# Evaluating Sediment-related Disaster Risk on Probability Using Weather Condition Factors

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## INTRODUCTION

Extreme weather such as heavy rainfall causes sediment-related disasters and residents suffer enormous damages. Japan's National Institute for Land and Infrastructure Management is taking computer software measures to protect against such disasters, not only equipment measures. For example, there are forecasting technologies that can evaluate the risk of future sediment-related disasters. In previous research, the risk was estimated using a risk line, which is generally called the critical line (CL), constructed by hourly accumulated rainfall and the soil water index (SWI). However, this technology often mistakes occurrence and nonoccurrence of disaster because it only classifies two patterns.

In this paper, the probability of sediment-related disaster for each weather condition factor is used in combination with hourly accumulated rainfall and the SWI to evaluate the risk of sediment-related disasters. Furthermore, the risk is evaluated with a probabilistic method, not with a binary method. Regarding weather conditions, we use five factors: K-index (KI, total value of difference in temperature at 850 hPa and 500 hPa, dew point temperature at 850 hPa and difference in dew point temperature at 700 hPa and temperature at 700 hPa), Showalter Stability Index (SSI, difference in temperature of a parcel lifted from 850 hPa to 500 hPa and temperature at 500 hPa.), precipitable water (PW, integration of specific humidity from land surface to 300 hPa), convergence of moisture flux at under layer (CFLX, integrated moisture flux convergence from surface to 850 hPa) and storm-relative helicity (SReH, integration of dot product of the difference between the wind vector and the motion vector of the storm and the vorticity vector).The number of landslides is used as the number of sediment-related disasters.

## ANALYSIS BY WEATHER CONDITION FACTORS

The risk of sediment-related disasters should be analyzed by probabilistic means as a disaster does not always occur, even where there is heavy rain. Therefore, in this paper, the factors of atmospheric conditions were used for this method, in addition to hourly accumulated rainfall and SWI. The frequency of occurrences (disaster rate, a numerical value calculated for each factor which is the ratio of the number of pieces of data for each value range when splitting the factor into a several value ranges and the number of occurrence of disasters) is calculated for each factor to investigate whether those factors are significant to risk evaluation. Some data about hourly accumulated rainfall, SWI, weather condition factors and occurrence in several districts of Japan was used from May to October from 2006 to 2014.

## RESULTS OF ANALYSIS

To evaluate differences in disaster rate by time periods or districts, the disaster rate was calculated for each individual time period and district. The evaluation results are shown in **Fig. 1** and **Fig. 2**. In these figures, the disaster rate on KI are not affected by time periods and districts. On the other hand, the disaster rate on hourly accumulated rainfall differ among their respective time periods or districts. The disaster rate for each weather condition factor was similar, although there are differences in the peak values to a certain extent.

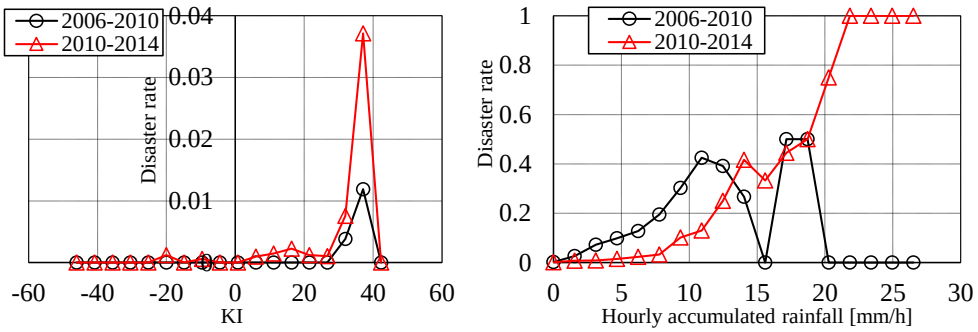


**Fig. 1** (a) The relation between KI and disaster rate in Kagoshima
(b) The relation between hourly accumulated rainfall and disaster rate in Kagoshima

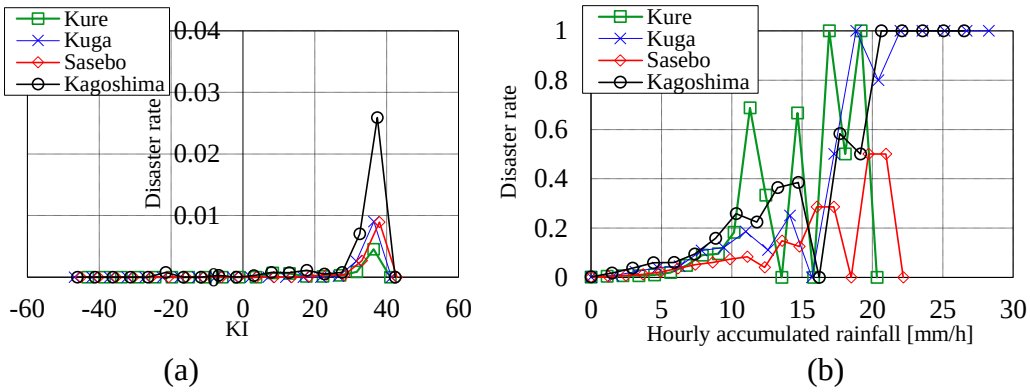


**Fig. 2** (a) The relation between KI and disaster rate
(b) The relation between hourly accumulated rainfall and disaster rate

## ACCURACY EVALUATION

A trial is planned for the summer of 2017, which intends to evaluate the accuracy of the analysis results. In the trial, weather condition data will be received in real time, and we will evaluate our risk estimation.

## CONCLUSION

The results showed that the disaster rate by weather condition factors does not depend on either time periods or districts. Therefore, the weather condition factors were effective for the evaluation of sediment-related disaster risk.

**Keywords**: sediment-related disaster, weather condition factors, hourly accumulated rainfall, soil water index