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4D imaging of the seism-geochemical dynamics leading to recent Campi Flegrei unrest

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Understanding what produced historical unrests at Campi Flegrei super volcanic caldera is key to forecasting eruptions at the volcano in the near future. Here, we present a novel seismic attenuation and 4D lapse-time source model spanning the years 1983-84 and working in parallel with geochemical data and physical simulations. Results reveal a 4-5 km deep, NNW-SSE striking hot zone, either a magma sill or fluid reservoir, offshore the city of Pozzuoli, feeding a reservoir of supercritical fluids/foams topping at a depth of about 3 km. Repeated injections of hot materials from depth in September-October 1983 into the reservoir produce a second fluid phase accumulating under a rock-physics derived caprock, enhancing subsidence. The release of this additional stress after the breaking of the reservoir, on April 1st 1984, leads to the opening of a western, morphologically-defined path, connecting the centre of the caldera with the site of its last eruption (1538 AD). The hot zone offshore Pozzuoli is the deepest source of seismic activity, ground deformation, and vertical/lateral fluid migration inducing subsidence detected at the volcano during its major monitored unrest (1983-84). Still active today and related to its last historical eruption, it thus controls unrest and eruptive behaviour of the area of highest volcanic hazard in continental Europe.