

Byeongseong Choi

Experience Summary

I have focused on probabilistic urban and environmental modeling, grounded in risk and reliability engineering, to support risk-aware and resilient communities. My research themes include probabilistic risk assessment, uncertainty-aware urban and environmental modeling, risk-informed decision-making for infrastructure systems, and large-scale and regional system modeling under environmental and natural hazard uncertainty. My work has been applied to regional-scale structural systems under seismic hazard and reliability-based infrastructure risk assessment, as well as to infrastructure and energy systems including building energy systems, environmental monitoring networks, and large-scale water systems. It further extends to urban environmental systems such as air quality, urban heat, and climatic uncertainty.

Education

Ph.D., Carnegie Mellon University, Pittsburgh, PA, 2023

Major concentration: Advanced Infrastructure Systems – GPA: 4.00/4.00

Title: Urban temperature and electricity demand: probabilistic modeling and adaptive decision-making

Thesis advisor: Prof. Matteo Pozzi & Prof. Mario Bergés

The thesis focused on developing an integrated framework for risk assessment of urban heat and its impact on building energy use. Research contributions include:

- Development of a probabilistic spatiotemporal model for rapid forecast of urban temperatures
- Investigation into the geolocational impacts of temperature on building energy consumption
- Analysis of the economic benefits of accurate temperature modeling for energy cost savings
- Data collection using a numerical weather prediction model with high-performance computing

M.S., Seoul National University, Seoul, Republic of Korea, 2017

Major concentration: Structural reliability – GPA: 4.17/4.30

Title: Efficient simulation-based approaches for community-level probabilistic seismic risk assessment

Thesis advisor: Prof. Junho Song

The thesis focused on developing computationally efficient algorithms for regional seismic loss estimation, focusing on the following topic:

- Development of computationally efficient sampling algorithms in probabilistic seismic risk analysis

B.S., Seoul National University, Seoul, Republic of Korea, 2015

Major: Civil and environmental engineering – GPA: 3.52/4.3

Professional Experience

InnoCORE Postdoctoral Fellow, KAIST (2026-)

Project: Development of an AX-based Intelligent Disaster Prevention Platform for Ultra-Safe SMR Construction Against Extreme External Hazards. Responsibilities included:

- Conducting research at the Korea Atomic Energy Research Institute (KAERI) on secondment from KAIST as part of the KAIST–KAERI InnoCORE program
- Developing probabilistic modeling and risk assessment frameworks for critical infrastructure to external hazards, including extreme rainfall and wind events under changing climate

Postdoctoral Fellow, The University of Texas at Arlington (2023-2026)

Project: SCC-IRG Track 1 - Enabling Smart Cities in Coastal Regions of Environmental and Industrial Change: Building Adaptive Capacity through Sociotechnical Networks on the Texas Gulf Coast (NSF # 2231557). Responsibilities included:

- Developed a modeling framework to optimally deploy a monitoring system for the air/water quality around the Corpus Christi Bay, Texas
- Developed a method to validate a low-cost monitoring system that captures spatiotemporal trends in environmental hazards
- Mentored three undergraduate students through the NSF-funded Research Experiences for Undergraduates (REU) program, guiding research methodologies, fostering academic development, and providing instruction in Python programming for data analysis
- Developed real-time air/water quality dashboard (dashboard.byeongsc.com)

Research Assistant, Carnegie Mellon University (2019-2022)

Project: SHADE - Surface Heat Assessment for Developed Environments (NSF #1664091). Responsibilities included:

- Development of a probabilistic spatiotemporal model for rapid forecast of urban temperatures
- Investigation into the geolocational impacts of temperature on building energy consumption
- Analysis of the economic benefits of accurate temperature modeling for energy cost savings
- Data collection using a numerical weather prediction model with high-performance computing

Associate Engineer, DAELIM Industrial Co. (now DL E&C), Seoul, Republic of Korea (2017-2018)

Project: West-coast Railroad (Construction Site #5). Responsibilities included:

- Checked design safety of temporary structures according to Korean design codes
- Managed project schedules using Primavera P6

Graduate Student Researcher, Seoul National University (2015-2016)

As a graduate student researcher, I participated in the following projects:

