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Temporal evolution of long-period activity at Mt. Etna - no apparent link with the 2004 eruption

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Between December 2004 and August 2005, more than 50,000 long-period events (LP) were recorded, encompassing the effusive eruption which started in September 2004. A large number of these events exhibit similar waveforms, indicating the involvement of a non-destructive, repeatable source process. The events were located using methods based on the cross-correlation analysis. The spectral and particle-motion analyses imply that the source is most likely related to the resonance of a fluid-filled buried cavity. Considering the significant amount of shear observed during polarisation analysis, a crack is a likely candidate for the geometry of the source. A fluid-related seismic source can be seen as an oscillating system - it has its eigenfrequencies and corresponding damping factors (Q-factors hereinafter). An alternative approach to the standard spectral analysis (FFT) of such systems is the SOMPI method based on the autoregressive models of linear systems, yielding source Q factors in addition to dominant frequency. These Q factors tell us about the time evolution of the physical properties of the fluid driving the source process. In our dataset, the most energetic part of signal consists of two eigenfrequencies, spanning the interval 0.5 - 0.8 Hz. Although the absolute value of the source Q-factors is contaminated by the path Q-factor, we observed there was no significant change in their relative values throughout the considered time period. The same holds for the observed eigenfrequencies. It tells us there was likely no significant change in the type of fluid or amount of gas involved in the source processes. Surprisingly, it seems to suggest that the LP-generating process was not related to the renewal of effusive activity at the Mt. Etna in September 2004. In future work we aim to put quantitative constraints on this interpretation based on

modelling of the source through complete waveform inversion.