Continuous monitoring of heat flux from steam heated soils of Etna

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We present soil temperature data from a peripheral fumarole emission of Mt Etna at the top end of a radial fracture called Bottoniera. This area lies in the northern flank of the volcano (2,500m a.s.l.), and was interested by fissure eruption during 2002/2003. In the steam heated soil lying around the fumarole release, a shallow vertical profile has been monitored from October 2009 to September 2012. We estimated the local surface heat flux and compared its time variations to the eruptive activity occurred during the monitoring period. The eruptive vents were located on the opposite flank, (>3200m a.s.l.), far about 4km. The heat flux from this peripheral emission has been highly influenced by the eruptive activity. Its time variations are correlated to the variable rates of products emitted from January 2011 to April 2012. Different ranges of heat flux values have been associated to the pre-eruptive phase, to the productive eruption period and to the end of this eruptive cycle. The decrease of heat flux was registered before the end of the eruptive cycle. The continuous thermal monitoring revealed in real time that ascending magma through the active conduits is the heating bottom source of the heat flux dispersed by a complex network of active fractures present in this area. The recorded data suggest the steam heated soil around fumaroles vents as a possible new investigation field for a low cost monitoring of the local variation in the structural weakness of the apparatus. Extending this thermal monitoring to the other steaming grounds of this complex volcanic system we could also follow variations of the fluid circulation paths and obtain direct information about local pore pressure changes. A multivariate analysis of recorded data could suggest, which part of this complex apparatus is being involved, time by time, with the ongoing evolution. It would contribute to the evaluation of flank instability caused by physical changes occurring on the network of active fractures, and inferred by multidisciplinary investigations (such as deformation patterns, tectonic lineaments and geochemical features of underground waters and diffuse gas emissions).