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Debris Flow Run-Off Simulation Using Terrain Scanning – An Example Of Songhe River Watershed, Taiwan

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Debris flow deposition potential area delineation is one of the most important elements for early warning and mitigation of the debris flow hazard. The debris flow potential area is mainly affected by geological and hydrological factors. In previous research, terrain scanning technique had been developed based on the energy transformation concept, in which the debris mixtures movement was governed by loss in potential energy. With the terrain topography and predetermined overflow point which debris mixtures started to deposit, the scanning process was developed for the probable fan area downstream of debris flow torrent. The zonation of scanning was rated according to the gradient in the radial direction and the possible flowing path could be determined. However, the possible flowing path of debris in radial direction and run out distance had not been considered. In order to take into account of such problems, the hydraulic flow analysis and the relationship between run out volume, area and distance were conducted. The direction of hydraulic flow was determined by the direction of steepest descent from each cell and can be easily calculated using Geographic Information System technique (GIS). It not only tracked debris mixtures but also transverse slope to assess the qualitative debris run-out potential energy. With the same unit length, cell with the higher elevation difference has been speculated to correspond to a higher kinematic energy for debris mixtures run off. Furthermore, the relationship between run-out volume, area and distance was estimated by statistic analysis using historic records of landslide debris volume (V) and run-out area (A) and length (L). The resulting run-out distance can be represented as $Log(L) = 0.5594Log(V)$

and$A = 28.814V^{2/3}$. In this research simulation of debris deposition process had been carried out using terrain scanning adopting a new debris flow disaster case in 2004, Songhe River watershed, as the study area. The results indicated good agreement to the field observation, and validated the feasibility of GIS technique on debris flow hazard potential mapping.

Keyword: terrain scanning, flow direction, GIS, run out distance