Postprint: Airborne LiDAR Identification of Geological Hazards in Complex Mountainous Regions

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Abstract

Geological hazard identification is fundamental to hazard susceptibility assessment, monitoring, and early warning. Traditional manual ground surveys and satellite remote sensing methods face significant challenges when identifying geological hazards in high-vegetation-covered mountainous areas with complex terrain. The development of airborne Light Detection and Ranging (LiDAR) technology provides a new solution for geological hazard identification in such environments. By utilizing acquired airborne LiDAR point cloud data, a high-resolution Digital Elevation Model (DEM) was generated through point cloud filtering and spatial interpolation. Combined with a DEM visualization method based on Sky View Factor (SVF), geological hazard identification research was conducted across an area of approximately 135 km^2 surrounding Danba County town in Sichuan Province, China. A total of 146 geological hazards were interpreted, covering a combined area of approximately 46.48 km^2 (33.4% of the total study area). The reliability of the airborne LiDAR identification results was verified through field surveys. Based on these findings, the spatial distribution patterns of geological hazards in the region and their influencing factors were analyzed. The research results provide valuable reference for geological hazard identification in high-vegetation-covered complex mountainous areas and offer data support for geological hazard prevention and risk assessment in Danba County.

Full Text

Preamble

Geohazard Recognition by Airborne LiDAR Technology in Complex Mountain Areas

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Abstract

Geohazard identification serves as the foundation for susceptibility assessment, monitoring, and early warning. Traditional methods based on manual field surveys and satellite remote sensing encounter significant challenges in high-vegetation, topographically complex mountain regions. The development of airborne Light Detection and Ranging (LiDAR) technology offers a novel solution for geohazard recognition in such environments. This study utilizes airborne LiDAR point cloud data to generate high-resolution Digital Elevation Models (DEMs) through point cloud filtering and spatial interpolation. Combined with DEM visualization using the Sky View Factor (SVF), we conducted geohazard identification across a 135 km^2 area surrounding Danba County in Sichuan Province, China.

A total of 146 geohazards were interpreted, covering approximately 46.48 km^2 and accounting for 33.4% of the total study area. The reliability of the LiDAR-based identification results was verified through field investigations. Based on these findings, we analyzed the spatial distribution patterns of geohazards and their influencing factors in the study area. The research outcomes provide valuable reference for geohazard identification in high-vegetation, complex mountain regions and furnish data support for geohazard prevention and risk assessment in Danba County.

Keywords: Geohazard identification; Airborne LiDAR; Remote sensing interpretation; Sky view factor; Complex mountain areas

Note: Figure translations are in progress. See original paper for figures.