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Image enhancements of Landsat 8 (OLI) and SAR data for preliminary landslide identification and mapping applied to the central region of Kenya

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Abstract

Image enhancements lead to improved performance and increased accuracy of feature extraction, recognition, identification, classification and hence change detection. This increases the utility of remote sensing to suit environmental applications and aid disaster monitoring of geohazards involving large areas. The main aim of this study was to compare the effect of image enhancement applied to synthetic aperture radar (SAR) data and Landsat 8 imagery in landslide identification and mapping. The methodology involved pre-processing Landsat 8 imagery, image co-registration, despeckling of the SAR data, after which Landsat 8 imagery was enhanced by Principal and Independent Component Analysis (PCA and ICA), a spectral index involving bands 7 and 4, and using a False Colour Composite (FCC) with the components bearing the most geologic information. The SAR data were processed using textural and edge filters, and computation of SAR incoherence. The enhanced spatial, textural and edge information from the SAR data was incorporated to the spectral information from Landsat 8 imagery during the knowledge based classification. The methodology was tested in the central highlands of Kenya, characterized by rugged terrain and frequent rainfall induced landslides. The results showed that the SAR data complemented Landsat 8 data which had enriched spectral information afforded by the FCC with enhanced geologic information. The SAR classification depicted landslides along the ridges and lineaments, important information lacking in the Landsat 8 image classification. The success of landslide identification and classification was attributed to the enhanced geologic features by spectral, textural and roughness properties.

Keywords

Image enhancement methods; Principal Component Analysis (PCA); Independent Component Analysis (ICA); False Colour Composite (FCC); Normalised Difference Mid Red (NDMIDR) spectral index; Landslides