Monitoring network for sediment discharge at mountain rivers in Japan

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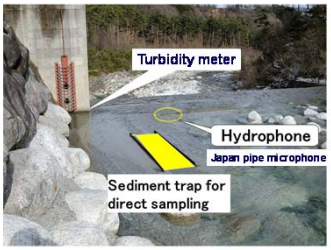
INTRODUCTION

In the last few decades, several studies on surrogate monitoring technologies, including acoustic and seismic methods etc., have been used to collect data about sediment load in mountain river. These advanced techniques for sediment load continuous monitoring might be effective not only for scientific issues, but also for the assessment of the watershed conditions. In Japan, Ministry of Land, Infrastructure, Transport and Tourism developed monitoring network for sediment discharge at mountain rivers in Japan since 2011. Here we introduce this monitoring network

Monitoring devices and network

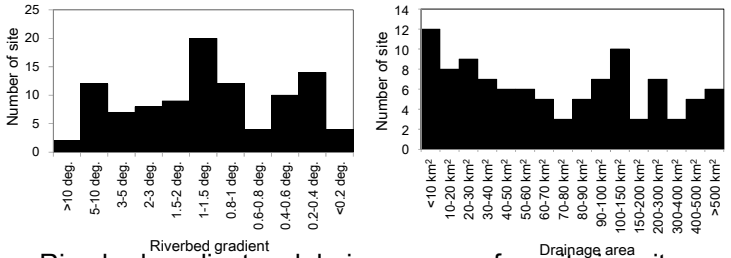
We commonly used Japanese pipe hydrophone (Japanese pipe microphone (JPH)) for bedload and turbidity meter for fine suspended sediment. Slot samplers have been set for several intensive site. We usually monitor every 15 min.



Monitoring station

To date, we installed around 100 observation stations for sediment discharge at mountain rivers in Japan. Riverbed gradient of the monitoring site is varied and ranged mainly from 10 deg. to 0.2 deg. Drainage area is mostly smaller than 500 km^2.

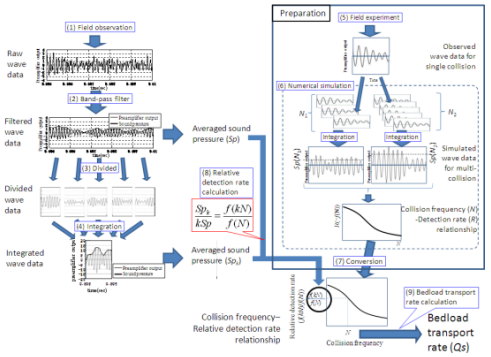
Location of monitoring station



Riverbed gradient and drainage area of monitoring site

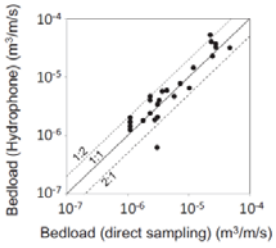
Calibration for JPH data

We used "ISP method" for data convert from raw data taken by JPH to bedload transport rate. In ISP method, it assumed that there is a correlation between observed sound magnitude and bedload transport rate. However, if the number of hit sediment particles per unit time becomes very large, interference should occur. So, in ISP method, we consider the effects of interference based on onsite experiment and numerical simulations.



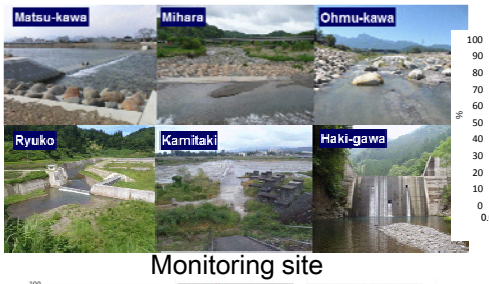
Flowchart of ISP method

We have examined the accuracy of JPH data and ISP method by comparing direct measurement data and estimation results. Then, we have showed that the data evaluated by the JPH well agreed with the data of direct sampling.

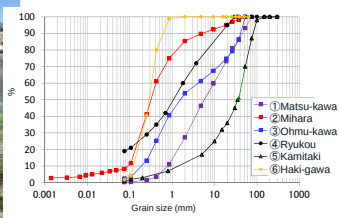


JPH vs. direct sampling

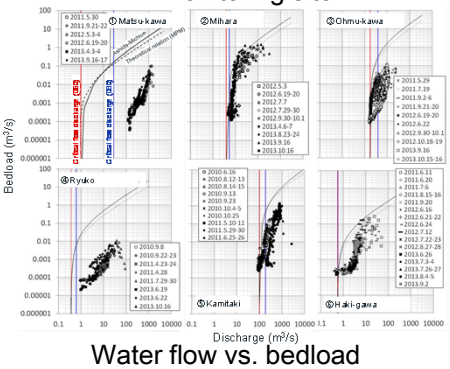
Selected results



Monitoring site



Grain size of riverbed



Water flow vs. bedload

We found that the grain size of riverbed give impacts on bedload transport characteristics. So, the widely distributed river has gradually increase of bedload.

Data Note

In 2016, we published first "Data Note" . In this Data Note, we compiled data of 55 observation station as monthly and daily sediment discharge volume, sediment discharge volume during each rainfall event.

Reference Data note for sediment discharge and hydrological observation at mountain rivers of Japan (FY 2009-2013)、NILIM Report 886, 412pp. 2016, *http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0886pdf/ks0886.pdf*

Ways forward

Still we have to pay a lot of budget and human power to maintain monitoring network. We should improve our monitoring method to sustainable monitoring. Moreover, we are discussing

-to use these data more effective land management

-to improve our early-warning system against sediment disasters through real-time monitoring.