Thermal remote sensing of the low-intensity carbonatite volcanism of Oldoinyo Lengai, Tanzania

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Abstract

Although Tanzania, Kenya and Ethiopia contain a number of active and potentially hazardous volcanoes, none of them are routinely or continuously monitored. Of these, Tanzania's Oldoinyo Lengai (OL) has been active almost continuously over the past two decades (since 1983). Recent activity has been confined to small-scale effusive and explosive eruptions of natrocarbonatite within the summit crater, with lava flows occasionally overflowing the crater rim and extending onto the volcano flanks. The automated MODVOLC algorithm falls short of detecting all thermal anomalies within OL's crater. The sensitivity of the algorithm is insufficient to detect anomalies of the size and magnitude presented by those at OL. We explore how Moderate Resolution Imaging Spectroradiometer (MODIS) infrared (IR) bands can still be used to monitor activity. We cross-verify our observations against field reports and higher resolution satellite images (ASTER, Landsat ETM+). Despite the limited extent and low temperature (~585°C) of natrocarbonatite lavas, relative variations in eruption intensity and periods of increased activity alternating with periods of reduced or no detectable activity can be observed using the MODLEN algorithm. Although activity in the past two decades has been moderate at OL, a more intense explosive eruption is overdue and there is a need for routine monitoring in the future. Our work makes a case for low-cost thermal IR monitoring as an essential component of such a monitoring programme at several Tanzanian, Kenyan and Ethiopian volcanoes. The approach presented here is already available for routine use.