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Laboratory experiments and continuous fluid monitoring at Campi Flegrei to understand pressure transients in hydrothermal systems

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The hydrothermal system beneath Campi Flegrei is strongly affected by sub-surface processes as manifested by the existence of a geothermal "plume" below Solfatara (Bruno et al. 2007), associated with formation of new fumaroles and the spatial pattern of exhalation vents. Within the frame of MED-SUV (The MED-SUV project has received funding from the European Union Seventh Framework Programme (FP7) under Grant agreement no 308665), pressure tansients in the hydrothermal system of Campi Flegrei shall be studied using a combination of laboratory experiments and continuous pressure/temperature monitoring at fumaroles, mudpools, hot springs, and geothermal wells. Four groundwater monitoring sites were installed in September 2013: one in the Fangaia mud pool inside Solfatara and three within the geothermal area of Agnano, which is located roughly 3 km to the East of the Solfatara crater. In 2014 additional sensors were installed in Pisciarelli. Autonomous devices are being used to record the water level and water temperature at 10 minute intervals. Records reveal significant changes of the hydrothermal system in September 2013 at the Agnano main spring during the night from 23 to 24 September. Both, the water level and the water temperature dropped significantly, confirmed by visual inspection of the spa operators. The pool of the main spring almost emptied and the flow rate was significantly reduced, implying a profound change in the system. Similar water level drops occurred in the following months.
Gas bubbles are likely to play a major role with respect to spatio-temporal variations in shallow fluid systems below Solfatara. Thus, additional to the field measurements we investigate potential bubble-related mechanisms capable to increase fluid pressure. The BubbleLab at GFZ has been setup. We are able to simulate earthquake ground motions with a shaking table, track the size and velocity of rising bubbles via a camera system, and quantify transients with a set of pressure sensors (up to 400 Hz). We designed an experimental setup to simulate dynamic triggering effects with and without particles under varying frequency and amplitude conditions. Results suggest that a trigger external to the actual vents, either sub-surface or remote (e.g. earthquake) might be capable of triggering the hydrothermal system.