- Preliminary Study to Develop Cyclic Disaster Framework Based on Quantified Risk of Urban Earthquakes (15RDPP-C102128-01): Mar 2016 - Feb 2017, supported by the Ministry of Land, Infrastructure, and Transport
- Convergence Research Center for Disaster-Hazard Resilience (2015R1A5A7037372): Aug 2015 - Feb 2016, supported by the National Research Foundation of Korea
- Development of Seismic Hazard Risk Management Model for Korea Using Open Access Software (400-20150011): May 2016 - Feb 2017, supported by Seoul National University

Teaching and Mentorship Experience

Guest Lecture / Invited Talk

- Invited Faculty Candidate Seminar, Department of Civil and Environmental Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea (June 29, 2026)

- Invited Faculty Candidate Seminar, School of Transdisciplinary Innovation, Seoul National University, Seoul, South Korea (June 2, 2026)
- Lab Seminar Invited by Prof. Junho Song, Structural and System Reliability Group, Seoul National University (January 16, 2026)
- Graduate Seminar, New Jersey Institute of Technology (December 8, 2025)
- Lab Seminar Invited by Prof. June-young Park, Humanized Built Environment Lab, The University of Texas at Arlington (September 10, 2026)
- Guest lecture in CE3342: Water Resources Engineering (September 2, 2025), The University of Texas at Arlington

Postdoctoral Fellow, The University of Texas at Arlington (2024-2025)

- Mentored three undergraduate students through the NSF-funded Research Experiences for Undergraduates (REU) program, guiding research methodologies, fostering academic development, and providing instruction in Python programming for data analysis

Teaching Assistant, Carnegie Mellon University (2019-2021)

- Fall 2019/2020/2021: served as a teaching assistant for the course, Exploring CEE: Infrastructure and Environment in a Changing World (12100). Duties included guiding group projects (truss assembly), holding office hours, and grading homework

Teaching Assistant, Seoul National University (2016)

- Fall 2016: served as a teaching assistant for the course, Statistics for Civil and Environmental Engineers (457.212). Duties included reviewing class materials, grading homework/exams, and developing basic training lectures in R programming.
- Spring 2016: served as a teaching assistant for the course, Topics in Structural Reliability (457.646). During the semester, I focused on supplementing class materials, particularly developing illustrative graphics to support students' understanding of basic concepts in structural reliability. The role also involved developing MATLAB-based examples for the course.

Skills and Software

Probabilistic modeling	Spatiotemporal modeling (air quality, urban heat), Probabilistic risk analysis (earthquake), Uncertainty quantification, Value of Information analysis
Programming	MATLAB, Python, and R (experience compiling codes for high-performance computing: Fortran, C++)
Software	WRF (weather simulation), EnergyPlus (building energy simulation), ERGO (multi-hazard assessment), OpenQuake (seismic risk analysis), GeNIe (Bayesian network), QGIS, MIDAS (finite element analysis), Primavera P6 (project management)

Honors and Awards

- Bradford and Diane Smith Graduate Fellowship in Engineering, Carnegie Mellon University, 2022
- Outstanding Paper Awards, Korean Society of Civil Engineers, KSCE 2016 CONVENTION, 2016

Webapp and Data

[A1] Air and Water Quality Monitor Dashboard for Local Communities around Corpus Christi

Bay, <https://dashboard.byeongsc.com>, 2023- (provided as test page)

- [D1] **B. Choi**, T. Kim, S. Yi, (2024), Non-linear Responses of SDOF Systems Under PEER Ground Motions with Scale Factors, *Mendeley Data*, V1, DOI: [10.17632/2zn5b999kp.1](https://doi.org/10.17632/2zn5b999kp.1)
- [D2] **B. Choi**, M. Bergés, E. Bou-Zeid, M. Pozzi, (2025), SHADE 2021: Meso-scale 2m air temperature around New York City and Pittsburgh, *Mendeley Data*, V3, DOI: [10.17632/pr4m594vmf.3](https://doi.org/10.17632/pr4m594vmf.3)

Peer-Review Service

Earthquake Engineering & Structural Dynamics, Wiley (2024–); Structural Safety, Elsevier (2024–); Environmental Research Communications, IOP Publishing (2025–); Stochastic Environmental Research and Risk Assessment, Springer (2025–); Discover Environment, Springer (2025–); Journal of Hydrology: Regional Studies, Elsevier (2025–); International Journal of Computational Intelligence, Springer (2025–); Engineering Research Express, IOP Publishing (2026–);

