

Use of a GIS-based 3D Deterministic Slope Stability Predicting Tool for Landslide Hazard Assessment in Zagreb Hilly Area, Croatia

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INTRODUCTION

The hilly slopes of Mt. Medvednica are located in the northwestern part of Zagreb City, Croatia. In this area, landslides, e.g. Kostanjek landslide and Črešnjevci landslide, have brought damage to many houses, roads, farmlands, grassland, and etc. Therefore, it is necessary to predict the potential landslides and to enhance landslide inventory for hazard mitigation and security management of local society in this area. In this study, a GIS-based three-dimensional deterministic model and probabilistic method is combined to assess potential landslide zones including their locations, size and sliding surfaces in Veliki potok catchment (**Fig.1**).

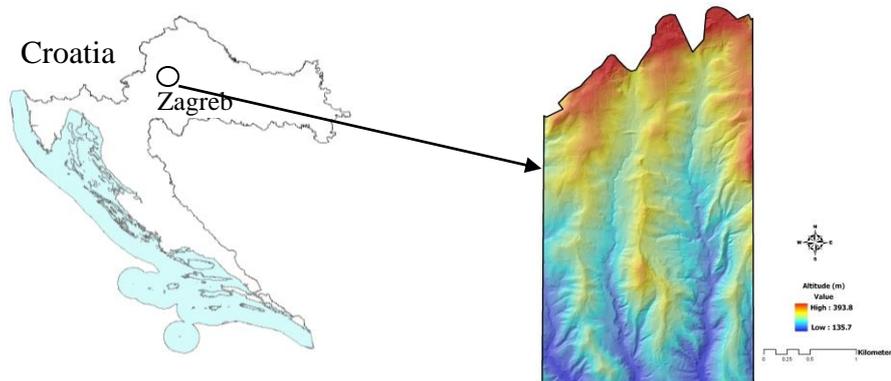


Fig. 1 The study area in Croatia

METHODOLOGIES AND RESULTS

When evaluating the landslide susceptibility of regional-scale area, processing large amounts of spatial data and identifying the potential instability zones would be arduous works. In this study, firstly, this study area is divided into slope units that have similar topographic and geological characteristics using hydrology analysis tool in ArcGIS. Then, a GIS-based modified three-dimensional Hovland's method for slope stability analysis is developed to identify the sliding surface and corresponding three-dimensional safety factor for each slope unit. The sliding surface is assumed to be the lower part of each ellipsoid. The direction of inclination of the ellipsoid is considered to be the same as the main dip direction of the slope unit. The center point of the ellipsoid is randomly set to the center point of a grid cell in the slope unit. The three-dimensional safety factor and corresponding critical sliding surface are

also obtained for each slope unit (**Fig. 2**). Thirdly, since a single value of safety factor is insufficient to evaluate the slope stability of a slope unit, the ratio of the number of calculation cases in which the three-dimensional safety factor values less than 1.0 to the total number of trial calculation is defined as the failure probability of the slope unit. If the failure probability is more than 70%, the slope unit is distinguished as ‘unstable’ from other slope units and the landslide hazard can be mapped for the whole study area (**Fig. 3**).

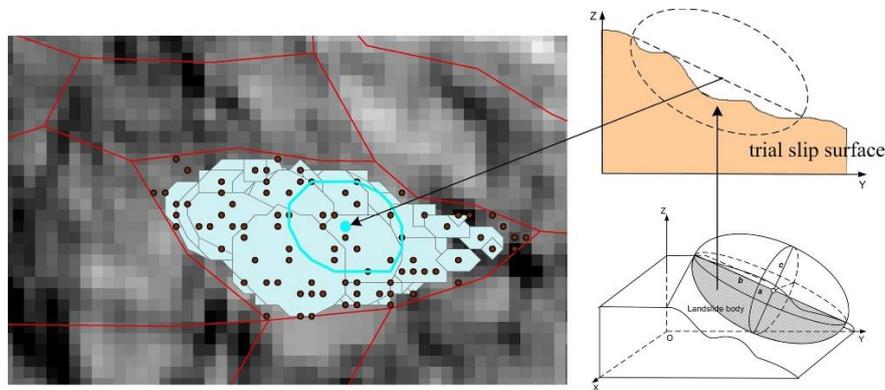


Fig. 2 Searching for the potential instability zone in a slope unit

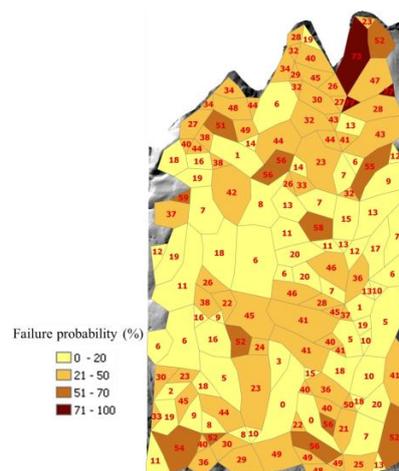


Fig.3 Failure Probability of slope units in Veliki potok catchment

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