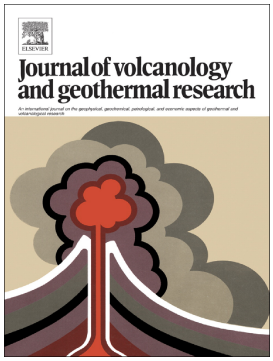

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Mapping Lava Flows from Satellite Remote Sensing Imagery through Random Forest Classification

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Abstract

Mapping lava flows using satellite images is an important application of remote sensing in volcanology. Several volcanoes have been mapped through remote sensing using a wide range of data, from optical to thermal infrared and radar images, using techniques such as manual mapping, supervised/unsupervised classification, and elevation subtraction. So far, spectral-based mapping applications mainly focus on the use of traditional pixel-based classifiers, without much investigation into the added value of object-based approaches and into advantages of using machine learning algorithms. In this study, Nyamuragira, characterized by a series of more than 20 overlapping lava flows erupted over the last century, was used as a case study. The random forest classifier was tested to map lava flows based on pixels and objects. Image classification was conducted for the 20 individual flows and for 8 groups of flows of similar age using Landsat 8 imagery and a DEM of the volcano, both at 30-meter spatial resolution. Results show that object-based classification produces maps with continuous and homogeneous lava surfaces, in agreement with the physical characteristics of lava flows, while lava flows mapped through the pixel-based classification are heterogeneous and fragmented including much “salt and pepper noise”. In terms of accuracy, both pixel-based and object-based classification performs well but