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Byeongseong Choi

Highlights

My research focuses on probabilistic modeling and decision-making for complex infrastructure, urban, and environmental systems. My work integrates uncertainty quantification, data-driven modeling, sensing, and system-level analysis to support decisions such as optimal sensor placement, energy purchasing, and risk-informed infrastructure management. It spans structural and infrastructure systems, building energy, environmental monitoring, urban climate, air quality, and water systems, with an emphasis on large-scale and spatially distributed systems under environmental and natural hazard 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
Advisors: Prof. Matteo Pozzi & Prof. Mario Bergés

The thesis focused on developing an integrated framework for risk assessment of urban heat and its impacts on building energy demand. Research topics include:

- Probabilistic spatiotemporal modeling for rapid urban temperature forecasting
- Analysis of spatial impacts of urban temperature on building energy
- Economic valuation of urban temperature modeling for energy cost savings
- High-performance computing for numerical weather prediction and data generation

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
Advisor: Prof. Junho Song

The thesis focused on developing computationally efficient methods for regional seismic risk and loss assessment, with emphasis on the following topics:

- Computationally efficient sampling methods for probabilistic seismic risk analysis
- Clustering-based risk assessment method for traffic network systems

B.S., Seoul National University, Seoul, Republic of Korea (2015)
Major: Civil and Environmental Engineering – **GPA:** 3.52/4.30

Professional Experience

InnoCORE Postdoc., Korea Advanced Institute of Science and Technology (2026-)
Project: AX-based Intelligent Disaster Prevention Platform for Ultra-Safe SMR Construction Against Extreme External Hazards

- Conducting joint research with the Korea Atomic Energy Research Institute (KAERI) through the KAIST–KAERI InnoCORE program
- Developing probabilistic hazard and risk assessment frameworks for critical infrastructure under extreme rainfall, wind, and climate change

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 (NSF # 2231557)

- Optimal monitoring frameworks for air and water quality around the Corpus Christi Bay, Texas
- Stochastic spatiotemporal models for air and water quality monitoring
- Mentoring of three undergraduate researchers through the Research Experiences for Undergraduates (REU) program (NSF Supplemental Funds: USD 16,000)
- Development of a 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)

- Probabilistic spatiotemporal modeling for rapid urban temperature forecasting
- Spatial analysis of urban temperature impacts on building energy consumption
- Economic valuation of temperature modeling for energy cost savings
- Numerical weather prediction and data generation using high-performance computing

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

Project: West-coast Railroad, Construction Site #5

- Safety assessment of temporary structures under Korean design codes
- Construction management

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

Participated in the following research projects:

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

Teaching and Mentorship Experience

Guest Lecture / Invited Talk

- 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

[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

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. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, DOI: 10.1061/AJRUA6.RUENG-197

[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

[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

[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

[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

[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

[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

[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

[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

Conferences & workshops

[C1] M. Hummel and **B. Choi**, (2025). Enhancing Low-Cost Sensor Networks through Multimodal 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