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Tidal and hydrological periodicities of volcano-tectonic seismicity at Campi Flegrei caldera.

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We analyse and compare volcano-tectonic seismicity, rainfall, atmospheric pressure, ground deformation and Earth tide time series at the Campi Flegrei caldera (CFc) in the time interval 2005-2016, looking for possible tidal and hydrological triggers of hydrothermal and seismic activity. By applying statistical analysis, we show that the occurrence of clustered seismicity at the CFc has a cyclic behaviour on several time scales, from semidiurnal and diurnal to longer periods, such as fortnightly, monthly, semiannual and annual. The medium and long-period time scales match those of the main lunar and solar tidal constituents, while the exactly 24-h and 12-h periodicities can be ascribed not only to the Earth tides but also to other effects such as atmospheric pressure and temperature variations. In addition, a clear dependence on rainfall arises from the analysis of the hydrological parameters, indicating a strong seasonal periodicity along the entire observational interval, with the most numerous and energetic seismic swarm occurring in the wet season.
We interpreted these observations in terms of a model linking magmatic degassing, ground deformation and seismicity. The proposed model considers the magmatic-hydrothermal fluid circulation system as a cascade hydraulic circuit, where in/out fluid flow and pressure condition of each segment are regulated by those of the contiguous ones. Our results suggest that volcano-tectonic seismicity at CFc is driven by both variations in the deep magmatic feeding system and exogenous phenomena, as rainfall or global inflation/deflation cycles of the Earth' s crust, controlled by the lunisolar interaction. Consequently, the role of exogenous triggers (combined with endogenous processes) in the evolution of the recent dynamics should be properly considered in the elaboration of volcanic risk scenarios.