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Investigation and study on debris flow risk perception and acceptable risk criteria in Taiwan

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Debris flow disaster mitigation is one of important issues to be addressed in Taiwan. Past studies in this field have been focused mainly on topics related to potential assessment and susceptibility characterizations. Some valuable research results have been completed. Application of risk management in debris flow disaster mitigation has gradually become an emerging topic, as an effective and comprehensive strategy on disaster management is still been sought for. One of the key elements in risk management is the establishment of rational risk acceptance criteria. Various factors have to be taken into account and whether the set of criteria can be operable is of great concern. The purpose of this study is to provide useful information for the establishment of acceptance criteria. First, the 39 debris flow events that claims death tolls for the past 20 years are compiled. The information is used to develop a questionnaire containing six questions for the tolerability and acceptability of the recurrence frequency of a debris flow disaster which would cause death and the death tolls in single debris flow event. The questionnaire is sent to general public, local government officer, and rescue members for a survey. In total, 681 effective samples is obtained. The response of each question is identified as 5 scales which is later transferred into scores using a triangular function. Through the application of fuzzy performance theory, the tolerability and acceptability of the recurrence frequency of a debris flow disaster and its corresponding number of fatalities (N) is calculated. The risk perception results are plotted in the form of log-log F-N curves where F is the frequency of N or more fatalities. The results indicate that the tolerability criterion is 10-2 while the F-N curve shows a minus-one trend. Compared with the F-N curve for slope stability in Hong Kong, the curve trend is similar but the tolerability criterion is one order higher. It indicates the tolerability of fatal debris flow event in Taiwan in higher that the fatal slope stability event in Hong Kong. The acceptability criteria are about 3x10-4 while the F-N curves also shows a minus-one trend. There is about 1 to 2 orders discrepancy between tolerability and acceptability F-N curves. The resulting F-N curves are useful reference for debris flow management by taking hardware and software approaches to reduce risk level.