Chapter 13
Early Warning Systems and Real-Time Decision Support: Leveraging GIS and Remote Sensing for Global Disaster Preparedness

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ABSTRACT

The chapter analyzes how Geographic Information Systems (GIS) and remote sensing can help fortify the early warning system (EWS) and prompt response decision support to international disaster readiness. It gives a review on the technological fundamentals, e.g., remote sensing platforms, GIS-based hazard modeling, and/or AI-enhanced geospatial analytics. Its use in applications involving floods, earthquakes, tsunamis, wildfires, and cyclones indicates how real-time information can be used to reduce risks proactively, direct evacuation, and design resilient infra-

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structure. Successes, challenges, and limitations in multi-hazard EWS are clear evidence of case studies at a global and regional level. The concluding chapter provides recommendations and future directions that are inclusive, reliable, and adaptive of systems and focuses on technology, policy, and community outlook on building resilient societies.

1. INTRODUCTION TO EARLY WARNING SYSTEMS

Natural disasters, including floods, cyclones, earthquakes and wildfires, as well as anthropogenic disasters, including industrial accidents, continue to test the security, infrastructure, and eco-systems of humans across the world. Increased frequency and severity of these hazards has further been aggravated by climate change, making it important to have in place effective preparedness mechanisms. Central to disaster preparedness is the Early Warning System (EWS) that aims to enhance the supply of timely, accurate, and actionable information to the stakeholders to initiate proactive measures to lessen loss of life and damages.

Modern EWS have four interconnected parts of which are risk knowledge, hazard monitoring, and warning dissemination, as well as response capability (UNDRR, 2020). When these factors work in coordination, it permits the authorities to transition away with reactive emergency responses to proactive ones. This has changed radically with the inclusion of Geographic Information Systems (GIS) and remote sensing tools, which provide a strong arm in the processing of hazard involvement, spatial analysis and real time surveillance. As an example, GIS enables the use of hazard maps in conjunction with socio-economic/demographic data to enhance evacuation design and the distribution of resources. Risk and hazard detection and tracking technologies, including satellites, drones, and LiDAR, improve monitoring and tracking at space and time domains. Collectively, these are the technologies that comprise the core of the current EWS and promote disaster preparedness on the global level (Coppola, 2020).

This section also examines how EWS can contribute to the disaster risk reduction and the global policy instruments that influence the development and application of EWS.

1.1 Role of EWS in Disaster Risk Reduction

Early Warning Systems are important components of the disaster risk reduction (DRR). Successful EWS fills this gap that exists between identifying a hazard and getting the community to act to address it, by converting scientific evidence into usable data. Through lead time, EWS allows governments, organizations, and people

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