



## **Comparison of channel responses to an intense storm event between two headwater streams: a case study from Tokachi River Basin in Hokkaido Island, Japan**

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In August, 2016, the Typhoon Lionrock brought heavy rainfall (> 500 mm/3 days) to the Tokachi River Basin in the eastern Hokkaido, Japan, causing serious damages on properties and infrastructure along the rivers. This study investigated the channel responses to the storm in the headwater rivers, Pekerebetsu (catchment area: 46.6 km<sup>2</sup>) and Kobayashi Rivers (catchment area: 41.9 km<sup>2</sup>). Both the rivers run through granite, and periglacial colluvial materials and terrace deposits in the upstream section (Pekerebetsu: 0-9 km, Kobayashi: 0- 9 km), and terrace deposits and flood plains in the downstream section (Pekerebetsu: 9 to 17.6 km, Kobayashi: 9 to 18.8 km). For Pekerebetsu River, a gorge was formed from 7.5 to 8 km due to hornfels underlain. Fragile tuff is also exposed from 13 to 14 km. The combination of LiDAR survey data obtained by manned and unmanned aviation vehicles, WorldView-3 satellite images, aerial photographs, and field survey suggested the occurrence of debris flow in the headwaters behaved like a switch to start the cycle of bank erosion and channel bed erosion and aggradation in the upstream sections. Larger amount of erosion was estimated in Pekerebetsu River because of steeper bed slope (3 to 5 degrees) than Kobayashi River (2 to 4 degrees) and the valley floor widened in the downstream of the gorge. In the upstream sections, the proportion of sediment contribution by erosion was 80 % from banks and 20 % from beds in Pekerebetsu River, while 64 % was from banks in Kobayashi River. Sediment produced by erosion triggered by debris flow mainly deposited from 10 to 11 km for both the river, along which channel bed slope reduced to 1 to 2 degrees. Bank erosion continued in the downstream section of Pekerebetsu River. The 68 % of total amount of sediment erosion was by banks due to erodible tuff, while only 4 % was estimated in the section of Kobayashi River. In Pekerebetsu River, sediment yielded from banks then caused aggradation from over 14 to 17.6 km, as eroding the banks further. In short, bed slope and geology, as well as valley alignment largely determined the manner of channel responses to the storm. This study also highlighted that river banks can be a major sediment source depending on the conditions, possibly causing sediment related disasters in the downstream.