Quantitative evaluation of sediment dynamics caused by extreme rainfall events in August 2016 in the Pankenushi River, Hokkaido, northern Japan

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In this study, we conducted satellite image analysis and laser profiler (LP) measurements to clarify the sediment dynamics quantitatively in the Pankenushi River, a headwater catchment of the Saru River, where the landslides and river bank erosion occurred by the extreme rainfall events associated with four typhoons in August 2016. The disturbed areas caused by landslides and river bank erosion across the catchment were extracted using the normalized difference vegetation index (NDVI) calculated from satellite images before and after heavy rain. LP measurements were conducted along the main river channel from the mid- to down-stream areas where the disturbance of the river channel was remarkable, and the topographical changes after the rainfall events were evaluated. The 197 of fresh landslides were found across the catchment, of which 155 (79%) were distributed in the igneous rock area in the upstream area where rainfall of 300 mm or more over 24 hours was concentrated. The depth of landslide scar was estimated as 2 m or less for the 90% of the fresh landslides (N= 57) in the mid- to down-stream area, where the LP measurements was conducted. The volume of eroded and deposited sediment in the landslide scars across the catchment were estimated to be about 470,000 m^3 and 70,000 m^3, respectively, based on the power relationship between the sediment volume and landslide area. In result, about 400,000 m^3 of sediment was found to be supplied from the slope to the river channel by landslides. Along the channel from the mid- to down-stream areas, the sediment volume of erosion and deposition were estimated to be about 1,000,000 m^3 and 330,000 m^3, respectively. The erosion volume along the channel was about 2.0 times greater than that by landslides across the catchment suggesting that not only the landslides but also the bank erosion could play a significant role in sediment supply downstream during and after the extreme rainfall events.

Keywords: Landslides, Bank erosion, Satellite image analysis, Normalized difference vegetation index, Laser profiler measurements

