World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:19, No:02, 2025

Enhancing Disaster Resilience: Advanced Natural Hazard Assessment and Monitoring

Authors : Mariza Kaskara, Stella Girtsou, Maria Prodromou, Alexia Tsouni, Christodoulos Mettas, Stavroula Alatza, Kyriaki Fotiou, Marios Tzouvaras, Charalampos Kontoes, Diofantos Hadjimitsis

Abstract : Natural hazard assessment and monitoring are crucial components in managing the risks associated with fires, floods, and geohazards, particularly in regions prone to these natural disasters, such as Greece and Cyprus. Recent advancements in technology led to the development of state-of-the-art systems for assessing and monitoring these hazards. These technologies, developed by the BEYOND Center of Excellence of the National Observatory of Athens, have been successfully applied in Greece and are now set to be transferred to Cyprus. The implementation of these advanced technologies in Greece has significantly improved the country's ability to respond to these natural hazards. Enhancing disaster resilience is crucial as it significantly improves our ability to predict, prepare for, and mitigate the impacts of natural disasters, ultimately saving lives and reducing economic losses. For wildfire risk assessment, a scalar wildfire occurrence risk index has been created based on the predictions of machine learning models. Our objective was to train an ML model that learns to derive a fire susceptibility score when given as input a vector of features assigned to certain spatiotemporal coordinates. Predicting fire danger is crucial for the sustainable management of forest fires as it provides essential information for designing effective prevention measures and facilitating response planning for potential fire incidents. For flood risk assessment, a multi-faceted approach has been employed, including the application of remote sensing techniques, the collection and processing of data from population, buildings, technical studies and field visits, as well as hydrological and hydraulic simulations. All input data are used to create precise flood hazard maps according to various flooding scenarios, detailed flood vulnerability and flood exposure maps, which finally produce the flood risk map. Critical points are identified, and mitigation measures are proposed for the worst-case scenario, namely, refuge areas are defined, and escape routes are designed. Flood risk maps can assist in raising awareness and save lives. For geohazards monitoring (e.g., landslides, subsidence), synthetic aperture radar (SAR) and optical satellite imagery have been combined with geomorphological and meteorological data and other landslide/ground deformation contributing factors. To monitor critical infrastructures, including dams, advanced InSAR (Interferometric SAR) methodologies are used for identifying surface movements through time. Monitoring these hazards provides valuable information for understanding processes and could lead to early warning systems to protect people and infrastructure. The success of these systems in Greece has paved the way for their transfer to Cyprus to enhance Cyprus's capabilities in natural hazard assessment and monitoring. This transfer is being made through knowledge transfer activities, fostering continuous collaboration between Greek and Cypriot experts. Furthermore, small demonstration actions are implemented to showcase the effectiveness of these technologies in real-world scenarios. In conclusion, the transfer of advanced natural hazard assessment technologies from Greece to Cyprus represents a significant step forward in enhancing the entire region's resilience to disasters. The EXCELSIOR project, funding this opportunity, is committed to empowering Cyprus with the tools and expertise needed to effectively manage and mitigate the risks associated with these natural hazards. Acknowledgment: Authors acknowledge the 'EXCELSIOR': ERATOSTHENES: Excellence Research Centre for Earth Surveillance and Space-Based Monitoring of the Environment H2020 Widespread Teaming project.

Keywords : earth observation, monitoring, natural hazards, remote sensing
Conference Title : ICCEEES 2025 : International Conference on Civil, Environmental Engineering and Earth Sciences
Conference Location : Tokyo, Japan
Conference Dates : February 25-26, 2025