Integrating GIS and Machine Learning for Flood Susceptibility Mapping in Essaouira, Morocco

Oral Communication

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Abstract

Climate change, rapid urbanization, and rising sea levels are increasingly exacerbating flood risks in coastal regions such as Essaouira, Morocco. To address these challenges, this study presents an integrated flood susceptibility mapping framework that combines Geographic Information Systems (GIS), remote sensing, and four machine learning models: Random Forest (RF), Artificial Neural Network (ANN), Support Vector Machine (SVM), and Logistic Regression (LR). A dataset of 1529 georeferenced flood and non-flood points was constructed and divided into 70% for training, 10% for validation, and 20% for testing. Key predictive variables included elevation, slope, land use/land cover, Precipitation, Temperature, proximity to rivers and the coastline. Among the tested models, Random Forest delivered the highest test accuracy (95.1%) and AUC (0.983), followed by ANN (92.0%, AUC = 0.962) and SVM (91.0%, AUC = 0.952). Logistic Regression yielded the lowest performance (82.2%, AUC = 0.842). The resulting flood susceptibility maps indicate that high-risk areas are primarily located near low-lying coastal plains, river basins, and rapidly urbanizing zones. The study demonstrates the effectiveness of combining spatial analysis with machine learning to support evidence-based flood risk management, urban planning, and climate adaptation strategies in vulnerable coastal environments.

Keywords

Flood susceptibility, Artificial Intelligence, GIS, Machine learning, Remote Sensing, Essaouira.