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In search of the magmatic signature: hints from inverse modelling of hydrothermal circulation at Campi Flegrei, Italy.

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The restless Campi Flegrei caldera has a remarkable history of ground deformation, dating back to Roman times and culminating in the 1538 Monte Nuovo eruption. More recently, non-eruptive unrest episodes featured meters of uplift, accompanied by shallow seismicity, and gravity changes. The unrest also involves changes the hydrothermal activity, with variation in the discharge rate of volcanic fluids, compositional changes and minor temperature fluctuations. The observed changes have been interpreted through the years as the result of a shallow magma intrusion, or as the response of the hydrothermal system to the arrival of hot magmatic gases, or with a combination of the two processes. Inverse modelling of hydrothermal circulation provides interesting hints on the evolution of the shallow hydrothermal system. In this work, we show some results obtained inverting geochemical (gas composition and temperature) and geophysical data (gravity changes and ground deformation) to infer the activity of the gas source that feeds the hydrothermal system. Thanks to the long data sets available at Campi Flegrei we can constrain the evolution of the magmatic degassing and assess to what extent the hydrothermal activity explains the observed signals. Despite the limits and the simplifications introduced in the model, these preliminary results offer an interesting insight into the magma vs hydrothermal fluids debate.