

Emergency Responses to Debris Flow Disaster at Serizawa, Nikko-city Triggered by the 2015 Torrential Rains in the Kanto and Tohoku Region

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INTRODUCTION

Torrential rains hit the Kanto and Tohoku regions in September 2015, resulting in record rainfall from the Kanto to Tohoku regions. This led to a debris flow and an enormous amount of damage in the Serizawa District, Nikko-shi, Tochigi Prefecture. This report describes the debris flow disaster and the actions taken in response.

OUTLINE OF DISASTER

As seen in **Fig. 1**, the record rainfall was caused by multiple occurrences of linear precipitation bands that formed between September 9 to 11. In particular, the total rainfall ranged between 500 and 600 millimeters, in Nikko-shi, Tochigi, located upstream in the Kinugawa River Basin. As a result, into predawn hours of September 10, several debris flows were triggered in eight separate mountain streams in the Serizawa area (see **Fig. 2**). Traffic on the municipal road was cut off and six houses were completely or partially destroyed. Despite this, there were few human casualties with only two inhabitants injured.

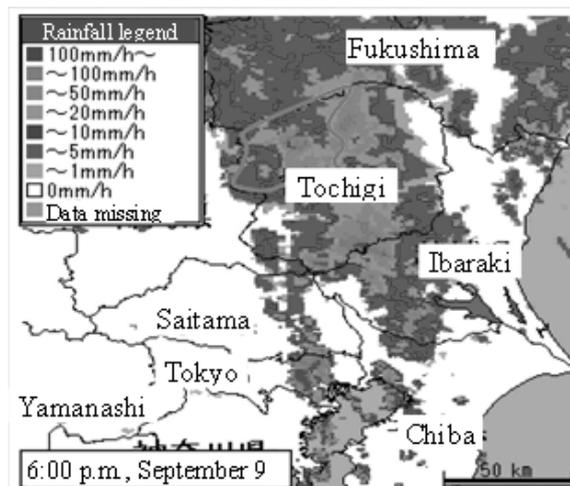


Fig. 1 Radar rainfall (00:00 a.m., September 10, 2015)

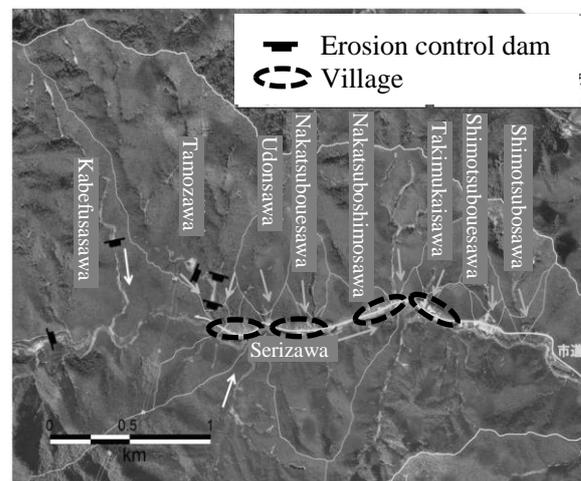


Fig. 2 Debrisflows map of Serizawa

SEDIMENT RUNOFF

In each mountain stream, traces of sediment yield (from slope failure, vertical erosion, gully erosion, river bank failure, etc.) were identified. by an analysis of the difference between the aeronautical laser surveys of. 2012and2015. It is believed that the debris flow resulted when rising stream water combined with fed-in sediment (**Photo 1**).

EFFECTS OF EROSION CONTROL FACILITIES

Debris flows also occurred in Tamozaawa. Three check dams install there, which caught and controlled the sediment and driftwood and prevented the damage from extending to the village located below (**Photo 2**).



Photo 1 Erosion of Nakatsubouesawa Stream

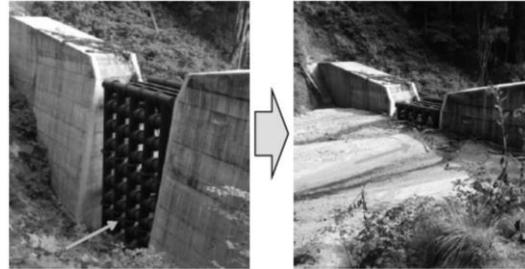


Photo 2 Effect of erosion control facility
(Tamozaawa Erosion Control Dam 1)

EMERGENCY REACTIONS TO THE DISASTER

1. Removing debris from the road

Since heavy equipment was available due to construction of an check dam in Serizawa's Udonsawa stream, it was used to quickly clear the municipal road cut off by debris, and temporarily restore the section washed away by rising waters. This made it possible to reopen the road by September 20 (**Photo 3**).



(a) Temporary restoration work underway

(b) Road temporarily restored

Photo 3 Removing debris from the road

2. Activities of sediment-related disaster specialists and the Technical Emergency Control Force

As sediment-related disaster specialists, three staff members from the National Institute for Land and Infrastructure Management and the Public Works Research Institute were sent to the affected area. In addition, the Technical Emergency Control Force (TEC-FORCE) was sent to Serizawa with the aim of urgently inspecting sediment-related disaster hazards.

CONCLUSION

Multiple debris flows were simultaneously triggered in the Serizawa District of Nikko City. This sediment-related disaster was immediately responded. Afterwards an emergency field survey was conducted, based upon which recommendations on a warning and evacuation system were provided to Nikko City. This has resulted in the prevention of repeat damage, and construction as remedial measures continues to make steady forward progress even now.

Keywords: torrential rains, debris flow, emergency reactions, effects of erosion control facilities