EGU2020-2604
https://doi.org/10.5194/egusphere-egu2020-2604
EGU General Assembly 2020

Holocene dyke-induced surface deformation at Krafla (Iceland) revealed by UAV-based high resolution 3D models

Alessandro Tibaldi, Elena Russo, and Luca Fallati
University of Milano Bicocca, Earth and Environmental Sciences, Milano, Italy (alessandro.tibaldi@unimib.it)

We analysed at very high detail the surface deformation along a volcanotectonic structure in the Krafla Fissure Swarm, located in the North Iceland Rift. The structure affects the Pleistocene Hituholar volcano and 12 ka old lava flows. The work has been carried out through the Structure from Motion technique (SfM) applied to UAV surveys, integrated with a lithostratigraphic and structural field survey. The resulting Orthomosaic and Digital Surface Model (DSM) have a resolution of 2.6 and 10 cm, respectively. The zone of deformation is characterised by topographic bulging, parallel extension fractures, and narrow grabens with locally floor uplift, which can be explained as the effect of shallow propagation of a dyke northward from the Krafla magma chamber. In fact, the study area has been interested by northward dyke propagation from the central Krafla volcano during several rifting events, among which the recentmost occurred in 1975-1984 (Krafla fire). The analysis of the very wide area covered by our UAV surveys indicates that changes in the pattern of surface deformation occur in correspondence of contacts between deposits with different rheological properties: the transition from very stiff lavas to soft hyaloclastites produces a change from extension fracturing to normal faulting. Moreover, we detected a series of extension fractures with NE-SW strike and left-lateral slip component, and NNW-SSE strike and right-lateral component, which are rotated clockwise and anticlockwise respect to the main NNE-SSW graben trend, and extend outward to the sides of the main deformation zone up to 17 m. We interpret these structures as originated in front of the dyke tip during its propagation and being successively bypassed by the dyke advancement. In case of an active volcanic zone, the comprehension of the surface deformation and of the significance of strike-slip faulting occurrence can help to determine how and where magma is propagating. Thus, these evidences may help to decipher geophysical data and surface structural data during volcano monitoring.