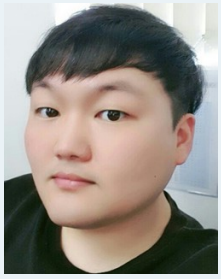
TAEYONG KWON, Ph.D.

Postdoctoral Researcher in Statistics

G-LAMP Research Institute, Chonnam National University, Republic of Korea

RESEARCH & COLLABORATION PROFILE |

KEY WORDS: Rainfall Nowcasting, Extreme Value Theory, Generative AI, Environmental Risk, Machine Learning



Research Snapshot. Dr. Kwon combines statistical modeling and artificial intelligence to predict rainfall and assess environmental extremes. The research spans radar nowcasting, spatiotemporal rainfall extremes, generative modeling of extreme particulate matter, and transformations for block minima, with applications in disaster preparedness, water management, and renewable energy planning.

RESEARCH EXPERTISE

- **Spatiotemporal deep learning:** ConvLSTM U-Net modeling of radar sequences, precipitation pattern clustering, and short-lead rainfall prediction.
- **Generative modeling of extremes:** ExGAN and generalized Pareto models for rare environmental scenarios and localized spatial extremes.
- **Extreme value statistics:** Generalized additive extreme value models (EVGAM), negative power transformations, L-moments, and return-level estimation.
- **Environmental risk assessment:** Spatial analysis of extreme rainfall and particulate matter for flood preparedness and energy planning.

RECENT RESEARCH HIGHLIGHTS

- **Radar rainfall nowcasting [1]:** Evaluated ConvLSTM U-Net models for 10-min forecasts using 2017–2021 radar data. Intensity-based clustering improved heavy-rainfall predictions when sufficient training data were available.
- **Typhoon-sensitive rainfall extremes [2]:** Analyzed 1995–2024 rainfall at 63 stations using EVGAM and local GEV refitting, producing 50- and 100-year return-level maps.
- **Extreme PM10 scenarios [3]:** Combined base and maximum ExGAN outputs using a pixel-wise maximum ensemble. The reported FID was 3.96; resulting risk maps support photovoltaic planning.
- **Block-minimum modeling [4]:** Co-developed negative power transformation models with L-moment estimation, yielding nonnegative return-level estimates for minimum rainfall inter-amount times.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: meteorology and hydrology | statistical modeling | AI | environmental and energy systems

- **1. High-resolution rainfall nowcasting:** Extend radar forecasting with LSTM and Transformer architectures, including ConvLSTM and Vision Transformer approaches that capture spatial patterns and temporal changes.
- **2. Generative AI and extreme value theory:** Extend ExGAN to rare heavy-rainfall scenarios; evaluate augmentation while preserving tail behavior and spatial dependence.
- **3. Interpretable climate prediction:** Predict rainfall and temperature using Random Forest and XGBoost on multivariate weather series. Use feature importance to identify predictive factors and support physical interpretation.

SELECTED RECENT PUBLICATIONS

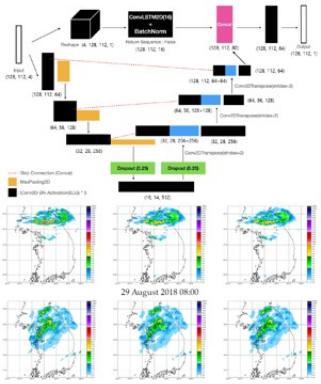
- **[1] Kwon et al.** Evaluation of High-Intensity Precipitation Prediction Using Convolutional Long Short-Term Memory with U-Net Structure Based on Clustering. Water **2024**, 16, 97. doi:10.3390/w16010097.
- **[2] Kwon et al.** Spatio-Temporal Extreme Value Modeling of Extreme Rainfall over the Korean Peninsula Incorporating Typhoon Influence. Mathematics **2025**, 13, 3915. doi:10.3390/math13243915.
- **[3] Kwon, Lee and Yoon.** ExGAN-based assessment of extreme particulate matter risk and regional energy strategy for solar photovoltaic power generation stabilization. Scientific Reports **2026**. doi:10.1038/s41598-026-65246-5.
- **[4] Prahadchai, Busababodhin, Kwon and Yoon.** Using Negative Power Transformation to Model Block Minima. Mathematics **2026**, 14, 1383. doi:10.3390/math14081383.

CONTACT

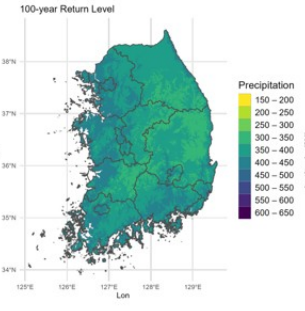
tdstat91@chonnam.ac.kr

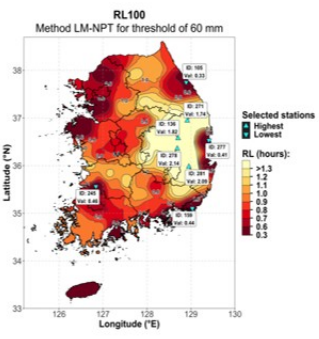
REPRESENTATIVE RESEARCH FIGURES / SCHEMES

Radar Rainfall Nowcasting



Return Level Estimation using EVD





GenAI-Powered Risk Mapping

