Characteristics Sediment Disaster in the Tottabetsu River, Hokkaido Prefecture, Caused by the Heavy Rainfall in August 2016

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INTRODUCTION

On August 2016, three typhoons hit Hokkaido for a week. After that, Typhoon NO.10 passed near Hokkaido. It caused the largest amount of rainfall on record in various regions. As a result, many slope failures and bank erosions occurred in Tottabetsu River. This phenomenon damaged to sabo structures built by Hokkaido Regional Development Bureau, and a large amount of sediment was transported downstream from Tottabetsu River basin. We considered the characteristics and quantification of sediment flow, in order to prepare for similar rainfalls in the future. We thought that this time is a good chance to verify the effect of sabo so far and to review the plan.

STUDY SITE

The Tottabetsu River flows from Tottabetsudake in Hidaka mountain range. It flows in rapid stream section. The length is about 25km. The slope of the river bed is ≥ 1 degrees. Then it flows in alluvial fan section. After about 20km, it joins Tokachi River. Tokachi River passes through Obihiro city, and flows into the Pacific. Ground sill in alluvial had been completed already, and we have constructed dams upstream.

The average annual rainfall in the region is about 900 mm, but the maximum 24hr rainfall on August 2016 was 450 mm in Tottabetsu River upstream areas. The rainfall in 2016 was relatively large in recent years, therefore the sediment flow scale was larger than in the past.

METHODS

We mapped the distribution of slope failures by the 2016 typhoons. The mapping is based on the aerial photography on September 2016 and satellite image on October 2016.

Then, we estimated the sediment budget. We generated digital elevation model (DEM) based on the aerial survey data in Tottabetsu River basin. We calculated the elevation difference between DEM data in 2013 and 2016 (**Fig.1**). Debris volume is the sum total of each elevation difference.

RESULUTS AND DISCUSSION

Based on the slope failure mapping, Tottabetsu River basin’s all slope failures square measure rate was calculated at approximately 0.5% of total basin’s areas. There was a similar heavy rain in the neighbor basins in this time, but their rate was calculated at 0.2% on average. Tottabetsu was comparatively large rate. An individual slope failure square measure in Tottabetsu River basin was calculated at approximately 1,000m^2 on average. It was small compared to the past deep-seated landslides in Japan. Therefore the normal prevention for debris flows is important in Tottabetsu River basin, not like deep-seated landslides.

The sediment budget in Tottabetsu River basin shows that approximately 4×10^6 m^3 of sediment was supplied from slope failures and bank erosions, and 2.6×10^6 m^3 was transported downstream from Tottabetsu River basin. In particular a large amount of sediment was supplied from specific branches. For example, Pirikapetanu branch was about 1×10^6 m^3. In alluvial fan, sediment flow's volume increased. The sediment supplied from bank erosions was about 1.3 times as much as the sediment deposited in river channel.

The breadth of the river has widened in some section of the alluvial fan area, based on comparing the aerial photography of 2013 and 2016 (**Fig.2**).

We surveyed downstream from Tottabetsu River basin after the 2016 typhoons. We could not find a large amount of sediment in river channel. We suppose that almost sediment flowed to coast, but we could not assess the influence of sediment in downstream from Tottabetsu River basin while higher water level.

CONCLUSIONS

Hokkaido Regional Development Bureau will inspect sabo master plan for Tottabetsu River basin. We would carry out sabo construction works in main stream. But we consider that dam construction works need selecting a target of branches. We suppose that efficient structures' disposition concerns the elevation difference between 2013 and 2016.

We consider bank erosions occurred in alluvial fan. We must consider preventing not only riverbed scour but also bank erosion in alluvial fan. We want to find out the efficient site and condition. We will continue to survey on field. In alluvial fan, we have no standard of inhibiting sediment generation. We must try to reveal the characteristics of the sediment disaster.

We will consider specific efforts in the future to mitigate sediment disaster based on this.

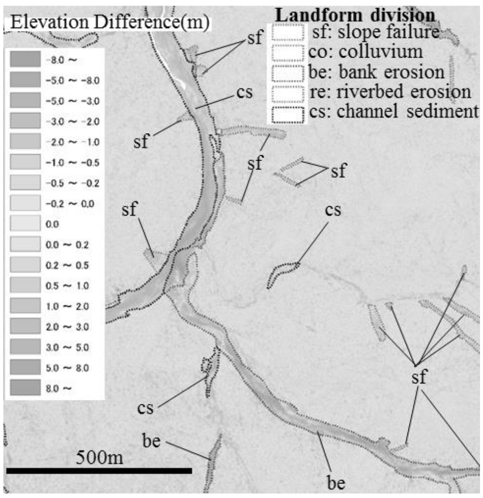

Fig. 1 Example of mapping the elevation difference between DEM data in 2013 and 2016

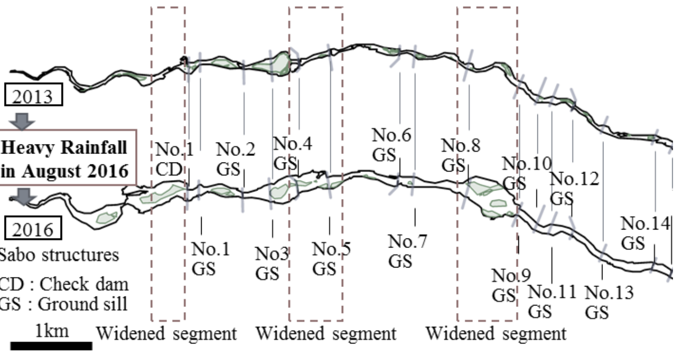

Fig. 2 Heavy rainfall in August 2016 widened river channel in alluvial fan

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