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Evidences of dynamic stress transfer at Mt. Etna volcano by regional and teleseismic earthquakes

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Influences of distant earthquakes on volcanic systems by dynamic stress transfer are well documented. We analysed seismic signals and volcanic activity at Mt. Etna during time periods characterised by strong regional and teleseismic earthquakes. Two periods, January 2006 and May 2008 showed variations clearly time-related to distant earthquakes. In the first period, characterised by mild volcano activity, the effect of the dynamic stress transfer, caused by a Greek earthquake (M=6.8), was duplex: i) banded tremor activity, whose source is generally related to the existence of a shallow hydrothermal system, changed its features and almost disappeared; ii) a swarm of volcano-tectonic earthquakes with focal depth of 10-15 km b.s.l. took place. The changes of the banded tremor were related to variations in parameters, such as heat and steam flows, permeability and porosity of the rocks, likely caused by weak dynamic stresses. On the other hand, VT earthquake swarm probably developed as a secondary process, promoted by the dynamically triggered activation of magmatic fluids. The second period, May 2008, showed an intense explosive activity. During this time interval the dynamic stress transfer, related to the arrival of the seismic waves of the Sichuan earthquake (M=7.9), affected the features of the seismo-volcanic signals and triggered an eruption on the following day. In particular, we observed a gradual decrease of volcanic tremor amplitude, just after the arrival of the teleseismic waves, related to tremor source shift, and an increase of both occurrence rate and energy of long period events. In this case, we suggest that dynamic stress transfer caused buildup of pressure in magma bodies, that was highlighted by the increase of LP activity. On the following day such increasing overpressure led to an eruption. In conclusion, phenomena of dynamic stress transfer have been recognized at Mt. Etna able to modify the state of the volcano. However, uncertainties still remain on the precise mechanisms by which dynamic stress alter the volcano system.