



Non-isothermal momentum transfer and ground displacements rate: Campi Flegrei caldera (Southern Italy) case study

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Campi Flegrei caldera (CFc) is a complex located in the Campanian plain region of south-central Italy, 15 km west of the city of Naples. The last eruption, testifying the persistent activity of the magmatic system, occurred in 1538, giving rise to an about 130 m spatter cone called Mt. Nuovo. Campi Flegrei area periodically experiences significant unrest episodes, which include ground deformation, the so-called "bradisismo".

Indeed, following the 1538 eruption, CFc entered a phase of subsidence that continued until 1950. The resurgence has produced, in 20th Century, at least three major uplift episodes in: 1950–1952, 1969–1972, 1982–1984 and some minor ones or "miniuplifts" in the last decades. The most recent and largest uplift episode occurred during 1982–1984 and was characterized by a vertical displacement of about 1.8 m in the Pozzuoli town (Osservatorio Vesuviano, 1985). It was partially recovered when 1 m subsidence took place from 1984 to 2004, but since 2005 up to now, the Campi Flegrei caldera has been rising again.

In this paper, we propose a thermo-fluid dynamics model to study the ground uplift episodes at the CFc. Our model is based on the solution of heat and momentum balance to obtain velocity of the fluid responsible for the ground deformation. In order to validate such modelling, we calculate the synthetic vertical ground displacements, produced by different overpressure sources, at each continuous GNSS station of NeVoCGPS (Neapolitan Volcanoes Continuous GPS) network, managed by Osservatorio Vesuviano, department of the Istituto Nazionale di Geofisica e Vulcanologia, spanning the whole CFc. Finally, we compare the modelled and observed vertical displacements (from GNSS measurements). The data set used in this study provide the complete dataset of GNSS time series of the North, East and Up components for 14 stations at Campi Flegrei area from January 2000 to July 2013.