Applications of Airborne Remote Sensing in Geological Hazards: Current Status and Prospects (Postprint)

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Abstract

Conducting geological surveys to understand the history and current status of geological disasters in advance holds significant importance for ultimately achieving the identification and early warning of potential hazards. At present, traditional manual ground-based survey methods encounter difficulties in discovering and investigating major geological disasters and hidden dangers in complex mountainous regions characterized by dense vegetation cover or steep terrain. In contrast, aerial remote sensing, as a multifunctional comprehensive detection technology, can efficiently acquire the developmental distribution characteristics and spatiotemporal evolution patterns of geological disasters due to its advantages such as unique viewing angles and independence from ground conditions. First, this paper summarizes the commonly employed aerial remote sensing platform types in the geological disaster domain and their development trends, analyzing the information processing technology advantages of different payload sensors and the primary geological disaster issues they address. Second, it reviews the key research achievements of aerial remote sensing technology across five application stages in geological disasters: basic topographic mapping, early identification, investigation and evaluation, medium- to long-term monitoring, and emergency response, while discussing the requirements, advantages, and disadvantages of various technical methods at each stage. Finally, it summarizes the deficiencies in the application research of aerial remote sensing technology in the geological disaster field and elucidates future development trends and recommendations.

Full Text

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Abstract

Understanding the historical occurrence and current status of geological hazards through geological surveys is crucial for the ultimate identification and early warning of potential disasters. However, traditional manual ground-based survey methods struggle to detect and investigate major geological hazards and hidden dangers in complex mountainous regions characterized by dense vegetation cover or steep terrain. Aerial remote sensing, as a multifunctional and comprehensive detection technology, offers unique advantages such as a broad field of view and independence from ground conditions, enabling efficient acquisition of the development, distribution characteristics, and spatiotemporal evolution patterns of geological hazards.

This paper first provides an overview of the commonly used aerial remote sensing platform types in the field of geological hazards and their development trends, analyzing the advantages of information processing technologies for different payload sensors and the primary geological hazard problems they address. Second, it reviews the key research achievements of aerial remote sensing technology across five application stages: basic topographic mapping, early identification, investigation and evaluation, medium- to long-term monitoring, and emergency response for geological hazards, while discussing the requirements, advantages, and disadvantages of various technical methods at each stage. Finally, the paper summarizes the deficiencies in current application research of aerial remote sensing technology in geological hazard management and outlines future development trends and recommendations.

Keywords: geological hazards; aerial remote sensing; airborne LiDAR; UAV; photogrammetry

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