

Spectral analysis of ground thermal image temperatures at Solfatara crater

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The Solfatara volcano, part of Campi Flegrei caldera (Italy), is monitored by INGV ground networks, including thermal infrared cameras (TIRNet network). This last network is composed by 5 permanent stations. They acquire portions of the Solfatara area characterized by significant thermal anomalies.

In this work the dataset is composed by 1347 daily samples from 2014 April 25th to 2017 December 31th, recorded by three TIR stations (Solf1, Solf2 and Ps1), and by environmental pressure and temperature variables.

A pre-processing on the data was carried out in order to remove the components associated to the seasonality and the influence of the tides on all the variables. We chose the STL algorithm (Seasonal Decomposition of Time Series by Loess; Cleveland et al. 1990), since it allows to decompose a time series into three components: seasonal, trend and remainder.

Then, we performed a harmonic analysis on the deseasonalized signals by using the T_Tide software (Pawlowicz et al., 2002) in order to identify and remove the main tidal constituents (diurnal, semidiurnal and long period).

The analysis of the residual time series allows to highlight possible temporal temperature variations both due to endogenous dynamics, or affected by other factors.

Possible correlation between thermal anomalies and the environmental parameters can be, then, underlined through spectral analysis (FFT). For the entire dataset, we calculated the periodograms in the band [10-120] day. This analysis permitted to evidence which are the components common with meto-environmental variables and which are features of a specific TIR-site. In particular, we found two spectral peaks, at about 30 and 50 days, common to all the considered variables. Moreover, Solf1 station shows a marked link to the external pressure for periods larger than 45 days, while Solf2 and Ps1 exhibit a behavior similar to external temperature starting from a period of 80 days.