Sooncheol Hwang, Ph.D.

Postdoctoral Researcher

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Biography

Sooncheol Hwang is a coastal researcher and code developer who conducts research on *Coastal Hazards*. His research highly focuses on the development of numerical models for simulating various nearshore hydrodynamics and transport phenomena (e.g., scalar transport governed by nearshore shallow water flows, storm surge, tides, wave breaking, rainfall, surface runoff, urban compound flooding), numerical schemes (e.g., HLL Riemann solver), and advanced simulation tools (e.g., **GPU**, **VR**). He has authored seven peer-reviewed publications on coastal hazard modeling, serving as the first author for *Communications in Nonlinear Science and Numerical Simulation* **(JCR Rank Top 5%)** and as the corresponding author for *JGR: Oceans* **(AGU journal)**. During his Ph.D. program, he received the *KU-Hydro Jr. Fellow Scholarship*, receiving **over $2,000** in scholarship funds from the graduate school in 2021. Currently, He serves as a postdoctoral researcher in the Future and Fusion Lab of Architectural, Civil and Environmental Engineering, working on a one-way coupling approach between dispersive/nondispersive shallow water models and two-dimensional wet/dry boundary reconstruction method.

Research Interests

▪ **Coastal Hazards:** compound flooding, storm surge, pollutant transport, rainfall-runoff, future climate, tides

▪ **Model development:** nearshore hydrodynamic and scalar transport model, rainfall-generated overland flow model

▪ **Numerical Scheme:** modified HLL Riemann solver for transport system, wet/dry boundary reconstruction

▪ **Advanced simulation:** GPU acceleration, VR, interactive simulation

Education & Employment

Postdoc | Future and Fusion Lab of Architectural, Civil and Environmental Engineering, Korea University, Republic of Korea, 2023.03 ~ Present

Ph.D. | Department of Civil and Environmental and Architectural Engineering, Korea University, Republic of Korea, 2017.03 – 2023.02

- Dissertation title: *Immersive and Interactive Multi-Physics Modeling of Coastal Hazards*

B.S. | School of Civil, Environmental and Architectural Engineering, Korea University, Republic of Korea, 2013.03 – 2017.02

Honors and Awards

Best Dissertation Award	2024	Korean Society of Hazard Mitigation
Best Dissertation Award	2024	Korea Water Resources Association
Best Paper Award	2024	Korean Society of Coastal and Ocean Engineers Annual Conference
Best Paper Award	2023	Korean Society of Coastal Disaster Prevention Annual Conference
Best Paper Award	2023	Korean Water Resources Association Annual Conference
KU-Hydro Jr. Fellow	2021	School of Civil, Environmental and Architectural Engineering, Korea University

Peer-Reviewed Publications († *denotes corresponding author*)

To be Published

1. **Hwang, S.** and Son, S.† (2024). A GPU-accelerated multi-physics modeling of shallow water flows through one-way coupling with an absorbing-generating boundary condition. (In Preparation)

2. Na, B., **Hwang, S.** and Son, S.† (2024). Surface Kinematics of Tide-induced Vortical Structures through Numerical Modeling and Drone Observation. (Near Submission)

3. **Hwang, S.**, Lynett, P., and Son, S.† (2024). A GPU-accelerated Numerical Model for Nearshore Scalar Transport by Dispersive Shallow Water Flows. *Journal of Advances in Modeling Earth Systems*. (Under Review)

4. **Hwang, S.** and Son, S.† (2024). Virtual reality-based hydrodynamic rainfall-runoff model for real-time flood simulation and simultaneous visualization. *Journal of Hydrology.* (Under Review)

Published

1. Qian, X., **Hwang, S.**†, and Son, S.† (2024). A Study on Key Determinants in Enhancing Storm Surges along the Coast: Interplay between Tropical Cyclone Motion and Coastal Geometry. *Journal of Geophysical Research: Oceans*, 129(2)

2. **Hwang, S.** and Son, S.† (2023). An efficient HLL-based scheme for capturing contact-discontinuity in scalar transport by shallow water flow. *Communications in Nonlinear Science and Numerical Simulation*, 127, 107531

3. Jung, T., **Hwang, S.**, and Son, S.† (2021). Development of a Numerical Model Considering Active Tsunami Generation. *Journal of Korean Society of Coastal and Ocean Engineers*, 33(4), 160-167

4. **Hwang, S.** and Son, S.† (2021). Development of an Advection-diffusion Model Using Depth-integrated Equations Based on GPU Acceleration. *Journal of the Korean Society of Hazard Mitigation*, 21(1), 281-289

5. **Hwang, S.**, Son, S.†, Lee, C., and Yoon, H. D. (2020). Quantitative assessment of inundation risks from physical contributors associated with future storm surges: a case study of Typhoon Maemi (2003). *Natural Hazards*, 104, 1389-1411

