



Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile

'Understanding volcanoes and society: the key for risk mitigation'



Multi-variate analysis of the monitoring data at Vulcano and Campi Flegrei

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Multi-variate dataset, Pattern Recognition, Monitoring data, Vulcano, Campi Flegrei

This contribution describes the work-in-progress within the project FREAPROB, funded by INGV. The ultimate goal is to seek signals or recurrent patterns within data of different nature (from geochemistry, geodesy, gravity and seismology), which are recorded at two of the best monitored volcanoes in the world, Vulcano and Campi Flegrei (Italy). In fact, despite the strong monitoring effort, the multivariate and objective analysis of the monitoring observations from different disciplines is still uncommon. The first step of our work has been the collection, collation and homogeneization of some of the available data. For the case of Vulcano, data from the continuous monitoring of the crater rim's fumaroles were collated with the records from the monthly surveys that have been carried out in the last 25 years to monitor the largest and most persistent fumaroles at La Fossa crater. The fumarole observations (consisting of temperature and geochemical variables) were further merged with the observations from the seismic network to constitute the base for a multivariate analysis. Aim of the analysis is the identification of typical patterns characterizing periods of (i) high versus low temperature at the fumaroles, (ii) high versus low gas concentration, and (iii) weak versus intense seismic activity. At Campi Flegrei, the dataset features all published geochemical data from the two main fumaroles (Bocca Grande and Bocca Nuova), gravity residuals, ground displacement and seismic activity, all recorded by Osservatorio Vesuviano in the last decades. This dataset has been analysed in search for recurrent patterns describing periods of higher fumarolic temperature or characterized by greater deformation rate. This contribution underlines and encourages the development of multivariate datasets and databases that allow searching, through objective statistical analysis, signals and patterns that are difficult to extract “by eye”.