EVALUATION OF DFLOWZ AND DEBRIS-2D MODELS USING ROAD NO. 1081 KM. 90 DATA IN NORTHERN, THAILAND

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1. INTRODUCTION

In northern Thailand, devastating landslides and debris flow frequently occur after heavy rainfalls. On 27 July 2018, there was a debris flow along the Santisuk-Bo Kluea (No. 1081) road in the Bo Kluea district, Nan province, Thailand, which limited the vehicles to accessing this area by a huge debris heap. Therefore, to prevent and minimize effects on people's life and economics, understanding the debris flow phenomenon is valuable.

There are several techniques to analyze and simulate debris flow in the market. This study focused on the evaluation of debris flow using the DFLOWZ and Debris-2D models. The data collected from the failure at Santisuk-Bo Kluea (No. 1081) road were used to validate the model results.

2. EVALUATION METHODS

The methods of the debris flow evaluation using the DFLOWZ and Debris-2D models are provided in the following sections. The total debris flow volume that occurred at the Santisuk-Bo Kluea (No. 1081) road was estimated using the Digital Elevation Model (DEM) analysis. The actual deposition and affected areas were depicted using aerial photos to validate simulated deposition areas.

The DFLOWZ model is software that can be used to evaluate the potential deposition area depending on the statistical-empirical model [1]. The input parameters used for the study are provided in Table 1.

Table 1. Input parameters for the DFLOWZ model

Parameters	Input Values
•Debris flow volume •Digital Elevation Model •Possible flow path •Uncertainty factors	•7863.43 m^3 •5×5 m^2 DEM •See Figure 1 • a = 0%, b = -60%

The Debris-2D model is a two-dimensional debris flow model that treats the debris flow as a continuum of non-Newtonian fluid with yield stress [2]. The Debris-2D model can be used to compute flow velocity, depth, and the affected area with a few requirements. Table 2 summarizes the input parameters used in the study.

3. RESULTS OF ANALYSIS

Figure 1 shows the deposition areas predicted using the DFLOWZ and Debris-2D models. Compared to the actual deposition area shown in Figure 1, it is indicated that the DFLOWZ model provides a better agreement compared to the actual deposited area. It was found that the differences in the deposition area and the overlapping deposition area obtained from the DFLOWZ model are 16% and 34%, respectively. For the Debris-2D model with the minimum yield stress of 8000 Pa, the differences in the deposition area and the overlapping deposition area are 51% and 16%, respectively.

Table 2. Input parameters for the Debris-2D model

Parameters	Input Values
•Debris flow volume •Digital elevation model •Simulation range •Yield stress	•7863.43 m^3 •5×5 m^2 DEM •729042-729407 E, 2131056-2130876 N •8000-10000 Pa

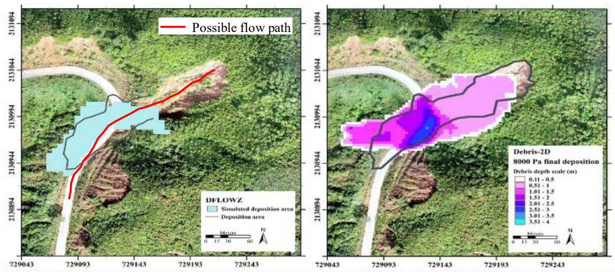

Figure 1. Deposition areas predicted from DFLOWZ model (left) and Debris-2D model (right).

4. CONCLUSIONS

The DFLOWZ and Debris-2D could be used for the debris flow analysis at the failure site. It was found that the DFLOWZ model provides a better agreement compared to the actual deposited area. It should be noted that prudential input parameters should be selected with caution. Especially, the yield stress, which is the main factor for the Debris-2D model, should be obtained from the testing suggested by Liu and Huang (2006).

REFERENCES

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