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Horizontal deformation patterns of an instable lava terrace at Sciara del Fuoco, Stromboli volcano (2003-2005) by using aerial image cross-correlation

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Throughout the 2002-2003 Stromboli eruption, the lava flows emitted form the vents at about 640 m a.s.l. covered large part of the tsunamigenic landslide formed on 30 December 2002, just at the onset of the eruption. The resulting compound lava field formed a thick lava terrace in the upper part, close to the vents, roughly corresponding with the head of the December 2002 landslide. The monitoring of movements of the lava field and of this unstable lave terrace was conducted by using multitemporal comparison of photogrammetric Digital Elevation Models and a geodetic network (THEODOROS system). These monitoring systems depicted a continuous deforming process characterized by a strong downslope motion accompanied with an important vertical component of the lava terrace.

Here, we proposed a new cross-correlation technique to study the horizontal deformation patterns, with very high spatial resolution, related with the destabilization processes of this lava terrace. We obtained horizontal deformation patterns by comparison of 3 orthophotomosaics covering the Sciara del Fuoco (September 2003, August 2004 and May 2005). Horizontal patterns indicate a decrease of deformation rates between 2003-2004 with respect to 2004-2005 period. Furthermore, a detailed analysis of the horizontal deformations shows that the first period was characterized by high and smooth strain field, while during the second one we observe the predominance of failure processes.