6. Na, B.† and **Hwang, S.** (2020). Highly Resolved Kinematics of Tide-induced, Geometry-governed Turbulent Whirlpools. *Journal of Coastal Disaster Prevention*, 7(4), 287-293

7. Lee, C., **Hwang, S.**, Do, K., and Son, S.† (2019). Increasing flood risk due to river runoff in the estuarine area during a storm landfall. *Estuarine, Coastal and Shelf Science*, 221, 104-118

Conference Proceedings (2020-2024) (* *denotes oral presenter*)

1. **Hwang, S.** and Son, S. (2023) Immersive Hydrodynamic Model for Flood Simulation with Virtual Reality Simulation Environment, 2023 AGU Fall Meeting, San Francisco, USA

2. Son, S., Qian, X., and **Hwang, S.** (2023) Understanding the Role of Cyclones Kinematics and Coastal Geometry in Developing Surge Levels along the Coast, 2023 AGU Fall Meeting, San Francisco, USA

3. **Hwang, S.*** and Son, S. (2023) Development of Immersive Hydrodynamic and Transport Model for Realtime Coastal Hazards Prediction and Visualization, 2023 Korean Society of Coastal and Ocean Engineers Annual Conference, Jeju, Republic of Korea

4. **Hwang, S.*** and Son, S. (2023) Development of Nearshore Scalar Transport Model using 3D Virtual Reality Visualization, 2023 Korean Society of Coastal Disaster Prevention Conference, Busan, Republic of Korea

5. **Hwang, S.*** and Son, S. (2023) Immersive urban flood simulation using virtual reality simulation environment, 2023 Korea Water Resources Association Conference, Kangwon, Republic of Korea

6. **Hwang, S.*** and Son, S. (2023). Development of Immersive Nearshore Scalar Transport Model with Real-time Interactive System, 2023 Joint Academic Conference of the Korean Association of Ocean Science and

Technology Societies, Busan, Republic of Korea

7. **Hwang, S.**[*], Lynett, P., and Son, S. (2022). NEARSHORE SCALAR TRANSPORT MODEL WITH VIRTUAL REALITY ENVIRONMENT, 37th International Conference on Coastal Engineering, Sydney, Australia

8. **Hwang, S.**[*] and Son, S. (2022). Development of Flow and Scalar Transport Model with Virtual Reality Environment, 2022 Joint Academic Conference of the Korean Association of Ocean Science and Technology Societies, Jeju, Republic of Korea

9. **Hwang, S.**[*] and Son, S. (2022). Development of immersive flood routing model using three-dimensional virtual reality visualization, 2022 Korea Water Resources Association Conference, Busan, Republic of Korea

10. Son, S.[*] and **Hwang, S.** (2022). Nearshore Scalar Transport Modelling Based on Boussinesq-Type Equations Wave Model, 2022 Korean Society of Coastal and Ocean Engineers Annual Conference, Gyeongju, Republic of Korea

11. **Hwang, S.** and Son, S.[*] (2022). Nearshore scalar transport modelling based on Boussinesq equations using GPU acceleration, International Estuary Symposium 2022, Busan, Republic of Korea

12. **Hwang, S.**[*] and Son, S. (2021). Development of Two-dimensional Scalar Transport Model Governed by Shallow Water System Using GPU Acceleration, 2021 Korean Wetlands Society Annual Conference, Mungyeong, Republic of Korea

13. **Hwang, S.** and Son, S. (2021). Analysis of Tide-induced Turbulent Whirlpool in Uldolmok Strait through High-resolution Numerical Modelling, Korean Society of Hazard Mitigation Conference, Republic of Korea

14. **Hwang, S.**[*] and Son, S. (2021). Development of GPU-Accelerated 2DH Hydrodynamic and Transport Model, 9th International Symposium on Environmental Hydraulics, Seoul, Republic of Korea

15. **Hwang, S.**[*] and Son, S. (2021). Development of 2DH hydrodynamic and scalar transport model based on hybrid finite volume/finite difference method, 2021 Korea Water Resources Association Conference, Gwangju, Republic of Korea

16. **Hwang, S.**[*] and Son, S. (2020). Development of Depth-Averaged Scalar Transport Model with Interactive System Based on GPU Acceleration, 2020 Korean Society of Coastal and Ocean Engineers Annual Conference, Jeju, Republic of Korea

17. **Hwang, S.** and Son, S. (2020). GPU-accelerated Simulation of a Dye Transport Due to a Breaking Solitary Wave Propagating over a Irregular Shallow Water Bathymetry, 2020 Korean Society of Coastal Disaster Prevention Conference, Republic of Korea