Publications

Peer-reviewed journals

*: corresponding author(s)

Published/Accepted

- [J1] Y. Lai*, **B. Choi**, and S.B. Roy, Probabilistic extreme rainfall projections under climate change: extending regional extreme value analysis with a climate-model-informed Bayesian approach. *Accepted as of April 23, 2026*
- [J2] **B. Choi**, M. Bergés, and M. Pozzi*, (2026). Value of probabilistic spatiotemporal urban temperature forecasts for building energy purchases in day-ahead market. *Energy and Buildings*, 116961, DOI: [10.1016/j.enbuild.2026.116961](https://doi.org/10.1016/j.enbuild.2026.116961)
- [J3] **B. Choi** and M. Hummel*, (2026). Optimal sensor placement in low-cost PM2.5 sensor networks using value of information and multimodal data fusion. *Environmental Research Letters*, 21 014004, DOI: [10.1088/1748-9326/ae2b89](https://doi.org/10.1088/1748-9326/ae2b89)
- [J4] **B. Choi**, S. Yi*, and T. Kim*, (2025). Seismic structural response and loss estimation for dense urban districts using neural network parameterized Gaussian process. *Earthquake Engineering and Structural Dynamics*, 55, no. 2: 397-412, DOI: [10.1002/eqe.70087](https://doi.org/10.1002/eqe.70087)
- [J5] **B. Choi** and J. Song*, (2026). Cross-entropy-based adaptive concurrent importance sampling for probabilistic seismic loss analysis of spatially distributed multi-state systems. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, DOI: [10.1061/AJRUA6.RUENG-1651](https://doi.org/10.1061/AJRUA6.RUENG-1651)
- [J6] **B. Choi**, M. Bergés, and M. Pozzi*, (2025). Uncertainty quantification of building energy use using a probabilistic spatiotemporal model of urban temperature. *Energy and Buildings*, 346, p.116155, DOI: [10.1016/j.enbuild.2025.116155](https://doi.org/10.1016/j.enbuild.2025.116155)
- [J7] Y. Lai*, **B. Choi**, and S.B. Roy, (2025). Bayesian inference of historical streamflow changes suggests further stress in the Colorado River Basin. *Journal of Hydrology: Regional Studies*, 61, p.102619, DOI: [10.1016/j.ejrh.2025.102619](https://doi.org/10.1016/j.ejrh.2025.102619)
- [J8] **B. Choi** and M. Hummel*, (2025). Spatiotemporal air quality prediction using stochastic advection-diffusion model for multimodal data fusion. *Environmental Research Letters*, 20 014065, DOI: [10.1088/1748-9326/ada397](https://doi.org/10.1088/1748-9326/ada397)

- [J9] **B. Choi**, M. Bergés, E. Bou-Zeid, and M. Pozzi*, (2021). Short-term probabilistic forecasting of meso-scale near-surface urban temperature fields. *Environmental Modelling & Software*, 145, p.105189, DOI: [10.1016/j.envsoft.2021.105189](https://doi.org/10.1016/j.envsoft.2021.105189)

