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The 2008 dike-fed Etna eruption: continuous tilt, focal mechanisms and structural investigations

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Starting from 8:40 GMT on May 13, 2008, a significant seismic swarm with focal mechanisms in extension, a progressive increase of the volcanic tremor amplitude and distinct ground deformation accompanied the uprise of a magmatic dike at Etna volcano (Italy), which reached the surface at 9:30 GMT. Then, lava fountains erupted from a N140°E fissure (3050-2950 m above sea level, asl). In the following two hours, the eruptive fissure propagated downslope southeastward, curving toward N120°E and reaching a minimum elevation of 2620 m asl. Meanwhile, eruptive activity abandoned the upper segment of the fissure focusing in its lowest portion, characterized by Strombolian activity. There, a lava flows erupted at high rates and rapidly expanded in the uninhabited Valle del Bove, reaching 6 km in length and a minimum elevation of 1300 m asl.
At 10:00 GMT the volcanic tremor reached its maximum amplitude. Then, the seismicity decreased, shallowed from -1.5 to +1.5 km relative to the sea level, and migrated about 2 km toward NNW. The epicenters were located in the upper portion of the NE Rift, where a dry, extensive ∼N-S fracture field began to form. These new fractures caused significant concern, raising the level of alert for the Civil Defence, because it was feared that they could propagate dangerously toward lower altitude, as happened in 1981.
Starting from 12:00 GMT the ground deformation significantly diminished, while the seismicity was characterized by compressive focal mechanisms. In the late afternoon the eruptive scenario became stable and was characterized by eruptive vents located at 2620-2800 m asl, feeding lava flows expanding inside Valle del Bove.
This work describes from a multidisciplinary standpoint the development of the eruptive and dry fractures accompanying the emergence of the magmatic dike in May 2008, focusing on its propagation and halting toward North. A model to infer on the dynamics of shallow dike emplacement is proposed.