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Relationship between surface temperatures and seismic activity at Vulcano, Aeolian Island (Italy)

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Time-series acquired during last years by surface monitoring parameters are compared, and the results are discussed, following a theoretical approach. Surface parameters are fluid temperature, soil temperatures and seismic activity at La Fossa of Vulcano. Discussed periods are 1998 and from 2004 to 2007, when time relationship between changes of the heat flow from the ground and seismic activity, resulted worth noting. Earthquakes originating in the area of Vulcano are associated with both fracturing and degassing mechanisms. The formers are related to the activity of tectonic structures; while the latter are connected to fluid dynamics within the interior of the volcanic apparatus. In November 1998 seismic activity at La Fossa sharply increased: Five events were registered, with seismic signals of typical faulting earthquakes, triggered by mechanism of shear fracturing and focal depths ranging 1-4 km. Fumaroles temperatures, recorded by continuous monitoring system of INGV - Palermo, showed a growing trend since October to November 1998, highlighting a big increase of heat transfer during the period, and also the soil temperature, out of the fumaroles field showed a marked increase. Fumaroles temperatures heralded the increase of heat and energy flow during a pre-seismic period of about 1 month. The transient variation of surface release reflect an excited state of the system and may have many different causes, not directly related to the magma. Indeed, stress drops generated by small fracturing earthquakes, introduce a significant perturbation in the system resulting in a relevant production of mass and energy flow. Until these flows counteract every stress gradient, they support stationary state of the system. The observed time relationships only allow a qualitative discussion about cause and effects, but doesn't allow any quantitative evaluation. Pressure transients generate anomalies (flows of mat-

ter, differential in heat flows, chemical reaction rates) whose time frame is specific, depending on many possible processes and path-ways. Fluid phases, along fumarolic conduits, reach the surface faster than the co-genetic earthquake, as the earthquake is embedded in a strain transient that broadly exceeds the time-space frame of the seismic transient (Lomnitz, 1994). On the other hand, in a volcano-tectonic context, different energy flows can either be a cause, either an effect of perturbation, depending on depth of their primary source. Thus, in some instances the strain transient related to local earthquakes produces anomalous chemical flows, while, in other instances the local seismic activity may be produced by chemical flows from the magmatic source. Following a period of lower energy release, other 3 anomalous periods were observed from November 2004, either in the seismic release and in the surface heat flow, even out from fumaroles. So far, the monitored sites resulted very sensitive to minor perturbations of the system. The comparative analysis of different time-series supplies information related to perturbations of the state variables, useful to verify conceptual framework and to better define “classical” and “new” monitoring techniques for volcanic, as well as seismic surveillance.