12th International Conference on Hydroscience & Engineering
Hydro-Science & Engineering for Environmental Resilience
November 6-10, 2016, Tainan, Taiwan.

Effectiveness of Sediment Transport Observations in Mountain Stream on Detecting Temporal Change of Deep-Seated Rapid Landslide Susceptibility

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ABSTRACT

Early warning system against sediment related disaster caused by deep- seated rapid landslide has been operated using exclusively rainfall data in Japan. Rainfall threshold from which we judge disaster risk is high is set based on past events relating to shallow landsides, so the effectiveness of the system is sometimes skeptical for deep-seated rapid landslide. For example, there was long time lag (1 and a half day – 2 and a half day) between the warning and the occurrence of deep-seated rapid landslides by Typhoon Talas, 2011 in Kii peninsula, Japan and evacuation was not executed adequately. However, it was recognized that there were sediment runoff until the occurrence of the landslides. We assume this will be a signal of deep-seated rapid landslide. Thus, it is important to consider not only rainfall but also sediment transport phenomena to operate warning system.

The aim of this study was to verify the effectiveness of sediment transport observation at upstream of a river on detecting temporal change of deep-seated rapid landslide susceptibility. We conducted debris flow monitoring using CCTV camera, bed load monitoring using hydrophone and water depth monitoring using water-level gauge, simultaneously. The observation was carried on in Yotagiri River basin, Japan. CCTV camera has been installed in a tributary of Yotagiri River (Onborosawa creek). Hydrophone and water-level gauge have been built in a check dam situated at the downstream of Yotagiri River.

We compared the difference between the observed data taken when debris flows occurred in Onborosawa creek and that taken during no debris flow event (Figure 1). There were two characteristics; first, temporal variation of bed load transport rate synchronized with that of water depth during no debris flow event. Second, when debris flows occurred, temporal variation of bed load transport rate synchronized with that of water depth during the early part of flooding, but bed load transport rate was still high after flood peak was recorded. Combined with sediment transport observation device such as hydrophone, it is expected to design real-time warning system to indicate urgency of deep-seated rapid landslide.

KEY WORDS: deep-seated rapid landslide, Bed load, Hydrophone, Real-time warning system.