

# Property of Sediment Movement in Azusa River (Kamikochi)

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## INTRODUCTION

The upstream region of the Azusa River in the Shinano River System which runs through the western part of Nagano Prefecture is widely known as Kamikochi, renowned for its beautiful mountainous scenery. Kamikochi is designated not only as the Chubu Sangaku National Park but also as a special place of scenic beauty and a special natural monument in Japan. With Taisho-ike pond located at the foot of Mt. Yakedake (2,455m), an active volcano, as the downstream end, Kamikochi is a grand valley at the elevation of 1,500m, catchment area of 112.4 km<sup>2</sup>, a channel length of 17.0km and an average river bed gradient of 1/55. In the upstream region and the tributary of the Azusa River, sediment production and discharge are active due to the steep terrain and fragile geology as well as severe weather conditions. A massive amount of sediment discharge from these areas and bank erosion cause a significant river bed changes in main stream of the Azusa River. The river bed has been increased 0.27m on average between 2003 and 2010. Thus, during the flood it is feared that there will be flooding into the important district of Kamikochi consisting of sightseeing and lodging facilities located along the main stream. Furthermore, heavy rain may causes debris flows and sediment discharge in the tributaries that sightseeing facilities were damaged and tourists were isolated due to severed roads and footpaths in the past.

Giving due consideration to the natural environment of Kamikochi, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has implemented sabo works to prevent such sediment related disasters in conjunction with and through close consultation with the Ministry of the Environment, Forestry Agency, and Nagano Prefecture. It is necessary to clarify the actual condition of sediment in the upstream region of the Azusa River and predict the future river bed changes and sediment discharge. To this end, the MLIT observes the rainfall of the entire basin including ridge lines and the discharge of the main stream and tributary. Based on these monitoring results, this study introduces the actual condition of sediment in the upstream region of the Azusa River (property of sediment movement) that has been clarified.

## OVERVIEW OF SEDIMENT MOVEMENT MONITORING IN UPSTREAM REGION OF THE AZUSA RIVER

In the upstream region of the Azusa River, sediment movements are being monitored to grasp 1) actual condition of sediment movement, 2) conditions governing sediment movement, and 3) the effect of sediment movement on the Kamikochi area. The rainfall and discharge, which control sediment movement, are observed by installing rainfall gauges and water level gauges. Rainfall gauges are installed at 9 locations in the mountain huts in ridge lines and valleys near the sediment production source. Rainfall gauges in the ridge line are used for observation only when the

mountain huts are open (for 5 months of the non-snow season). Water level gauges are installed at 9 locations in tributaries and from the upstream to downstream of the main stream where sediment discharge is significant. The discharge of main stream is calculated according to the relationship between the water level and discharge (H-Q formula) and the discharge of tributaries according to Manning's formula. The location of monitoring equipment is shown in Fig. 1.

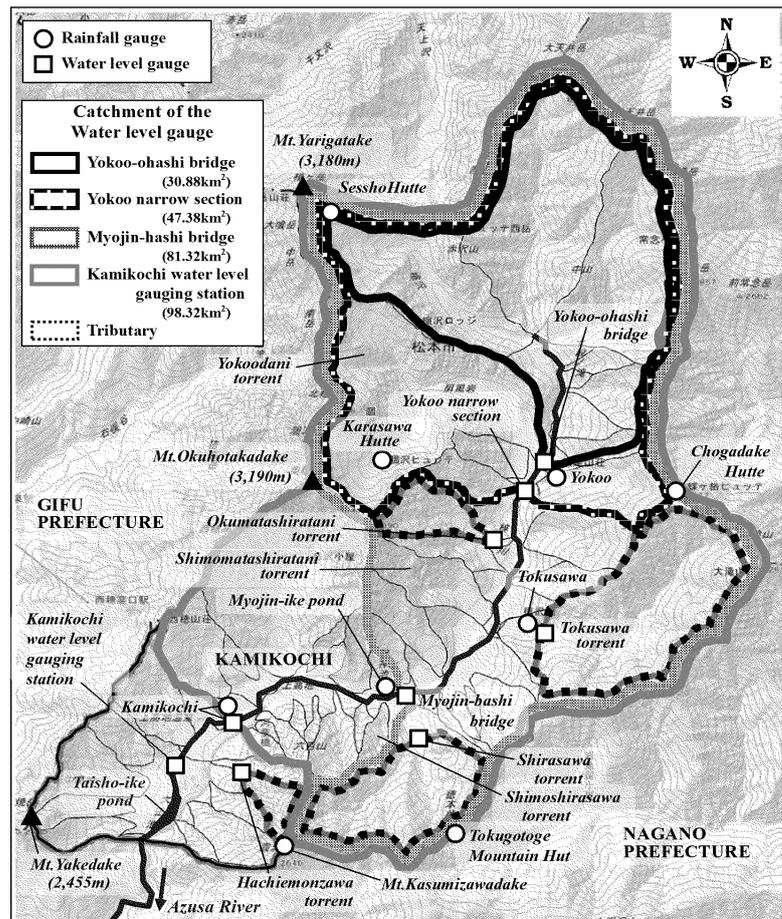
### PROPERTY OF SEDIMENT MOVEMENT AND RAINFALL-RUNOFF

Using the results of aerial photograph interpretation, LiDAR, river bed cross-sectional surveying, and field investigations, sediment discharge were confirmed from the upstream areas such as Yokoodani torrent, Okumatashiratani torrent, Shimomatashiratani torrent, Tokusawa torrent, Shirasawa torrent, Shimoshirasawa torrent and Hachiemonzawa torrent flow into the main stream. There were 5 floods between April 2015 when installation of the monitoring equipment was completed and November 2016. We observed the discharge of the main stream and the tributaries as well as the rainfall precipitation, rainfall waveform, and movement of rainfall area of the entire upstream region of the Azusa River. Focusing on the peak discharge of the main stream during flood, it was confirmed that the Kamikochi water level gauging station at the most downstream observation point has a discharge almost twice that of Yokoo-ohashi bridge, the most upstream observation point, and that the peak appearance time is delayed for about 1.5 hours

### CONCLUSIONS

Based on the past study results and the 5 floods observed between April 2015 and November 2016, the property of sediment movement and rainfall-runoff in the upstream region of the Azusa River were considered. However, because the observation period was only two years and the scale of observed floods was small, there are challenges to be addressed. These include examining the H-Q formula during flood, property of discharge in tributaries at the time of debris flow, and calculation of sediment volume of entire upstream region of the Azusa River that are necessary for calculating the discharge accurately. To clarify the property of sediment movement in the upstream region of the Azusa River, it is necessary to monitor the sediment movement continually.

**Keywords:** Kamikochi, sediment movement, monitoring, rainfall-runoff



**Fig.1** Location of the monitoring sites