



Permanent terrestrial geodetic system for monitoring the stability of the 2007 Lava Fan in the Sciara de Fuoco (Stromboli volcano, Italy)

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At the end of the 2002-2003 eruption, a terrestrial monitoring system was installed for routinely measuring the movements of benchmarks installed inside the Sciara del Fuoco (hereafter SdF) (Puglisi et al., 2005). This system, named THEODOROS, is based on a remotely controlled robotized Total Station installed near Punta Labronzo, on the northern border of the SdF. The 2007 eruption caused a dramatic change in the operations of THEODOROS. The 2007 lava flows, indeed, destroyed all benchmarks installed on the northern part of the SdF, leaving only those on its central part. This eruption produced a lava fan at the base of the SdF, due to the rapid cooling of the lava flows when entering into the sea. the continuous overlapping of several flows during the eruption, indeed, build a thick lava body (the fan); it was emplaced on a very steep slope, partially originated during the landslides occurred on December 2002, producing an hazard condition due to the possible fast sliding of this fan into the sea. In order to monitor the stability of this lava fan, a new terrestrial geodetic network, was implemented on 6 April 2007, by installing 5 reflectors along a profile crossing the lava body, approximately over the old coastline. Later on, in June 2007, 4 further reflectors were installed at higher and lower altitude with respect to the previous profile, to obtain more information on the overall deformation of the lava body. Measurements were rather noisy during the first months, but a better definition of the reference system strongly improved the quality of the data. The position of the 9 benchmarks over the lava fan allows the areal distribution of the deformation to be drawn. The measurements carried out every 10 minutes allow us to follow with high temporal detail their motion.

The data collected since the end of the eruption highlighted a significant downslope motion of the entire lava fan, decreasing from the South to the North, where the body is buttressed by the rocky northern wall of SdF. The ground velocity, especially the vertical component, was initially very high but it progressively decreased in time, and it is still decreasing albeit with a lower rate. The initial main vertical deformation and the temporal and spatial pattern of the deformation suggest that, at least during the very first months after the end of the eruption, part of the deformation was due to the thermal contraction of the thick lava body.