

Remotely Sensed Geospatial Analysis Towards Disaster Preparedness: A Case Study in Malaysia Tectonically Active Earthquake Zone, Ranau, Sabah

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SUMMARY

Frequency, intensification, and magnitudinal effects of tectonic-based reactivated disasters are unpredictable, difficult to quantify and timely. Malaysia tectonic setting is such that it is located on the Eurasian plates where the surrounding plates are moving towards it. Though considered as laying in a low seismic region but relatively engulfed by less than 300km from the tectonically active Ring of Fire. From the recent 6.0 Mw earthquake in Ranau, Sabah that occurred on 5th June 2015 give rise to the emergence of many issues and problems, highlighting the requirements for seismotectonic assessment of Malaysia. Its progressively prolonged swarms after-shocks poses an even bigger threat to people living within the earthquake zone which triggered further cascading geological hazards for instance, mud-flood. These predicament transmits instantaneous awareness to the general community and demands immediate findings towards disaster recovery, preparedness, as well as requires prompt research-based outputs. These outputs can help in convincing policymakers on creating proper guidelines to the stakeholders and community so as to reduce risk and create preparedness for the unprecedented disaster. This paper presents an objective and quantitative method for mapping and assessing geodynamic phenomenon and its activities in a tectonically active region in Malaysia. We evaluate past- and recent earthquakes and their cascading hazards using spatiotemporal multi-sensory remotely sensed data analysis, local-, expert knowledge and in-situ measurement. We first used historical records and recent data seismotectonic activities to prepare an inventory of the earthquakes that have occurred in Sabah between 1897 and 2015, which resulted in 250 events with 110 events occurring in 2015. Remotely sensed data, including WorldView-2 and interferometric synthetic aperture radar (ifSAR), as well LiDAR can be used to objectively map, monitor and model earthquake events. We identified geomorphological features related to fault zone phenomenon utilizing object-oriented image based analyses and developing a rule-set to recognize and match patterns from processed high resolution remotely-sensed data that represents the geomorphological features on the ground. Fresh under-vegetated triangular facets,

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eroded dog-legged river continuity, widening mud-volcanoes, small clustered landslides, deep-seated lineaments and acutely steep valleys found within an undulated landscape are amongst the most commonly related geomorphological features to a tectonically active zone. A review of seismotectonic studies in Sabah will also be intensively given. Elements at risk for earthquakes were extracted and spatially evaluated for vulnerability and risk analysis. This paper also highlights current research direction, e.g. object-oriented analysis, data-fusion, geomorphometry, participatory-GIS, and crowd-sourcing for supporting multi-scale geo-tectonic hazard and risk assessment in a complex seismic environment. The emergence of multistage processing and geo-analysis improved our ability and understanding of the earth dynamicity in a tectonically active zone. This collaborative research of geospatial-tectonic in Malaysia can significantly contribute to the multi-, trans-, and inter- disciplinary research for reducing disaster risk and building a resilient community in the tropics.

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