Conferences & workshops

- [C1] M. Hummel and **B. Choi**, (2025). Enhancing Low-Cost Sensor Networks through Multi-modal Data Fusion: Application of a Probabilistic Spatiotemporal Air Quality Model, USA, EGU General Assembly 2025, Vienna, Austria, 27 April–2 May 2025, EGU25-10518, <https://doi.org/10.5194/egusphere-egu25-10518>, 2025
- [C2] M. Hummel, O. Jenewein, K. Bezboruah, Y. Liu, K. Masten, **B. Choi**, and A. Sakalker, (2024) A Community-Led Approach to Environmental Monitoring and Adaptive Capacity Building in the Coastal Bend Region of Texas, USA, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-6142, <https://doi.org/10.5194/egusphere-egu24-6142>, 2024
- [C3] **B. Choi** and M. Hummel, (2023). Improving the Accuracy of a Low-Cost Environmental Monitoring System Through Application of a Stochastic Advection-Diffusion Model. *American Geophysical Union Fall Meeting 2023*. December 13, 2023
- [C4] **B. Choi**, M. Bergés, and M. Pozzi, (2023). Value of accurate urban weather prediction in the day-ahead energy market, *ICASP14-14th International Conference on Applications of Statistics and Probability in Civil Engineering*, July 2023, Dublin, Ireland
- [C5] **B. Choi**, M. Bergés, and M. Pozzi, (2022). Spatio-temporal modelling for meso-scale surface temperature, *ICOSSAR 2021-2022, 13th International Conference on Structural Safety & Reliability*, 13-17 September 2022, Shanghai, China (virtual oral presentation)
- [C6] **B. Choi**, M. Bergés, and M. Pozzi, (2022). Short-term probabilistic heat-induced risk assessment on urban scale energy system, *Engineering Mechanics Institute Conference*, Johns Hopkins University, Baltimore, MD, May 31-June 3, 2022
- [C7] **B. Choi**, M. Pozzi, M. Bergés, and E. Bou-Zeid, (2021). Data-driven short-term prediction of meso-scale surface temperature, *Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference*, Virtual, May 25-28, 2021
- [C8] **B. Choi**, M. Bergés, E. Bou-Zeid, and M. Pozzi, (2020). Probabilistic approaches for surrogate modeling with high-dimensional data to predict short-term meso-scale surface temperature. *American Geophysical Union Fall Meeting 2020*. Virtual, December 15, 2020
- [C9] **B. Choi**, M. Pozzi, and M. Bergés, (2020). Heat risk assessment using surrogate model for meso-scale surface temperature, *Machine Learning for Engineering Modeling, Simulation, and Design Workshop at Neural Information Processing System 2020*, Virtual, December 12, 2020
- [C10] **B. Choi**, M. Pozzi, M. Bergés, and E. Bou-Zeid, (2020). Developing time-variant filter for meso-scale surface temperature prediction, *International Association for Bridge and Structural Engineering (IABSE) Conference 2020*, Seoul (remote), November 9-10, 2020
- [C11] **B. Choi**, M. Bergés, E. Bou-Zeid, and M. Pozzi, (2019). A non-stationary surrogate model for meso-scale surface temperature with extracted diurnal spatial patterns. *American Geophysical Union Fall Meeting 2019*. San Francisco, December 10, 2019
- [C12] **B.-S. Choi**, J. Byun, and J. Song, (2017), Efficient earthquake loss estimation by cross-entropy-based adaptive importance sampling, *12th International Conference on Structural Safety and Reliability (ICOSSAR2017)*, Vienna, Austria, August 6-10

- [C13] **B.-S. Choi** and J. Song, (2017), Novel sampling methods for seismic impact analysis of urban communities and complex infrastructure systems, *IFAT 2017 Third International Forum on Advanced Technologies*, Hualien, Taiwan, March 9-11
- [C14] **B.-S. Choi** and J. Song, (2016), Cross-entropy-based adaptive importance sampling for probabilistic seismic risk assessment of lifeline networks considering spatial correlation, *Urban Transitions Global Summit 2016*, Shanghai, China, September 5-9
- [C15] **B.-S. Choi** and J. Song, (2016), Dimension reduction techniques and efficient sampling method for regional seismic loss assessment, *Korean Society of Civil Engineers 2016 Convention*, Jeju, Korea, October 19-21
- [C16] **B.-S. Choi**, J. Song, and S. Chi, (2016), Probabilistic seismic risk assessment of lifeline networks using cross-entropy-based adaptive importance sampling, *Probabilistic Safety Assessment and Management 13*, Seoul, Korea, October 2-7
- [C17] J. Song and **B.-S. Choi**, (2016), Reliability analysis of complex infrastructure systems using cross-entropy-based adaptive importance sampling, *Workshop on Resilience of Urban Infrastructure*, April 24-26, Toronto, Canada
- [C18] J. Song and **B.-S. Choi**, (2016), Seismic risk assessment for traffic network using adaptive sampling, *2016 Conference of the Earthquake Engineering Society of Korea*, March 18, Suwon, Korea
- [C19] E. Choi, **B.-S. Choi**, J. Song, (2015), Probabilistic loss assessment of earthquakes in Korea using open-source software platforms, *2015 Autumn Conference of the Earthquake Engineering Society of Korea*, September 10-12, Jeju, Korea