Geophysical Research Abstracts
Vol. 18, EGU2016-12945, 2016
EGU General Assembly 2016

Risk Evaluation of Multiple Hazards during Sediment and Water Related Disasters in a Small Basin

Kazuki Yamanoi (1) and Masaharu Fujita (2)

(1) Graduate School of Engineering, Kyoto University, Kyoto, Japan (yamanoi.kazuki.57n@st.kyoto-u.ac.jp), (2) Disaster Prevention Research Institute, Kyoto University, Uji, Japan (fujita.masaharu.5x@kyoto-u.ac.jp)

To reduce human damage due to sediment and water related disasters induced by heavy rainfall, warning and evacuation system is very important. In Japan, the Meteorological Agency issues the sediment disaster alert when the potential of sediment disaster increases. Following the alert, local government issues evacuation advisory considering the alert and premonitory phenomena. However, it is very difficult for local people to perceive the dangerousness around them because the alert and advisory do not contain any definite information. Therefore, they sometimes misjudge the evacuation action. One reason of this is not only crucial hazards but also relatively small-scale multiple hazards take place and rise evacuation difficulties during sediment and water related disaster. Examples of small-scale hazards include: rainfall-associated hazards such as poor visibility or road submergence; landslide-associated hazards such as slope failure or sediment inflow; and flood-associated hazards such as overtopping of river dike, inundation, or destruction of bridges. The purpose of this study was to estimate the risk of multiple hazards during disaster events by numerical simulation.

We applied the integrated sediment runoff model on unit channels, unit slopes, and slope units to an actual sediment and water related disaster occurred in a small basin in Tamba city, Hyogo, Japan. The maximum rainfall per hour was 91 mm (17/09/2014 2:00∼3:00) and the maximum daily precipitation was 414mm. The integrated model contains semi-physical based landslide prediction (sediment production) model, rainfall runoff model employing the kinematic wave method, model of sediment supply to channels, and bedload and suspended sediment transport model.

We evaluated the risk of rainfall-associated hazards in each slope unit into 4 levels (Level I $\sim$ IV) using the rainfall intensity I_r [mm/hour]. The risk of flood- associated hazards were also estimated using the ratio of calculated water level and dike level from the initial bed h_w. The evaluation of the risk of landslide-associated hazards used the landslide index I_l obtained by landslide model. Both maximum and average value of the index of plural slope units located in the slope units were employed to consider the uncertainty of the landslide model.

As a result, the temporal and spatial variation of the risk level was obtained. Comparing to the disaster report, the time when the risk of landslide-associated and flood-associated hazards exceeded level III corresponded to the actual occurring time. The risk of rainfall-associated hazards and landslide-associated hazards near the designated shelter exceeded Level III from 1:00, 1 hour before the rainfall peak (2:00∼3:00), and the risk of flood-associated hazards here reached to Level IV at 2:45. These results implied that the evacuation after 1:00 was exceedingly difficult because of the 3 kinds of hazards attacked continuously. In conclusion, the time when they can evacuate is limited to 0:00∼1:00 around the sediment disaster alert (at 0:20).