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Long term variations at Campi Flegrei (Italy) volcanic system highlighted by the monitoring of hydrothermal activity

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Long time-series of chemical composition of fumaroles and of soil CO₂ flux reveal that important variations in the activity of Solfatara fumarolic field, the most important hydrothermal site of Campi Flegrei, occurred in the 2000-2008 period. A continuous increase of the CO₂ concentration and a general decrease of the CH₄ concentration are interpreted as the consequence of the increment of the relative amount of magmatic fluids, rich in CO₂ and poor in CH₄, hosted by the hydrothermal system. Contemporaneously the H₂O-CO₂-He-N₂ gas system shows remarkable compositional variations in the samples collected after July 2000 with respect to the previous ones, indicating the progressive arrival at the surface of a magmatic component different from that involved in the 1983-84 bradyseism. The change starts in 2000 concurrently with the occurrence of relatively deep long periods seismic events which, in our interpretation, were the indicator of the opening of an easy pathway for the transfer of magmatic fluids towards the shallower, brittle domain hosting the hydrothermal system. Since 2000 this magmatic gas source is active and causes ground deformations, seismicity as well as the expansion of the area interested by diffuse soil degassing of deeply derived CO₂.