



## **Long-term stress-strain analysis of volcano flank instability: the eastern sector of Etna from 1980 to 2012**

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We investigated the evolution of seismicity and deformation in the unstable eastern flank of Etna volcano over a thirty-year period (from 1980 to 2012). By comparing seismicity along the northern border (Pernicana fault system) of the sliding flank and the deformation of the eastern flank, a significant temporal correlation has been revealed between periods of flank acceleration and seismic activity intensification. Two marked phases have been observed in 1984-1988 and in the years following 2002. These two phases are separated by a long period from 1988 to 2001, in which the flank sliding slowed down and the seismicity dropped drastically. This common temporal evolution in the deformation rate and seismic release supports the hypothesis that the seismicity in the northern border can be viewed as a marker of the response to accommodate the stress exerted by the traction of the eastern flank sliding. This interplay has also been corroborated by FEM numerical computations that highlight a good correlation between the seismicity pattern and areas of positive stress changes induced by the sliding surface. The cause triggering the marked flank sliding is not univocal. The two intense phases of flank acceleration are representative of two main sources: volcano flank instability stretching the eastern sector in the first 1984-1988 phase and magmatic intrusions pushing the eastern flank seaward since the 2002-03 eruption. Establishing the relationship between flank acceleration and seismic activation, therefore, is critical to understanding Etna's mechanical behavior, and could give insights into the processes regulating the unstable flank response.