

## **Abstract**

After more than thirteen years of continuous mud eruption, Lusi (NE Java Basin, Indonesia) is defined as a sediment hosted hydrothermal system. Due to its longevity, Lusi is a main subject for scientific research offering a unique setting to study the origins of hybrid hydrothermal systems. Therefore, scientists continue to investigate the eruptive activity of Lusi. Recent field observations and research show that in addition to the regular hydrothermal activity at Lusi, there are periods when the eruptions occur more vigorously. This enhancement is defined as hydrothermal waves and is characterized by rapid flooding of the streams that drain the hydrothermal pond formed around Lusi's vents. In addition, sharp increases in temperature as well as in CO<sub>2</sub> and CH<sub>4</sub> concentrations of the fluids are the effects currently under analysis. Scientists argue that this enhanced hydrothermal activity may be a result of fluid injections from the nearby volcanic complex. However, additional external factors that may also have implications for this increase in hydrothermal activity are poorly understood. In this study, we analyze the flow rate data and the temperature of the streams surrounding the hydrothermal pond recorded in 2017. Our focus is to identify hydrothermal wave activity and determine the potential implications of external forcing (e.g. atmospheric temperature/pressure and gravitational forces) on the system by using a quantitative approach. We found further evidence of hydrothermal wave occurrence in three surveyed streams. Furthermore, we propose that this enhancement in hydrothermal activity is not modulated by perturbations from gravitational forcing (solid earth and oceanic tides), but it is moderately triggered by atmospheric temperature and pressure variability. These results provide insight on the sensitivity of Lusi and improve our understanding of new-born hydrothermal systems.

**Keywords:** *hybrid hydrothermal system, triggering, external forcing, modulation.*