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Doming and faulting processes driving ground deformation at Campi Flegrei caldera (southern Italy): a modeling for the last 6 ka

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We investigated the major episodes of dome growth in the Campi Flegrei caldera occurred during the last period of large eruptive activity (Epoch 3, between 5.5 and 3.5 ka), and in the historical time. The first doming event occurred at the start of Epoch 3 where the caldera floor raised for at least 100 m. Following the Plinian eruption of Agnano-Monte Spina (AMS, 4.55 ka), a new uplift phase occurred with the set up of several lava domes (e.g., Olibano, Accademia and Solfatara cryptodome), the Averno-Solfatara (AVS, 4.3 ka) and Astroni (AST, 4.2 ka) eruptions. This unrest episode was accompanied by severe and widespread faulting and fracturing well recorded in the stratigraphic record (Vitale et al., 2019). Finally, the last episodes of doming occurred before the eruption of Monte Nuovo volcano (MN, 1538 CE) and in the last century (1950-1985 CE). The 1538 CE uplift reached a maximum vertical displacement of ca. 15 m, whereas the 1950-1985 events reached a total dislocation of ca. 4 m. In order to study the former ground deformation pattern, we reconstructed the top surface of the La Starza succession, the latter formed by marine-transitional sediments deposited between 15 and 5.5 ka deposited in large part of the caldera floor. We used information from onland well-logs and seismic profiles in the Gulf of Pozzuoli. The same approach was used for the top surface of the younger marine succession, called Pozzuoli Unit (PU) (Isaia et al., 2019), emplaced following the AMS eruption and predating the AVS eruption. Subtracting the historical deformation pattern and considering the sea-level change in that time frame, we observe that the center of vertical deformation was located, for both Top Starza and Top PU surfaces, close to the Cigliano vent, and therefore not coinciding with the 1538 CE and recent deformation center, both defined by the same deformation center located close to the town of Pozzuoli. The resulting surfaces well mark local deformations related to the activity of major faults and the minor caldera formed following the AMS Plinian eruption. The restoring of the deformation of major faults with the Okada's fault model has furnished useful information about the amount of displacement and rates of the faults' activity in the last ca. 6 ka.

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