Louisiana Coastal Master Plan. (2019-2021) Assisted a multi-agency team in making various improvements to the risk modeling component of the Coastal Master Plan, including updates to accommodate an expanded suite of synthetic storms, development of a building-level coastwide structure inventory, and changes to levee fragility modeling.

SELECTED PUBLICATIONS AND TECHNICAL REPORTS

NB Geldner, DR Johnson, J Doss-Gollin, K Keller, Efficient Flood Risk Mitigation and Intersectional Equity Implications: A Case Study in New Orleans /In review at Nature Communications

DR Johnson, NB Geldner, J Liu, UL Baldos, T Hertel, Reducing US biofuels requirements mitigates short-term impacts of global population and income growth on agricultural environmental outcomes /Energy Policy, 2023

DR Johnson, J Wang, NB Geldner, AB Zehr, Rapid, risk-based levee design framework for greater risk reduction at lower cost than standards-based design /Journal of Flood Risk Management, 2022

DR Johnson, JR Fischbach, NB Geldner, MT Wilson, C Stelzner, Coastal Louisiana Risk Assessment (CLARA) Model Summary Report /Louisiana Coastal Protection and Restoration Authority, 2021

DR Johnson, NB Geldner Contemporary decision methods for agricultural, Environmental, and resource management and policy \ Annual Review of Resource Economics

P Bagchi, NB Geldner, BR deCastro, VR De Jesús, SK Park, BC Blount Crotonaldehyde exposure in US tobacco smokers and nonsmokers: NHANES 2005-2006 and 2011-2012 \ Environmental Research

SELECTED PRESENTATIONS

2023, Efficient Nonstructural Flood Risk Mitigation and Intersectional Equity Implications / State of the Coast Conference, NB Geldner, DR Johnson, J Doss-Gollin, K Keller

2023, Coastal Compound Flooding for the Louisiana Watershed Initiative – The Extended Joint Probability Method with Optimal Sampling / State of the Coast Conference

2021, Coastal Master Plan – Risk Assessment: Social Vulnerability and other Metrics / State of the Coast Conference, NB Geldner, DR Johnson, JR Fischbach, MT Wilson, C Stelzner

2021, Multi-Objective Optimization of Tradeoffs and Synergies Between Structural and Nonstructural Coastal Protection Projects / Society for Risk Analysis Annual Meeting, NB Geldner, J Wang, AB Zehr, DR Johnson