18. **Hwang, S.**[*], Son, S., and Lynett, P. (2020). A GPU-ACCELERATED MODELING OF SCALAR TRANSPORT BASED ON BOUSSINESQ-TYPE EQUATIONS, virtual International Conference on Coastal Engineering

19. **Hwang, S.** and Son, S.[*] (2020). Development of Advection-Dispersion Model Based on Boussinesq Equations Using GPU Acceleration, 2020 Korean Society of Hazard Mitigation Conference, Republic of Korea

20. **Hwang, S.**[*] and Son, S. (2020). Numerical Simulation Using Tracer Model Solving Depth-Integrated Advection-Diffusion Equation Based on GPU Acceleration, 2020 Joint Academic Conference of the Korean. Association of Ocean Science and Technology Societies, Busan, Republic of Korea

21. **Hwang, S.**[*] and Son, S. (2020). Development of interactive tracer transport model coupled with Boussinesq equations, 2020 Korea Water Resources Association Conference, Jeju, Republic of Korea

Invited Talks

1. Immersive Modeling of Coastal Hazards, *1st Young Generation (YG) Subcommittee Seminar*, Korean Society of Coastal and Ocean Engineers, Republic of Korea, 2023

2. Coastal Disaster Modeling using Virtual Reality Simulation Environment, *Coastal Engineering Subcommittee Seminar,* Korea Water Resources Association, Kumoh National Institute of Technology, Republic of Korea, 2023

Academic Articles

1. Development of Technology for Optimal Flood Response and Effect Analysis Reflecting Watershed Characteristics, KSCE Journal of Civil Engineering, 2023 *(in Korean)*

2. Quantitative Evaluation of Future Storm Surge Flood Risk: A Case Study of Typhoon Maemi (2003), *Water for Future*, Korea Water Resources Association, 2021 *(in Korean)*

3. Development of Interactive Advection-Diffusion Model using GPU Acceleration, *Water for Future*, Korea Water Resources Association, 2020 *(in Korean)*

Research Projects

Co-investigator (Mar 2023 – Present)	Development of technology for optimal flood response and effect analysis reflecting watershed characteristics, sponsored by Korea Environmental Industry & Technology Institute
Co-investigator (Mar 2019 – Present)	Development of an Immersive Wave-Current Model based on 3D Virtual-Reality Architecture, sponsored by National Research Foundation of Korea
Co-investigator (Nov 2021 – May 2022)	Development of Virtual Reality Based Flood Routing Model, sponsored by Korea Water Resources Corporation
Co-investigator (Jul 2018 – Dec 2020)	Development of Tsunami Prediction Technique Considering Fault Failure History, sponsored by Korea Meteorological Administration
Co-investigator (Jan 2018 – Dec 2018)	Practical Technologies for Coastal Erosion Control and Countermeasure, sponsored by Ministry of Oceans and Fisheries
Co-investigator (Mar 2023 – Present)	Basic research for development of storm surge evaluation method for the design basis and the beyond design basis sea water level of a nuclear power plant, sponsored by Korea Institute of Nuclear Safety
Co-investigator (Jun 2017 – May 2020)	Development of Faster-Than-Realtime, Integrated Inundation Model based on GPU-Acceleration, sponsored by National Research Foundation of Korea
Co-investigator (Apr 2017 – Sep 2018)	Development of the Evaluation Technology for Complex Causes of Inundation Vulnerability and the Response Plans in Coastal Urban Areas for Adaptation to Climate Change, sponsored by Ministry of the Interior and Safety
Co-investigator (Mar 2017 – Dec 2018)	Development of Inundation Mapping Technique due to the Riverine and Coastal Flood from Scenario-based Multiple Causes, sponsored by Ministry of the Interior and Safety

Teaching & Mentoring

Teaching Assistance

1. Graduate | Hydro-environmental Research Seminar, Korea University (2022)
2. Undergraduate | Future of Civil, Environmental and Architectural Engineering, Korea University (2022)
3. Undergraduate | Virtual Engineering Laboratory, Korea University (2021, 2022)
4. Undergraduate | Coastal Disaster Modelling, Korea University (2021, 2022)
5. Graduate | Hydrodynamics (2019), Korea University
6. Undergraduate | Coastal & Harbor Engineering (2017, 2018, 2019, 2020), Korea University
7. Undergraduate | Computer Languages Lab (2017, 2019, 2020), Korea University
8. Undergraduate | Fluid Mechanics (2017, 2018, 2020, 2021, 2022), Korea University

Mentoring

1. Graduate Student | Xiaojuan Qian, Korea University, 2019 Fall – Present
2. Graduate Student | Junsu Noh, Korea University, 2020 Spring – Present
3. Graduate Student | Sehyuk Im, Korea University, 2023 Spring – Present
4. Graduate Student | Jihyeon Yoon, Korea University, 2023 Spring – Present

References

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