Remote sensing study of sector collapses and debris avalanche deposits at Oldoinyo Lengai and Kerimasi volcanoes, Tanzania

Author(s)

M. Kervyn , G. G. J. Ernst , J. Klaudius , J. Keller , E. Mbede & P. Jacobs

Abstract

Evidence for volcano collapse and debris avalanche deposits (DADs) at Oldoinyo Lengai (OL), Tanzania, has been obtained from mapping and fieldwork. Three major DADs have been identified, named Zebra, Cheetah and Oryx DADs. Field evidence indicates geologically young ages. On this basis a remote sensing (RS) study of the active carbonatite volcano OL and the surrounding rift plain was carried out, using Shuttle Radar Topography Mission (SRTM) digital elevation data, Landsat and ASTER imagery, geological maps and aerial photographs. The SRTM digital elevation model (DEM) allowed morphological characterization of OL and reassessment of the volcano volume to 41±5 km^3. This enabled the identification of collapse scars, fields of large hummocks (>300 m across), sharp deposit edges typical of DADs, and estimation of the minimum thickness of the DADs. Multispectral and topographic RS data interpretation allowed mapping of the extent and estimation of the volume of two sector-collapse scars and three DADs. The DADs extend up to 24 km from OL and have volumes ranging from 0.1 to ~5 km^3. Striking radial ridges and grooves were identified in some parts of the DADs. The morphological variability for ridges and grooves in different DADs is attributed to contrasting flow dynamics and avalanching material. A volcano collapse and the corresponding DAD, ~1 km^3 in volume, were also characterized by RS at the nearby Kerimasi volcano. The presence of young DADs highlights the need for routine monitoring of ground deformation and seismicity at OL to anticipate hazardous events.