

Assessment of immediate and five-year earthquake impacts on river systems in Sabah, Malaysia using multi-temporal satellite imageries

ABSTRACT

Earthquake is one of the most destructive natural disasters, which cause immediate and long-term changes to the river systems. This research aimed to examine the immediate and five-year impacts of the 2015 Ranau Earthquake (6.0 Mw) on river systems in Malaysian state of Sabah, a region of low earthquake hazard. We used object-based classification on Landsat 8 (2014 and 2015) and Sentinel-2A (2020) satellite imageries to derive land cover time series for investigating the impacts on the riparian areas. The earthquake removed vegetation in the riparian zones of four rivers, the highest being the Penataran River (69.21 ha). During the immediate impact period (2014-2015), river bar formation occurred in all rivers, with the largest increase occurring in the Kadamaian River (56.97 ha), followed by the Panataran River (54.36 ha), which had no river bar before the earthquake. The river bar of the Kadamaian River continued to increase, whereas the river bar of the Panataran River decreased five years after the earthquake. Land cover transition analysis revealed that 78.39 ha of vegetation, barren land, and river water areas changed to river bars in the Kadamaian riparian area during the immediate impact period. Except for 26.87 percent of river bars in the Kadamaian riparian area in 2015, most river bars transitioned to other land cover types five years later. During the period of immediate impact, 22.05 ha of vegetation and 10.71 ha of river water were transformed into river bars along the Penataran River. Five years later, except for 16.2 ha, all river bar areas had transitioned to other cover types. Additionally, 17.7 ha of new river bars were formed. This study provides crucial data on post-earthquake land cover changes, particularly river bar formation and changes, for assessing the earthquake impacts on the river systems and supporting impact mitigation.